Vall d'Hebron Hospital

Vall d'Hebron Barcelona Hospital Campus

Generalitat de Catalunya
Departament de Salut

Institut Català de la Salut

2022 CWIG ANNUAL CONGRESS

14-16 SEPTEMBER 2022

COURSE DIRECTION

DEPARTMENT OF PEDIATRIC SURGERY

HOSPITAL UNIVERSITARI VALL D'HEBRON

BARCELONA- SPAIN

http:// cwigcongressbarcelona2022.com

PROGRAM & CHAIRS

JOSE RIBAS MILANEZ CAMPOS
PRESIDENT OF CWIG
THORACIC SURGEON
UNIVERSITY OF SAO PAULO MEDICAL SCHOOL, DIVISION OF THORACIC SURGERY.
HOSPITAL ISRAELITA ALBERT EINSTEIN SAO PAULO, BRAZIL

MARCELO MARTINEZ FERRO
SECRETARY OF CWIG
PEDIATRIC SURGEON
FUNDACION HOSPITALARIA CHILDREN'S HOSPITAL
BUENOS AIRES, ARGENTINA

ANDRE HEBRA
SCIENTIFIC COMMITTEE OF CWIG
PEDIATRIC SURGEON
GOLISANO CHILDREN'S HOSPITAL
FORT MYERS, USA

ANTONIO MESSINEO
EUROPEAN MEMBER OF EXECUTIVE COMMITTEE OF CWIG
PEDIATRIC SURGEON
CONSULTANT IN THORACIC SURGERY, HUMANITAS GAVAZZENI
BERGAMO, ITALY

MANUEL LOPEZ
CONGRESS DIRECTOR
PEDIATRIC SURGEON
UNIVERSITY HOSPITAL OF VALL D'HEBRON
BARCELONA, SPAIN

ANA LAIN
CONGRESS CO-DIRECTOR AND PROGRAM CHAIR
PEDIATRIC SURGEON
UNIVERSITY HOSPITAL OF VALL D'HEBRON
BARCELONA, SPAIN

ROBERT J. OBERMEYER
PROGRAM CO-CHAIR
PEDIATRIC SURGEON
CHILDREN HOSPITAL OF THE KING'S DAUTHERS
NORFOLK, USA

HOST FACULTY AND LOCAL ORGANIZING COMMITTEE

LAURA GARCIA, CARLOS GINE, RODRIGO MALUJE, IVAN VILLAVERDE

UNIVERSITY HOSPITAL OF VALL D'HEBRON

GENERAL INFORMATION
VENUE

SALA DE ACTOS – PABELLÓN DOCENTE
HOSPITAL UNIVERSITARI VALL D'HEBRON
PASSEIG VALL HEBRON 119 -129
BARCELONA-SPAIN

VALL D'HEBRON BARCELONA HOSPITAL CAMPUS

https://www.vallhebron.com/en

BARCELONA- SPAIN

GENERAL INFORMATION
VENUE

SALA DE ACTOS – PABELLÓN DOCENTE HOSPITAL UNIVERSITARI VALL D'HEBRON
PASSEIG VALL HEBRON 119 -129
BARCELONA-SPAIN

WELCOME ADDRESS

DEAR HONORED COLLEAGUES,
IT IS A PLEASURE TO WELCOME YOU ALL TO THE 22TH ANNUAL MEETING OF CHEST WALL INTERNATIONAL GROUP (CWIG)
CONGRESS IN BARCELONA!

WE ARE HAPPY THAT IT IS POSSIBLE TO ORGANIZE A CONGRESS WITH PHYSICAL PARTICIPATION, BUT ALSO FOR THOSE WHO CAN'T TRAVEL, WITH AN OPPORTUNITY TO ATTEND VIRTUALLY OUR MEETING.

THE SCIENTIFIC OFFICE AND PROGRAM CHAIRS HAVE PUT TOGETHER A VERY EXITING SCIENTIFIC PROGRAM IN WHICH YOU CAN ENJOY ALL THE IMPORTANT ASPECTS OF CHEST WALL SURGERY INCLUDING PECTUS DEFORMITIES, CHEST WALL ONCOLOGICAL CONDITIONS, CHEST WALL RECONSTRUCTION, AND NEW IDEAS AND TECHNIQUES. IN THE GALA DINNER, YOU WILL ENJOY A ROBUSTLY FLAVORED FINE DINING AND PARTY.
OUR CONGRESS OFFER LIVE SURGERY DEMONSTRATIONS PERFORM BY THE MAXIMAL EXPERTS' SURGEONS AROUND THE WORLD. WE HAVE 6-7 SELECTED CASES OF STANDARD AND COMPLEX PECTUS DEFORMITY REPAIR WITH DIFFERENT TECHNIQUES AND STRATEGIES OF THE STATE-OF-THE-ART.
THE DISCUSSION BETWEEN THE OPERATING TABLE AND THE AUDITORIUM WILL BE RELENTLESS THROUGHOUT THE COURSE OF SURGERY TO COMBAT EVERY RISK-PRONE ELEMENT OF PECTUS SURGERY.
DRY LAB ALLOWS IN-PERSON PARTICIPANTS THE OPPORTUNITY TO MANEUVER MULTIPLES STATIONS AND PERFORM VARIOUS STEPS OF THE NUSS PROCEDURE.

WE ARE HOPE YOU WILL ENJOY THE CONGRESS!

PR. JOSE RIBAS MILANEZ CAMPOS
PRESIDENT OF CWIG

==

CWIG EXECUTIVE BOARD

Dr. José Ribas M. Campos
CWIG President
Thoracic Surgeon
Hospital das Clinicas of the Medical School
University of Sao Paulo
Sao Paulo, Brazil

Dr. Manuel LOPEZ
CWIG President-Elect
Head of Department of Pediatric Surgery & Urology
University Hospital of Vall d'Hebron
Barcelona, Spain

Dr. Frank-Matin Haecker
CWIG Past-President & Treasurer
Pediatric Surgeon
Children's Hospital of Eastern Switzerland
St. Gallen, Switzerland

Dr. Marcelo Martinez-Ferro
CWIG Secretary
Chief of the Division of Pediatric Surgery
Fundación Hospitalaria Salud Materno Infanto Juvenil
Buenos Aires, Argentina

Dr. Mustafa Yuksel
CWIG Past-President & Honorary member President :
Professor of Cardiac & Thoracic Surgeon
Marmara University Medical faculty
Istanbul, Turkey

Dr. Andre Hebra
CWIG Scientific Committee
Director of Pediatric Surgical Services
Golisano Children's Hospital
Fort Myers, Florida. USA

CWIG EXECUTIVE BOARD

Dr. Dawn Jaroszewski
Department of Cardiovascular and Thoracic Surgery
Mayo Clinic
Phoenix, Arizona.USA

Dr. Lisa E. McMahon
Pediatric Surgeon
Phoenix Children's Hospital
Phoenix, Arizona.USA

Dr. Rebeccah La Nan Brown
Pediatric Surgeon
Children's Hospital Medical Center
Cincinnati, Ohio.USA

Dr. Maira Kalil
Thoracic Surgeon
Santa Izabel Hospital
Salvador, Bahia - Brazil

Dr. Caroline Fortmann
CWIG Webmaster
Pediatric Surgeon
Hannover Medical School
Hannover- Germany

Dr. Antonio Messineo
Pediatric & Thoracic Surgeon
Humanitas Gavazzeni Hospital,
Bergamo, Italy

CWIG EXECUTIVE BOARD

Dr. Ivan Schewitz
CardioThoracic Surgeon
Consultant and head of department Medunsa
Pretoria, South Africa

Dr. Horacio Abramson
Thoracic Surgeon
Associate Director of Thoracic Surgery at
Buenos Aires University
Buenos Aires, Argentina

Dr. Sadashige Uemura
Pediatric Surgeon
Head of the Department, Nishinomiya Watanabe Cardio-vascular Center
Nishinomiya, Japan

Dr. Jean-Marie Wihlm
Thoracic Surgeon
Professor Emeritus at "Louis Pasteur" University
Strasbourg, France.

Dr. Vladimir Kuzmichev
Thoracic Surgeon
University Hospital in Moscow
Moscow, Russia

Dr. Robert Obermeyer
Pediatric Surgeon
Children's Hospital of The King's Daughters
Norfolk, Virginia. USA

Dr. Gaston Bellia
Pediatric Surgeon
head of Clínica Mi Pectus at Fundación Hospitalaria
Buenos aires, Argentina

CWIG FORMER PRESIDENTS & HONORARY MEMBERS

Dr. Donald Nuss
CWIG Past-President
Professor of Surgery and Pediatrics,
Emeritus, Eastern Virginia Medical School,
Norfolk, Virginia. USA

Dr. Hans Pilegaard
CWIG Past-President
Professor of Cardiac & Thoracic Surgery
Ass. Professor in surgery
Aarhus University Hospital.
Aarhus, Denmark

Dr. Robert Kelly
CWIG Past-President
Professor of Surgery and Pediatrics.
Emeritus, Eastern Virginia Medical School.
Norfolk, Virginia. USA

Dr. Hyung Jo Park
CWIG Past-President
Professor of Cardiac & Thoracic Surgery
Seoul St. Mary's Hospital, The Catholic University of Korea
Seoul, South Korea

Dr. Mustafa Yuksel
CWIG Past-President & Honorary member President
Professor of Cardiac & Thoracic Surgeon
Marmara University Medical faculty
Istanbul, Turkey

HONORARY MEMBERS

Dr. Claus Petersen
Pediatric Surgeon-Retired
Dept. of Pediatric Surgery, Hannover Medical School
Hannover, Germany

GENERAL INFORMATION

“JOIN VIRTUAL SECTION”

SPECIAL GUESTS FROM
CHEST WALL INJURY SOCIETY (CWIS)
EUROPEAN SOCIETY OF THORACIC SURGEONS (ESTS)

THOMAS W. WHITE	**UNITED STATES**
SERVET BÖLÜKBAS	**GERMANY**
DANIEL MILLER	**UNITED STATES**
GIUSEPPE MARULLI	**ITALY**

“KEYNOTE LECTURE IN CRYOABLATION”
BY
ANDREA TRESCOT-UNITED STATES

GENERAL INFORMATION
INSTRUCTION FOR PRESENTERS

ORAL COMMUNICATIONS HAVE BEEN DIVIDED INTO FOUR GROUPS.

I: Wednesday 14th. 10:00-11:00
II: Wednesday 14th. 13:00-14:00
III: Thursday 15th. 12:00-13:00
IV: Friday 16th. 14:30-15:30

Please check in the SCIENTIFIC PROGRAM **the allotted time and group for your presentation.**
http://cwigcongressbarcelona2022.com

- All presenters should deliver their USB stick in the speakers preview area (designed in the congress venue) at least 30 min. Prior to the presentations.
- All presentations will be made through Laptop on the speakers' podium and not through personal PCs for compatibility safety.
- Data projectors for computer presentation from a Notebook or PC.
- If you have videos in your presentations should be in MP4 format.
- All **five minutes oral presentations**, including Case Report session, have three minutes for presentations and two minutes for discussion.

IT IS VERY IMPORTANT TO STAY WITHIN THE ALLOCATED TIME FRAME. OTHERWISE, YOUR PRESENTATION WILL BE DISCONTINUED BY THE SESSION CHAIRPERSONS.

GENERAL INFORMATION
INSTRUCTION FOR PRESENTERS

ALL ELECTRONIC-POSTERS WILL BE AVAILABLE DURING ALL THREE-DAYS MEETING IN THE POSTER ROOM.

POSTER DESIGN GUIDES

THE POSTER MUST BE DIGITAL, SIZE 70CM WIDE X 120CM TALL, VERTICAL VIEW, PDF FORMAT. USE THE FOLLOWING LINK TO ACCESS CWIG POSTERS FOLDER. UPLOAD YOUR POSTER AS A PDF FILE AND NAME IT

POSTERS-COMMUNICATIONS: WILL BE PRESENT AT THE LUNCH-TIME ON WEDNESDAY 14TH ON THE CONFERENCE ROOM.
Please check in the SCIENTIFIC PROGRAM **the allotted time for your presentation. http://cwigcongressbarcelona2022.com**

You will have **2 MINUTES FOR PRESENTATION AND 1 MINUTE FOR DISCUSSION.** We encourage you to respect the presentation time.
Use the following link to access CWIG Poster presentations folder. Upload your presentation as a Microsoft Power Point file with a maximum of 3 slides and name it.

WEDNESDAY, 14th SEPTEMBER

08:00-08:45 — **REGISTRY-DOCUMENTATION**

08:45-09:00 — **WELCOME**

Dr. ALBERT SALAZAR. CEO OF VALL D'HEBRON HOSPITAL
JOSE RIBAS MILANEZ CAMPOS. PRESIDENT OF CWIG
MANUEL LOPEZ. COMMITTEE CHAIRMAN

09:00-10:00 — **ROUND TABLE: CARDIO-PECTUS (4 LECTURES) 10-5 MIN**

MODERATOR: HANS PILEGAARD-ROBERT KELLY

09:00-09:15 — **DAWN JAROSZEWSKI**
09:15-09:30 — **MARCELO MARTINEZ-FERRO**
09:30-09:45 — **REBECCAH BROWN**
09:45-10:00 — **ANA LAIN**

10:00-11:00 — **ORAL COMMUNICATIONS I (12 PAPERS)**

3 min presentation -2min discussion
MODERATORS: LISA MCMAHON-MUSTAFA YUKSEL

10:00-10:05 — **The novel approach in sternal cleft repair**. Joao Paulo Cassiano Macedo, Jose Ribas M de Campos, Miguel Lia Tedde, Paulo M Pego-Fernandes.Hospital das Clinicas da Faculdade de Medicina de São Paulo,Brazil.

10:05-10:10 — **Technical adaptation of first rib resection by VATS for the Thoracic Outlet Syndrome**. Joao Paulo Cassiano, Jose Ribas M de Campos, Alessandro W Mariani, Mario Ghefter, Paulo M Pego-Fernandes.Hospital das Clinicas da Faculdade de Medicina de São Paulo, Brazil.

10:10-10:15 — **The place of thoracostomy-thoracomyoplasty in the management of chronic pleural empyema.** lakranbi Marouane,F. Lamouime, M. Rhaouti, H. Harmouchi, Maha Tachaouine , Y. Ouadnouni,M. Smahi. University Hospital Fez Morocco.

10:15-10:20 — **Principals of sternal repair after sternal dehiscence. A tertiary care single center experience.** Nora Mayer,M.Kapdagli, P.Perikleous, F.De Robertis, J. Finch, N. Asadi, E. Beddow, V. Anikin. Harefield Hospital. London, UK.

10:20-10:25 — **Sternal cleft repair and prevention of pectus excavatum in newborns: a combined approach.** Michele Torre, Girolamo Mattioli, Federica Lena, Liliana Piro.I RCCS G. Gaslini Hopital. Genova,Italy

10:25-10:30 — **Preoperative Nuss procedure metal allergy patch testing results in an increase in titanium bar utilization without effectively identifying patients who develop clinical metal allergy.** Krista Lai,Vijay Viswanath, Benjamin E Padilla, Zeb Hunteman, Melissa Nguyen, Justin Lee, Daniel Ostlie, Lisa McMahon, David M Notrica. Phoenix Children's Hospital. USA.

WEDNESDAY, 14th SEPTEMBER

10:30-10:35	**The impact of the Eckart Klobe vacuum bell device on the quality of life of children and young people.** Ashley Johnstone,Lori Ellis, James Andrews, Carl Davis, Kath Sharp. Royal Hospital for Children, Glasgow,Scotland.
10:35-10:40	**Cardio-Pulmonary function in adolescents with Pectus Excavatum and the impact of surgical intervention.** Paul Burns,C Davis, J Andrews, M Jacovides, A Johnstone, R Langley, P Davies. Royal Hospital for Children, Glasgow, Scotland
10:40-10:45	**The Quality of Life of Children and Adolescents with Anterior Chest Wall Deformity.** Ashley Johnstone,Carl Davis, James Andrews, Kath Sharp, Nicola Roberts. Royal Hospital for Children, Glasgow, Scotland
10:45-10:50	**Surgical Reconstruction of the Pectus Arcuatum Using Chondrosternoplasty.**Tunc Lacin,Esra Yamansavcı Sirzai, Sezer Aslan, Gamze Gul Tiryaki, Jeyhun Pashayev, Reyhan Ertan. Turkey
10:50-10:55	**Pectus Carinatum treatment: our 35 cases open surgery experience.** Volkan Karaçam,Fatma Mutlu, Umut Öykü Iskenderoğlu, Aydin Şanli. Turkey
10:55-11:00	**18 years of experience in Minimally Invasive Pectus Surgery: Bar Removal.** Nezih Onur Ermerak,Sezer Aslan, Esra Sirzai, Tunc Lacin, Mustafa Yuksel.Marmara University, Department of Thoracic and Esophageal Surgery. Istanbul, Turkey
11:00-11:30	**COFFEE BREAK**
11:30-12:00	**"PRESIDENTIAL ADDRESS" JOSE RIBAS MILANEZ CAMPOS** **INTRODUCTION: FRANK-MARTIN HAECKER**
12:00-13:00	**ROUND TABLE "CRYOANALGESIA"** **MODERATORS: HYUNG JOO PARK-REBECCAH BROWN**
12:00-12:20	**"KEYNOTE LECTURE" BY ANDREA TRESCOT (20 MIN)**
12:20-12:30	**ROBERT KELLY. Norfolk, USA**
12:30-12:40	**SUNGSOO LEE. Seoul, South Korea**
12:40-12:50	**GASTON BELLIA. Buenos Aires, Argentina**
12:50-13:00	**LAURA GARCIA. Barcelona, Spain**

WEDNESDAY, 14th SEPTEMBER

13:00-14:00

ORAL COMMUNICATIONS II (12 PAPERS)
3 min presentation -2min discussion
MODERATORS: IVAN SCHEWITZ-CLAUS PETERSEN

13:00-13:05 **Lightweight disposable elastomeric PCA versus standard syringe driver PCA**. Karen Mackintosh, Ashley Johnstone, Margaret Canning, Graham Bell. NHS Greater Glasgow

13:05-13:10 **Ultrasound-Guided Percutaneous Cryoanalgesia for Pectus Excavatum: Same Day, 24 Or 48 Hs Before**. María Velayos López, Karla Estefanía, Mercedes Alonso, Antonio J Muñoz, Raquel Torres, Francisco Reinoso-Barbero, Carlos De la Torre. Hospital Universitario La Paz, Madrid.

13:10-13:15 **Cryoanalgesia in combination with the novel pre-habilitation program 'Back on feet' are the essential parts of ERAS protocol in the surgical treatment of children with funnel chest deformation.** Slawomir Zacha, Barbara Jastrzębska, Aleksander Szwed, Agata Andrzejewska, Elżbieta Modrzejewska, Karolina Skonieczna-Żydecka, Honorata Mruk - Mazurkiewicz, Jowita Biernawska. Department of Paediatric Orthopaedics and Oncology of the Musculoskeletal System of the Pomeranian Medical University in Szczecin. Poland.

13:15:13:20 **Forgotten Branch of the Intercostal Nerve: Implication for Cryoablation Nerve Block for Pectus Excavatum Repair.** Joel Talsma, Melanie Kusakavitch, Dawon Lee, Christoph Niederhauser, Doruk Ozgediz, Olajire Idowu, Sunghoon Kim. University of California San Francisco. USA

13:20:13:25 **Intercostal Nerve Cryoablation for Surgical Correction of Pectus Excavatum: Operative Experience with One Minute Ablation.** Suhail Zeinddin, Samuel C. Linton, Michela Carter, J. Benjamin Pitt, Guillermo Ares, Jesse Arseneau, Fizan Abdullah, Seth D. Goldstein, MPhil. Ann & Robert H. Lurie Children's Hospital of Chicago. USA.

13:25:13:30 **Improved outcomes with increasing Expertise in Thoracoscopic Intercostal Cryoanalgesia during MIRPE: Insights from a single-center consecutive cohort of 136 patients treated within 5 years.** Toselli Luzia, Bellia-Munzón G, Sanjurjo D, Vallee M, Martinez-Ferro M. Fundacion Hospitalaria. Buenos Aires, Argentina.

13:30:13:35 **Intraoperative cryoanalgesia vs. epidural anesthesia in multimodal pain management after Nuss procedure.** Sjoerd de Beer, Jong de JR, Oomen MW, Zwaveling S, Heurn van LWE. Amsterdam UMC.

13:35-13:40 **Three Year Experience with Percutaneous Cryoanalgesia. What We Have Learned**. Carlos de la Torre Ramos, M. Velados, M.Alonso. Hospital Universitario La Paz, Madrid.

13:40-13:45 **Cryo-Intercostal Nerve Ablation: An Old Technique for a New Application for Pain Management after Pectus Excavatum Repair.** Hyung Joo Park, Gong Min Rim. Seoul St. Mary's hospital.

13:45-13:50 **Results of Orthosis Application in Pediatric Age Group Pectus Carinatum Patients.** Esra Yamansavcı Sirzai, Nezih Onur Ermerak, Tunç Laçin, Mustafa Yüksel. Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital. Istanbul, Turkey.

13:50-13:55 **Early modifications in pressure of correction and treatment in pectus carinatum patients undergoing treatment with a dynamic** compressor **system.** Toselli Luzia, Chinni E, Vallee M, Sanjurjo D, Elmo G, Bellia-Munzón G. Fundacion Hospitalaria. Buenos Aires, Argentina.

WEDNESDAY, 14th SEPTEMBER

13:55-14:00

Results of Vacuum Therapy in Pediatric Age Group Pectus Excavatum Patients. Esra Yamansavcı Sirzai, Sirzai, Nezih Onur Ermerak, Tunç Laçin, Mustafa Yüksel. Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital. Istanbul, Turkey

14:00-15:00

OPEN LUNCH

14:00-15:00

POSTERS WITH DISCUSSION
MODERATORS : JEAN-MARIE WIHLM-GASTON BELLIA

14:00-14:03

Functional upper limb assessment after sternal clavicular joint resection without prosthetic reconstruction. Joao Paulo Cassiano Macedo, Alessandro W Mariani, Paulo M Pego-Fernandes, Ricardo M Terra. Hospital das Clinicas da Faculdade de Medicina de São Paulo,Brazil.

14:03-14:06

Pushing the Boundaries of MIRPE: First Experience with a Four-Bar Technique. Mustafa Yuksel,Hasan Ersoz.Izmir Katip Celebi University, Faculty of Medicine, Department of Thoracic Surgery, Izmir,Turkey.

14:06-14:09

Evaluation of thoracic vertebrae rotation and deformity in patients with chest wall deformities using dynamic surface topography. Rohleder, Stephan,Wolf C., Konradi J., Koenig T., Betz U., Schwind M. Department of Pediatric Surgery, University Medical Center Mainz, Germany.

14:09-14:12

Translation, cultural adaptation and linguistic validation of the Pectus Excavatum Evaluation Questionnaire. Nicky Janssen, Jean HT Daemen, Elise J van Polen, Yanina JL Jansen, MD Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos.Zuyderland Medical Center, Heerlen, Netherlands.

14:12-14:15

3D printed titanium bar in MIRPE - case report. Marian Molnar,Barbora Spakova, Anton Dzian. Universtiy Hospital Martin, Slovakia

14:15-14:18

Modification of the Abramson procedure for minimal invasive repair of pectus carinatum: introduction of a Pectus Carinatum System; Preliminary Results. Nicky Janssen,Jean HT Daemen, Yanina JL Jansen, Hans G. Van Veer, Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos. Zuyderland Medical Center, Heerlen, Netherlands.

14:18-14:21

New pectus-up system for surgical correction of pectus excavatum: importance of the correct screw fixation. Yury Bellido Reyes, Sara Vicente Antunes, José Zapatero Gaviria, Pablo Fernandez Gómez Escolar, David Rincon García, Juan Manuel Corral Cano, Lisette Rico Martine, Rodrigo Arroyo Fernandez, Ignacio Muguruza Trueba, Ignacio. Grupo Hospitales Públicos QuironSalud. Madrid, Spain.

14:21-14:24

Causes of Vacuum Bell Treatment Withdrawal: Insights from a series of 186 patients over a 7-year period. Luzia Toselli, Vallee Maxroxia, Bellia-Munzon Gastón, Sanjurjo Daniela, Elmo Gastón, Martinez-Ferro Marcelo. Fundación Hospitalaria. Buenos Aires, Argentina.

14:24-14:27

Pectus Arcuatum: description of a hybrid surgical technique. Isabel González, Ana Laín, Laura García, Carlos Giné, Rodrigo Maluje, Manuel López. Vall d'Hebron Hospital. Barcelona, Spain.

WEDNESDAY, 14th SEPTEMBER

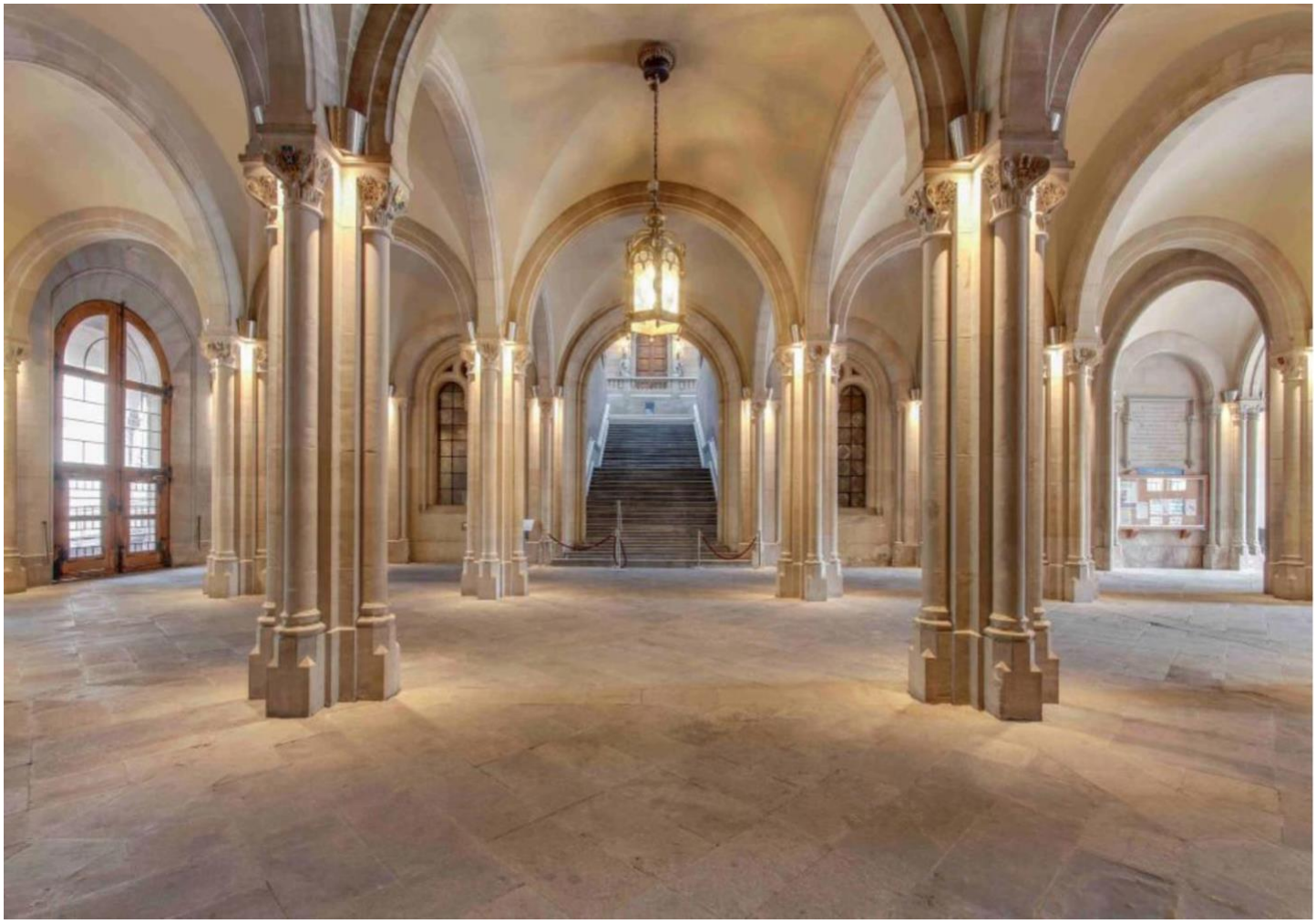
14:27-14:30	**Surgical Repair of Pectus Carinatum and Mixed Deformities: The Sandwich Technique.** Kwanyong Hyun, Hyung Joo Park. Seoul St. Mary's Hospital. Seoul, South Korea.
14:30-14:33	**Impact of Chest Wall Resection After Neoadjuvant therapy in Lung Resection Patients for Non-Small Cell Lung Cancer**
	Sternal Cleft: Case Series. Esra Yamansavcı Sirzai, Mustafa Yuksel, Salih Cüneyt Aydemir, Ilhan Ocakcioglu, Oğuzhan Özyurtkan. Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital. Turkey
14:33-14:36	**Single-stage approach for correction of pectus excavatum and open-heart surgery: Multicenter Data.** Nezih Onur Ermerak, Firas Abu-Akar, Murat Akkus, Dawn Jaroszewski, Vladimir Kuzmichev, Tunc Lacin, Esra Sirzai, Mustafa Yuksel. Marmara University, Department of Thoracic and Esophageal Surgery, Istanbul,Turkey.
14:36-14:39	**Minimally Invasive Repair of Pectus Excavatum.** Tunc Lacin, Esra Yamansavci Sirzai, Nezih Onur Ermerak, Sezer Aslan, Gamze Gul Tiryaki, Jeyhun Pashayev, Reyhan Ertan, Mohamad Kenan Atasi. Marmara University, Department of Thoracic and Esophageal Surgery, Istanbul,Turkey.
14:39-14:42	**Chest Wall Reconstruction with Prosthetic Materials.** Tunc Lacin, Nezih Onur Ermerak, Esra Yamansavci Sirzai, Sezer Aslan, Gamze Gul Tiryaki, Jeyhun Pashayev, Reyhan Ertan, Mohamad Kenan Atasi, Bedrettin Yıldızeli. Marmara University, Department of Thoracic Surgery, Istanbul, Turkey
14:42-14:45	**Fluid collections complications after Nuss procedure in paediatric patients: Can we predict them?** Alejandra Castrillo, Ana Laín, Laura García, Carlos Giné, Rodrigo Maluje, Haider Ali Khan, Manuel López. Vall d'Hebron Hospital. Barcelona, Spain.
14:45-14:48	**Management of fluid collections after Nuss procedure in pediatric patients: a single center Experience.** Khan Riaz Haider Ali, Laín A, García L, Giné C, Maluje R, Castrillo A, López M. Vall d'Hebron Hospital. Barcelona, Spain.
14:48-14:51	**The perfect shape of the pectus bar for the Nuss procedure.** Ivan Schewitz. Netcare Waterfall City Hospital. Pretoria, South Africa.
14:51-14:54	**Surgical Management of Pectus Excavatum and Pulmonary Bula Via Single Port. A Rare Congenital Association.** Emmanuel Peña**,** Peiro Osuna R. P, Hernández Arguelles E. Solorzano Campos L.M. Casillas Enríquez J. D. Montiel Bravo G. Posadas Trujillo O.E. Olaya López E. García Villalvazo S. L. Salvador Zubirán National Institute of Medical Sciences and Nutrition. Mexico.
14:54-14:57	**Pectus Up New Generation: extrathoracic technique for Pectus Excavatum treatment.** Juan José Fibla Alfara. Hospital Universitari Sagrat Cor de Barcelona – Grupo Quirón. Spain
15:00-16:00	**LIVE TRANSMISSION FROM DRY-LAB (MANIKIN SIMULATORS) MODERATORS: JOSE RIBAS & MARCELO MARTINEZ-FERRO**
16:00-18:00	**DRY-LAP - GROUPS 1-2**
16:30-17:00	**OPEN COFFEE BREAK**
19:3021:00	**WELCOME RECEPTION**

WELCOME RECEPTION

Gran Vía de les Corts Catalanes, 585 080007 Barcelona

HOW TO GET: https://goo.gl/maps/iuAe2

https://www.youtube.com/watch?v=m4hzeAn50rM&t=15s



MAIN HALL OF THE HISTORIC BUILDING

THURSDAY, 15th SEPTEMBER

08:00-09:00 — **DRY-LAP GROUP 3**

09:00-09:45 — **LECTURES I (3) 15 MIN EACH**
MODERATORS: FRANK MARTIN HAECKER- HANS PILEGAARD
DONALD NUSS. LEADERSHIP & COORDINATION IN PECTUS TEAM
ANDRE HEBRA. PREVENTING MAJOR COMPLICATIONS DURING PECTUS SURGERY
MUSTAFA YUKSEL. THREE BARS TECHNIQUE IN NUSS PROCEDURE

09:45-10:00 — **LIVE SURGERY "CASE PRESENTATION" (CASE 1 & 2)**

10:00-12:00 — **LIVE SURGERIES 1 & 2**
MODERATORS: AUDITORIUM: RIBAS MILANEZ CAMPOS
OR: MARCELO MARTINEZ FERRO

10:30-11:00 — **OPEN COFFEE BREAK**

12:00-13:00 — **ORAL COMMUNICATIONS III (12 PAPERS)**
3 min presentation -2min discussion
MODERATORS: MAIRA KALIL- FRANK MARTIN HAECKER

12:00-12:05 — **Does overcorrection of the sternum position in the initial Nuss procedure in pectus excavatum patients treated in the pre-pubertal period prevent recurrence with growth?** Masahiko Noguchi,Kou Hasegawa, Nagano Children's Hospital. Japon.

12:05-12:10 — **Evaluation of MIRPE Success in Patients Aged Forty and Over.** Hasan Ersoz, Rezzan Karaali, Mustafa Yüksel.Izmir Kâtip Çelebi University- Izmir,Turkey

12:10-12:15 — **Simultaneous Treatment of Chest Wall Deformity, Scoliosis and Kyphosis.** Ikromjon Uralboev, Khamdamov M.M., Shadieva Kh.N., Woo Sunyoung.Samarkand Regional Children's Multibranch Medical Center, Samarkand Medical University, Uzbekistan.

12:15-12:20 — **A method for correcting Acquired Pectus Carinatum (APC) using an orthosis after open heart surgery (sternotomy) in children.** Ikromjon Uralboev, Khamdamov M.M., Shadieva Kh.N., Woo Sunyoung.Samarkand Regional Children's Multibranch Medical Center, Samarkand Medical University, Uzbekistan.

12:20-12:25 — **Short-, Cross-, and Sandwich bars – New Techniques in Pediatric Pectus Surgery.** Anja Christina Weinhandl, Wiener Caspar, Yüksel Mustafa, Rebhandl Winfried. Department of Pediatric surgery, Medical University of Vienna, Vienna

THURSDAY, 15th SEPTEMBER

12:25-12:30 12:30:12:35 12:35-12:40 12:40-12:45 12:45-12:50 12:50-12:55 12:55-13:00	**Clavicle-Bar Distance: A Practical New Measure to Evaluate Bar Displacement after Minimally Invasive Repair of Pectus Excavatum (MIRPE).** Alana Cozzer Marchesi, José Ribas Milanez de Campos, Miguel Lia Tedde, Aldo Parodi Pita, Vanessa Moreira, Paulo Manuel Pêgo Fernandes. University of São Paulo, Brazil **Pericardial agenesis is not a contraindication for the Nuss procedure: a case report.** An-Lies Provoost,Willy Coosemans, Hans Van Veer. University Hospitals Leuven, Belgium. **Nuss bar removal without straightening is a safe technique: A single center experience.** Nicky Janssen, Jean HT Daemen, Omar Ashour, Luca van Hulst, Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos. Zuyderland Medical Center, Heerlen, Netherlands **Consensus Statement: Perioperative Care for Pectus Excavatum; an Expert-Led Modified Delphi Survey among Chest Wall International Group Members.** Nicky Janssen, Jean HT Daemen,Elise J van Polen, Yanina JL Jansen, Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos. Zuyderland Medical Center, Heerlen, Netherlands **Nuss Procedure, Easier, Faster and Safer with A "Non-Invase or Minimal-Invasive" Sternal Elevation Maneuver.** Alana Cozzer Marchesi, José Ribas Milanez de Campos, Miguel Lia Tedde, Aldo Parodi Pita, Vitor Floriano Salomão Junior, Carlos C. Carita, Paulo Manuel Pêgo Fernandes, Hyung Joo Park. University of São Paulo,Brazil. **A Current Modification of MIRPE: Cross-Bar Technique –Multicenter Retrospective Study.** Hasan Ersöz, Rezan Karaali, Vladimir Kuzmichev, Winfried Rebhandl, Firas Abu Akar, Marouane Lakranbi, Mustafa Yüksel. Izmir Katip Celebi University, Faculty of Medicine, Department of Thoracic Surgery. Turkey **Vacuum Bell Treatment of Pectus Excavatum in Children: Our Experience.** Marcos Prada Arias, Javier Gómez Veiras, Belén Aneiros Castro, Patricia Rodríguez Iglesias, Pilar Fernández Eire, Margarita Montero Sánchez. Department of Pediatric Surgery. Galicia Sur Health Research Institute. University Hospital Álvaro Cunqueiro, Vigo, Galicia, Spain
13:00-13:30	**LUNCH-BOX**
13:30-13:45	**LIVE SURGERIES-CASE PRESENTATION (CASE 3 & 4)**
13:45-15:45	**SURGERIES 3 & 4** **MODERATORS: AUDITORIUM: ANDRE HEBRA** **OR: MARCELO MARTINEZ FERRO**

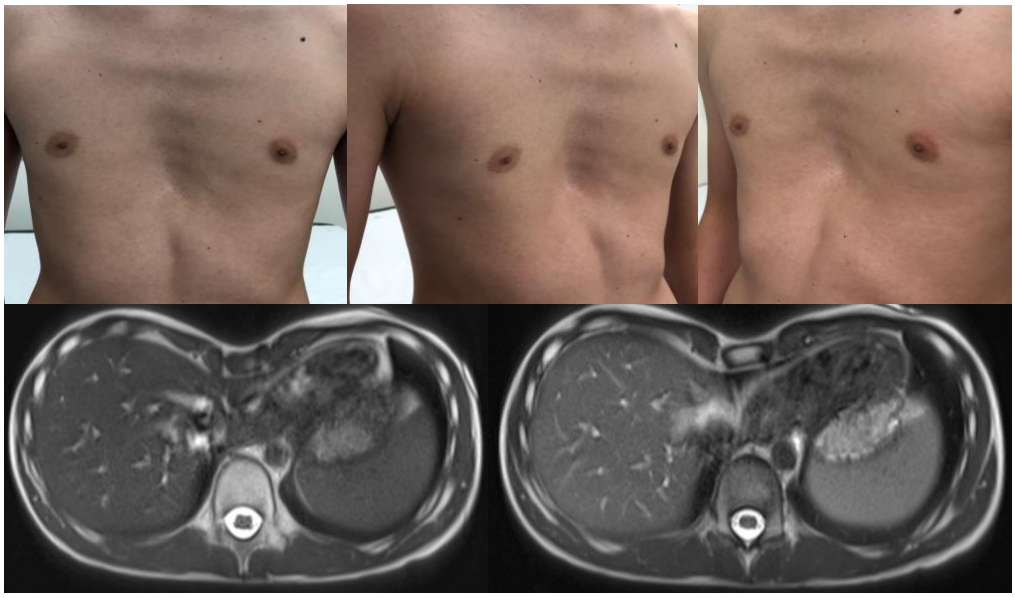
THURSDAY, 15th SEPTEMBER

15:45-16:15	**COFFEE BREAK**
	LECTURES II (5) 15 MIN EACH
16:15-17:30	**MODERATORS: DONALD NUSS-SADASHIGE UEMURA**
16:15-16:30	COSTAL FLARING WITH OR WITHOUT PECTUS. **JEAN-MARIE WIHLM.**
16:30-16:45	REVIEW OF INDICATIONS OF NUSS PROCEDURE. **ANTONIO MESSINEO.**
16:45-17:00	20 YEARS OF HISTORY OF VACUUM BELL. **FRANK-MARTIN HAECKER.**
17:00-17:15	METAL ION ABSORTION AFTER PECTUS BAR INSERTION **CAROLINE FORTMANN.**
17:15-17:30	ASYMPTOMATIC PEX TREATMENT WITH 3D CUSTOM-MADE IMPLANTS. BEST INDICATIONS AND RESULTS: A MULTIDISCIPLINARY EXPERIENCE IN EUROPE**.** **JEAN-PIERRE CHAVOIN.**
17:30-18:00	**ROUND TABLE IN "STERNAL ELEVATION" 3 LECTURES. 10 MIN 6-4 MODERATOR: DAWN JAROSZEWSKI**
17:30-17:40	**HYUNG JOO PARK**
17:40-17:50	**HANS PILEGAARD**
17:50-18:00	**ROBERT OBERMEYER**
18:00-18:30	**EXECUTIVE BOARD MEETING**

THURSDAY, 15th SEPTEMBER
CASE PRESENTATION 1 & 2

LIVES SURGERIES
MODERATORS :
AUDITORIUM : JOSE RIBAS MILANEZ CAMPOS
OPERATIVE ROOM: MARCELO MARTINEZ FERRO

PECTUS EXCAVATUM



SURGEONS :
ROBERT KELLY-ROBERT-OBERMEYER-MANUEL LOPEZ

THURSDAY, 15th SEPTEMBER
CASE PRESENTATION 1 & 2

MODERATORS :

AUDITORIUM : JOSE RIBAS MILANEZ CAMPOS

OPERATIVE ROOM : MARCELO MARTINEZ FERRO

PECTUS CARINATUM

SURGEONS:

HYUNG JOO PARK-ANA LAIN

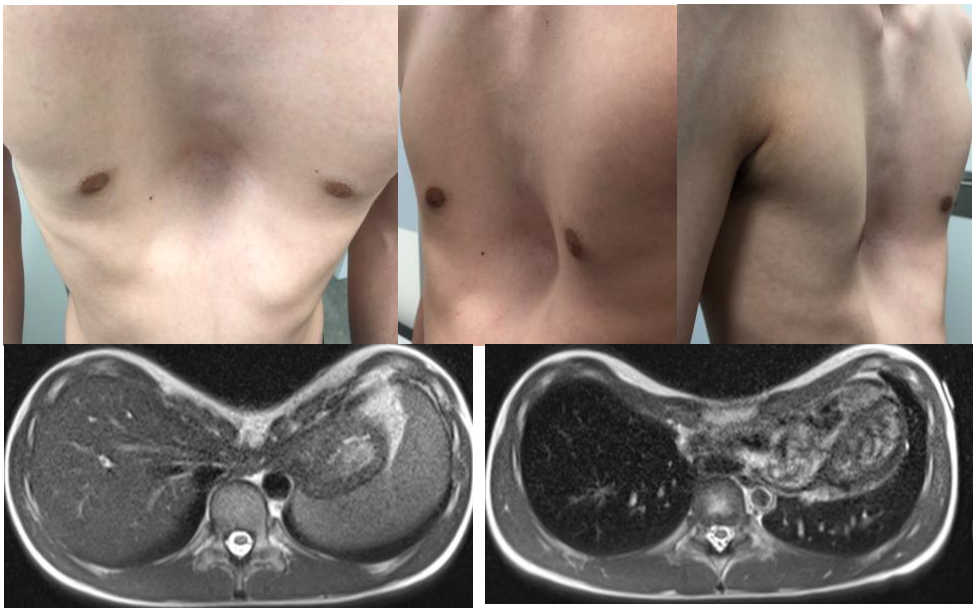
THURSDAY, 15th SEPTEMBER
CASE PRESENTATION 3 & 4

MODERATORS:

AUDITORIUM: ANDRE HEBRA

OPERATIVE ROOM: MARCELO MARTINEZ FERRO

PECTUS EXCAVATUM



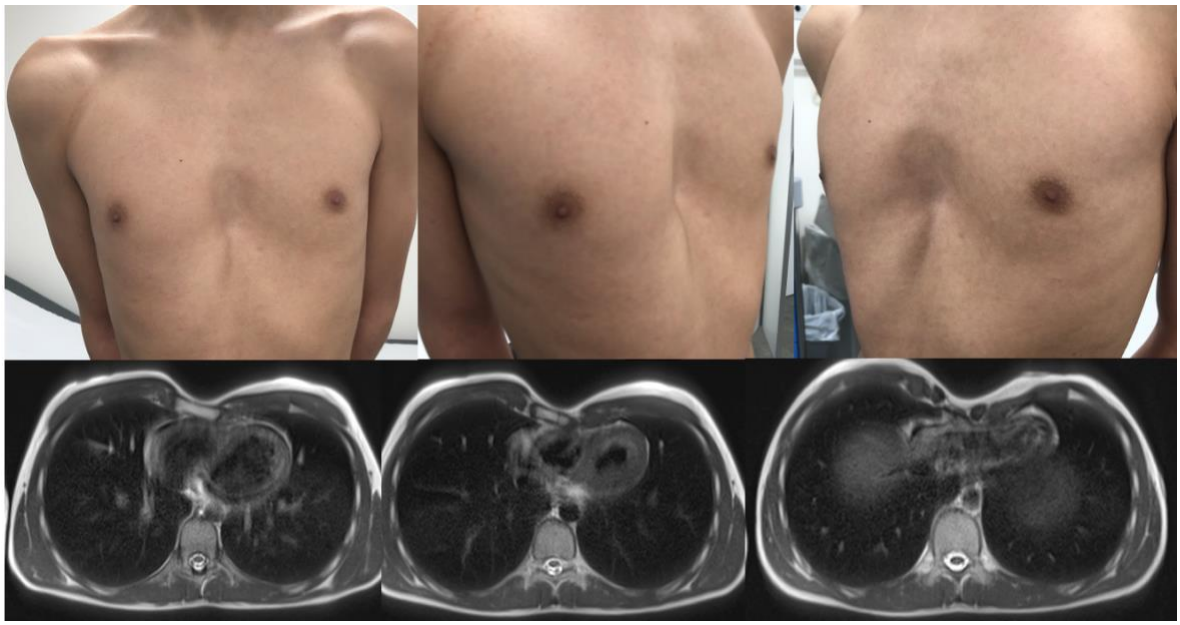
SURGEONS

DAWN JAROSZEWSKI – ANA LAIN

THURSDAY, 15th SEPTEMBER
CASE PRESENTATION 3 & 4

MODERATORS:
AUDITORIUM: ANDRE HEBRA
OPERATIVE ROOM: MARCELO MARTINEZ FERRO

"CRANE-POWERED ENTIRE CHEST WALL REMODELING"



SURGEONS:
HYUNG JOO PARK-MANUEL LOPEZ

	FRIDAY, 16th SEPTEMBER
08:00-09:00	**DRY-LAP GROUP 4**
09:00-09:30 **09:00 -09:15** **09:15 -09:30**	**LECTURES III (2) 15 MIN EACH** **MODERATORS: SUNGSOO LEE-CAROLINE FORTMANN** ENTIRE CHEST WALL REMODELING. **HYUNG JOO PARK.** RECURRENCE OF PEX AFTER BARREMOVAL. **SADASHIGE UEMURA.**
09:30-09:45	**LIVE SURGERIES-CASE PRESENTATION (CASE 5 & 6)**
09:45-13:00	**SURGERIES 5 & 6** **MODERATORS:** **AUDITORIUM: LISA MCMAHON** **OPERATIVE ROOM: DAWN JAROSZEWSKI**
10:30-11:00	**OPEN COFFEE BREAK**
13:00-13:30 **13:00-13:15** **13:15-13:30** **13:30-13:33**	**LECTURES IV (2) 15 MIN EACH** **MODERATORS: HYUNG JOO PARK** UPDATE OF ABRAMSON TECHNIQUE. **HORACIO ABRAMSON** SLIPPING RIBS. **LISA MCMAHON.** **Minimal invasive approach of Slipping Rib Syndrome: Case Report.** Carmen López, Ana Laín, Laura García, Carlos Giné, Iván Villaverde, Rodrigo Maluje, Manuel López. Vall d'Hebron H. Barcelona,Spain
13:30-14:30	**OPEN LUNCH** **POSTERS -VISITING**

FRIDAY, 16th SEPTEMBER

14:30-15:30

ORAL COMMUNICATIONS IV (12 PAPERS) (3-2MIN) MODERATORS: ROBERT OBERMEYER-IVAN SCHEWITZ

14:30-14:35

A new option for chest wall reconstruction in the patients undergoing thoracectomy. Joao Paulo Cassiano Macedo, Jose Ribas M de Campos, Pedro H N Xavier de Araujo, Paulo M Pego-Fernandes, Ricardo M Terra. Hospital das Clinicas da Faculdade de Medicina de São Paulo, Brazil.

14:35-14:40

Ribcare® Universal Modular Self-Assembly Chest Wall Reconstruction System. Joonsuk Park, Yoonji Jung. Seongnam Citizen's Medical Center, Gyeonggido, Korea

14:40-14:45

New Technique for the Reconstruction of Sterno-Clavicular Block with A 3d Planned Functional Customized Prosthesis. Unai Jimenez Maestre, Jose Ramón Cano, Odile Ojanguren, Donato Monopoli, Juan Carlos Rumbero, Naia Uribe-Etxebarria, Monica Lorenzo, Lucía Hernandez, Marta Fernando, Claudia Loidi, Oscar Ruiz, Rafael Rojo. Cruces Universitary Hospital. Spain.

14:45-14:50

Innovative Modified Abramson Technique for Older Patients. Claudio Andreetti, Peritore Valentina, Teodonio Leonardo, Argento Giacomo, Tiracorrendo Matteo, Ibrahim Mohsen, Maurizi Giulio, Ciccone Anna Maria, Rendina Erino Angelo. Sapienza University of Rome, Italy.

14:50-14:55

Sternectomy and sternal reconstruction with titanium bars over latissimus dorsi flap without prosthetic mesh. Saumench-Perramon, Roser, Rami-Porta, R. Hospital Dr. Trueta. Girona, Spain.

14:55-15:00

Chest wall reconstruction with titanium bars, porcine dermal collagen implant and latissimus dorsi falp after right upper lobectomy and chest wall resection. Saumench-Perramon, Roser, Rami-Porta, R. Hospital Dr. Trueta. Girona, Spain.

15:00-15:05

Minimally invasive repair of pectus carinatum by the Abramson method: A systematic review. Jean HT Daemen, Tessa C M Geraedts, Yvonne L J Vissers, Karel W E Hulsewé, Hans G L Van Veer, Horacio Abramson, Erik R de Loos. Zuyderland Medical Center.Netherland.

15:05-15:10

Surgical treatment of non-union rib fractures with titanium clips system. Pablo Moreno de la Santa. Hospital Ribera Povisa, Spain.

15:10-15:15

Outcomes from a Nurse Practitioner Led Dynamic Compression System Bracing Program for Pectus Carinatum. Stephen Trinidad, Emily McKenna, Todd Jenkins, Christina Bates, Aimee Kraemer, Abigail Sester, Victor F Garcia, Rebeccah L Brown. Cincinnati Children's Hospital Medical Center.USA.

15:15-15:20

Anterior Chest Wall resection and reconstruction for cancer: early and long-term results. Alessandro Gonfiotti, Domenico Viggiano, Ottavia Salimbene, Stefano Bongiolatti, Sara Borgianni, Luca Voltolini. Thoracic Surgery Unit, Careggi University Hospital, Florence, Italy.

FRIDAY, 16th SEPTEMBER

15:20-15:25	**Nitinol ribfixation combined with VATS minimally invasive alternative for conventional screw-plate fixation in acute flailchest and multiple ribfractures, leading to smaller incision size.** Pieter Jan Van Huijstee, A.P.A. Greeven. Haga Teaching Hospital, The Hague,Netherland.
15:25-15:30	**Preoperative planning and simulation of hybrid surgery for complex cases with Poland Syndrome using 3D technology.** Luzia Toselli, Ana Lain, Manuel Lopez, Laura García, Elena Arana, Daniela Sanjurjo, Maxroxia Vallee, Gastón Bellia. Hospital Vall D' Hebron- Fundación Hospitalaria. Buenos Aires-Argentina, Barcelona-Spain.

15:30-16:18	**FILMS-SECTIONS (15 MIN EACH 8-4 DISCUSSION)** **MODERATORS: REBECCAH BROWN- MAIRA KALIL**
15:30-16:42	NEWS STABILIZER FOR NUSS BAR. **MIGUEL TEDDE**
15:42-16:54	CRANE-POWERED ENTIRE CHEST WALL REMODELING IN REPAIR OF PECTUS CONCAVO-CONVEXUS. **HYUNG JOO PARK.**
15:54-16:06	POLAND SYNDROME. **MICHELLE TORRE.**
16:06-16:18	BOSTANSI NEW'S TECHNIQUE. **KORKUT BOSTANSI.**
16:18-16:50	**OPEN COFFEE BREAK**
16:50-17:50	**JOIN VIRTUAL SECTION (4 LECTURES)** **CWIS AND ESTS** **MODERATORS : JOSE RIBAS-JEAN-MARIE WIHLM**
16:50-17:05	**THOMAS W. WHITE.** RIB FRACTURE REPAIR: CURRENT CONCEPTS
17:05-17:20	**DANIEL MILLER.** OPTIMAL MANGEMENT OF ACUTE STERNAL & COSTOCONDRAL FRACTURE.
17:20-17:35	**GUISEPPE MARULLI.** MULTIDISCIPLINARY APPROACH FOR COMPLEX RESECTION AND RECONSTRUCTION OF CHEST WALL TUMORS
17:35-17:50	**SERVET BÖLÜKBAS.** PARTIAL & COMPLETE RESECTION AND RECONSTRUCTION OF THE STERNUM FOR BREAST CANCER METASTASIS.

FRIDAY, 16th SEPTEMBER

17:50-18:10

MY WORST NIGHTMARE

17:50-17:55

DEVASTATING NEUROLOGICAL COMPLICATION AFTER MINI-INVASIVE CORRECTION OF PECTUS. Pavol Omanik, Igor Beder. Pediatric Surgery Department, National Institute of Children's Diseases. Slovak Republic

17:55-18:00

ELEVATION OF THE STERNUM AND CARDIAC ARREST: A CASE OF "PERSEVERING" THORACOPLASTY. Roberto Lo Piccolo, F. Facchini, A. Martin, R. Coletta, E. Rovero, K.Bici, Z. Ricci, D. Albino, A. Morabito. Department of Pediatric Surgery, Meyer Children's Hospital, University of Florence, Florence, Italy.

18:00-18:05

SKIN EROSION AFTER ABRAMSON PROCEDURE AFTER TREATMENT FOR PNEUMOTHORAX: A CASE REPORT WARNING FOR MUSCLE WASTING FOLLOWING LONGSTANDING PAIN TREATMENT. Hans Van Veer, Silke Scheers, Willy Coosemans. University Hospitals Leuven, Dept. of Thoracic Surgery. Leuven, Belgium.

18:05-18:10

MY WORST NIGHTMARE. Maíra Kalil Fernandes, Camilla Matos Pedreira, Fernando Gomes Oliveira Neto, Gustavo Almeida Fortunato, Iury Andrade Melo, Sergio Tadeu Lima Fortunato Pereira. Hospital Santa Izabel,Brazil.

18:10-18:40

GENERAL ASSEMBLY
JOSE RIBAS-MARCELO MARTINEZ FERRO

20:30

GALA DINNER

FRIDAY, 16th SEPTEMBER
GALA DINNER
20:30

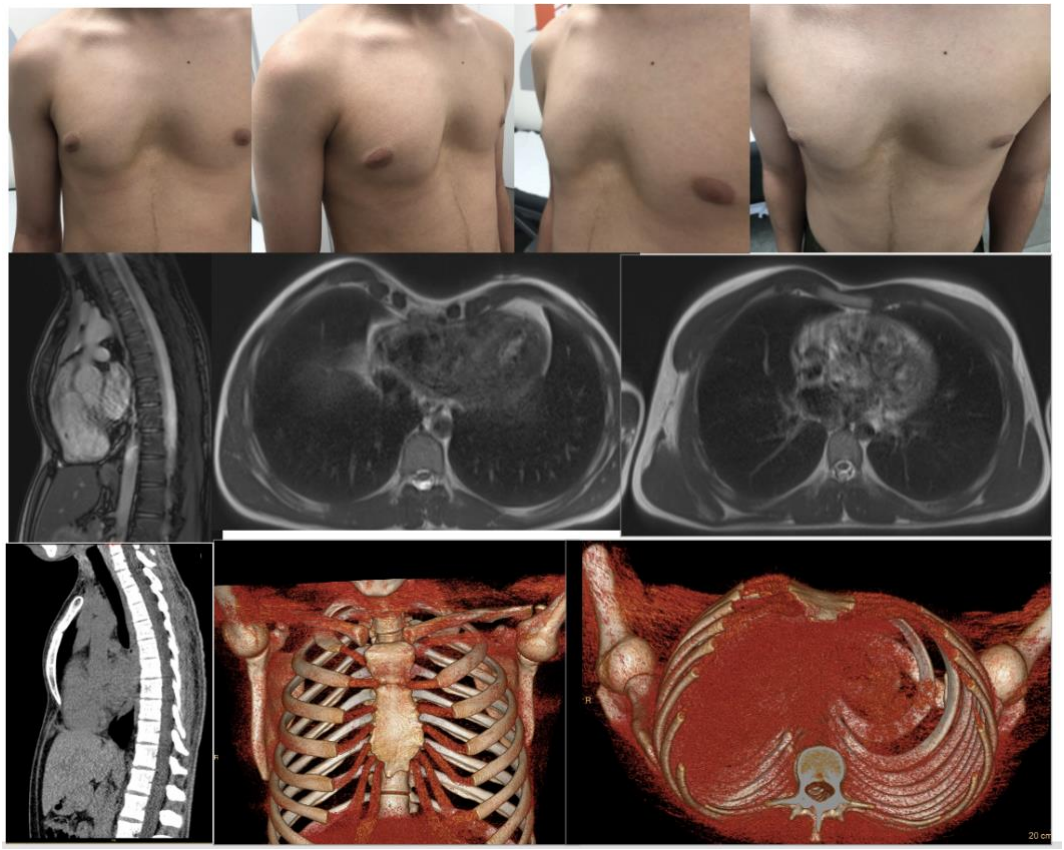
A bus will be available to pick you up at the hotel NEGRESCO PRINCESS and PLAZA CATALUNIA at 8:00 pm

AWARD TO HONORARY MEMBERS. JOSE RIBAS
HISTORY OF CWIG. MUSTAFA YUKSEL

FRIDAY, 16th SEPTEMBER
LIVES SURGERIES
5 & 6

MODERATORS:
AUDITORIUM: LISA MCMAHON
OPERATIVE ROOM: DAWN JAROSZEWSKI

CURRARINO SILVERMAN

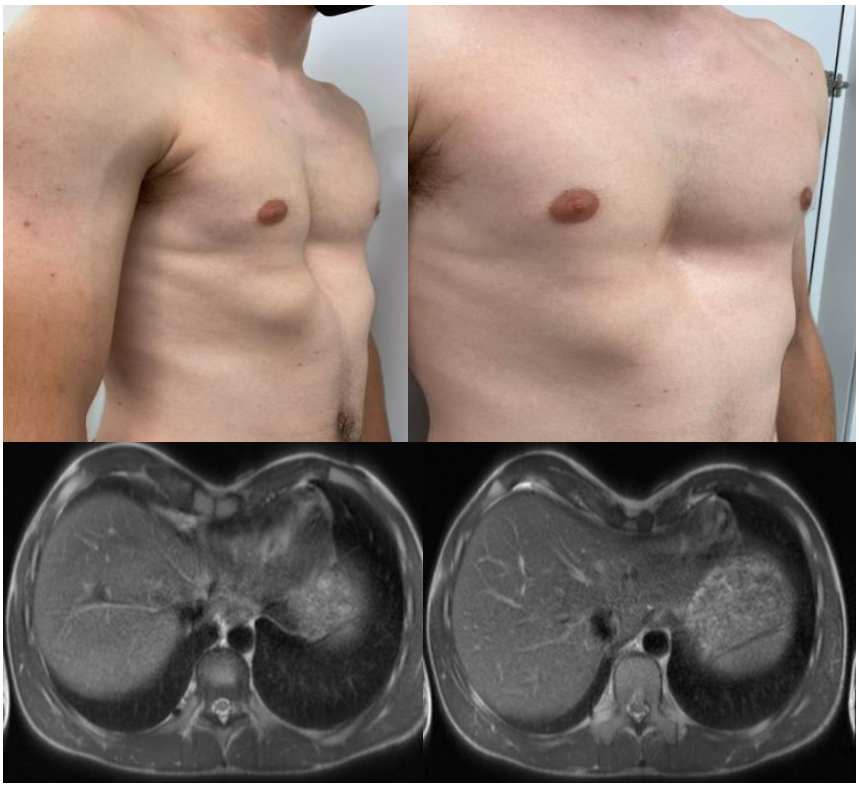


SURGEONS: JOSE RIBAS MILANEZ CAMPOS-LAURA GARCIA

FRIDAY, 16th SEPTEMBER
LIVES SURGERIES
5 & 6

MODERATORS:
AUDITORIUM: LISA MCMAHON
OPERATIVE ROOM: DAWN JAROSZEWSKI

PECTUS EXCAVATUM & CRYOANALGESIA BY THORACOSCOPY



SURGEONS:

MARCELO MARTINEZ-FERRO-GASTON BELLIA-MANUEL LOPEZ

POSTERS

Severe complications after reconstructive chest wall surgery. Marco N Andreas, Julia Strauchmann, Johann Pratschke, Jens-Carsten Rückert, Elsner Aron. Charité Hospital - Universitätsmedizin Berlin, Germany.

Chest Wall School. Ashley Johnstone,James Andrews, Carl Davis, Graham Bell, Kay Reilly, Kath Sharp Royal Hospital for Children, Glasgow, Scotland

A 16-year-old with Severe Pectus Excavatum, kyphoscoliosis and Marfan syndrome. Paul Burns, C Davis, A Johnstone. Royal Hospital for Children, Glasgow, Scotland

Chest Wall Reconstruction with No Visible Bone Callus In Complex Ribs Fractures. Emmanuel Peña Gomez Portugal, Hernández Arguelles E. Solorzano Campos L. Peiro Osuna P. Casillas Enríquez J. D. Bolaños Morales F. Zavala Vázquez S. Sánchez Pereda D. Ceballos Villalva C. Montiel Bravo G. Posadas Trujillo O.E. Salvador Zubirán National Institute of Medical Sciences and Nutrition. Mexico Vall d'Hebron Hospital. Barcelona General Hospital of Pachuca Hidalgo. Mexico

Costochondral Synostosis Case Report and Surgical Management. Emmanuel Peña Gomez Portugal, Peiro Osuna R.P. Hernández Arguelles E. Solorzano Campos L.M.M. Bolaños Morales F. Zavala Vázquez S. Sánchez Pereda D. Ceballos Villalva C. Casillas Enríquez J. D. Posadas Trujillo O. E. Salvador Zubirán National Institute of Medical Sciences and Nutrition. Mexico Vall d'Hebron Hospital. Barcelona General Hospital of Pachuca Hidalgo. Mexico

Surgical treatment of Pectus Excavatum: Mini Invasive Repair of Pectus Excavatum vs Sternal prosthesis implantation. Flavio Facchini, Antonio Messineo, Alessandra Martin, Roberto Lo Piccolo, Fabio Dell'Otto, Valentina Gatti, Antonino Morabito. Meyer Children's Hospital, Florence, Italy

Resection and Reconstruction of A Chest Wall Hamartoma in a 13 month-old. Tunc Lacin, Esra Yamansavci Sirzai, Gamze Gul Tiryaki, Sezer Aslan. Marmara University, Department of Thoracic Surgery, Istanbul, Turkey

Rhabdomyolysis Following Nuss Procedure: A Prospective Study in Children. Carlos de la Torre Ramos, K. Estefanía, C. Fernández. Hospital La Paz, Madrid, Spain.

Dermatofibrosarcoma protuberans: an agressive thoracic tumor managed with a combined technique. Maíra Kalil Fernandes, Camilla Matos Pedreira, Ricardo Lopes de Moraes Oliveira, José Dias Andrade Neto, Caio Diniz Chalhoub Coelho Lima, Sérgio Tadeu, Lima Fortunato Pereira. Hospital Santa Izabel, Brazil

DRY-LAP
Work with Newest Chest Wall Instrumentation

Conference agenda will include hands-on learning sessions in a simulation lab with brand new pectus equipment from Zimmer Biomet, Metrum Cryoflex Atricure, PrimeMed Korea, MedXpert, Ventura Medical.

SIMULATION LAB

Simulation and immersive learning lab allow in-person participants the opportunity to maneuver freely among multiples stations and perform various steps of the Nuss technique, Sternal elevation, Cryoablation, rib fracture plating, Pectus-Up.

Different simulators with the newest industry will be used to learn. For the Nuss procedure we have the support from Stryker.

The Hands-On Workshop will consist of 6 stations and will be carried out under medical direction.

STATIONS

STATION 1	**PRIMEMED TECHNIQUE** **Hyung Joo Park, MD, PhD**
STATION 2	**STERNAL ELEVATION WITH PRIMEMED SCREW TECHNIQUE** **Hyung Joo Park, MD, PhD**
STATION 3	**CRYOTHERAPY TRANSTHORACIC ATRICURE METHOD** **Sjoerd de Beer, MD.**
STATION 4	**ZIMMER BIOMET TECHNIQUE** **Robert J. Obermeyer, MD**
STATION 5	**PECTUS-UP TECHNIQUE** **Lourdes Camps, MD**
STATION 6	**MEDXPERT PECTUS** **Carlos De La Torre, MD**
STATION 7	**RIB FIXATION** **Pablo Moreno, MD**
STATION 8	**PERCUTANEOUS CRYOANALGESIA METRUM-CRYOFLEX** **Edmund Jielbasa, MD**

CWIG

Vall d'Hebron
Barcelona Hospital Campus

THE ORGANIZING COMMITTEE ACKNOWLEDGES THE FOLLOWING SPONSORS FOR THEIR PRECIOUS SUPPORT TO THE CONGRESS ORGANIZATION

PLATINIUM SPONSORS

EVO MEDICAL

EVOMEDICAL COMPANY, founded in Barcelona, SPAIN in 2017, is a recognized leading distributor in Spain of the highest quality medical devices and the best products around the world on Chest Wall Deformities (Park's Bars, Vacuum Bell, Dynamic Compression System, Pectus-Press, Metrum Cryoflex for Analgesia and Minimal invasive surgery devices 3mm instruments, 3mm Sealer and 5mm Stapler (CoolSeal).
We are focused on providing solutions that improve patients' quality of life in a cost effective and sustainable way, pride and on delivering outstanding customer service.

www.evomedical.es

PLATINIUM SPONSORS

stryker

Making my healthcare in **Surgery**

BETTER and SAFER

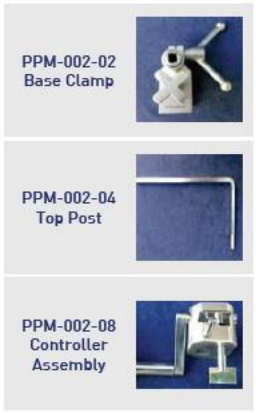
https://www.stryker.com

GOLD SPONSORS

Primemed Inc.
(주)프라임메드

PARK'S PECTUS SYSTEM

THE NEXT GENERATION OF PECTUS SURGERY



Developed by;
Hyung J. Park, MD.,Phd.

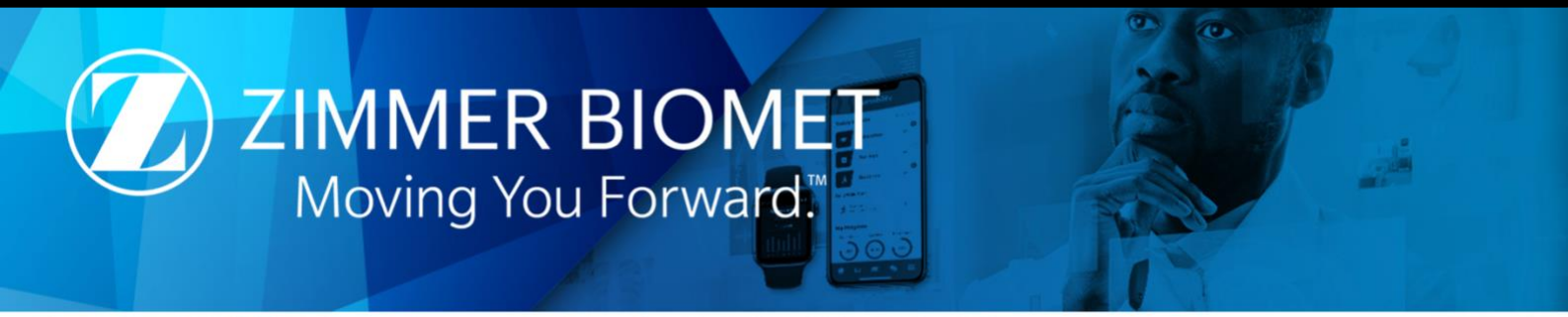
Professor and Director
Department of Thoracic and Cardiovascular Surgery
The Catholic University of Korea, Seoul St. Mary's Hospital

For more information on Pectus Procedures, Please see on YouTube.

Pectus Fixator and Bridge
(https://www.youtube.com/watch?v=qhySnNzWfBU)
Flarebuster Technique
(https://www.youtube.com/watch?v=WAAwWw3uAJ4)
Bridge
(https://www.youtube.com/watch?v=iVaOEtPfX5g)
The Sandwich Techniq
(https://www.youtube.com/watch?v=j0a_mRMd0bk)

http://primemedinc.com

GOLD SPONSORS



ZIMMER BIOMET OFFERS A MYRIAD OF SOLUTIONS TO ASSIST THORACIC SURGEONS FROM RIGID FIXATION SOLUTIONS; PECTUS BAR IMPLANTS TO ADDRESS PECTUS EXCAVATUM DISORDERS AND CLINICAL RESEARCH TRIALS VALIDATING EFFECTIVENESS. ZIMMER BIOMET CONTINUOUSLY PURSUES THE MOST INNOVATIVE AND CLINICALLY RELEVANT SOLUTIONS TO MEET THE NEEDS OF THORACIC SURGEONS AND THEIR PATIENTS. THROUGH A COLLABORATIVE APPROACH WITH HEALTHCARE PROFESSIONALS, WE EXPAND THE POSSIBILITY THAT EVERY PATIENT RECEIVES THE PRODUCTS NECESSARY FOR OPTIMAL CARE.

STERNAL CLOSURE

SternaLock® Blu Primary Closure System

SternaLock® 360 Sternal Closure System

SternaLock® XP Rigid Fixation System

CARDIOVASCULAR

DoubleWire(tm) Sternal Closure

Surgical Punches

Pacing Wires

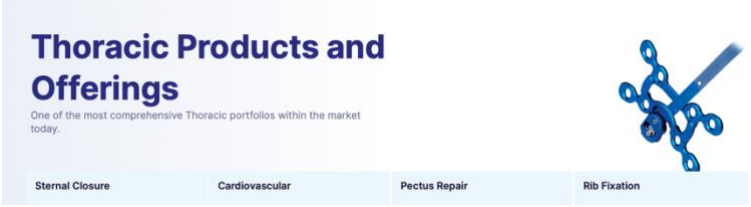
PECTUS REPAIR

Pectus Bar

RIB FIXATION

RibFix Blu® Thoracic Fixation System

RibFix Advantage® Intrathoracic Rib Fixation System



https://www.zimmerbiomet.com

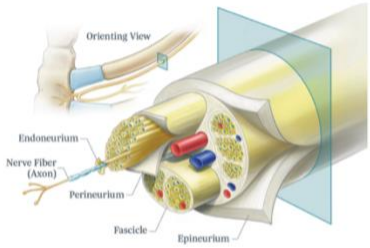
SILVER SPONSORS

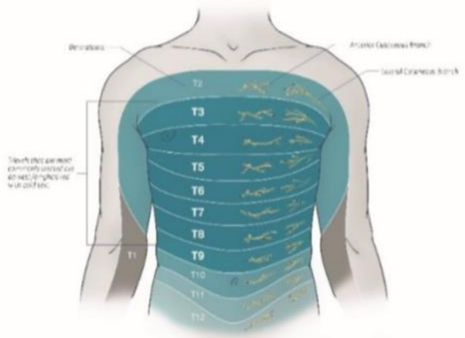
AtriCure

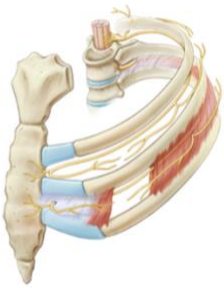
Providing Several Months of Post-Operative Pain Relief

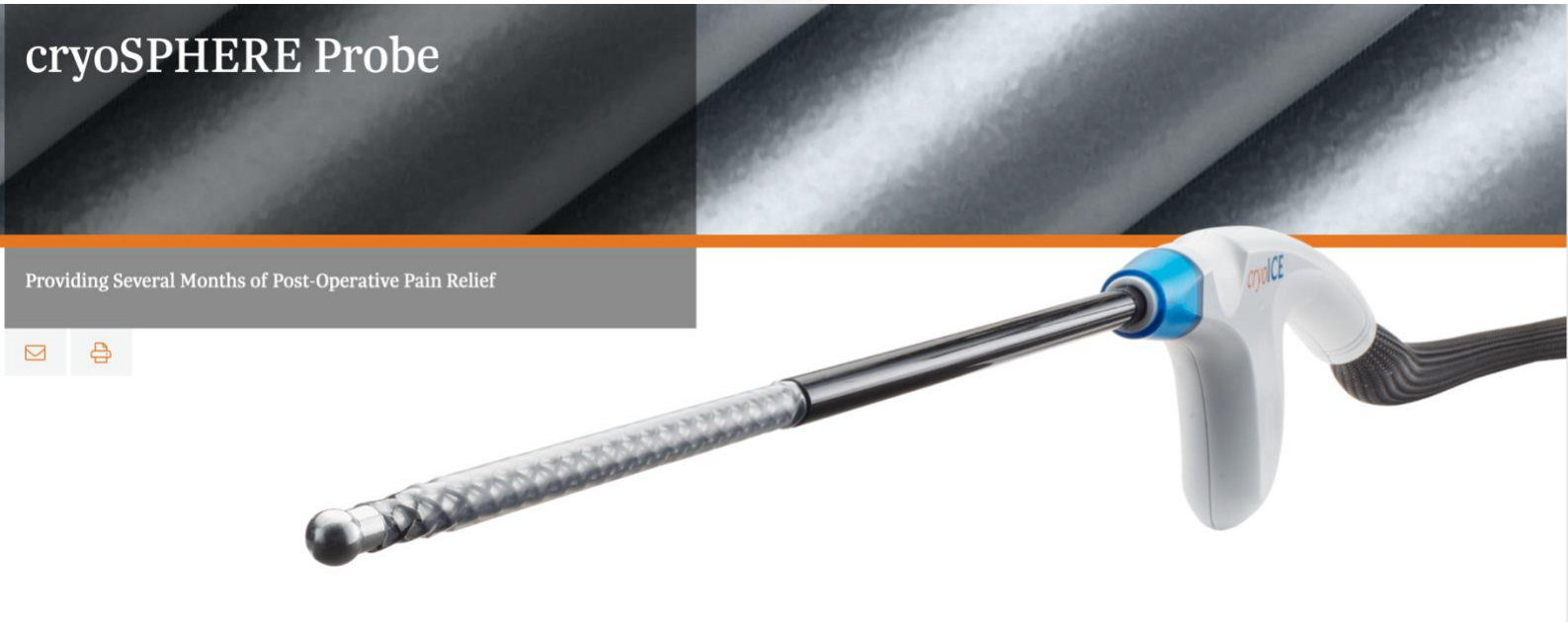
Cryo Nerve Block Therapy (cryoNB) harnesses the power of cryotherapy to provide a new form of temporary pain relief for patients who undergo certain invasive cardiac or thoracic surgical procedures. This technology uses a unique freezing method to temporarily block pain signals from nerves in the affected area, providing an effect that's similar to a local anesthetic.

Cryotherapy was originally developed as a treatment for cardiac arrhythmias. AtriCure consulted with leading pain management experts to develop new techniques for applying cryoNB to nerves, specifically in order to block pain. AtriCure's cryoICE cryoSPHERE cryoablation probes are sterile, single use devices intended for use in blocking pain by temporarily ablating peripheral nerves in adult patients. cryoNB is also indicated for ablation of peripheral intercostal nerves for patients of at least 12 years of age.







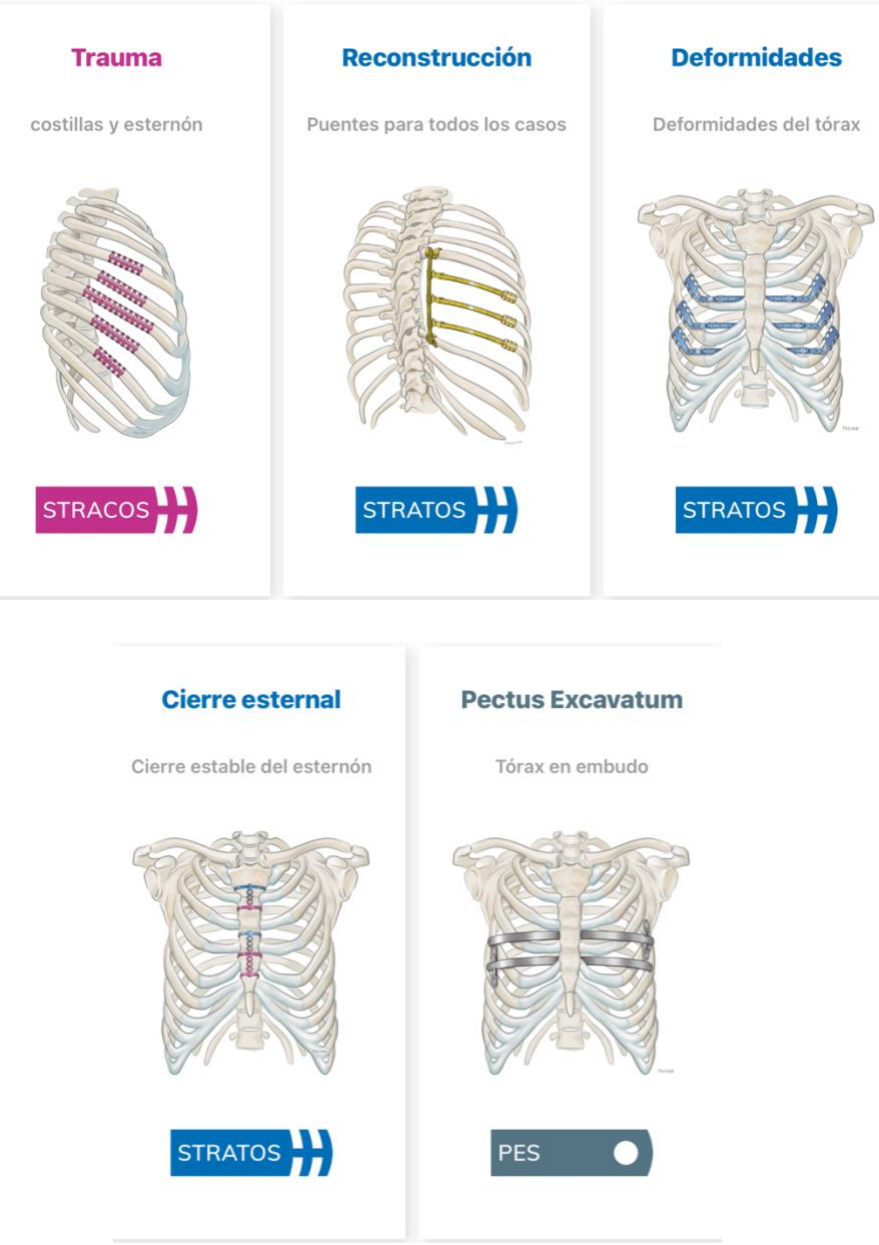


https://www.atricure.com

SILVER SPONSORS

MEDXPERT

THE CHEST WALL COMPANY



OUR NAME SAYS IT ALL. WE OFFER A UNIQUE RANGE OF IMPLANTS FOR BONY THORAX INDICATIONS, WHICH ENABLE FUNCTIONAL, DYNAMIC AND STABLE INTERNAL FIXATION.
STRATOS, STRACOS AND PES ARE SURGICAL IMPLANTS AND INSTRUMENTS FOR THE SUPPORT OF THORACIC DEFORMITIES (FUNNEL CHEST / PIGEON CHEST), FOR CHEST WALL RECONSTRUCTIONS AFTER TUMOR REMOVAL AND FOR THE TREATMENT OF FRACTURES AND/OR OSTEOTOMIES OF THE RIBS AND STERNUM.

https://medxpert.de

SILVER SPONSORS

pectusUp
VENTURA MEDICAL TECHNOLOGIES

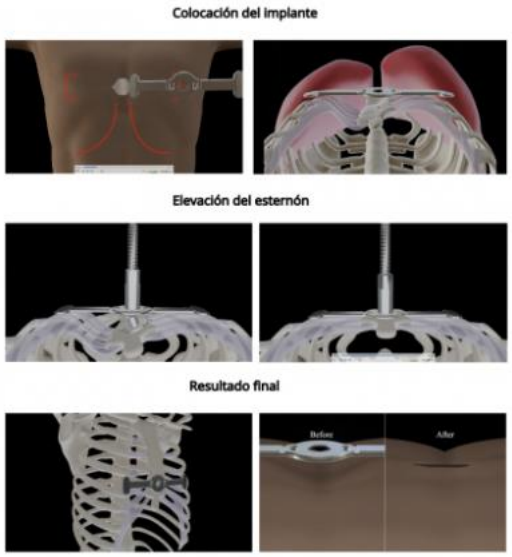
Ventura Medical Technologies has developed the Pectus Up**.** It is a new minimally invasive surgical technique for the repairing treatment of the *Pectus Excavatum.*

The Pectus Up consists of an implant and a set of tools used in a new method that is very minimally invasive and therefore not very painful, which entails a short period of convalescence and without serious complications.

The procedure is as follows: the Pectus Up **implant** is placed on top of the sternum, at the **subpectoral** level, in the most sunken area of the chest. Subsequently, by means of an elevation system, the sternum is lifted to the desired position and is fixed with the implant.

This new method for the surgical treatment of the *Pectus Excavatum*, is very minimally invasive and implies important advantages over other currently existing surgical techniques. The most important are: being an extrathoracic surgical procedure, with a short duration of the intervention which reduces the risk of affecting the internal organs and the appearance of serious complications; not being very painful intervention with a low consumption of analgesics; requiring short hospital stays; having a short recovery period; and not requiring intensive care.

Patients with *Pectus Excavatum* who have been treated with the Pectus Up system highlight this process for being less painful, for the fast incorporation into daily life and a short hospital stay. This is due to the fact that the patient is subjected to a minimally invasive and not very complex procedure.



https://pectusup.com

Eckart Klobe

Vacuum Bells

SILVER SPONSORS

PECTUS LAB

Pectuslab is an institution that focuses on recovery products for pectus deformations by researching, developing and producing these products. Also provides service after the sale. Worldwide, there are few products in pectus deformation recovery products field, Pectuslab has managed to add their own brand and products into this field. Pectuslab, gives clinical support, follows the process and takes action for development.

Pectuslab.com

SILVER SPONSORS

PAMPAMED
Medical Innovations

Non-surgical
Non-invasive medical products

Surgical
Innovative solutions for surgery

Services
In Pampamed we work daily in order to provide a service of excellence to the client

Device designed for the gradual correction of thoracic asymmetries, specifically Pectus Carinatum. Equipped with an innovative system of applied force measurement and adjustment mechanisms that guarantees the effectiveness of the treatment.

Erkom 3D Thoracic implants

Implantable system for the correction of thoracic malformations, manufactured specifically for each patient.
A 3D model based on the patient's measurements is printed and tested on the patient prior to the manufacturing of the implant.
The implants can be made either in Steel or Titanium.

Pampamed.com

SILVER SPONSORS

METRUM CRYOFLEX is a Polish company well-established European manufacturer of medical devices. In our offer you can find wide range of devices for cryotherapy, pressotherapy, ozone therapy and most recently laser medicine. During last 29 years we have produced and sold more than 10 000 units on global medical market. Over 7000 private clinics are using our devices worldwide. Within last 4 years we have allocated over 2 million Euro for R&D programs, design & production of technologically innovative products like surgical diode lasers, cryosurgical and cryotherapeutical devices which are protected by several international patents.

CRYO-S Painless for cryoanalgesia in pectus excavatum, thoracic surgery APPLICATIONS

Bilateral thoracoscopy for intraoperative intercostal nerve cryoablation

Ultrasound-guided percutaneous bilateral intercostal nerve cryoanalgesia

Chest wall pain with multiple conditions including post-thoracotomy neuromas, persistent pain after rib fractures and post-herpetic neuralgia in thoracic distribution

Post-op pain prophylaxis after lobectomy and other lung surgeries

Post-op pain prophylaxis after rib fracture, flouting rib

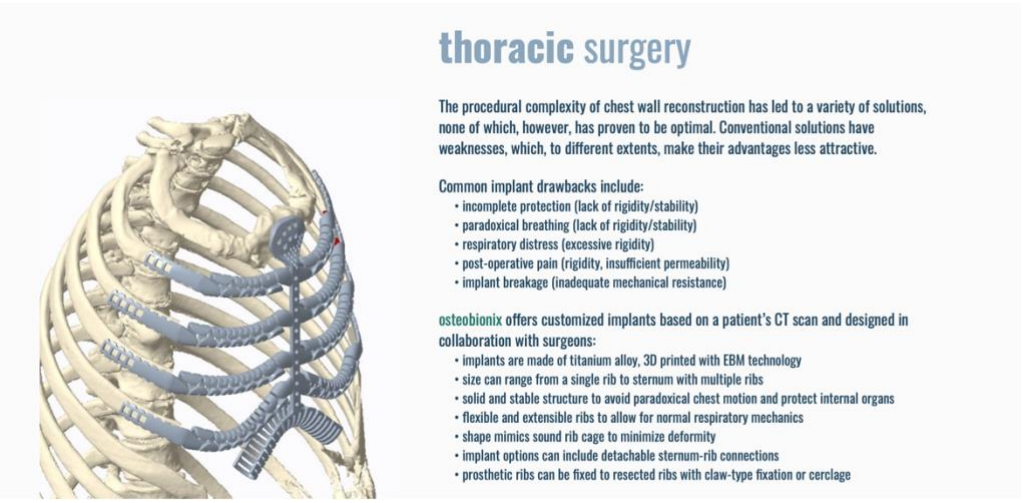
https://www.metrum.com.pl

SILVER SPONSORS

osteobionix

from replacement to regeneration

Our expertise originates from a long experience in studying challenging bone and joint conditions and looking for the most suitable tailored solutions to treat them. We have learned a lot over the years, but there are two notions we love to stick to. To start with, every clinical case is unique because every patient is unique. As far as we can, we will provide surgeons with the most specific solution for each patient. Additionally, the human body has outstanding self-healing capabilities. We will always choose less invasive, tissue sparing surgical solutions, provided that such solutions are safe and effective. When standardized solutions cannot guarantee optimal treatment, osteobionix can help identify, design and manufacture a custom-made solution for each patient. osteobionix designs and manufactures clinically validated, high-quality, cost-effective patient-specific solutions for orthopaedic, trauma, spine, thoracic and craniomaxillofacial surgery.



http://www.osteobionix.com

SILVER SPONSORS

Anatomik Modeling

3D custom-made implants

The society

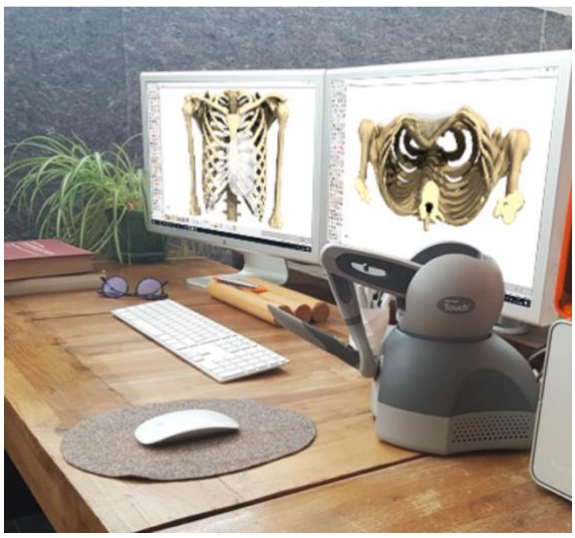
AnatomikModeling designs and develops custom-made implants, that are perfectly fitting each patient's anatomy.

These implants are used to compensate for a congenital deformity or trauma, in particular for pathologies such as **Pectus Excavatum** (funnel chest or sunken chest), **Poland syndrome** (complete or partial absence of the pectoralis muscle) or calf atrophy.

But also to treat **stenosis** or other pathologies of **airways**, for patient with complex anatomy.

Silicone implant

Implants are made with the latest-generation polymerised silicone and are definitive :



https://www.anatomikmodeling.com

SILVER SPONSORS

KLS martin GROUP

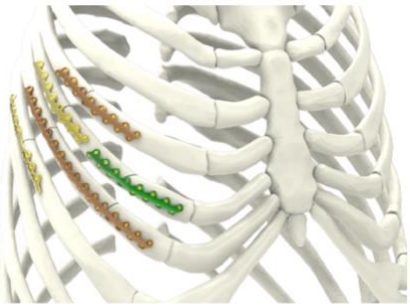
Surgical Innovation is our Passion

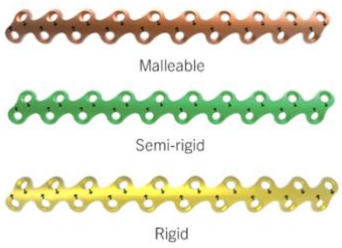
This is a promise we have pursued in surgery since 1896. With this claim in mind, we develop and market medical technology solutions, such as implant systems, sterilization containers, and surgical instruments as well as Individual Patient Solutions. In many cases, we have set new benchmarks.

IMPLANTS THORACIC

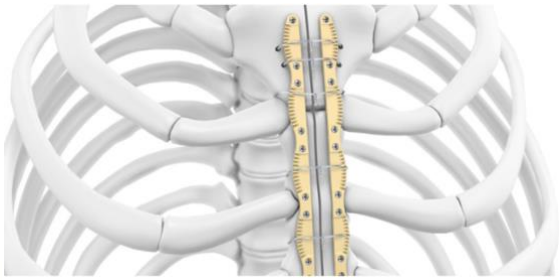
STERNAL PLATING

L1 RIB





LONGITUDINAL STERNAL STABILIZATION



KLSMARTIN.COM

REGISTRATION

	After 15th July
Active CG members **Non CWIG members**	600 € 650 €
Virtual registration	120 €
One day registration	250€
Gala Dinner	100 €
Gala Dinner for one day registration	130€
Gala Dinner for Accompanying	120 €

Onsite Registration fee includes: Access to the scientific sessions, Dry-Lap live surgeries, lunches, coffee breaks, course materials (scientific program and certificate of attendance).

VIRTUAL REGISTRATION FEE DOES'T INCLUDE "LIVE SURGERIES & HANDS ON"

Registrations must be made through the website

http:// cwigcongressbarcelona2022.com

Cancellations made before 1st August, will be refunded 85% of the registration fee. After that date, no refund will be made.

CALL FOR ABSTRACTS AND INTERACTIVE CASE REPORTS &
MY WORST NIGHTMARE
"ALL TOGETHER AGAIN"

If you are interested in presenting a case report for discussion with the experts, please send it until July 18TH,2022 to:

abstract@cwigcongressbarcelona2022.com

"DURING THE MEETING AT THE OPEN LUNCH TIME ALL THE POSTERS WILL BE PRESENTED AND DISCUSS WITH THE EXPERTS"

ACCREDITATION

This activity has been planned and implemented in accordance with the Accreditation requirements and polices of the accreditation Council for Continuing Medical Education (ACCME) through the join providership of Universidad Autónoma de Barcelona and University Hospital of Vall d'Hebron.

ACCREDITATION STATEMENT

Accreditation by the EACCME® confers the right to place the following statement in all communication materials including the event website, the event programme and the certificate of attendance. The following statements must be used without revision: "The Chest Wall International Group Annual Congress 2022, Barcelona, Spain, 14/09/2022-16/09/2022 has been accredited by the European Accreditation Council for Continuing Medical Education (EACCME®) with 23 European CME credits (ECMEC®s). Each medical specialist should claim only those hours of credit that he/she actually spent in the educational activity."
"Through an agreement between the Union Européenne des Médecins Spécialistes and the American Medical Association, physicians may convert EACCME® credits to an equivalent number of AMA PRA Category 1 CreditsTM. Information on the process to convert EACCME® credit to AMA credit can be found at www.ama-assn.org/education/earn-credit-participation-international-activities."Live educational activities, occurring outside of Canada, recognised by the UEMS-EACCME® for ECMEC®s are deemed to be Accredited Group Learning Activities (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada."

ABSTRACTS

ORAL PRESENTATIONS

The novel approach in sternal cleft repair.

Joao Paulo Cassiano Macedo, Jose Ribas M de Campos, Miguel Lia Tedde, Paulo M Pego-Fernandes.
Hospital das Clinicas da Faculdade de Medicina de São Paulo.Brazil

Background: The sternal cleft is a rare congenital affection due to the absence of sternal bar union. Surgical treatment is necessary to protected mediastinal structures.
However, the literature has already reported several cases of series, technical difficulties are frequently seen. Therefore, we are driving modifications in the technique to respond to some of this technical adversity. The study's purpose is to show innovations to deal with adversity during the procedure.
Material and Methods: Case series in which three patients were submitted to a new approach in sternal cleft correction. Technical novelty, case conduction, outcomes, and follow-up were also reported.
Results: We add a double layer of a bovine pericardial patch between the gap of the sternal bars when it could not be primarily closed. In addition to a three or four PDS (polydioxanone) number 1 interrupted stitches were now performed to maintain the approximation of the sternal bars and the chondral grafts middle line placed. The mean of hospital internment was 6 days, range 5-7 days. The surgical procedure was uneventful in all cases. Seroma was evidenced in one case, requiring aspiration twice. Surgical site infection and prosthesis removal were not necessary.
Discussion: We did not find any local complications as a response to prosthesis use. The aesthetic aspect, the lack of paradoxical movement, and the association with CT-Scan findings showed us a good biocompatible of the materials in sternal reconstruction.

Technical adaptation of first rib resection by VATS for the Thoracic Outlet Syndrome.

Joao Paulo Cassiano Macedo, Jose Ribas M de Campos, Alessandro W Mariani, Mario Ghefter, Paulo M Pego-Fernandes.
Hospital das Clinicas da Faculdade de Medicina de São Paulo.Brazil

Background: Thoracic outlet syndrome (TOS) stands for subclavian vessels and brachial plexus compression in the superior thoracic aperture, the thoracic outlet. Etiologies can be varied as surgical techniques. The objective of this study is to introduce technical modifications regarding the new work incision placement, pleura hydro dissection, and the use of ultrasonic bone cutter (Piezosurgery®, Mectron Medical Technology, Carasco, Italy). These modifications can facilitate rib dissection and increase safety.
Methods: The procedure was performed in 5 patients with TOS and cervical rib. The surgery was indicated in vascular TOS and after clinical worsening in neurogenic TOS despite the treatment.
Results: The mean operative time was 2 hours, half an hour faster than the standard approach. The mean thoracic drainage time and length of stay were two and four days respectively. All patients on the 30 postoperative days had improved symptoms; patients 2, 3, and 4 were asymptomatic, patients 1 and 5 had diminished the pain medication usage daily to occasional.
Conclusion: We could face several advantages regarding our new approach. First, the apical pleurectomy was easier to perform after hydro dissection and the surgical field stayed clear during the procedure. Second, the ultrasonic bone cutter is safer because it does not cause injury to subclavian structures. Third, the finger is used for palpation and blunt digital dissection. These help to identify the structures and to detach the rib from the chest wall. Finally, it had an esthetically acceptable result as the patient's arm covers the scar.

The place of thoracostomy-thoracomyoplasty in the management of chronic pleural empyema.

Lakranbi Marouane, F. Lamouime, M. Rhaouti, H. Harmouchi, Maha Tachaouine , Y. Ouadnouni, and M. Smahi.
University Hospital Fez Morocco.

Background: The occurrence of empyema following a pneumonectomy or a chronic pleural pocket is a severe complication of which management is long and difficult. The authors report their experience managing this complication, including infection control, by emptying the pleural pocket through a thoracostomy coupled with a myoplasty to erase the pleural pocket completely.
Materials and methods: This is a retrospective study conducted between 2009 and 2019 concerning the records of 14 patients treated for empyema, whether in the aftermath of a lung resection or as part of a chronic calcified pleural pocket.
Results: All 14 patients included in the study were male aged from 21 to 66 years. 6 of which presented a pyothorax complicating a pneumonectomy. 3 cases presented a post upper lobectomy pyothorax. For the other 5 patients, there was a post-tuberculous chronic calcified pleural pocket, for which attempts of decortication seemed impossible. We observed in total 6 cases of bronchopleural fistula. All patients had received evacuation of the pleural contents through a thoracostomy in preparation for a possible filling thoracomyoplasty. The evolution of pleural cavities following thoracostomy was favourable on the septic map leading to a retraction of the pleural cavity and its spontaneous closure in 4 patients. In 8 patients, thoracomyoplasty was necessary. Postoperative and long-term evolution was satisfactory in all patients, and no deaths were recorded in connection with this technique.
Conclusion: Pyothorax complicating a pneumonectomy cavity and calcified pleural pockets are a serious complication. the management is long and delicate. The use of thoraco myoplasty is an effective alternative to filling the cavity in fragile patients with significant operative risk.

Principals of sternal repair after sternal dehiscence – a tertiary care single center experience.

Nora Mayer, M. Kapdagli, P. Perikleous, F. De Robertis, J. Finch, N. Asadi, E. Beddow, V. Anikin.
Harefield Hospital.

Background: Sternal dehiscence following median sternotomy for cardiac surgery occurs in 0.9 - 5% of the patients. Main symptoms are pain and positional discomfort, clicking sensations and unstable sternum. Sternal repair remains a complex operation for highly selected patients. Titanium bars have been successfully used for sternal reconstruction. Omentoplasty has shown to increase local blood supply and could be beneficial in sternal repair after coronary artery bypass grafting (CABG) with harvesting of bilateral internal thoracic arteries.

Methods: Complex sternal repair for sternal dehiscence was performed in 19 patients (85.7% male) with mean age 63y (SD +-10) in the period from 09/2010 to 07/2022 in our tertiary care single centre. Titanium bar repair plus omentoplasty was done in 84.2% (N=16) of the patients while 15.8% (N=3) underwent titanium bar fixation only. A standardized surgical approach with reopening of the median sternotomy and fixation of the sternum with titanium bars (The STRAsbourg Thoracic Osteosynthesis System - STRATOS™, MedXpert) plus laparotomy and omentoplasty was performed.

Results: Patients diagnosed with sterile sternal dehiscence had previously undergone CABG in 73.7% (N=14), CABG + valve replacement in 15.8% (N=3) and valve replacement alone in 10.5% (N=2). Bilateral internal thoracic arteries had been harvested in 42.1% (N=8) of the patients. Mean BMI was 33.1kg/m2 (SD +-5.2), diabetes mellitus was diagnosed in 36.8% (N=7), 10.5% (N=2) were current smokers, 63.2% (N=12) ex-smokers and COPD was present in N=1 (4.8%). N=3 (14.3%) of the patients underwent incisional hernia repair within the initial procedure. Mean LOS was 22 days (SD +-28.7). Mean survival was 114.9 months (SD +-10.86). 30- and 90- day mortality was 0%. The four registered deaths were all unrelated to the sternal reconstruction. 57.1% (N=12) patients underwent elective bar removal. Late complication incisional hernias had to be surgically repaired in N=6 (31.6%) patients after a mean of 29.7 months (SD+-13.8).

Conclusion: Based on our single-centre experience, highly selected and motivated patients benefit from standardized complex sternal repair with titanium bars and omentoplasty.

Sternal cleft repair and prevention of Pectus Excavatum in newborns: A combined approach.

Michele Torre, Girolamo Mattioli, Federica Lena, Liliana Piro.
IRCCS G. Gaslini.Genova, Italy

Background: sternal cleft is a rare malformation and its association with pectus excavatum is reported in 5% of cases according to the literature. In our experience this clinical association is more common. We evaluated in our series the occurrence of pectus excavatum after sternal cleft repair and present a new surgical technique to address at the same time sternal cleft closure and pectus excavatum prevention.
Methods: clinical data from patients treated for sternal cleft and followed up at our institution from 2006 to 2021 were collected. The incidence of associated pectus excavatum was evaluated.
Results: All our seven patients with sternal cleft had associated pectus excavatum, which in most cases occurred after surgical repair, regardless of the clinical features (partial or complete sternal cleft) or the surgical technique used (primary closure or with prosthetic material). Pectus excavatum was mild in most cases but surgical repair was required in two cases. This surgery was complicated by the presence of adhesions between the pericardium and the sternum. In the last case, presenting with pectus excavatum already at birth, we adopted a new surgical approach,aiming at correcting sternal cleft and pectus excavatum at the same time: a “sternal sandwich” between a substernal absorbable “bar” (rolled Vicryl mesh) and pre-sternal resorbable plate.
Conclusions: pectus excavatum is commonly associated with sternal cleft. We propose a surgical approach, easy to perform by using only absorbable material, which could help to correct pectus excavatum at the time of sternal cleft repair or prevent its subsequent development.

Preoperative Nuss procedure metal allergy patch testing results in an increase in titanium bar utilization without effectively identifying patients who develop clinical metal allergy.

Krista Lai, Vijay Viswanath, Benjamin E Padilla, Zeb Hunteman, Melissa Nguyen, Justin Lee, Daniel Ostlie, Lisa E McMahon, David M Notrica.
Phoenix Children's Hospital.USA

Background: Metal allergy following placement of a Nuss bar for repair of pectus excavatum is a rare, but serious complication with potential significant morbidity. Literature reported rates vary from 2-6% and there is no consensus regarding preoperative allergy testing. This study aims to compare titanium bar use and allergic reactions with different preoperative testing strategies.
Methods: A retrospective chart review was performed on patients undergoing the Nuss procedure from July 2009 to June 2022. Demographics, operative details, and postoperative reaction data were collected. Three regimens were compared: 1) minimal testing (MT), 2) routine testing (RT), 3) targeted testing (TT) based on personal/family history of metal allergy and/or personal history of atopy. Patients with a positive metal allergy to nickel/chromium/molybdenum (Ni/Cr/Mo), components in the Zimmer Biomet ASTM F 138 Pectus Bar, or strong clinical concern for metal allergy received a titanium pectus bar.
Results: During the study period, 764 patients underwent the Nuss procedure for repair of pectus excavatum. Overall, 475 (62.2%) patients underwent preoperative metal allergy testing, and 104 (21.9%) patients had positive allergy testing results to any metal. Allergies to Ni, Cr, or Mo were found in 84 (17.7%) patients, constituting 80.8% of all metal allergies detected. Pectus bar allergies occurred in 19 patients (2.5%); 10 patients (10/475, 2.1%) with metal allergy testing vs. 9 patients (9/285, 3.2%) without testing (p=0.37). Three patients who received a titanium bar experienced an allergic reaction. In patients with a bar allergy, 5 patients received no treatment, 9 patients received steroids, 6 patients received antibiotics, and 1 patient had an early bar removal. The mean follow-up time was 116.9 ± 12.6, 65.6 ± 16.1, and 20.5 ± 11.2 months for the MT, RT, and TT groups respectively.
Table 1 details demographics and allergy test results by testing period. The RT and TT groups had significantly higher use of titanium bars (19.7% and 17.3%) compared to the MT group (7.3%) ($p<0.05$). However, 30 of the 68 titanium bars in the TT group were placed based on strong clinical concern for metal allergy and did not undergo testing.
Conclusion: Both routine (93%) and targeted (51%) preoperative metal allergy testing strategies resulted in very high rates of titanium bar placement, both nearly 20%. The frequency of clinical bar allergy was similar in all time periods and ranged from 1.4% to 3.3% (p=0.28). There was no difference in the frequency of bar allergy when comparing tested and non-tested patients, nor between routine and targeted testing strategies. The benefits of preoperative metal allergy testing are unclear.

The impact of the Eckart Klobe Vacuum Bell device on the quality of life of children and young people.

Ashley Johnstone, Lori Ellis, Mr James Andrews, Mr Carl Davis, Dr Kath Sharp.
Royal Hospital for Children, Glasgow.Scotland

Background: Pectus excavatum is the most common chest wall deformity and has traditionally been managed by surgical intervention. An alternative, non-surgical approach, The Eckart Klobe Vacuum Bell was introduced as a treatment option to our service in 2018. We report on our experience of using the device as an alternative treatment for pectus excavatum and its impact on the quality of life of our children and young people.

Methods: Between November 2018 and January 2022, the Physiotherapy Team at the Royal Hospital for Children provided a vacuum bell device to those children attending the Scottish National Chest Wall Service that were assessed and deemed appropriate by an experienced clinician. As part of the consultation, a measurement of the depth of the pectus excavatum from the deepest point was taken using a standardized, wooden scaled rod and measured in centimeters and each patient completed a Pediatric Quality of Life Inventory (PedsQL) questionnaire.

Results: 20 patients (18 males, 2 females) age 9-17 years were included in the data analysis. Patients were included if they had completed the outcome measurements at baseline, completion and at least 1 follow up in between. The median and interquartile range (IQR) was calculated for each outcome measure at baseline, 3 months, 6 months, and completion. The median depth of pectus excavatum prior to use of the vacuum bell device was 1.75cm (0.50-4.00) which decreased to 0.60cm (0.00-3.00) on completion (Figure 1). There was a significant difference in the depth of the chest between baseline and 3 months ($p=0.001$), baseline and 6 months ($p=0.000$) and baseline and completion ($p=0.000$).

Conclusion: Treatment of Pectus Excavatum using the Eckart Klobe vacuum bell device can result in reduction in deformity depth and provides an alternative conservative treatment option to traditional surgical management. Follow up at three months, six months and on completion shows a statistically significant improvement in the depth of chest wall deformity. Total, Emotional and Physical Quality of Life scores are also significantly improved however this does not correlate with the change to the depth of pectus excavatum. This is suggestive that even minimal change to the depth of pectus excavatum from the Eckart Klobe vacuum bell device may improve quality of life. Further long-term follow-up is required to establish the impact of the Eckart Klobe Vacuum Bell device on the quality of life of children and young people and to determine whether short term improvements in quality of life are sustained.

Cardio-Pulmonary function in adolescents with Pectus Excavatum and the impact of surgical intervention.

Paul Burns, C Davis, J Andrews, M Jacovides, A Johnstone, R Langley, P Davies.
Royal Hospital for Children, Glasgow, Scotland.

Background: Some people with Pectus Excavatum (PE) have impaired lung and cardiac function (1,2). Surgical correction by the Nuss procedure can be performed to fix the aesthetic defect with some studies showing that it can also improve pulmonary function and aerobic capacity in adults (3). However, other studies have shown no improvement in physiological function post-surgery (4).

Objectives: Our primary objective was to determine the occurrence of impaired cardio-pulmonary function in adolescents with PE and to assess for any improvement in physiological function after at least 1 year post Nuss repair. A secondary objective was to look for an association between a low peak oxygen uptake (VO2peak) and activity levels.

Methods: This was a retrospective analysis of data which was obtained during routine clinical assessment of patients with PE before and after surgery. Pulmonary function tests (PFTs) were performed prior to a cardiopulmonary exercise test (CPET). This was performed on a cycle ergometer with an incremental ramp protocol. Breath by breath gas analysis was measured alongside a 12 lead ECG, blood pressure and peripheral Oxygen saturation. All patients were strongly encouraged to exercise to a volitional maximum.

Results: Twenty-nine (twenty-five male) had pre- and post-surgery PFT and CPET measurements. The average duration between tests was 1.5 years. Summary statistics are presented in table 1 with the mean and 95% confidence interval for pre- and post-surgery tests. Prior to surgery, forty five percent (13/29) had evidence of a restrictive defect with a FVC and/or TLC below the lower limit of normal (LLN < -1.645 Z scores). Fifty two percent (15/29) had a reduced aerobic capacity with a peak oxygen uptake (VO2peak) below the LLN. Eight had evidence of ventilatory limitation with a breathing reserve of less than 20% at peak exercise.

Height, weight and BMI all significantly increased post-surgery ($p < 0.05$). There was no significant change in any of the pulmonary function or CPET parameters post-surgery ($p > 0.05$).

Figure 1 shows boxplots of the VO2peak Z score for patients who were classed as sedentary or active if they were performing regular physical exercise. Patients who were physically active had a significantly higher VO2peak Z score than those that were sedentary ($p = 0.002$)

Conclusion: A significant number of adolescents with Pectus excavatum have a restrictive defect on their baseline PFTs and a reduced aerobic capacity. Ventilatory limitation is not the limiting factor for most patients. There does not seem to be any significant improvement in cardio-pulmonary function after 1 year post Nuss repair. There is evidence that a sedentary lifestyle and therefore de-conditioning are the cause of the reduced aerobic capacity in a significant number of patients.

The quality of life of children and adolescents with anterior chest wall deformity.

Ashley Johnstone, Carl Davis, James Andrews, Kath Sharp, Nicola Roberts.
Royal Hospital for Children, Glasgow.

Background: A Systematic Literature Review was performed to evaluate the current evidence on the QoL of children and young people with Anterior Chest Wall Deformity (ACWD) and identify the factors that influence it. The findings of this review will be presented.
Methods: Using a defined search strategy, a systematic review of the literature was performed using PRISMA guidelines.
Results: The search identified 282 articles, after refinement, the full text of 47 studies were reviewed and 21 included in the review (15 prospective, and 6 retrospective). A total of 18 studies described QoL associated with the correction of ACWD, and 3 studies reported on QoL without correction. The surgical correction of ACWD was reported in 17 studies and non-surgical correction in two studies. A total of seven disease specific and 22 generic QoL measures were used across the studies. The variation in QoL outcome measures, together with a lack of consistency in the time scales of data collection, did not allow for direct comparison between studies. The improvement in psychosocial QoL following correction of ACWD is clear. However, the impact on physical QoL is less defined and external factors that may influence QoL are uncertain. The literature identified primarily surrounds QoL outcomes in relation to surgical correction and is not representative of all children and young people with ACWD.
Conclusions: The literature provides a limited understanding of the impact of ACWD on the QoL of children and young people. Future work should look to increase understanding of the significance of the type and severity of the deformity. Furthermore, a greater understanding is required regarding the quality of life of those who opt for no intervention in addition to those who undergo both surgical and non-surgical correction.

Surgical reconstruction of the Pectus Arcuatum using chondrosternoplasty.

Tunc Lacin, Esra Yamansavcı Sirzai, Sezer Aslan, Gamze Gul Tiryaki, Jeyhun Pashayev, Reyhan Ertan.
Marmara University, Department of Thoracic Surgery, Istanbul, Turkey.

Background: Pectus arcuatum is a rare chest wall deformity characterised by protrusion of the manubrium and superior costal cartilages and excavation of the corpus sterni. It is a subtype of carinatum deformity – namely chondromanubrial type. Modified Ravitch surgical techniques have been used to correct this type of deformity. This study presents our chondrosternoplasty technique to correct arcuatum deformity in 16 patients.

Methods: Between November 2018 and July 2022, 16 patients (12 M, 4 F, mean age 26,3 years, range: 17-47 years) underwent modified Ravitch chondrosternoplasty. Through vertical mid-sternal incision in males and submammary incision in females, the sternochondral joints which create the protrusion were resected saving their perichondrium and a horizontal full osteotomy was performed in a wedge manner at the most protruding point of the sternum. A second partial (only the anterior pericondrium) osteotomy was added at the most concaved point if needed. The sternum was stabilised using two vertical parallel titanium plates in 11 patients. We have placed an additional pectus bar to 5 patients to reinforce the concave part. Bone fragments of the wedge osteomies were re-inserted to the osteotomy sites to enhance bone healing. Postoperative pain management included iv PCA, parenteral paracetamol and NSAIDs.

Results: Mean operation duration was 142 minutes (range: 100-210 minutes). Average blood loss was 100 cc. Patients were discharged in 6 days (range:4-9 days). One patient had a seroma from the incision site. Turnaround time to work was 3 weeks. Average follow-up was 34 months. Patient satisfaction was 100%.

Conclusion: Pectus arcuatum which is a complex chest wall deformity can be corrected successfully using chondrosternoplasty with high patient satisfaction rates.

Pectus Carinatum treatment: our 35 cases open surgery experience.

Volkan Karaçam, Fatma Mutlu, Umut Öykü Iskenderoğlu, Aydin Şanli.
Dokuz Eylül University Research and Application Hospital.

Background: Minimally invasive methods are the first choice for surgical repair of chest wall deformities. In this way, through to the Nuss Procedure described by Donald Nuss in 1987 and the Abramson procedure described by Abramson in 2005, surgical correction of many chest wall deformities was performed. Unfortunately, some cases aren't very suitable for the minimally invasive method. The demand for open surgical procedures still continues, especially in mixed type chest wall deformities. In this study, we aimed to talk about and our clinical experience and our patients who underwent open surgery due to chest deformity in our clinic.

Methods: Between 2011 and 2021, 34 patients who underwent open surgery were evaluated in terms of age, gender, type of chest wall deformity, surgical procedure performed, number of incisions, number of ribs excised, whether instrumentation was applied, hospitalization time and recurrence.

Results: Twenty-four of the cases were male and 10 were female (mean age 20.14 years, 12-45, med 20). 18 of them have pectus carinatum and 16 of them have mixed type chest deformity. Only open surgery was performed in 23 patients, 10 underwent open surgery and Nuss, and 1 underwent open surgery and Abramson. Nuss operation was previously performed in 6 of the patients who had only open surgery. The reason for the need for a second surgery after Nuss in these patients was the development of ovarian reduction. The number of incisions varied between 1-3, depending on the surgical procedure performed. 19 bars, two for two patient and one for 15 patients, were inserted. Wedge resection of the sternum was performed in 19 patients, and 10 of these patients had a mixed type and 9 had a pectus carinatum chest deformity. Partial rib resection was performed in 32 patients. Two patients who did not undergo rib resection were patients with mixed-type chest deformity who underwent Nuss+ wedge resection of the sternum. The mean hospitalization time was 4.22 days (med:4, 2-10 days). Except for one case, all cases were followed without drains in the postoperative period. Pneumothorax was observed in 3 patients as a postoperative complication. Patients were evaluated with a satisfaction questionnaire in the postoperative period. Patients who were asked to score between 1 and 5 for their satisfaction with the final image of the chest wall gave mean 4.5 points.

Conclusions: Although there are minimally invasive procedures such as Nuss and Abramson in the surgical treatment of chest wall deformities, open surgery is still a preferable procedure in cases with asymmetric or mixed chest wall deformities. In our clinic, we prefer open surgery or combined treatments for deformities above the nipple. There is no difference in the hospitalization period compared to minimally invasive surgeries, and excellent results can be obtained with open surgery. As a result, the selection and implementation of the most appropriate procedure with the appropriate equipment and experienced surgical team is of great importance in order to ensure patient satisfaction.

18 years of experience in minimally invasive pectus surgery: Bar removal.

Nezih Onur Ermerak, Sezer Aslan, Esra Sirzai, Tunc Lacin, Mustafa Yuksel.
Marmara University, Department of Thoracic and Esophageal Surgery, Istanbul, Turkey.

Background: MIRPE has been widely accepted as surgical technique and requires bar removal surgery 2-3 years after correction. As the number of the cases increased, data also regarding bar removal operations become significant. We hereby share our 18 years of experience in bar removal surgery after the first MIRPE operation at our institution in 2005.
Methods: Data between 2005-2022 were collected retrospectively from a prospective database. Data regarding demographics, peri- and post-operative outcomes, number of the bars and stabilizers, length of hospital, duration of the surgery, morbidities and mortality were recorded.
Results: Between 2005-2022; 1094 patients underwent MIRPE at our institution and of them; bars of 769 patients (70.9%) were removed. Mean duration for surgery and mean time from MIRPE to bar removal were 40 minutes and 29.2 months, respectively. Mean length of hospital stay was 1 day. We had to perform early bar removal for some patients due to intractable pain in 7 patients, metal allergy in 3 patients and infection in 2 patients. Among these patients, the number of the bars removed were 1 in 528 patients (68.7%), 2 bars in 224 patients (29.2.7%) and 3 bars in 17 patients (2.2%). 201 patients (%26.1) needed hemovac drain after the removal. 77 (10.1%) patients had postoperative skin infection/seroma which mostly treated conservatively. We experienced significant bleeding in 8 patients. Only two of them needed intervention which was VATS for one and extension of the incision for the other one. Conservative management with packing was enough for the other 6 patients. The results were satisfactory after the bar removal for most of the patients. Only 14 (1.8%) of the patients had recurrence of the deformity. We did not experience mortality or severe morbidity in the whole series.
Conclusion: Bar removal surgery has a higher safety profile but in rare cases may be associated with major complications such as bleeding. This risk is higher in patients with challenging MIRPE. We recommend bilateral opening of surgical incisions, complete unbending the bar and adequate dissection for the total release of bars and stabilizers to avoid such catastrophic complications. We should keep in mind that; these bleedings mostly stop with conservative management, but we should always be ready for further intervention.

Lightweight disposable elastomeric PCA versus standard syringe driver PCA.

Karen Mackintosh, Ashley Johnstone, Margaret Canning, Graham Bell.
NHS Greater Glasgow & Clyde.

Background: RAVITCH and NUSS procedures are surgical procedures to correct pectus deformities, associated with significant post-operative pain. This can limit early mobilization and prolong hospital stay (1). Patient controlled analgesia (PCA) is an established analgesic technique in paediatric anaesthesia with a role in the management of post-operative pain. PCA pumps are used to deliver this technique in children, requiring regular monitoring to reduce adverse effects (2). Traditionally, electronic programmable pumps e.g., Alaris model, with pre-set parameters would be deliver analgesia via a syringe driver mounted on a drip stand, which usually requires additional staff to aid mobilisation. There is growing interest in elastometric PCA models due to their minimal interference with activities of daily living, silent operation, portability and cost effectiveness (3). The aim of the project is to compare PCA pumps – the electronic Alaris model versus the elastometric Accufuser model, in terms of pain scores, mobilization, failure rate, side effect profile and staff/patient experiences for chest wall patients.

Method: We searched the Acute Pain Service Database to identify patients, who used the Alaris or Accufuser PCA pump for analgesia post NUSS or RAVITCH procedure. Only patients who had adjunctive intrathecal opioid were included. Fifty-five patients were identified over 3 years – 29 in the Alaris group and 26 in the Accufuser group. Individual patient's clinical notes were reviewed to identify intrathecal opioid and dose used; PCA pump and opioid used; pain scores over a 22 hour period; post-operative mobilization day; failure rate and side effect profile. We interviewed the multi-disciplinary team, including physiotherapists, nursing staff and a Pain Nurse Specialist to obtain their experiences of each pump. Patients, who had used the Accufuser, were asked about their experiences in a questionnaire.

Results: One hundred percent of patients had intrathecal opioid with an adjunctive PCA pump – 53% used the Alaris model and 47% used the Accufuser model. The median number of hours where pain scores <4/10 were similar for each model. Both devices had a comparable side effect profile with high rates of nausea and vomiting. All patients mobilised by day 1 post-operatively, with no difference between groups. Only two patients had to switch PCA models due to lack of training and side effects with the Accufuser. Amongst staff, Accufuser PCA was the preferred model. Staff valued the reduction in lines and alarms with this model leading to greater confidence in patient independence. Patients reported a high satisfaction rate with the Accufuser.

Discussion: This retrospective project suggests the elastometric Accufuser PCA provides a similar level of pain relief with a comparable side effect profile compared to the traditional electronic Alaris model for chest wall patients. We did not demonstrate a difference in the post-operative day of mobilisation. Staff testimony reported fewer support personnel were required and greater patient confidence in early mobilization was achieved with the Accufuser.

Ultrasound-guided percutaneous cryoanalgesia for Pectus Excavatum: Same day, 24 or 48 hours before surgery.

María Velayos López, Karla Estefanía, Mercedes Alonso, Antonio J Muñoz, Raquel Torres, Francisco Reinoso-Barbero, Carlos De la Torre.
Hospital Universitario La Paz.

Background: The addition of ultrasound-guided percutaneous cryoanalgesia (PCr) for pain management after pectus excavatum(PE) surgery offers a new and advantageous approach. Our aim is to describe our experience with PCr applied on the same day, 24 and 48 hours prior to PE surgery.
Material and Methods: Prospective study in patients undergoing ultrasound-guided PCr(2019-2022) divided into 3 groups: PCr on the same day of surgery(PCrSD), PCr 24 hours before(PCr24) and PCr 48 hours before(PCr48). We describe the application of the technique and the data obtained by comparing the 3 groups.
Results: We present 42 patients (25 PCrSD, 11 PCr24, 6 PCr48). PCr24 had a shorter procedure duration than PCrSD(65.8 vs. 91.2 min; p=0.048). Related to analgesia, PCr24 and PCr48 showed lower opioid consumption than PCrSD in PCA volume (48.5 and 49.6 vs 75.1 ml; p=0.015) and PCA time (23.3 and 23.8 vs 34.3 hours; p=0.01). Degree of pain (VAS scale) on the day of surgery and on the 2nd postoperative day was lower in PCr24 and PCr48 than in PCrSD(4 and 2 vs 5; p=0.012; 0 and 1 vs 2; p=0.01, respectively) as well as shorter hospital stay(3 and 3.5 vs 5 days; p=0.021). In addition, PCr24 showed lower opioid consumption and hospital stay than PCr48 (p>0.05). The greatest savings in hospital costs were obtained in the PCr24 group.
Conclusions: PCr48 and PCr24 prior to PE surgery offers lower opioid consumption, less pain and shorter hospital stay than PCrSD. PCr24 is comparable to PCr48, but seems to show advantages and simpler logistics for the patient and the hospital.

Cryoanalgesia in combination with the novel prehabilitation program 'Back on feet' are the essential parts of ERAS protocol in the surgical treatment of children with funnel chest deformation.

Slawomir Zacha, Barbara Jastrzębska, Aleksander Szwed, Agata Andrzejewska, Elżbieta Modrzejewska, Karolina Skonieczna-Żydecka, Honorata Mruk - Mazurkiewicz, Jowita Biernawska.
Department of Paediatric Orthopaedics and Oncology of the Musculoskeletal System of the Pomeranian Medical University in Szczecin.

Background: The funnel chest deformation is a great challenge for therapeutic teams due to the risk of the patient experiencing severe pain in the postoperative period as well as chronic pain. The use of many analgesic drugs, including opioids, is associated with adverse side effects, difficulties with rehabilitation, an increased risk of complications, prolonged hospitalization and costs of the procedure. Cryoanalgesia as a part of multimodal analgesia along with the education and prehabilitation of the patient according to the novel application 'Back on Feet' as well as the interdisciplinary care in accordance with the ERAS protocol, has a real impact on the optimization of perioperative care.
The aims of the study were the assessment the effectiveness of cryoanalgesia as a method of pain control and the impact of preoperative preparation according to the novel 'Back on Feet' program.
Methods: A prospective observational study was conducted, which involved 30 patients (average age 15 years) diagnosed with funnel-chest treated using the Nuss method. The procedure was carried out under general and regional anaesthesia.
Eight patients were given intraoperative cryoanalgesia using the Cryo-S Painless device (Metrum – Cryoflex Polska Sp. z o.o.). This was the first time cryoanalgesia procedure was performed in children in Poland. This group of patients was prepared according to the prehabilitation with 'Back on feet' application and ERAS protocols. The results were compared in terms of demographics, pain levels, side effects of the pain relief medications in the postoperative period, quality and length of rehabilitation, patient satisfaction using the Quality-of-Life questionnaire, and the total costs of hospitalization.
Results: There were significant differences in terms of pain intensity, time and quality of rehabilitation, after the operation and after hospital discharged with the group of patients who experienced cryoanalgesia. The length of the hospitalization was shorter in this group. The total cost of hospitalization was comparable. Patient satisfaction and the improvement in their quality of life was higher in the patients who were prepared using 'Back on Feet' and ERAS protocols.
Conclusions: This study confirmed the effectiveness of cryoanalgesia as a method of pain control regarding long term period, and the beneficial effect of preoperative preparation using the novel "Back on feet" program.

Forgotten branch of the intercostal nerve: Implication for cryoablation nerve block for Pectus Excavatum repair.

Sunghoon Kim, Joel Talsma, Melanie Kusakavitch, Dawon Lee, Christoph Niederhauser, Doruk Ozgediz, Olajire Idowu.
University of California San Francisco,USA

Background: Although often labeled minimally invasive procedure, Nuss procedure is one of the most painful operations that pediatric surgeons inflict on children. The Achilles heel of Nuss procedure has been extreme post-operative pain and chronic pain that can last for months. To rectify this shortfall, we first reported in 2016 the use of cryoanalgesia for Nuss procedure. The use of cryoanalgesia has made the operation less ominous for patients since cryoablation not only blocks the immediate post-operative pain but the smoldering pain that lasts for about a month for a typical Nuss procedure patient. One unexpected observation from intercostal nerve cryoablation for Nuss procedure has been an apparent delay in full regional anterior chest block after cryoablation. This prompted us to investigate the anatomy of the intercostal nerve in human cadavers to better understand this observation. In this report, we resurrect the forgotten branch of intercostal nerve, the collateral branch, which was described by anatomists from King's College of England in 1932, and we delineate the course of the lateral cutaneous branch. With better understanding of the intercostal nerve anatomy, we correctly applied cryoablation to achieve minimal pain for patients who underwent the Nuss procedure.

Method: Cadaveric Specimen Dissections: adult cadavers were used to visualize the branching patterns of the intercostal nerves. Starting at rib 1 and continuing to rib 12, the ribs were cut following the midclavicular line using a saw or bone cutters. A transverse incision was made following the inferior margin of rib 12 bilaterally. The underlying intercostal muscles and costal pleura were dissected and the anterior chest wall was then elevated and removed as an intact unit. The contents of the thoracic cavity were removed to fully visualize the posterior and lateral thoracic walls. The costal pleura was removed and the path of the intercostal nerves of ribs 4, 5, 6, and 7 were dissected to visualize the main intercostal nerve, the collateral branch of the intercostal nerve, the lateral cutaneous nerve, and any communicating branches between these nerves. To determine the exact location of the midaxillary line, the distance from the spinous process to the center of the sternum was measured. The midaxillary line was obtained by dividing this measurement in half. Cryoablation: Double lumen endotracheal intubation was utilized to better visualize the lateral chest wall. T-fastener suture technique was used to elevate patient's anterior chest. Anterior mediastinal dissection was done using an endopeanut under thoracoscopic view. After the anterior mediastinal dissection, a thoracoscope travelled through the anterior mediastinum to visualize the contralateral chest wall. Cryoprobe from AtriCure was used from the ipsilateral chest wall side to cryoablate the main intercostal nerve, lateral cutaneous branch, and the collateral branch medial to the mid-axillary line for intercostal nerves 4,5,6 and 7 under thoracoscopic view- 16-point applications. Verbal pain scores (0 to10) were obtained from the patients on post-operative day one.

Results: Cadaver dissection: 11 cadavers were dissected. The path of the main intercostal and lateral cutaneous branch course on the inferior rib surface of the corresponding intercostal nerve. Total of 92 lateral cutaneous branches of the intercostal nerve were dissected and measured as they pierced the intercostal muscle. Most lateral cutaneous branches of the intercostal nerve pierced the intercostal muscle lateral to the midaxillary line 78.3%, medial to midaxillary line (18.5%) or on the midaxillary line 3.3%. The collateral branch of the intercostal nerve separated near the spine and travelled along the superior surface of the next lower rib. Cryoablation: 16 male patients underwent Nuss procedure and cryoanalgesia. Mean age of the patients was 14.9 year (range 12-19), mean Haller index was 3.95 (range 3.27-6.4), mean Pain score (0 to 10 maximum) was 1.1 (range 0-3).

Conclusion: Accurate understanding of the intercostal nerve anatomy improved the outcome of Nuss procedure cryoanalgesia. As a result of this study, the collateral branch of the intercostal nerve has been resurrected from obscurity and insignificance. Cryoablation of the collateral branch doubles the intraoperative cryoablation time (from 8-point applications to 16 point application) but patients are grateful for the time well spent.

Intercostal nerve cryoablation for surgical correction of pectus excavatum: Operative experience with one minute ablation.

Suhail Zeinddin, Samuel C. Linton, Michela Carter, J. Benjamin Pitt, Guillermo Ares, Jesse Arseneau - Fizan Abdullah, Seth D. Goldstein, MPhil.
Ann & Robert H. Lurie Children's Hospital of Chicago.USA

Background: Intraoperative intercostal nerve cryoablation has emerged as a promising modality for postoperative analgesia following Surgical Correction of Pectus Excavatum (SCOPE). Cryoprobe applied to thoracic nerve roots from pleural space and cooled to -50◦c to -70◦c No difference in immediate changes to the nerve between 1- and 2-minute freezes in histologic study1 Initial clinical trial in thoracotomy patients showed efficacy with a 1-minute freeze.
Aim: Describe our center's experience with one minute per level cryoablation over our first 100 patients and compared to our average prior to Cryo use
Methods: A retrospective institutional review of patients undergoing SCOPE with one Nuss bar was performed to compare patients pre- and post-intercostal nerve cryoablation implementation. Cryoablation was performed as one minute for each of the thoracic intercostal nerves 3-7. Compared outcomes, operative times, and cost between pre- and post-implementation groups.
Results: 198 patients underwent SCOPE Intraoperative intercostal nerve cryoablation (Cryo, n=100) Preoperative thoracic paravertebral catheters (NoCryo, n=98). Surgical time was on average 9 minutes longer for the Cryo group ($p<0.01$). Median length of stay for the Cryo group was 3 days shorter compared to the NoCryo group ($p<0.01$). The Cryo group had a 19-fold and 5.6-fold reduction in average inpatient and total postoperative opioid usage, respectively ($p<0.01$). Total hospital costs were significantly lower in the Cryo group ($p<0.01$). Overall complication rate was not statistically significant different between the two groups.
Conclusions: After performing 100 cases, using one-minute Cryo led to a shorter hospital length of stay with far less need for systemic opioids compared to conventional analgesia without an increase in complications. Cut-to-close surgical time added on average about 9 minutes to our pre-Cryo operative time. Cryo hospitalization was associated with lower cost compared to pre-Cryo hospitalizations at our institution. Further research into the optimal time of cryoablation in terms of pain control and sensation recovery is needed.

Early modifications in pressure of correction and treatment in Pectus Carinatum patients undergoing treatment with a dynamic compressor system.

Toselli Luzia, Chinni E, Vallee M, Sanjurjo D, Elmo G, Bellia-Munzón G.
Fundación Hospitalaria.Buenos Aires,Argentina

Background: The employment of a dynamic compressor system (DCS) is currently one of the most popular approaches for the treatment of pectus carinatum. However, evidence of immediate changes in chest wall pressure of correction (PC) and the pressure of treatment (PT) at the beginning of DCS treatment is lacking. This information is relevant because variation in PC and PT guide the attending physician in the gradual increase of pressure through brace adjustments. Therefore, in this study, we aimed to determine and evaluate the variations in PC and PT prior to DCS implementation, after 15 minutes, and 1 month of use.

Materials and Methods: Prospective observational study including all consecutive patients with pectus carinatum who visited our outpatient pectus clinic and received their pectus carinatum DCS (®FMF Dynamic Compressor system) between June 2021 and June 2022. Patients who did not return to the 1-month visit were excluded. Technique: During the fitting consultation, the initial pressure of correction was measured, and after fitting the DCS, the initial pressure of treatment was measured. A 15-minute walk was indicated to all the patients for feedback on comfort and doubts. On their return, 15-minute pressure of correction and 15-minute pressure of treatment were assessed. Patient indications during the first month included wearing the DCS for 6 hrs the first 15 days, and 12 hrs the next 15 days for soft tissue habituation. PC and PT were reassessed at the 1-month visit.

Results: Sixty-four patients were included (91% males) with a mean age of 13.5±1.8 years.

Pressure of correction: PC showed a consistent decrease from baseline to 15 minutes (6.98±2.2 vs. 5.84±2.3, $p<0.0001$) and from 15 minutes to 1 month (5.84±2.3 vs. 5.26±2.0, $p=0.004$).

Pressure of treatment: Although the decrease in baseline PT was not significant when compared to the 15-minute PT (1.12±0.2 vs. 1.04±0.9, $p=0.46$), a significant drop was noted when compared to the 1-month PT (1.04±0.9 vs. 0.72±0.5; $p=0.022$).

Discussion: These results suggest that pressure reductions occur early in the implementation of the DCS for the treatment of pectus carinatum. Thus, further studies are warranted to determine whether adjustment periods may be shortened without increasing pre-sternal soft tissue injuries.

Improved outcomes with increasing expertise in thoracoscopic Intercostal cryoanalgesia during MIRPE: Insights from a single-center consecutive cohort of 136 patients treated within 5 years.

Toselli Luzia, Bellia-Munzón G, Sanjurjo D, Vallee M, Martinez-Ferro M.
Fundacion Hospitalaria.Buenos Aires, argenitna

Background: Since the introduction of thoracoscopic intercostal cryoanalgesia (TIC) during minimally invasive repair of pectus excavatum (MIRPE), several studies have reported a reduction in the requirement of postoperative opioids and in length of stay. However, evidence of the influence of the learning curve in the results of TIC during MIRPE is lacking. Thus, we sought to explore the relationship between procedural experience and the clinical outcome of TIC in a large series of patients treated by the same surgical team.

Materials and Methods: Retrospective study including all consecutive patients undergoing TIC during MIRPE in a single center specialized in the treatment of thoracic malformations, since October 2018. All patients were operated by the same team of surgeons using the same pre and postoperative pain management approach. For a comprehensive comparison, the sample was divided in consecutive tertiles according to date of surgery. Technique: Cryoablation was applied for 2 minutes at -70°at 5 intercostal spaces bilaterally (from the 3rd to the 7th) under thoracoscopic guidance prior to the retrosternal passage of the introducer. Main technical details: 1) selective bronchial intubation to achieve intermittent complete lung collapse enabling access to the posterior intercostal groove without contact between the probe and the lung; 2) introduction of the cryoprobe through the lateral skin incisions, 1 cm lateral to the anterior axillary line; 3) application of the cryoprobe at the center of the intercostal space with a subsequent cephalad thrust; 4) maintenance of the cryoprobe tip parallel to the upper rib; 5) lateralization of the operating bed to the right when performing TIC on the left side for medial mediastinal shift.

Results: We included 136 patients. We did not identify differences between groups regarding age (p=0.57), Haller index (p=0.45), correction index (p=0.53), number of implants (p=0.34), and duration of surgery (p=0.46) (Table 1). The duration of cryoanalgesia decreased significantly with procedural experience (early 39.2±14.6 min, intermediate 35.4±7.6 min, contemporary 33.2±6.3 min p=0.020). Variables related to in-house pain control including number of opioid doses (OD) administered (early 1.3±1.5 OD, intermediate 0.8±1.1 OD, contemporary 0.7±1.0 OD, p=0.048) and postoperative length of stay (early 1.6±0.9 days, intermediate 1.5±1.1 days, contemporary 1.1±0.3 days, p=0.03) decreased significantly with procedural experience.

Conclusions: Increasing expertise in thoracoscopic intercostal cryoanalgesia during minimally invasive repair of pectus excavatum enabled a significant decrease in the length of stay and in-house opioid requirement.

Intraoperative cryoanalgesia vs. epidural anesthesia in multimodal pain management after Nuss procedure.

Sjoerd de Beer, Jong de JR, Oomen MW, Zwaveling S, Heurn van LWE.
Amsterdam UMC. Netherland

Background: Although Nuss procedure for pectus excavatum is minimal invasive, it is known for its significant postoperative pain. This generally leads to a longer hospital stay (LOS) and a high consumption of opioids.
Methods: A retrospective single center study of 66 consecutive patients undergoing Nuss procedure between January 2019 and july 2022 was performed to assess the effectiveness of multimodal pain management containing cryotherapy (CRYO, n=33) versus epidural anesthesia (EPI, n=33). The first 33 patients received epidural anesthesia for 3-4 days, combined with patient-controlled systemic opioid analgesia (PCA). The last 33 patients received inta-operative bilateral thoracoscopic T3-T9 intercostal nerve cryoablation, combined with PCA. If necessary additional pain treatment was given. Primary outcomes were LOS and Opioid consumption, secondary outcomes were Visual Analogue Scale (VAS) pain scores scores and operation time.
Results: Median age was 16 for both groups. Median LOS in the CRYO group was shorter than in the EPI group: 3 (IQR 3-4) vs. 6 (IQR 5-8) days (P<0.001). After 1 week 2/33 patients (6%) in the CRYO group still used opioids vs. 15.33 (45%) in the EPI group (p<0.001). After 6 weeks in both groups, one patient still used opioids. PCA systemic opioids could be stopped at postoperative day 1 (median) in the CRYO group vs. day 4 in the EPI group (p<0.001). Median VAS scores at day 0, 1 and 2 were lower in the CRYO group (resp. 2 vs. 3; 3 vs. 4 (p=0.004); 2 vs. 4 (p=0.001)). 10/33 patients (30%) were discharged with opioids in the CRYO group vs. 32/33 (97%) in the EPI group (p<0.001). Median operation time (sign in to end surgery) was shorter for the EPI group (119 (IQR 100-134) vs. 130 (IQR 121-145), p=0.016). Additional pain medication was administered in 2/33 (6%) in the CRYO group and in 29/33 (88%) in the EPI group (ketamine 3 vs. 0%, Clonidin 3 vs. 58%, Gabapentin 0 vs. 79%).
Conclusions: Cryotherapy combined with PCA (opioids) as a multimodal postoperative pain management for Nuss procedure is more efficient than the combination of epidural anesthesia with PCA. Patients were discharged earlier, had better pain scores and a significant reduction in opioid use.

Three year experience with percutaneous cryoanalgesia. What we have learned.

Carlos de la Torre Ramos, M. Velados, M. Alonso.
Hospital Infantil La Paz.

Background: Cryoanalgesia(PCr) has been used for pain management for pectus excavatum(PE) in recent years. Our aim is to describe our experience with Percutaneous Cryoanalgesia for PE and other indications (OI), emphasizing on its advantages and disadvantages.

Material and Methods: A prospective analysis was performed in patients undergoing PCr from January 2019 to July 2022 at our institution. We describe indications, protocols, technique and postoperative issues, together with demographic, clinical, radiological, analgesic needs and complications. Follow-up data focused on the first postoperative month.

Main results: We present 72 patients (62PE/10 OI). Amog PE patients PCr was applied on the Same Day in 30, 24hrs before in 24 and 48hrs before in 8. Related to analgesia, PCr24 and PCr48 showed lower opioid consumption than PCrSD in PCA volume (49.6 and 48.5 vs 75.1 ml; p=0.015) and PCA time (23.3 and 23.8 vs 34.3 hours; p=0.01). Degree of pain (VAS scale) on the day of surgery and on the 2nd postoperative day was lower in PCr24 and PCr48 than in PCrSD (4 and 2 vs 5; p=0.012; 0.2 and 1 vs 2; p=0.043, respectively) as well as shorter hospital stay (3 and 3.5 vs 5 days; p=0.021). In addition, PCr24 showed lower opioid consumption and hospital stay than PCr48 (p>0.05). PCr24 saved €2602.8 per patient versus PCrSD and 723€ versus PCr48; and PCr48 saved 1879.8€ per patient versus PCrSD. No patient of the group refused a double anesthethic procedure when indicated (24 and 48 hours before) and there were no complications. Among other indicatios PCr was used for rib fractures, slipping rib syndrome and lung transplant. Comparing to conventional analgesia PCr provide a better pain control with lower opioid consumption and faster recovery.

Conclusions: PCr 24hrs prior to PE surgery offers lower opioid consumption, less pain and shorter hospital stay. PCr24 is comparable to PCr48, but seems to show advantages and presents simpler logistics. Our data suggest that PCr, especially PCr24, provides hospital cost savings. Finally, PCr is a viable option for postoperative pain control for other thoracic procedures.

Cryo-intercostal nerve ablation: An old technique for a new application for pain management after Pectus Excavatum repair.

Hyung Joo Park, Gong Min Rim.
Seoul St. Mary's hospital.

Background: The conventional postoperative pain management, including intravenous patient-controlled analgesia (PCA) and local anesthetic infusion to the para-costal region (the pain-buster) has been sub-optimal after pectus excavatum repair. The cryo intercostal nerve block analgesia used to be the method for a post-thoracotomy pain control. On the basis of its proposed mechanism of action, we hypothesized that cryoanalgesia could be a superior method for pain management.

Materials and Methods: Twenty-seven patients undergoing MIRPE between age of 10 to 20 years during March 2022 and June 2022 were enrolled in a randomized controlled trial. Visual Analog Scale (VAS) was used for the pain assessment (Fig 1). And to interpret VAS score, we hypothesized VAS score under 4 for acceptable state for pain. The two groups are assigned as Group C (Cryo intercostal nerve blocks + IV PCA + Pain-buster) (n=14) and Group P (IV PCA + Pain-buster) (n=13). The VAS outcomes measured at postoperative 6/12/24/48/72 hours. Total operating time, total opioid consumption, length of stay, and PO complications were compared in both groups. Intercostal nerve cryoablation was performed with cryoprobe at -100℃ for 2 minutes from the 4^{th} to 7^{th} Intercostal nerves bilaterally under thoracoscopic assistance. Intravenous PCA was the mixture of IV fentanyl 10 mcg/kg in normal saline 100 mL with basal rate of 0.5 cc/hr, bolus dose of 1 cc, and lockout time was 10 min. The pain-buster (On-Q TM) was the continuous infusion of 0.5% bupivacaine at the rate of 2ml/hour via a subcutaneous catheter placed next to the rib cage.

Results: There were no difference between two groups in age, gender, severity of deformity, or postoperative outcomes. The mean operation time was 51 minutes longer in Group C than Group P (174 min. vs. 123min, p=0.247). VAS score was different between both Groups (Fig. 2). The intercostal nerve cryoablation (Group C) showed less pain throughout the course. The average VAS-R difference range was 1.52 to 2.32 ($p<0.05$). Both groups showed over moderate pain scale numbers in immediate PO (5.21 vs. 7.08), but in Group C, the pain was decreased to mild after 72 hours whereas Group P was still had moderate pain (2.08 vs. 4.86, p=0.013). Total opioid consumption, which calculated in total P.O Morphine equivalent, however, showed no statistically significant difference (32.61mg in Group C vs. 32.13mg in Group P, p=0.68). The hospital stay also was not different (5.8days in Group C vs. 4.7days in Group P, p=0.237). There were no complications such as pneumothorax, pleural effusion, neurologic complications, and bar dislocations in both groups. There were no adverse reactions observed during or after the intercostal nerve cryoablations.

Conclusions: In this small cohort's preliminary data analysis, adding cryo intercostal nerve blocks to the conventional conservative pain management strategy improved postoperative pain control. However, cryoablation of the intercostal nerves did not demonstrate sufficient efficacy to reduce the pain scale to zero to mild immediately following surgery. Given its procedural invasiveness and additional instrumentation, its use in routine pectus surgery has yet to be determined. In addition, its long-term effects and potential adverse reactions require investigation.

Results of orthosis application in pediatric age group Pectus Carinatum patients.

Esra Yamansavcı Sirzai, Nezih Onur Ermerak, Tunç Laçin, Mustafa Yüksel.
Health Sciences University Dr. Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital.

Background: Pectus carinatum (PC) is a chest wall deformity, known as pigeon chest, characterized by varying degrees of anterior protrusion of the sternum and sternocostal cartilages. It is the most common chest wall deformity after pectus excavatum. This study presents the results of patients under the age of 18 who underwent orthotic treatment for PC.
Materials and Methods: Between January 2015 and January 2022, orthotic treatment was applied to 1235 patients due to PC. Among these patients, 1174 patients aged 18 years and younger were included in the study and analyzed retrospectively. First week, patients were recommended to start with low compression pressures at least 12 hours per day. At the end of 2 weeks, the targeted compression level of orthosis adjustment was reached.
Results: 1015 (86%) of the patients were male and 159 (14%) were female and the mean age of the patients was 12.6 ± 3.67. Asymmetric/mixed excavatum deformity was present in 157 (13.3%) patients. Carinatum pressures were recorded on average 6.18 ± 2.22 kg/cm at baseline. After an average of 7.88 ± 2.71 months in 950 patients, the carinatum pressure control decreased to an average of 2.32 ± 1.67 kg/cm. After the treatment, orthosis was started again in 24 (2.04%) patients due to recurrence of the carinatum after an average of 9.25 months. The orthotic treatment used for recurrence was successfully terminated after an average of 5.15 months. 15 (1.27%) patients could not complete the treatment protocol due to irregular use, and 3 (0.25%) patients decided to get operated. We have 224 (19%) patients who are still under treatment. The only morbidity of the treatment was ecchymosis in the application area in 22 (1.8%) patients.
Discussion and Conclusion: Orthotic treatment has entered our daily practice and replaced surgical treatment of PC in children under 18 years of age who has PC. We believe that this method, which has high treatment compliance and successful results, is a technique that can be used safely in the treatment of carinatum.

Results of vacuum therapy in pediatric age group Pectus Excavatum patients.

Esra Yamansavcı Sirzai, Nezih Onur Ermerak, Tunç Laçin, Mustafa Yüksel.
Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital.

Background: Pectus excavatum (PE) is the most common deformity of the chest wall and is mostly operated for cosmetic reasons in young adults under the age of 20. This study presents the results of patients under the age of 18 who underwent vacuum therapy for PE.
Materials and Methods: Between January 2018 and January 2022, vacuum therapy was recommended for 553 patients due to PE. Vacuum therapy was started in 466 of these patients. Patients are recommended to use the vacuum for 15 minutes in the mornings and 15 minutes in the evenings during the first week. The application duration was increased to 30 minutes in the mornings and 30 minutes in the evenings in the second week. The ultimate application duration was reached at the 3rd week as 1 hour in the mornings and 1 hour in the evenings.
Results: There were 378 (81.2%) male and 88 (18.8%) female patients. The mean age of the patients was 11.25 years (6 months - 17 years). Asymmetric/mixed excavatum deformity was present in 51 (10.9%) patients. The mean depth of the deformity was recorded as 2.79 +/- 0.86 cm at the beginning of the treatment. In 331 patients, a 50,17% reduction in pectus depth was detected in the controls after an average of 9.66 (6 - 20 months) months. In 23 patients, there was no change in depth despite 9 months of use. We have 112 patients who are still under treatment. Petechiae in the application area was observed in 4 (1.12%) patients.
Discussion and Conclusion: In patients with pectus excavatum presenting for cosmetic and psychological reasons in childhood, it is possible to achieve satisfactory results by eliminating surgical risks with vacuum therapy.

Does overcorrection of the sternum position in the initial Nuss procedure in Pectus Excavatum patients treated in the pre-pubertal period prevent recurrence with growth?

Masahiko Noguchi, Kou Hasegawa.
Nagano Children's Hospital.

Background: At this meeting in 2015, we reported that the postoperative sternum position shifted downward after bar removal in pectus excavatum patients treated with the Nuss procedure. Reducing the angle of the manubrium along the head–foot axis most affected this shift. We also confirmed that there was no significant difference in degree of change in sternum position between groups that underwent primary Nuss surgery before and after puberty.
On the other hand, the recurrence rate was reported to be about 5% after bar removal in patients with pectus excavatum treated with the Nuss procedure. Kelly suggested that pectus excavatum can recur during the pubertal growth spurt after repair early in childhood. However, Park reported the benefit of early correction and that recurrence was due to inadequate lifting of the chest wall. However, he did not describe the suitable target point to prevent recurrence. Overcorrection is a common way of preventing recurrence with growth in plastic surgery procedures, such as cleft lip. Therefore, we postulated that it may be useful to form the sternum in the overcorrected position considering the amount of relapse of the sternum after bar removal. Here, we conducted a simulation study by incorporating growth as factor into thoracic models created with reference to the thoracic morphology determined from postoperative CT images of pectus excavatum patients treated with the Nuss procedure. Using these models, we examined how thoracic morphology changes with growth.
Materials and Methods: We used the finite element human body model, THUMS v4.0.2 (TOYOTA®), which can accurately reproduce the shape and strength of the human body. Two forms, corresponding to non-overcorrected and overcorrected types, were selected from postoperative CT images after the initial Nuss procedure. Using the conversion tool (Simpleware Synopsys®), the thoracic shape and features of each pattern were extracted from CT images. The shape of the basic model was morphed to the analytical model. Finally, growth along the longitudinal direction of the costal cartilage using thermal expansion simulation was added to the models.
Results: In all models, the sternum position gradually moved dorsally with growth, and the anteroposterior diameter of the thorax decreased. This change was particularly remarkable in the non-overcorrected type. However, the portion of the sternum was maintained at approximately the same height as the chest wall. Moreover, the costal arch protruded with growth in all models. However, unlike other models the caudal end of the sternum was located dorsal to the costal arch in the non-overcorrected type. This morphological change of the simulation in the non-overcorrected type model was considered to correspond to recurrence. On the other hand, in the overcorrection type, although similar changes were observed, the portion of the sternum remained anterior relative to the ribs and did not lead to recurrence.
Conclusions: The results of this simulation study showed that overcorrection of the sternum position is useful to prevent recurrence of pectus excavatum with growth. We considered the position of the lower costal margin immediately after the initial operation to be significantly related to subsequent recurrence.

Evaluation of MIRPE success in patients aged forty and over.

Hasan Ersoz, Rezzan Karaali, Mustafa Yüksel.
Izmir Kâtip Çelebi University- Izmir Turkey.

Background: In the article in which the original Nuss Method performed for the treatment of pectus excavatum deformity is described, the application is recommended for patients up to 15 years of age, while MIRPE is performing at older ages patients today as a result of the modifications made on this technique over the years.Over 30 years old Patients' operations are called advanced age applications.Applications in the fourth and even fifth decades are very rare.We designed this study in order to compare the success of these patients with the correction success we have made in previous decades, since there are patients in our centers for whom these extreme age corrections have been made and these have not been discussed in the literature before.

Methods: We analysed 10 patients aged 40 and over, and the other patient group in which the same number of cases were randomly selected aged 18-39 years who were operated in our centers between August 2010 and March 2022. We compared the groups retrospectively in terms of patient satisfaction, surgeon satisfaction, operation times, number of bars used, postoperative hospital stay duration, number of drains inserted, preoperative and postoperative state indices, bar removal times, complications and mortality.

Results: 80% of the patients were male and the mean age was 40.4±16.03 years. The mean Haller index was 4.04±0.64 preoperatively and 2.69±0.28 postoperatively. The patients were followed for an average of 8.40±2.19 years. When the patient groups were compared, the mean age was 25.9±5.32 years for group 1 and 54.90±6.85 years for group 2. In the comparison of the parameters evaluated between the groups, the variables of Postoperative Haller index, Surgeon Evaluation score and postoperative tube thoracostomy need ($p<0.05$) were statistically significantly different between the groups. No difference was observed in other variables. While there is a moderately positive and significant relationship between the age of the patients and their hospital stay ($r = 0.540$, $p = 0.01 <0.05$), there is a negative and moderate relationship with the patient evaluation score ($r=-0.447$, $p= 0.048<0.05$), a significant relationship was observed. There was a negative and high-level significant ($r=-0.772$, $p=0.00<0.05$) significant relationship between physician evaluation score and patient age. It was observed that there was a significant and high-level ($r=0.727$, $p=0.00<0.05$) relationship between the postoperative Haller index and the patient's age.

Discussion and Conclusions: Studies in the literature indicate that the best method for the treatment of pectus excavatum is MIRPE. Our results are also consistent with this. However, unlike the studies in the literature, what makes our study valuable is the handling of much older patients. Because while 3rd decade patients are defined as advanced age in studies in the literature, these patients are included in the younger age group in our study. 4th and 5th decade patients were described as older patients in our study. However, in the results we obtained in our study, similar to the literature, we found findings against advanced age between the two groups in a few data such as surgeon satisfaction, patient satisfaction, hospital stay and Haller index. However, the important thing is that there was no difference in vital data such as complications and mortality. This is because these patients, although uncomfortable in the early postoperative period, will live with their heart and lungs freed from pectus excavatum deformity in their old age, away from compression. Since there is no increase in pathologies that will affect the long-term results of the patient such as mortality or complications, it is possible to say that performing this surgery at an advanced age is more "uncomfortable" for the early period, but quite "safe" in the long run.In this study, in which we evaluated elderly patients, the results we obtained after surgery show that PE can be treated regardless of age when diagnosed.

Simultaneous treatment of chest wall deformity, scoliosis and kyphosis.

Ikromjon Uralboev, Khamdamov M.M., Shadieva Kh.N., Woo Sunyoung.
Samarkand Regional Children's Multibranch Medical Center, Samarkand Medical University, Uzbekistan.

Background: Pectus Carinatum (PC), kyphosis, lumbar-lordosis, scoliosis and rib deformity is a complex congenital malformation with anatomical and cosmetic defects.
Aim: Evaluate the effectiveness of Simultaneous Complex Conservative Treatment (SCCT) of PC, Scoliosis, Kyphosis, lumbar-lordosis and rib deformity in children.
Material and methods. 208 patients aged 5-19 examined. Radiography and MRI were done. By localization:
PC in combination: -with thoracic-kyphosis and kyphoscoliosis – 198(95.2%) -with lumbar-lordosis – 8(3.8%)
-cervico-lumba- lordosis I-II stage – 2(1.0) By degree: PCII deg.+thoracic kyphosis – I-deg. – 41(19.7%) PCII deg.+thoracic kyphosis – II-(A-B) deg. – 62(29.8%) PCII deg.+thoraco-lumbar kyphosis III-deg. 2(1.0%) PCIII deg.+thoracic kyphosis – I-deg. – 44(21.1%) PCIII deg.+thoracic kyphosis – II-(A-B) deg. – 39(18.7%) P II-III deg.+kyphoscoliosis I-deg. – 10(4.8%) PCII-III deg.+lumbar lordosis I-II-deg. – 8(3.8%) PCII-III deg.+thoracic kyphosis – II-(A-B) deg. and cervico-lumbar lordosis I-II stage – 2(1.0%). The indications for conservative therapy with thoracic frame deformation were a cosmetic defect, compression of intrathoracic organs, intervertebral nerves and intercostals muscles damage. Previously, we used a generally accepted three-stage conservative method of treatment (62(29.8%)): compression orthoses (16 months), soft posture corrector (8-12 months); rib bandage (6-8 months). The main disadvantage of this method is duration. In 59(28.3%) patients with PC combination with kyphosis, we used a two-stage method of wearing compression orthoses with a soft posture corrector and a soft corrective rib band for 14-18 months. The simultaneous use was inconvenient causing weight lost. Since 2019, 87(41.8%) patients have been treated with a SCCT using compression orthoses combined posterior metal corrective plates and anterior rib corrective bandage for 11-13months and exercise therapy.
Results: After 8-12-16 months, we got 161(77.4%) "good", 34(16.3%) "satisfactory", 13(6.3%) recommended to wear the corrector again. Alignment of chest frame and vertebral column consequently improved the functional parameters of intrathoracic organs, state and function of intervertebral nerves and muscles. After cosmetic correction the psychological state of patients increased.
Conclusion. This proposed method of treatment makes it possible to obtain a high percentage of good results.

A method for correcting acquired Pectus Carinatum (APC) using an orthosis after open heart surgery (sternotomy) in children.

Ikromjon Uralboev, Khamdamov M.M., Shadieva Kh.N., Woo Sunyoung.
Samarkand Regional Children's Multibranch Medical Center, Samarkand Medical University, Uzbekistan.

Aim: Evaluation the effectiveness of a conservative method for the treatment of acquired Pectus carinatum (APC) using an orthosis after open heart surgery in children.
Material and methods: In order to eliminate APC after sternotomy performed in patients with open heart surgery, we examined 22 children aged 3 to 14. We divided the patients into groups depending on the beginning of the correction: 1st: 12(54,5%) children - from 6 to 10 months, 2nd: 7(32.0%) patients - from 10 months to 2 years, 3rd: 3(13,5%) children - more than 2 years after surgery. By age: We also compared the effectiveness of correction depending on age: from 3 to 6 in 13(59.1%) and from 7 to 14 in 9(40.9%). According the types of deformation: symmetrical in 16(73.0%) and asymmetrical - in 6(27.0%). All patients underwent echocardiography, ECG, radiography, chest MRI, the amount of compression depending on the degree of deformation and the "reaction of the heart" to the procedure. Cardiac responses were assessed before and after orthosis fitting and every 2 weeks thereafter. At the same time, the issue of further compression and continuation of treatment was being solved. The observation period was 15 months.
Results. According to the results of our study, we noted an almost complete restoration of the shape of the chest visually and according to MRI within 12 months in 10(45,5%) of patients from the 1st group, 2 (9.1%) of patients in this group continued to wear the orthosis for a longer period (about 15 months), the restoration of the form was incomplete for them. In the 2nd group, we received a positive result in 4(18,2%) of patients, but in a longer period (more than 12 months), in 3(13,6%) from this group, treatment continues at the moment and the restoration of the shape of the chest is incomplete. In patients of the 3rd group, in 3(13,6%) of patients, the results were unsatisfactory. By age: If we evaluate the effectiveness of our method in children depending on age, then in the younger and middle age groups the results were satisfactory in 10(46.0%) patients, which we attribute to a more flexible chest frame, faster healing and greater adaptability to the orthosis, in the older age group the results were satisfactory in 4(18.2%) patients.
Conclusions. A new conservative method for correcting APC after open heart surgery (sternotomy) by wearing an orthosis can be considered effective if it is used early after surgery (6-12 months) and in children of younger and middle age groups (3-12 years).

Short, cross, and sandwich bars. New techniques in pediatric pectus surgery.

Anja Christina Weinhandl, Wiener Caspar, Yüksel Mustafa, Rebhandl Winfried.
Department of Pediatric surgery, Medical University of Vienna, Vienna.

Background: Open procedures have been replaced by minimally invasive techniques (Nuss-Procedure, MIRPE/MIRPC) in the correction of pectus excavatum (PE), pectus carinatum (PC) and combined forms of PE and PC (e.g. pectus concavo-convexus/crumpled chest wall). Herein, we report our experiences with the modified short bar-minimally invasive pectus excavatum- (MIRPE) and carinatum-repair (MIRPC), and the sandwich repair with external and internal bars for the repair of excavatum/carinatum complex.

Method: Between January 2019 and July 2022, 49 patients (9 MIRPC, all male; 39 MIRPE, 33 male, 7 female; 1 combined PE/PC-repair, sandwich-technique) underwent minimally invasive correction of PE, PC or combined forms of PE and PC using the modified short bar-MIRPE/MIRPC. Besides the shorter bars, this technique allows the use of more than one bar, running crosswise or parallel, allowing correction of asymmetric or combined forms.

Results: All 49 patients tolerated the procedure well. Mean operation time was 127 minutes, the median hospital stay length was 4.5 days. A total of 90 bars were implanted as followed: 9 single-bars for MIRPC, and, respectively 7 single bars, 19 parallel bars, 13 cross-bars (3 single cross, 10x 3 bars/cross + parallel) for MIRPE technique and another 2 bars for the sandwich-technique. Intraoperative complications were not recorded. Early complications were observed in 6 patients (12,24 %), and late complications were observed in 2 patients (4 %). The most common complications were metal allergy and pleural effusion. In one female patient bar dislocation occurred, leading to revision and bar replacement. No bar rotation war observed.

Conclusion: The modified short bar-MIRPE/MIRPC and the sandwich technique are safe and effective methods for treating chest wall deformities in children and adolescents. They provide excellent cosmetic and aesthetic results as well as subjective satisfaction with the outcome of surgical treatment. By using shorter bars and optionally more than one bar at the same time, asymmetric or combined forms can be treated effectively.

Clavicle-bar distance: A practical new measure to evaluate bar displacement after minimally invasive repair of Pectus Excavatum (MIRPE).

Alana Cozzer Marchesi, José Ribas Milanez de Campos, Miguel Lia Tedde, Aldo Parodi Pita, Vanessa Moreira, Paulo Manuel Pêgo Fernandes.
University of São Paulo.

Background: Bar rotation is a potential and serious postoperative complication of MIRPE, the current preferred method for surgical correction of pectus excavatum. At the moment, the bar displacement index (BDI) is the most widely used radiological measure to evaluate this complication. However, the anatomical boundaries on which it is based are not always identifiable on the chest X-Ray (CXR), impacting on the reproducibility of the index. Here we propose a new and simple radiological measure to assess bar displacement in the post-surgical follow-up of MIRPE - the Clavicle-Bar Distance (CBD).

Materials and Methods: The Clavicle Bar Distance (CBD) is based on the measurement of the distance from the border (either superior or inferior) of one of the clavicles to the superior border of the bar on the posteroanterior (PA) CXR. The line drawn between these reference points must be perpendicular to the bar, and since it is possible to use different landmarks on the clavicles, CBD must be measured in the same way on a particular patient. If CBD changes significantly from the first CXR to the posterior ones, bar displacement is diagnosed - a downwards rotation is thought of when there's an increase in CBD value, and an upwards rotation when this number decreases. The performances of BDI and CBD were retrospectively assessed for bar displacement by two thoracic radiologists from our department. Our results showed that in 12 of the 30 cases, the borders of the sternum were not clearly identifiable on the lateral CXR, making it impossible to determine the BDI. On the other hand, CBD was measurable in all cases.

Discussion: The greatest impediment in measuring BDI is the superposition of structures with similar densities in the lateral CXR incidence. CBD was thought as an alternative to overcome this obstacle, with the use of the extremity where the clavicle articulates with the manubrium as the major reference in the PA CXR.

Conclusion: Our opinion is that CBD is a simple and quick-to-use tool to aid on bar displacement evaluation after MIRPE on all patients. It can be performed anywhere, by any physician that has the availability of an X-Ray equipment. The exact cutoff values on CBD variation for this objective are yet to be determined with additional studies, but it is already possible to determine the occurrence of bar displacement with this measure as it is presented now.

Pericardial agenesis is not a contraindication for the Nuss procedure: A case report.

An-Lies Provoost, Willy Coosemans, Hans Van Veer.
University Hospitals Leuven.

Background: Pericardial agenesis is a rare congenital defect characterized by partial or complete absence of pericardium. Generally, it is asymptomatic and is diagnosed only incidentally.
Case Report: An 18-year-old male patient presented at the outpatient clinic with atraumatic left thoracic chest wall pain and exercise intolerance. On clinical examination a deep pectus excavatum was visualized at the lower half of the anterior chest wall, which was confirmed by chest wall computed tomography. A Haller index of 3.8 was documented. The patient was scheduled for a Nuss procedure to correct the chest wall deformity. Intraoperatively, agenesis of the left anterior pericardium was diagnosed without evidence of additional anatomic anomalies. Using a video-assisted thoracic surgery (VATS) procedure, a single nickel steel bar was inserted successfully during an uncomplicated procedure. The immediate postoperative course was uneventful, and at consecutive follow-up clinics the functional, radiological and aesthetic results were satisfactory. Due to the COVID-19 pandemic, removal of the Nuss bar was delayed upon 5 years after placement. Considering the potential formation of scar tissue between the cardiac ventricle and the bar, right thoracoscopy was performed prior to bar removal showing the bar well tucked away in an as-expected fibrotic sheath at the level of the anterior chest wall with the beating heart well away. The bar was removed safely under direct thoracoscopic vision confirming a safe retraction plane without the need for performing any intrathoracic dissection. No cardiac injury occurred. The postoperative course after bar removal was uneventful with no complications at 6 weeks follow-up.
Conclusion: This case report highlights an uneventful bar placement and removal of a Nuss bar in a patient with pericardial agenesis. Thoracoscopic assessment, bimanual mediastinal tunnel technique and visual guidance during initial correction prevents acute injury to the heart. As to avoid injury when removing the bar, thoracoscopic assessment should be performed prior to removal of the bar to guarantee an adhesion free plane between the right ventricle of the heart and the bar.

Nuss bar removal without straightening is a safe technique: A single center experience.

Nicky Janssen, Jean HT Daemen, Omar Ashour, Luca van Hulst, Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos.
Zuyderland Medical Center, Heerlen, Netherlands.

Background: Nuss bars that have been placed to correct pectus excavatum are usually removed after a period of two to three years. Bar removal can result in potentially life-threatening complications. To minimize this risk a recent systematic review recommends in-situ straightening of the bar before removal. Alternatively, the bar can be removed without straightening by extraction along the thoracic curvature. This study reports our single-center experience with this latter technique for bar removal, with focus on perioperative complications.
Methods: A single-center retrospective observational cohort study was conducted. Consecutive patients undergoing Nuss bar removal between 2011 and 2020 were eligible for inclusion. The primary outcome was the incidence of perioperative complications. Secondary outcomes included duration of operation, blood loss, and length of postoperative hospital stay.
Results: A total of 331 patients were included. Of these, 288 (87%) were male with a median age of 20 years (interquartile range 19 - 26). Perioperative complications occurred in a total of 4 patients (1%) following Nuss bar removal. Two patients (0.6%) experienced major complications (deep incisional surgical site infection and hemothorax respectively); there was no mortality. The median duration of surgery was 30 minutes (interquartile range 20 - 40). Patients were discharged after a median postoperative stay of one day (interquartile range 1 - 1).
Conclusions: Nuss bar removal without prior in-situ bar straightening appears to be a safe and effective technique. It is associated with a low complication rate of 1%.

Consensus statement: Perioperative care for Pectus Excavatum; an expert-led modified delphi survey among chest wall international group members.

Nicky Janssen, Jean HT Daemen, Elise J van Polen, Yanina JL Jansen, Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos.
Zuyderland Medical Center, Heerlen, Netherlands.

Background: Pectus excavatum is the most common congenital anterior chest wall deformity. Currently, a wide variety of diagnostic protocols and criteria for corrective surgery are being employed. Their use is predominantly based on local preferences and experience. To date, no guideline is available, introducing heterogeneity of care as observed in current daily practice.
Research Question: The aim of this study is to create an expert-based consensus guideline concerning the diagnostic protocol, indications for surgical correction, and postoperative evaluation of pectus excavatum.
Study Design and Methods: This multi-round expert-led modified Delphi survey evaluated agreement on statements regarding the diagnostic protocol, indications for surgery, and further postoperative evaluation. Both national and international experts were invited. The study consisted of three consecutive rounds, shaping a final expert-based consensus guideline. Consensus was achieved if at least 70% of participants provided a concurring opinion.
Results: All three rounds were completed by a total of 57 experts (response rate: 19%), Consensus was achieved on 18 out of 62 (29%) statements. Regarding the diagnostic protocol, participants agreed to routinely include conventional photography. In the presence of cardiac impairment an electrocardiogram and echocardiography were indicated based on expert consensus. Upon suspicion of pulmonary impairment, spirometry was recommended. In addition, consensus was reached on the indications for corrective surgery, including symptomatic pectus excavatum (both physical and cosmetic) and progression. It was moreover agreed that a plain chest radiograph must be acquired directly after surgery, while both conventional photography and physical examination should be part of routine postoperative follow-up. Based on these results, a consensus guideline was drafted.
Interpretation: Through a multi-round expert-led modified Delphi survey, an international consensus guideline was drawn concerning the diagnostic protocol, indications for surgical repair and postoperative evaluation of pectus excavatum. This guideline intends to aid standardization of pectus excavatum care.

Nuss procedure, easier, faster and safer with a “non-invase or minimal-invasive” sternal elevation maneuver.

Alana Cozzer Marchesi, José Ribas Milanez de Campos, Miguel Lia Tedde, Aldo Parodi Pita, Vitor Floriano Salomão Junior, Carlos C. Carita, Paulo Manuel Pêgo Fernandes, Hyung Joo Park.
University of São Paulo.

Introduction: For many years, a variety of surgery techniques represented the "golden standard" for patients with pectus excavatum (PE). This situation changed when Donald Nuss first introduced minimally invasive repair of pectus excavatum (MIRPE). In a small number of patients, as described in the literature, cardiac perforation and aortic injury have occurred during MIRPE.
Some centers use sternal elevation as it makes the mediastinal dissection easier and safer. There are several options available for sternal elevation: creation of an additional tunnel higher up and leaving the first introducer in place to keep the sternum elevated; elevation of the sternum by using the Vacuum system; the “crane technique” using instruments like a retractor inserted either through an additional sub-xiphoid incision or laterally in the sternum; elevation of the sternum by using Park’s Crane Technique.
Material and Methods: The chest is palpated, and the deepest point of the depression is marked. The intercostal spaces that are on the same horizontal plane as the deepest point are at the top ridge of the depression. We separate the sternum body into 3 parts and calculate where the two screws will be placed.
Using a small incision in the skin, the two screws are inserted into the sternum, with the exact size previously calculated by the CT-Scan. With the “Stop Plate”, we are sure that the screw will be placed in the ideal position. The holes where steel wire number 5 will be positioned at a distance of 1.2 cm above the stop plate, the sternum will be pulled upward, thus allowing the best exposure of the anterior mediastinal region to perform the retrosternal tunnel. According to our experimental studies, each screw can hold up to 50 kg.
We are currently performing in our service a protocol of 20 surgeries to correct pectus excavatum, for the sternum elevation, the screw and crane technique was utilized (being 10 of them using 1 bar and lateral stabilizers and the other 10 using 2 bars and lateral fixation bridges). The surgeries discussed in this paper began to be performed in November 2021, until today, 17 surgeries have been performed. The screws used were 8mm and 10mm, as measured previously using a preoperative thoracic CT scan of the sternum. There were no intraoperative or postoperative complications in these cases.
Discussion: Sternal elevation is not necessary for all patients, however in very deep and asymmetric cases, older patients with a rigid thoracic cage, for the beginner surgeons or teaching residents, is extremely helpful and even when associated with other methods like the bilateral thoracoscopic approach to perform MIRPE in young and adult patients.
Conclusion: MIRPE and all technical modifications presented by Park et al. 2016 have undergone a thoughtful learning curve. Using our modified “minimally-invasive” technique for sternal elevation, and also associated with the continuous technical refinements, we are completely sure that we are able to significantly decrease the complication rates and the postoperative morbidity, have better results and improve the quality of life for all patients.

A current modification of MIRPE: Cross-bar technique – multicenter retrospective study.

Hasan Ersöz, Rezan Karaali, Vladimir Kuzmichev, Winfried Rebhandl, Firas Abu Akar, Marouane Lakranbi, Mustafa Yüksel.
Izmir Katip Celebi University, Faculty of Medicine, Department of Thoracic Surgery.

Background: The gold Standard technique used to day for Pectus excavatum (PE) correction is "Minimally Invasive Repair of Pectus Excavatum Surgery (MIRPE)". There are two known surgical techniques in MIRPE for using more than one bar: parallel or cross bar placement techniques. While the parallel bar is routinely applied in many centers, clinics applying the cross-bar technique are limited in the world. In this multicenter study, we aimed to evaluate the data of these rare clinics in which the cross-bar technique was applied, among countries. In these clinics, we planned to determine the effectiveness of the crossbar technique by comparing it with the parallel bar technique in terms of many parameters such as the physiology and satisfaction of the patients, as well as the satisfaction of the surgeons.
Results: A total of 418 patients from Turkey, Russia, Israel and Austria were included in the study. The mean age of the patients was 23.22±8.3, and 82.54% were male. In the comparison of surgical techniques, the number of bars used, intraoperative blood loss, patient satisfaction score and bar removal time were favour of parallel bar technique ($p<0.05$). However, bar infection and recurrence rates were also higher in surgeries performed with the parallel bar technique ($p<0.05$). Parameters found to be statistically different in the comparison of countries; The mean age of the patients reported from Austria is younger (17.03±4.45/year), the shortest operation time (49.22±12.77 min) is in Turkey, intraoperative blood loss (17. 83±8.77/ml) was the highest in Austria, hospital stay was the shortest in Israel (2.82±0.87/day) and the longest in Russia (9.14±2.84/day). The highest patient satisfaction score was in Austria (9.65±0.65) and the lowest in Israel (7.64±1.69), and the lowest physician evaluation score was in Israel (8.55±0.93). BMI was found to be lowest in Austria (19.22±2.89kg/m2) and highest Haller index (5.75±2.07) in Austria.
Conclusion: As a result, both techniques have their own advantages and disadvantages. The selection of the appropriate method in the use of multiple bars should be provided according to the experience of the surgeon. It is normal for countries and clinics to have their own dynamics and differences, depending on how they get used to the crossbar. For clearer information on the comparison of these two methods, prospective randomized controlled studies are needed in which patient characteristics will be selected similarly.

Vacuum bell treatment of pectus excavatum in children: Our experience.

Marcos Prada Arias, Javier Gómez Veiras, Belén Aneiros Castro, Patricia Rodríguez Iglesias, Pilar Fernández Eire, Margarita Montero Sánchez.
Department of Pediatric Surgery. Galicia Sur Health Research Institute. University Hospital Álvaro Cunqueiro, Vigo, Galicia, Spain.

Background: The vacuum bell is a non-surgical treatment option for pectus excavatum. Few studies have evaluated its efficacy in children, so there are few specific recommendations for this age group.
Objective: To evaluate pediatric cases treated with the vacuum bell, in order to establish specific recommendations for these patients.

Materials and Methods: Retrospective study of the children (<15-year-old) treated with vacuum bell in our department since 2010, collecting different variables, among them: initial and final wall depth, corrected wall depth expressed as a percentage of the initial depth, daily hours of use, duration of treatment and complications. The patients were categorized into groups according to the different daily hours of use and treatment periods for statistical analysis.
Results: A total of 52 patients were studied; 43 male and 9 female. The majority (92.3%) had symmetrical pectus excavatum. No significant differences were observed among the different groups in relation to the initial wall depth, the Haller index and the final wall depth. The corrected wall depth increased in relation to the daily hours of use, with significant differences, but not in relation to the treatment periods.
Complications were described in 13 cases (25%), all minor and of short duration at the beginning of treatment. Most of the patients were satisfied and only 4 (7.7%) required surgery after using the vacuum bell.
Conclusions: The effectiveness of the vacuum bell is directly related to the daily hours of use, being especially effective after 6 hours. The treatment period seems less relevant and a duration longer than 12 months are not associated with better results. In summary, the vacuum bell is well tolerated, it has minor complications and it can be an alternative treatment to surgery in some cases.

A new option for chest wall reconstruction in the patients undergoing thoracectomy.

Joao Paulo Cassiano Macedo, Jose Ribas M de Campos, Pedro H N Xavier de Araujo, Paulo M Pego-Fernandes, Ricardo M Terra.
Hospital das Clinicas da Faculdade de Medicina de São Paulo.

Background: Chest wall tumors and benign chest wall disease are uncommon in daily practice. The goal of the oncological procedure is local disease control and relief of symptoms in the palliative approach. In addition to, chest wall reconstruction plays an important role in the outcomes. Currently, there is a huge variety of materials market, from synthetic, absorbable, and non-absorbable. However, the best option has not yet been well defined. Vitagraft is an osteoinductor and osteoconductor used for bone regeneration. It is a synthetic, biocompatible, absorbable, non-cytotoxic, non-immunogenic, and non-pyrogenic synthetic material. It consists of a nanometric ceramic of tricalcium phosphate in the β phase (β-TCP) and the copolymer polylactic glycolic acid. So, this study intends to assess in a prospective view the safe of Vitagraft use in extensive chest wall reconstruction.

Methods: A prospective study in which patients were submitted to FTCWR and reconstruction was based on Vitagraft use. Each use was followed for a minimum period of three months after the surgical intervention. The following variables will be considered: KPS, ECOG, histological type, preoperative radio or chemotherapy, previous surgical treatment, defect size, type of myocutaneous flap, local and systemic recurrence, the time between surgeries, survival, disease-free time, and mortality.

Results: From the total of eleven patients, eight resections were performed due to tumor findings. One patient was submitted to surgery as a consequence of sternal cleft and another because of Poland's syndrome. One sternectomy was a consequence of late sternal dehiscence. Primary closure was performed in 63.6%of the patients, while *Latissimus dorsi* and abdominal flap were necessary in two cases respectively. Vitagraft was massively used in association with polypropylene mesh, a total of eight times. Lonely Vitagraft was used in two patients, and once with bovine pericardium. Reoperation was required in two cases, and prosthesis removal was necessary for one of them. Respiratory failure and major systemic complications were not evidenced.

Conclusion: In our study, the first to assess Vitagraft application regarding extensive chest wall reconstruction, the second operation was necessary in 28%, and removal was mandatory in 14%. Until now, the three-month postoperative chest tomography has been show good prosthesis's biocompatibility. We need further details about the ossification time specially relating to the size of resection.

Ribcare® universal modular self-assembly chest wall reconstruction system.

Joonsuk Park, Yoonji Jung.
Seongnam Citizen's Medical Center, Gyeonggido, Korea.

Background: Extensive chest wall resection and reconstruction is still a technical challenge for thoracic surgeons. Recently, 3D rendered and printed metas prosthesis has been developed and used. However, some patients cannot afford this State-of-the-Art technique due to time and money problem.

Methods: We tried for several years to develop chest wall reconstruction prosthesis, which is mechanically strong, durable enough, readily available, easily individualized, bio-compatible, and intuitively modifiable. Reusability in case of un-expedited extraction was also considered. The concept of on-site assembling modular metal plate was originated from rib metal plates, widely available already. Ribcare® system consists of wide sternal plates, curved rib plates and anchoring screws with various size.

Results: Since 2016, 12 patients underwent chest wall reconstruction after radical resection using Ribcare® system and all successful. There was no postoperative complication, post-reconstruction dehiscence nor problems related with adjuvant radiation. We would like to present 4 representative cases which can describe the feature and usefulness of this system (readily available, versatile and intuitive).

New technique for the reconstruction of sterno-clavicular block with a 3D planned functional customized prosthesis.

Unai Jimenez Maestre, Jose Ramón Cano, Odile Ojanguren, Donato Monopoli, Juan Carlos Rumbero, Naia Uribe-Etxebarria, Monica Lorenzo, Lucía Hernandez, Marta Fernando, Claudia Loidi, Oscar Ruiz, Rafael Rojo.
Cruces Universitary Hospital.

Background: The sterno-clavicular reconstruction after resection, specifically when both joints are involved and even more when the affectation is asymmetric, is a real surgical challenge. So far, it has not been described any definitive technique that can assure the durability and functionality of the new articulations.
The recent development of 3D planned customized implants is a real revolution because it allows the reconstruction of big wall defects both functionally and anatomically, increasing the surgical radicality if necessary. We present a new technique for the customized reconstruction of the esterno-clavicular block.
Case presentation: Male of 67 years old. Background of left nefrectomy for the treatment of renal carcinoma 4 years before. He presented bone oligoprogression with isolated metastasis in the right clavicle involving the first rib and sternal manubrium. After initial treatment with radiotherapy and without systemic disease following discontinuation of sunitinib, we considered the surgical resection as the best treatment option after discussion in the multidisciplinary board. We designed a 3D customized prosthesis with sternal, right clavicle and left clavicle pieces in titanium. The new joints were fabricated in polyetheretherketone (PEEK). After thorough planification and discussion between engineers and surgeons, considering biomechanical and medical aspects, we decided to assemble the parts with donor tendons allowing an anatomical and functional reconstruction (details in video). The surgical intervention proceeded without complications and as planned preoperatively. The coverage of the implant was done with a latissimus dorsi flap. The postoperative period was uneventful with immobilization of both shoulders for 4 weeks and functional rehabilitation for 2 months. After 1 year of follow-up the patient has a 70% mobility of the joints and is autonomous for all the activities. We present the video of the surgical procedure with preoperative images and patient status.
Conclusions: The customized prosthesis for the esterno-clavicular area allows the surgeon a maximum surgical aggressiveness enabling a stable, anatomic and functional reconstruction.

Innovative modified Abramson technique for older patients.

Claudio Andreetti, Peritore Valentina, Teodonio Leonardo, Argento Giacomo, Tiracorrendo Matteo, Ibrahim Mohsen, Maurizi Giulio, Ciccone Anna Maria, Rendina Erino Angelo.
Sapienza University of Rome.

Background: Classic Pectus Carinatum (CPC) known also as pigeon breast, is a congenital anterior chest wall disease. The incidence of this deformity is approximately 1:1000. Males are more frequently affected with a ratio of 4:1. CPC is characterized by symmetric sternal protrusion due to abnormal costal cartilages expression. Surgery to correct this defect remains a cosmetic procedure. The most common surgical technique for CPC deformity correction was Ravitch's Technique (RT). In 2005 another mini-invasive surgical technique to correct CPC was introduced, The Abramson's Technique for pediatric patients. In our center we developed a modified Abramson's Technique (AMT) available for older patients. AMT consists in a partial bilateral disconnection of pectoral muscles, bilateral costal cartilages resection in the point of maximum protrusion (two cartilages for side) and a wedge resection of the anterior corthex of the sternum, using a four centimeters longitudinal sternal skin incision. A metallic bar is placed presternally through two lateral incisions to compress the sternum, and then are fixed in both sides to the chest wall. After eight months metallic bar is removed.

Methods: This is a retrospective case-control study. We enrolled 42 patients affected by CPC treated whit RT from 2018 to 2022 and 38 affected by CPC treated with AMT. We evaluated the two groups in terms of: Quality of life before (QoL) and after surgery (WHOQOL-BREF – Nuss Questionaire modified for Adult - NQmA), post operative pain (McGill questionaire), and post operative satisfaction (MDACS Scale). All the results were collected in a database.

Results: Patients treated mean age was 23.8± 5.68; CI 95% in RT and 24.6 ± 2.11; CI 95% for those patients treated by AMT. Confronting post operative results of WHOQoL-BREF psychological section between RT and AMT there was a better result for AMT (t-Test: P: 0,023). Both groups had a statistically significant results in NQmA in psychological result (t-Test: P: 0,000). Post operative pain was statistically less in AMT than RT (40.9 ± 6.68 vs 32.4 ± 1.85 CI 95% - p 0,011). MDACS scale showed a statistically significative results in terms of Scar for AMT vs RT (Mean 0,2 ± 0,26 vs 0,6 ± 0,32 CI 95% - p: 0,037).

Conclusions: The technique that we developed in our center allowed older patients to undergo less demolitive surgery, with less post operative pain, providing better surgical results in term of scar and ultimately a better QoL in terms of psychological health.

Sternectomy and sternal reconstruction with titanium bars over latissimus dorsi flap without prosthetic mesh.

Saumench-Perramon, Roser, Rami-Porta, R.
Hospital Dr. Trueta.Girona, spain

Case presentation: A 59-year-old female, with a history of resected renal cell carcinoma of the kidney 8 years before, was admitted to the hospital with a mass in the upper two-thirds of the sternum. The computerized tomography of the chest revealed a 9x7x7 cm solid tumor of the sternum with suspicious invasion of the pericardium and the pectoralis major muscles. Positron emission tomography showed abnormal uptakes at the sternum, compatible with tumor activity and the right humerus, compatible with inflammation due to a previous recent accident. Resection was indicated based on the clinical suspicions of primary tumor of the sternum versus solitary metastasis from a renal cell carcinoma. A subtotal sternectomy was performed in block with the manubrium, the sternal body (except for 2 cm of the lower third of the sternal body and the xiphoid), anterior arches (6 cm in length) of the first four ribs, the internal one third of both clavicles, both pectoralis major muscles ant the anterior mediastinal fat. The skin, the subcutaneous tissue and the pericardium were not involved. To reconstruct the defect a bilateral latissimus dorsi muscle flaps were developed, transferred anteriorly and sutured to the midline. Two metals bars (Strasbourg Thoracic Osteosyntheses System-StratosTM, MedExpert ®) were fixed to the 2nd and to the 5thribs. The free ends of the bars were passed anteriorly through two apertures done in the right latissimus dorsi and then posteriorly through two apertures in the left latissimus dorsi muscle so they did not get in contact with the lung. Their ends were finally fixed to the 2nd and 5th left ribs. The subcutaneous tissue and the skin were sutured over the muscles and bars. Non-invasive ventilation was required for five days after the operation but otherwise the postoperative course was uneventful and the patient was discharge on the 15th postoperative day with good ventilatory mechanics.

Conclusion: The interposition of the muscle flaps between the lung and the bars made the use of meshes unnecessary. This reconstruction provided good cosmetic and functional results without using meshes or cements.

Chest wall reconstruction with titanium bars, porcine dermal collagen implant and latissimus dorsi falp after right upper lobectomy and chest wall resection.

Saumench-Perramon, Roser, Rami-Porta, R.
Hospital Dr. Trueta, Girona, Spain

Case presentation: A 73-year-old male patient presented with pain of several months' duration in the right chest wall, with no shortness of breath, cough, expectoration or fever. Physical examination revealed a right antero-lateral chest wall deformity, consisting of a hard mass with no inflammation or ulceration, protruding behind the right pectoralis major muscle. There were no other relevant findings. A chest x-ray revealed a large opacity involving the right upper lobe and the chest wall. A computed tomography confirmed the presence of a mass of 9cm of largest dimension clearly involving the right upper lobe and transgressing the chest wall and involving three ribs. A positron emission tomography showed abnormal uptake (SUVmax: 24.3) in the mass with no other uptake in any other organ. A transparietal needle biopsy revealed undifferentiated carcinoma with no further specification. For the purpose of invasive staging, an EBUS-TBNA was performed and the cytology examinations of the subcarinal and right inferior paratracheal lymph nodes were negative. Furthermore, a video-assisted mediastinoscopic lymphadenectomy was performed, and all removed nodes (8 right inferior paratracheal, 3 left inferior paratracheal and 1 subcarinal,) were negative. The patient was discussed in the multidisciplinary team meeting and resection was proposed as primary therapy, because there were no signs of distant dissemination and the tumor mass, though big, seemed completely resectable. The clinical classification was T4N0M0. The patient underwent in block right upper lobectomy with resection of the antero-lateral portions of the second to the fifth ribs and partial resection of the right serratus muscle. Lymphadenectomy of the hilar, interlobar, para-esophageal, pulmonary ligament and axillary nodal stations was performed. Reconstruction of the chest wall defect was carried out with two metal bars fixed to the third and fifth ribs (Strasbourg Thoracic Osteosyntheses System-StratosTM, MedExpert), a porcine dermal collagen mesh (Permacol TM Surgical Implant Â®) sutured to the margins of the defect to prevent direct contact of the lung with the titanium bars, and a right latissimus dorsi muscle flap that covered all the chest wall defect. The final pathologic diagnosis was pleomorphic sarcomatoid carcinoma of the right upper lobe measuring 9.5 cm with chest wall invasion. All lymph nodes and all surgical margins were negative. Pathologic classification did not differ from the clinical and the resection was considered complete (R0). The postoperative course was uneventful. The patient received adjuvant platinum-based chemotherapy and remains free from disease 8 months after the operation.

Conclusion: The reconstruction with the combination of porcine tissue, titanium bars and muscle flap provided rigidity, stability and good cosmetics with no paradoxical movements.

Minimally invasive repair of Pectus Carinatum by the Abramson method: A systematic review.

Jean HT Daemen, Tessa C M Geraedts, Yvonne L J Vissers, Karel W E Hulsewé, Hans G L Van Veer, Horacio Abramson, Erik R de Loos.
Zuyderland Medical Center.

Background: The aim of this review is to provide an overview of the outcomes after minimally invasive pectus carinatum repair (MIRPC) by the Abramson method to determine its effectiveness.
Methods: The PubMed and Embase databases were systematically searched. Data concerning subjective postoperative esthetic outcomes after initial surgery and bar removal were extracted. In addition, data on recurrence, complications, operative times, blood loss, post-operative pain, length of hospital stay, planned time to bar removal and reasons for early bar removal were extracted. The postoperative esthetic result, was selected as primary outcome since the primary indication for repair in pectus carinatum is of cosmetic nature.
Results: Six cohort studies were included based on eligibility criteria, enrolling a total of 396 patients. Qualitative synthesis showed excellent to satisfactory esthetic results in nearly all patients after correctional bar placement (99.5%, n = 183/184). A high satisfaction rate of 91.0% (n = 190/209) was found in patients after bar removal. Recurrence rates were low with an incidence of 3.0% (n = 5/168). The cumulative postoperative complication rate was 26.5% (n = 105/396), of whom 25.0% required surgical re-intervention. There were no cases of mortality.
Conclusions: Minimally invasive repair of pectus carinatum through the Abramson method is effective and safe. Its efficacy is demonstrated by the excellent to satisfactory esthetic results in 99.5% and 91.0% of patients after respectively correctional bar placement and implant removal. Future studies should aim to compare different treatment options for pectus carinatum in order to elucidate the approach of choice for different patient groups.

Surgical treatment of non-union rib fractures with titanium clips system.

Pablo Moreno de la Santa.
Hospital RIBERA Povisa, Spain

Background: Rib fractures are generally considered to be self-healing and that the pain and disability disappear between 6 and 8 weeks. Standard treatment consists of pain relievers and rest. But there are studies that show that chronic pain after rib fractures can reach up to 30% of patients. One of the best-known causes is the lack of union of rib fractures, which is called non-union or pseudoarthrosis.

Methods: The patients had a chest CT scan showing non-union of the rib fractures. The chest trauma had occurred at least three months before the surgical indication. The patients had rib pain since the trauma, which prevented them from working or engaging in moderate physical activity. They required daily analgesia. The patient agreed to rib osteosynthesis as surgical treatment by signing an informed consent. The database was included: Demographic data and risk factors. Data related to surgery and hospital admission. Postoperative follow-up in the outpatient clinic until discharge: level of pain, need for analgesia and physical activity.

Results: Between 2008 and 2021, sixty patients with non-union of rib fractures were surgically treated with two titanium clip osteosynthesis systems at our institution. 17 patients (28%) had initially been treated conservatively at our hospital, while 43 patients (72%) were referred from other hospitals. In most patients, the cause of the initial trauma was related to their work activity. In all patients, the confirmation diagnosis was made with a CT scan of the chest with 3D reconstructions that showed the lack of union of the fractures. In 10 patients (17%) in which chest CT was inconclusive or questionable, confirmation with a bone SPECT was performed. In the demographic data and in the risk factors, the male sex stands out, reaching 90%. The smoking habit of 52%. 17% quit after the trauma and 35% were active smokers at the time of surgery. 48 (80%) patients were overweight, and 20 of them were obese. 7 patients had a history of anxiety or depression and needed medical treatment. The surgery was performed on a scheduled basis. The same surgical technique was used in all patients. Open reduction of the fracture and internal stabilization. In 38 patients (63%) with the presence of pseudoarthrosis, the area was resected. No bone graft was used in any patient. For the stabilization of the fractures, the following systems were used: STRACOS System (titanium clips) and STRATOS System MedXpert GmbH (titanium clips and bar). There were no postoperative complications except for one residual pleural effusion that was successfully drained by thoracentesis. 128 ribs required surgical stabilization, with a mean of 2.1 ribs per patient and a range between 1 to 6. The mean surgical delay was 180 days. The mean surgical time was 111 minutes, and the mean hospital stay was 4 days. In 29 (48%) of the patients, stabilization was performed using only titanium clips, in 13 (22%), clips and a bar were used, and in 18 (30%), the combination of both systems. All patients were followed up in the Thoracic Surgery outpatient clinic until discharge. The time of medical leave, pre and postoperative, was recorded. The mean total sick leave was 258 days, with a range between 115 and 734 days. The total postoperative discharge time had a mean of 63 days, with a range between 13 and 168 days. The need for analgesia was scored according to its intensity: no opioids, mild opioids, and strong opioids. Before surgery, all patients required daily analgesia for pain control. 60% required the use of opioids of which, 6 patients (10%) needed strong opioids. At the time of discharge, 81% of the patients did not need analgesics of any kind and 6% occasional anti-inflammatories. 8% required mild opioid analgesia, and 3 patients (5%) required strong opioids chronically. Physical activity at the time of discharge and in the return to working life was coded in the database. After rib osteosynthesis, 84% of patients recovered normal physical activity like that prior to trauma. The 54 patients who worked before the trauma had sick leave at the time of surgery. At the time of discharge: 43 patients (80%) had returned to their previous job, 6 (11%) had returned to work with some physical limitations and in 5 (9%) patients the medical leave was definitive with no possibility of returning to work. During the first year of follow-up after surgery of the 218 stabilized fractures, 5 broken clips (2,3%) of 9 segments were found in 4 patients. In 2 patients the fractures

were consolidated and the osteosynthesis material was removed. In the other 2 patients, the fractures were non-union, and the fractured clips were replaced with clips and bars. In one patient, the osteosynthesis material was removed along the first year after surgery. The reason for the clip's withdrawal was rib pain and a sensation of stiffness in the chest wall. At the time of material removal, the fractures were consolidated and there was no involvement of the intercostal nerve. This patient had a medical history of fibromyalgia with chronic pain and episodes of anxiety that required analgesic and anxiolytic treatment before the trauma. After removal of the osteosynthesis material, the intensity of the pain remained the same, and she was referred to the pain clinic, requiring treatment with narcotics.

Conclusions: After surgical stabilization of rib non-union, most of the patients improved their quality of life, being able to resume their previous physical activity and return to work. Complications associated with this procedure are rare. A small group of patients remained with residual pain, which they controlled with minor analgesics and allowed them to continue with the same type of life as before the trauma and even in some cases return to work. In our experience, the use of titanium clips system offers great results.

In our opinion, the choice of patients must be meticulous, especially in those with previous pathologies that require analgesia or anxiolytic treatments. It would be necessary to carry out a study in patients with risk factors to assess whether rib osteosynthesis in the acute phase will reduce the number of cases of pseudoarthrosis. Rib non-union demands a period of prolonged medical leave, the postoperative period is like that of patients surgically treated in the acute period. A question that should be clarified, is what the ideal delay for the treatment of this pathology is.

Outcomes from a nurse practitioner led dynamic compression system bracing program for Pectus Carinatum.

Stephen Trinidad, Emily McKenna, Todd Jenkins, Christina Bates, Aimee Kraemer, Abigail Sester, Victor F Garcia, Rebeccah L Brown.
Cincinnati Children's Hospital Medical Center.USA

Background: Dynamic compression system (DCS) bracing can be used to treat Pectus Carinatum (PC). The high success rate coupled with the opportunity to avoid operative morbidity has led to its widespread adoption as a first-line treatment for most patients with PC. There are a variety of techniques, protocols and providers who have implemented a DCS bracing treatment program. Thus, our first goal was to report our experience with a nurse-practitioner (NP) led program and our four-year outcomes data. There is also evidence that compliance, age, and chest wall characteristics including asymmetry, pressure of initial correction (PIC), and initial drop in pressure of correction – termed ΔPC1 – may have an impact on the likelihood of achieving neutral chest. Thus, the second study goal was to evaluate what factors are predictive of successful therapy in our patient population.
Methods: We conducted a retrospective cohort study using a prospectively maintained database. All patients with PC who presented between 3/01/2018 and 2/28/2022 were considered for inclusion. Patients presented to clinic where they were evaluated by one of two pediatric surgeons. If bracing was indicated they were fitted for a brace by our NPs who then followed them for the duration of treatment. On subsequent visits, the pressure of therapy was adjusted through a standard protocol based on their pressure of corrections until neutral chest was achieved, after which they were slowly weaned off the brace. We report overall summary statistics and univariate survival analyses to evaluate what factors - including age, sex, PIC and ΔPC1 – were predictive of successful therapy – defined as achieving neutral chest as assessed by both patient and provider.
Results: There were 449 patients who presented for brace fitting, 49 of whom did not return for brace application. A further 117 were excluded for lack of follow-up with two or fewer total visits. Thus, 283 patients were included in the analyses. Of these, 121 achieved neutral chest, 14 discontinued therapy (four from treatment failure and nine from elective discontinuation), and 148 are in therapy or were lost to follow-up while in therapy. Median age was 14 (IQR 12-15), 90% were male, median PIC was 4.13 PSI (IQR 3.17 – 5.3) and median ΔPC1 was 1.34 PSI (IQR 0.54 – 2.25). Based on survival curve estimates, median time to achieving neutral chest was 1.44 years (95% CI 0.99 – 2.01). On univariate survival analyses, age and sex were not associated with treatment outcomes, while lower PIC and higher ΔPC1 were predictive of successful therapy. Specifically, for every unit increase in PIC, there was a 21% decrease in the chance of successful therapy (HR 0.79, 95% CI 0.70 – 0.88) and for every unit increase in ΔPC1 there was a 69% increase in chance of successful therapy (HR 1.69, 95% CI 1.47 – 1.95).
Conclusions: Most patients with PC can be successfully treated with DCS bracing. Furthermore, DCS bracing programs can be successfully managed by NPs. On preliminary analysis, lower PIC and higher ΔPC1 are predictive of successful treatment. We plan to pursue further multivariable survival analyses.

Anterior chest wall resection and reconstruction for cancer: Early and long term results.

Alessandro Gonfiotti, Domenico Viggiano, Ottavia Salimbene, Stefano Bongiolatti, Sara Borgianni, Luca Voltolini.
Thoracic Surgery Unit, Careggi University Hospital, Florence, Italy.

Background: Anterior chest wall reconstruction (CWR) after sternal resection for malignancy are not standardized and it's still matter of debate among surgeons. Aim of this study was to review our experience with CWR for primary and secondary tumours involving the sternum, focusing on surgical techniques, strategies for reconstruction and oncological results.
Methods: From January 2005 to July 2022, 48 patients (32 male, 66%) underwent n=33 (68.7%) sternal surgical excision for primary (chondrosarcoma n=24 patients, 50%; osteosarcoma n=6, 12.5%; Ewing sarcoma n=1, 2.1%; other n=2, 4.1%) and n=15 (31.3%) for secondary (breast cancer n = 9, 18.7%; kidney carcinoma n=2, 4.1 %, HCC n = 1, 2.1%, GIST n = 1, 2.1%; other n=2, 4.1%) sternal tumours.
We performed partial sternectomy in n=40 patients (83.3%) and in n=8 patients (16.7%) total sternectomy en-bloc with the sternocostal cartilages; n=11 patients (22.9%) underwent partial sternectomy (only resection of the manubrium) we performed also clavicles resection. The reconstruction includes prosthetic materials and muscle flap: rigid material, STRATOS (Strasbourg Thoracic Osteosynthesis System), was used in n=23 patients, (47.9%), in combination with non-rigid materials in n=17 patients (74%); in particular we used polytetrafluoroethylene patch in n=9 cases (39,1%) and porcine-derived acellular cross-linked dermal matrix (PACLIDEM) in n=8 cases (34.8%). In two more recent cases (4.1%) we performed a reconstruction based on a custom 3D-printed titanium prosthesis in combination with PACLIDEM and myo-cutaneous flap.
Muscle flap was necessary, alone or in combination with rigid and/or non rigid materials, in n= 44 patients (91.7%).
Results: The 30-day mortality rate was 0, overall complication rate was 14.5% (n = 7 patients). The median ICU stay was 1.5 days and median hospital stay was 9 ($\pm$17.7) days. Complete resection (R0) was obtained in all patients. With a median follow up of 41 months, the Overall survival (OS) at 5- and 10-year's results 65% and 57% respectively (Fig.1); in the group of primary neoplasm OS rate at 5 and 10 years was 81 % and 68% (Fig.2). Disease free survival (DFS) rate at 5 years for selected primary sternal tumors was 68% (Fig.3). Higher grading was identified as negative prognostic factor.

Nitinol ribfixation combined with VATS minimally invasive alternative for conventional screw-plate fixation in acute flail chest and multiple rib fractures, leading to smaller incision size.

Pieter Jan Van Huijstee, A.P.A. Greeven.
Haga Teaching Hospital, The Hague.

Background: Surgical Stabilization of Rib Fractures (SSRF) is being performed increasingly, with screw-plate fixation often performed as preferred method. We present our experience with patients treated by a novel screw less osteosynthesis technique using shape memory alloy NiTinol plates. We noticed comparable results of thoracic wall stability can be achieved due to this new implant combined with VATS to check internally for thoracic wall stability. Moreover, potentially improve outcome by using smaller incisions and less invasive dissection thereby creating a smaller surgical insult.
Methods: From Jan 2019 till December 2021, 62 patients underwent Acute rib fixation (within < 1 week after trauma) by NiTinol osteosynthesis for acute factures indications including: clinical or radiological flail-chest or multiple rib fractures. Demographics, data of operation, admission and 90 days follow-up were collected. Number of fractured ribs and number of fixated ribs and surgical approach and length and number of incisions was noted.
Results: All 62 patients had at least 90 days of follow up. 42 patients (68%) with flail chest and 20 patients (32%) with multiple rib fractures using a total of 321 NiTinol Fixation-plates. Median age was 61 years (Interquartile Range (IQR) 50-72). Wound infection was seen in three patients (3%). After 90 days no plate failure was seen, comparable to literature. On long term follow up two patients had asymptomatic implant breakage of a NiTinol Fixation-plate shown on Thoracic X-ray after >6 months, without implant removal being necessary.
Conclusions: NiTinol rib fixation is a promising technique for fixation of acute types of thoracic wall injuries. These 62 patients show at least 'non-inferiority' compared to conventional techniques regarding thoracic wall stability and complications. Combined with VATS remarkably smaller incisions with largely muscle-sparing dissection were possible through Nitinol-osteosynthesis. During the time the Nitinol plates where used, incision became smaller and due to the VATS incision could be planned better and number of fixation plates dropped. For difficult fractures or locations Nitinol was combined with conventional plate/screw fixation. Future research is needed to show further clinical advantages of this novel promising technique.

Preoperative planning and simulation of hybrid surgery for complex cases with Poland syndrome using 3D technology.

Luzia Toselli, Ana Lain Fernández, Manuel Lopez Paredes, Laura García Martínez, Elena Arana Martín-Bejarano, Daniela Sanjurjo, Maxroxia Vallee, Gastón Bellia-Munzón.
Hospital Vall D' Hebron y Fundación Hospitalaria.

Objective: To report preoperative planning, simulation, and surgery for complex cases with Poland Syndrome using 3D technology.
Materials and Methods: Step 1: Diagnosis. During a thorough physical examination, target areas of the chest wall are identified using medical photographs, as well as medical videos to evaluate lung herniation during the Valsalva maneuver. Pectoral and mammary gland aplasia or agenesis are observed. The primary complementary studies are chest computed tomography (CT) and 3D reconstruction. Step 2: Preoperative planning. Determination of surgical goals is performed, including hemithoracic asymmetry compensation, repair of sternal curvature and rotation, chondrocostal agenesis, resolution of pulmonary hernia, and mammary or pectoral reconstruction. Materials required are defined including: Intrathoracic implants design for correction of hemithoracic asymmetries and excavated deformity association. Sternotomy design on 3D printed models to correct sternal curvature and rotation. Design of cutting guides. Extrathoracic plate design for sternal and costo-sternal fixation. Simulation in real size, 3D printed in polylactic acid, customized chest wall models is performed. During this stage, the cutting guides are used to determine the exact location, direction, and depth of sternotomies to be performed at surgery, rib plating is tested, and intrathoracic implant templates are fitted on the patient. A step-by-step guide is elaborated to aid the surgeon in the operation room. Step 3: Procedure. The preoperative plan is followed.
Results: In 2022, two patients with complex Poland Syndromes were submitted to the process above. The first case was a female with rib agenesis, pulmonary hernia, and an arcuate sternum. The second case was a male with right pectoral aplasia, right 3rd and 4rth chondrocostal agenesis, longitudinally right-rotated sternum, hemithoracic asymmetry, and cardiac compression. In both cases, the four steps comprising the preoperative planning and simulation with 3D technology were executed precisely, and no plan alterations were required. The first case had a tissue expander placement, and received a customized, priorly simulated in a real size 3D printed model, a sternal plate, a costo-sternal metallic rib, and a latissimus dorsi muscle flap. The second case received a sternal fixating plate after two wedge, derotational sternotomies; a metallic rib; and two retrosternal implants. (Figure 1)
Conclusions: We report a process comprised of preoperative planning, simulation, and surgery using 3D technology for the resolution of highly complex cases of Poland syndrome. We consider that this process decreases surgical improvisation allowing for preemptive determination of necessary materials and detailed surgical steps.

Minimal invasive approach of slipping rib syndrome: Case report.

Carmen López-Hierro, Ana Laín, Laura García-Martínez, Carlos Giné, Iván Villaverde, Rodrigo Maluje, Manuel López.
Hospital Universitari Vall d'Hebron.

Background: Slipping rib syndrome (SRS) is an under-diagnosed and infrequent cause of chronic pain in the upper abdomen or lower chest wall, produced when the false ribs' cartilaginous part slides underneath the adjacent one due to a lack of fusion. It is usually diagnosed in young female athletes and it can associate other chest wall defects. Treatment ranges from conservative management with rest and ice, through conventional analgesics, steroids or botox rib blocks, cryoanalgesia, to surgical treatment; which involves resection of the abnormal costal cartilages. Rib stabilization with plating or suture may be added. Laparoscopic approach has only been described once on a 4-case series.
Aim: To describe a laparoscopic approach for bilateral rib cartilage resection via three ports to treat slipping rib syndrome. Affected rib location and resection technique is reported.
Case report: A 16-year-old taekwondo athlete female was referred to our outpatient clinic due to bilateral lower rib pain of 12 months of evolution. Bilateral SRS was diagnosed. The long-lasting pain impeded her training and competition leading to a mixed anxiety-depressive disorder and frequent migraines.
Conservative treatment was indicated initially, but due to the persistence of the symptoms a cryoablation of T9 and 10 was performed, without success. At this point surgical treatment was indicated. A 3 port (umbilical and both flanks) laparocopy was performed and transparietal resection of the affected rib cartilages including their perichondrium (9th right cartilage and 10th bilaterally) was carried out. Fusion absence of both 9th and 10th bilateral costal cartilage was confirmed intraoperatively. Postoperative evolution was uneventful with a hospital stay of 3 days. Oral analgesics were suspended in the first postoperative month and she was discharged from the Pain Unit 6 weeks after the surgery. She reported an improvement on her migraines and her mixed anxiety-depressive disorder and remains currently asymptomatic after a follow-up of 18 months with a complete restoration of her physical activity.
Conclusions: Laparoscopic SRS approach is a feasible therapeutic minimally invasive option that allows access to both sides with the same ports adding cosmetic benefits. Perichondrium resection is essential in order to minimize recurrence.

MY WORST NIGHTMARE

My worst nightmare: Devastating neurological complication after mini-invasive correction of Pectus Excavatum.

Pavol Omanik, Igor Beder.
Pediatric Surgery Department, National Institute of Children's Diseases, Bratislava, Slovak Republic.

Background: Adverse reactions and complications in connection with mini-invasive pectus excavatum correction can range from minor to life-threatening. The authors present a unique case of a patient who developed a severe neurological deficit after mini-invasive correction of pectus excavatum.
Case report: A 16-year-old patient with symptomatic pectus excavatum, connected with compression of the right atrium and ventricle verified by cardiac workup, was indicated for Nuss correction. Mini-invasive surgery was performed with thoracoscopic assistance, under general anaesthesia with epidural analgesia, without complications. A weak triparesis developed, affecting both the lower limbs and the left upper limb on the first postoperative day. Immediate MRI revealed multi-segmental acute transverse myelopathy ranging from C1 to Th11, with maximal cervical involvement, without intraspinal hemorrhage. An intravenous combination of antibiotics, virostatics, and corticosteroids was used in the acute phase of treatment. Both infectious and autoimmune etiology was ruled out by diagnostic lumbar puncture. The neurological status has gradually improved during intensive rehabilitation in a specialized center, the patient is able to walk with support, but there is still a problem with micturition 6 months postoperatively. Follow-up MRI showed significant regression of signal changes as well as spinal cord oedema, reduced to the C5 - Th2 range.
Conclusions: Serious neurological complications associated with general anaesthesia and epidural analgesia in children are rare and their exact incidence is unknown. The causal factors may be iatrogenic occlusion of the anterior spinal artery, perioperative hypotension, the neurotoxic effect of a local anaesthetic, an autoimmune process, an infection or a hematoma in the epidural space. Individual case reports have been published in direct connection with thoracotomy in children, but never after surgical correction of the pectus excavatum so far. Unambiguous etiology is usually not found (in up to 70% of cases), similarly to the presented case report.

Elevation of the sternum and cardiac arrest: A case of “persevering” thoracoplasty.

Roberto Lo Piccolo, F. Facchini, A. Martin, R. Coletta, E. Rovero, K.Bici, Z. Ricci, D. Albino, A. Morabito.

Department of Pediatric Surgery, Meyer Children's Hospital, University of Florence, Florence, Italy.

Background: Cardiac arrest during the Nuss procedure is a lethal and well-known complication. It's often related to cardiac or big vessels injury during mediastinal dissection with surgical instruments or passing the retrosternal bars. We present a rare case of cardiac arrest developed after bilateral thoracoscopy and during the mobilization of the sternum, without any direct cardiac injury. We want to focus on this life-threatening complication and to discuss the possible mechanisms of cardiac arrest.

Case presentation: A 15-years old male diagnosed with pectus excavatum eccentric long canal type (the Grand Canyon type) was admitted to the Department of Pediatric Surgery of Meyer Children's Hospital in March 2022. Physical examination shown a BMI of 18,67 (high: 180 cm and weight: 60,5 kg). Preoperative evaluation included computerized tomography that confirmed the diagnose with and a Haller Index of >3.7 and no others significative findings. Cardiopulmonary exercise test (CPET) revealed an exercise intolerance (functional aerobic impairment) with a respiratory oxygen uptake (Vo2 max) of 53%; Color Doppler Echocardiography presents mild tricuspid regurgitation. Patch test for metals and chemical components resulted negative. Patient has been used vacuum bell for six years, with limited aesthetic improvement. Nuss technique was performed by bilateral thoracoscopy. Sternal elevation was achieved by the crane technique providing a simultaneous lift of the anterior chest wall and progressive reduction of the pectus excavatum. Under thoracoscopic vision a surgical stainless-steel wire suture was delivered through the sternum, between the outer and inner tables of the bone. Anterior chest wall was slowly and progressively lifted until the point at which maximum correction of the pectus deformity was achieved. Suddenly, during this maneuver the patient presented a ventricular fibrillation (VF) and went into cardiac arrest. Cardiopulmonary resuscitation immediately (CPR) started and was performed for two minutes. During the massage there was bleeding from the thoracoscopic accesses. Considering the potential and unrecognized cardiac injury, induced by the passage of the suture through the sternum, an emergency left thoracotomy was performed. Exploration did not reveal any heart or great vessel lesions. After two minutes of CPR, sinus rhythm was restored, and the patient's vital signs became progressively stable. After exclusion of hemothorax, tension pneumothorax and cardiac injury we decided to complete the chest modeling using the highly modified Ravitch repair (HMRR) technique. We performed osteotomies of 3rd and 4th sternocostal joints and positioned a Nuss' bar with bilateral stabilizers.

Conclusions: We presented a case of cardiac arrest without any cardiac abnormalities in preoperative studies and cardiac injury during the Nuss procedure.

We want to analyze the possible mechanisms of cardiac arrest and the lessons learned from this complication. We describe the first case, to date, in which a thoracoplasty was performed, after cardiac arrest, despite complication.

Skin erosion after Abramson procedure after treatment for pneumothorax: A case report warning for muscle wasting following longstanding pain treatment.

Hans Van Veer, Silke Scheers, Willy Coosemans.
University Hospitals Leuven, Dept. of Thoracic Surgery.

Background: The Abramson procedure is one of the techniques in the armentarium of the chest wall surgeon to treat pectus carinatum. Although infrequent, skin erosion may become a reason for premature bar removal. We present a case of early bar removal following muscle wasting after pleurodesis for pneumothorax.

Case report: An 18-year-old patient underwent an Abramson procedure for his slightly asymmetric but prominent pectus carinatum because of disturbed self-image. Correction of the deformity went well with correct positioning of the bar in a subpectoral plane. Postoperative chest X-ray demonstrated a decent reduction of the pectus carinatum. Postoperative recovery went well and prosperous. Four months postoperatively, he suffered a blunt chest trauma leading to dyspnea. At the emergency department in another hospital a right sided pneumothorax with full collapse of the lung was diagnosed. Bar position remained correct with no breakage of the wires. He underwent consequently thoracoscopic pleurodesis with apical pleurabrasion and caudal talc poudrage. Postoperative recovery was complicated with prolonged pain treated with fentanyl patches. Other diagnoses for prolonged pain were excluded by means of a bone scintigraphy and ultrasound of the shoulder. Due to the ongoing pain, his appetite decreased and he suffered 2kg weight loss, mainly due to muscle wasting. Brown discolorations of the overlying skin at the left side of the chest wall occurred another 3 months later. Local corticosteroid cream was applied, unfortunately with an adverse effect as the bar got more palpable. The further evolution led to only a paper-thin coverage of skin over the bar – without perforation-, which forced the surgical team to bring the patient to theatre, excise the translucent skin and provide a pectoralis musculocutaneous advancement flap over the remaining bar. For postoperative support to the wound a Prevena VAC ® system was applied, which could be removed on the ward the 5th postoperative day. The wound healing was uncomplicated with suture removal at POD 14. Unfortunately, three months later and one year after the initial Abramson procedure he suffered from another, now left-sided pneumothorax and was readmitted again for apical bullectomy and talc poudrage. Also, this hospital admission led to decreased nutritional intake. Two weaks later, we noticed reoccurrence of imminent skin erosion despite the earlier musculocutaneous advancement flap. At that occasion, the bar was removed one year after implantation, and as such one year prematurely.

Conclusion: We present a case of skin erosion of an Abramson bar, after muscle wasting following pleurodesis for pneumothorax, leading to premature bar removal. The chest wall community should be aware of this rather exceptional occurrence of pneumothorax and need for pleurodesis in this type of patient and the risks postoperative muscle wasting may involve despite initial meticulous placement of the bar.

My worst nightmare.

Maíra Kalil Fernandes, Camilla Matos Pedreira, Fernando Gomes Oliveira Neto, Gustavo Almeida Fortunato, Iury Andrade Melo, Sergio Tadeu Lima Fortunato Pereira.
Hospital Santa Izabel, Brazil

Male patient, 22-year-old, with asymmetric Pectus excavatum associated with mild scoliosis, without dyspnea or palpitation symptoms, but with anxiety and suicidal ideation. Initially, physical activity and Global Postural Reeducation were recommended, in addition to psychological follow-up. A talk to reassure the parents was carried out together with the preparation for the surgery. During the surgical planning, age and chest rigidity, in addition to asymmetry, were considered, and a minimally invasive correction was chosen, with placement of a bar, two stabilizers and minimal chondrotomies to make the chest more flexible. Postoperatively, the patient had persistent fever, which started in the first postoperative day, progressing to a drop in hemoglobin on the 3rd POD and changes in the chest X-ray, with pleural effusion on the right side. A thoracostomy was performed with pleural drainage, with output of 700 ml of hematic secretion. The fever continued, and Enterobacter Aerogenes was identified in a urine culture sample and an antibiotic was commenced. The patient remained subfebrile, despite antibiotic therapy, presenting, on the 9th POD, a heart murmur, with suspicion of infective endocarditis. Transesophageal echocardiogram without signs of vegetation or intracardiac mass, but with increased right intraventricular pressure and pulmonary hypertension. At that point, pulmonary embolism or bar compression was suspected. An angiotomography was performed, which confirmed the displacement of the bar with right ventricular compression. It is important to highlight that the patient had no chest deformity or loss of correction. A chest x-ray with anteroposterior view also did not show any changes. The patient was reoperated on the 13th POD, after waiting for material to be brought from another state. Intraoperatively, laceration of the intercostal space with displacement of the bar was observed. Bar removal under direct vision by videothoracoscopy. Release of the sternum was performed with bilateral chondrectomies, and modeling of excess cartilage. A retrosternal "web of strong wires" was made to try to support the sternum. The displacement of the bar in the Pectus minimally invasive correction can occur, but usually with a richer clinical presentation, such as intense pain, alteration in the shape of the chest, loss of correction, visualization of the material in the subcutaneous tissue. In the case described, the clinical picture was different, and the suspicion was only possible due to a change in cardiac auscultation, which started to present a murmur, with pulmonary hypertension being identified with signs of compression of the right ventricle on the echocardiogram. The development of the surgical technique and the team's experience (in this case it was at the beginning of the learning curve), allows us to raise some questions and changes in behavior: 1. The availability of adequate material is extremely important, and improvisation should not be accepted; 2. In an adult chest, the placement of two bars fixed in bridge, divides the force, stabilizing the bars and reducing the possibility of displacement; 3. Cardiac auscultation should be part of the clinical evaluation; 4. Did the use of a mixed technique with chondrotomies contribute to the outcome? 5. When does sternum rotation contraindicate this technique?

POSTER PRESENTATIONS

Functional upper limb assessment after sternal clavicular joint resection without prosthetic reconstruction.

Joao Paulo Cassiano Macedo, Alessandro W Mariani, Paulo M Pego-Fernandes, Ricardo M Terra.
Hospital das Clinicas da Faculdade de Medicina de São Paulo, Brazil

Background: The sternal clavicular joint (SCJ) resection is used as a treatment of SCJ infections. Reconstruction with a prosthesis can lead to reinfection, but theoretically, it is preferable due to functional impairment risk. However, the post-operative functional upper limb evaluation is poorly documented. The objective of this study is to assess the upper limb function after SCJ resection and reconstruction without a prosthesis to determine if there is any functional impact and to grade it.
Methods: We performed a clinical and functional evaluation of patients with SCJ resected and reconstructed without prosthesis as a treatment to SCJ infection in the period between 2012-2018. The evaluation was composed by a questionnaire (pain scale and daily activity evaluation) and examination (inspection, mobility, and strength). Nine patients were assessed, of whom seven had unilateral surgery.
Results: The questionnaires regarding pain and daily activities limitations showed improvement in 100% of the cases. Just one case of possible nerve injury with paresthesia. On the physical exam, only small alterations on inspection were found in 8 patients. Mobility was considered normal in 33%, partially impaired in one test in 22%, and partially impaired in two or more tests in 44% of cases. Strength was graded 5 (maximum strength) and symmetric in seven patients.
Conclusión: Patients after SCJ resection without prosthetic reconstruction showed a good outcome, especially on pain and daily activity. Even though, small impact on mobility and strength has occurred.

Pushing the boundaries of MIRPE: First experience with a four-bar technique.

Mustafa Yuksel, Hasan Ersoz.
Izmir Katip Celebi University, Faculty of Medicine, Department of Thoracic Surgery, Izmir, Turkey

Several modifications to minimally invasive repair of pectus excavatum have been reported to date. Of these, the use of multiple bars was a major development. At present, there are two established techniques: cross bar and parallel bar placement. We used a combination of both parallel and cross-bar techniques in a 25-year-old male patient with deep, Grand Canyon type pectus excavatum, placing a total of four bars and four stabilizers. The patient had no complications during the first two months of postoperative follow-up. We share this case report as the first experience using this modified technique in the literature.

Evaluation of thoracic vertebrae rotation and deformity in patients with chest wall deformities using dynamic surface topography.

Rohleder, Stephan, Wolf C., Konradi J., Koenig T., Betz U., Schwind M.
Department of Pediatric Surgery, University Medical Center Mainz, Germany.

Background: Scoliosis and thoracic vertebral rotation is associated with chest wall deformities. However, the impact of asymmetry in pectus excavatum (PE) and pectus carinatum (PC) on thoracic deformity has not been clarified in detail. This study examined the implication of asymmetric chest wall deformities on the thoracic spine using surface topography based motion analysis.
Methods: A total of 20 patients PE and PC were prospectively analyzed between January 2020 and April 2022 by thoracic MRI and dynamic surface topography (Diers-formetric 4D motion lab). Pearson correlation coefficient was used to assess the relationship between sternal rotation (SR) and Haller index (HI) one the one side and thoracic scoliosis angle (SA) (Img 1) and deformity on the other side.
Results: Mean SR was 15 degrees (standard deviation 11.1, 95% confidence interval: 9.8–20.2). Half of the patients (n=10) had scoliosis with a CA > 10 degrees (frontal plane) and the maximum vertebrae rotation (transversal plane) was found at level T6 and T7 in PE and PC. Preoperatively SR and HI correlated positively with thoracic SA (rSR = 0.585, pSR = 0.023, rHI = 0.555; pHI = 0.032).
In PE subgroup we noted a positive correlation of right sided deflection of the line plumb line in frontal plane and HI (rHI =0.648, pHI =0.009, n=15).
Conclusion: Surface topography-based motion analysis is a valuable and radiation free tool to assess spine misalignment in patients with chest-wall deformities. Sternal rotation in PE and PC has a high probability to effect statics and posture of the thoracic spine. Therefore, spinal malalignment and deformity should be evaluated routinely in these patients.

Translation, cultural adaptation and linguistic validation of the Pectus Excavatum evaluation questionnaire.

Nicky Janssen, Jean HT Daemen, Elise J van Polen, Yanina JL Jansen, Karel WE Hulsewé, Yvonne LJ Vissers, Erik R de Loos.
Zuyderland Medical Center, Heerlen, Netherlands.

Background: Pectus excavatum often imposes significant burden on the patients' quality of life. The pectus excavatum evaluation questionnaire is the most employed disease specific instrument to measure patient-reported outcome measures. A translation and linguistic validation of this questionnaire is presented for its use in the Dutch pediatric pectus excavatum population.
Methods: The 22-item pectus excavatum evaluation questionnaire was translated and adapted according to the leading guidelines for the translation of patient reported outcome measures. Conceptual equivalence and cultural adaptation were emphasized.
Results: One forward translation was produced through reconciliation of two forward translations. Back translation resulted in 15 identical items, as well as 6 literal, and 1 conceptual discrepancy. The latter was expected as during the forward translation a more culturally appropriate translation was chosen. Ten patients were involved during the cognitive debriefing process, following which one item was revised and the final Dutch version was established.
Conclusions: We provide a culturally appropriate and linguistically validated Dutch version of the pectus excavatum evaluation questionnaire.

3D printed titanium bar in MIRPE - case report.

Marian Molnar, Barbora Spakova, Anton Dzian.
University Hospital Martin, Slovakia.

Background: MIRPE is the preferred surgical method for the operative correction of pectus excavatum, which consists in the retrosternal insertion of a metal bar under thoracoscopic vision.
Methods: The authors present the case of a 20-years old patient with pectus excavatum, who was diagnosed with an iron allergy before the planned MIRPE operation. The patient underwent a CT scan with 3D reconstruction of the skeleton. Based on the 3D reconstruction of the skeleton, a digital model of the chest wall correction was created together with the model of bar required for the correction. According to the model, the placement of the bar, the point of entry of the bar into the chest, its bending, and the length of the required bar were calculated. According to this pattern, a bar of the desired shape and a bar stabilizer were printed on a 3D printer from a titanium compound. This bar, after being sterilized, was implanted during surgery.
Discussion: MIRPE is currently one of the most widely used surgical methods for pectus excavatum treatment. There are several models of bars and instruments for this surgical technique. If the patient has an allergy to stainless steel, a titanium plate and stabilizer is a suitable substitute. Not every plate manufacturer also produces titanium components. In that case, 3D printing of a titanium bar is a suitable alternative. The digital model of the planned correction of the chest before the operation enables a 3D visualization of the expected result of the correction, it allows determining the length of the necessary bar, its bending at the ends and also the planned place of insertion into the chest. Based on such a model, it is possible to print the necessary plate on a 3D printer. Digital reconstruction of the chest before surgery proves to be a suitable method for preparing a bar before surgery according to the individual needs of the patient. The application of 3D printing for the production of medical materials opens up new possibilities for the production of necessary aids for surgical practice, taking into account the individual needs of the patient.

Modification of the Abramson procedure for minimal invasive repair of Pectus Carinatum: Introduction of a Pectus Carinatum system; preliminary results.

Nicky Janssen, MD, Jean HT Daemen, MD, Yanina JL Jansen, MD PhD, Hans G. Van Veer, MD, Karel WE Hulsewé, MD PhD, Yvonne LJ Vissers, MD PhD, Erik R de Loos, MD PhD.
Zuyderland Medical Center.

Background: Pectus carinatum is the second most common congenital thoracic wall deformity that is characterized by a protruding sternum. The deformity can be surgically corrected via the minimally invasive Abramson technique. During this procedure, a presternal metal correctional bar is implanted to redress the sternum to its natural position. During numerous steps of this procedure, manual compression is applied over the sternal deformity. In order to ease the procedure and reduce variability we slightly modified the Abramson technique by introducing the Pectus Carinatum System. The aim of this study was to report our preliminary experience with this novel approach.
Methods: We provide a step-by-step description of the surgical technique. The Pectus Carinatum System is installed on a table-mounted retractor system and generates a constant mechanical compression over the protruding sternum to maintain its intended anatomical position. No manual compression is required.
Results: Two pectus carinatum patients treated with our slight modification of the Abramson technique, were identified. In both patients a satisfactory surgical result was established and no complications occurred.
Conclusion: The results of this preliminary study indicate that our approach enables an easy, predictable and less labor-intensive placement of the presternal metal bar, without interfering with the safety of the procedure.

New Pectus-Up system for surgical correction of Pectus Excavatum: Importance of the correct screw fixation.

Yury Bellido Reyes, Sara Vicente Antunes, José Zapatero Gaviria, Pablo Fernandez Gómez Escolar, David Rincon García, Juan Manuel Corral Cano, Lisette Rico Martine, Rodrigo Arroyo Fernandez, Ignacio Muguruza Trueba, Ignacio.
Grupo Hospitales Públicos QuironSalud Madrid.

Background: Pectus excavatum is the most common chest deformity, with predomination in male sex. Patients may complain of physical and psychological symptoms after puberty. The surgical correction reduces the symptoms, improves cardiopulmonary function and quality of life. However, the methods of surgical repair remain controversial.
Methods: We present the case of a 16-year-old male with the presence of pectus excavatum with a Haller's index of 3.1, correction index of 26.8%, asymmetry index of 0.07, sternal depth of 2.6 cm and sternal thickness of 0.9 cm. The main symptom was the body image concerns. He underwent pectus up surgery with the new developed pectus-up kit 2 (Ventura®, Spain). During the surgery, the sternal implant was fixed to the sternum with 12 mm screws, however once lifted up it detached from the sternum producing cortical bone damage. Therefore, a new area was chosen and the sternal implant was fixed with 14 mm screws, which allowed the sternum to be lifted up and anchored to the bar (164 mm). There were no postoperative complications. Follow-up one year after surgery showed a good aesthetic result, except a small atrophic scar.
Conclusion: The proper screw selection and placement is a key step in pectus up surgery for correction of pectus excavatum with good postoperative result.

Causes of vacuum bell treatment withdrawal: Insights from a series of 186 patients over a 7-year period.

Luzia Toselli, Vallee Maxroxia, Bellia-Munzon Gastón, Sanjurjo Daniela, Elmo Gastón, Martinez-Ferro Marcelo.
Fundación Hospitalaria.

Backgraound: Compliance remains one of the most challenging issues of vacuum bell (VB) treatment of pectus excavatum (PEx). Although different series have reported up to 30% dropout rates, other underlying reasons remain unexplored. We therefore sought to explore, for the first time, reasons for abandonment in a cohort of patients with PEx.
Materials and Methods: A survey was conducted via telephone to all patients who withdrew from PEx treatment with VB between May 2013 and January 2020 in a single pectus clinic (Table 1). Withdrawal was defined as lost to follow-up after one year from the last visit. We analyzed the answers and classified them accordingly.
Results: During the study period, 186 patients received a VB prescription. Sixty-three (34%) patients withdrew from VB treatment. Although surveys were submitted to all of them, 28 patients answered (82% male, mean age 15.2 ± 8.8 years). The mean initial external pectus depth was 1.9 ± 0.6 cm. Although the mean duration of treatment until withdrawal from follow-up was 5.6 ± 9.0 months, patients referred a mean of 22.6 ± 13.2 months of unmonitored use. The most frequent self-referred causes of withdrawal were loss of negative pressure (36%), pain (25%), discomfort (21%), and skin alterations (21%). The leading suggestions to increase compliance made by the patients were a closer surveillance (21%) and a smaller device (7%). In addition, 23 (82%) responded that they might resume VB therapy and 11 (39%) said they might be willing to undergo surgery of PEx.
Discussion: This study was the first to provide insights regarding the reasons for VB withdrawal for the treatment of PEx, underscoring loss of negative pressure, pain, discomfort, and skin alterations. Strategies directed to reduce these complaints such as device adaptations to decrease loss of negative pressure or closer surveillance might improve compliance. Of note, a large proportion responded that that they would be willing to resume VB therapy or even elect surgery suggesting that follow-up on patients who dropout might be effective in motivating them to restart treatment.
Table 1. Survey on patients who withdrew from vacuum bell treatment of pectus excavatum. Did you perform vacuum bell treatment for your Pectus Excavatum? For how long? Did you discontinue the vacuum bell treatment? Why? Are you still using the vacuum bell? How many hours a day? What positive aspects did you find concerning the treatment? What negative aspects did you find concerning the treatment? Do you think you need any other type of treatment at this time? Would you use the bell again to treat your Pectus Excavatum? Why? Would you undergo surgery to resolve your Pectus Excavatum? Did you visit any other Center for your Pectus Excavatum after interrupting follow-up at our Pectus Clinic? Do you have any suggestions to increase patient adherence to vacuum bell treatment?

Pectus Arcuatum: Description of a hybrid surgical technique.

Isabel González-Barba Neira, Ana Laín, Laura García, Carlos Giné, Rodrigo Maluje, Manuel López.
Hospital Universitario Vall d'Hebron.Barcelona, Spain

Background: Pectus Arcuatum (PA) is a very rare anterior chest wall deformity resulting from a premature sternal synostosis. It is characterized by a short and broad sternum with a severe outward sterno-manubrial angulation, a mild to moderate lower-third-sternal depression and a bilateral thoracic chondral deformity comprising the second to fifth costal cartilages. Unlike other chest wall deformities, surgical correction continues to be the only treatment option. We report our initial experience using a hybrid technique and evaluate the results.

Methods: We reviewed patients with PA who underwent a hybrid technique between January 2019 to June 2022. Surgical technique. We combined the Nuss procedure with a modified Ravitch procedure. All patients underwent either percutaneous or thoracoscopic cryoanalgesia to improve postoperative pain management. The Nuss procedure was performed first. We employed Park's crane technique to elevate the sternum and a bipolar device to safely complete the trans-mediastinal thoracoscopic dissection. A single bar was inserted under thoracoscopic vision.

The sternochondroplasty was performed through a 3-4-centimeter-long mid-sternal skin incision in males and concave transverse incision in females. After dissecting the sternal insertions of both pectoralis major muscles, bilateral subperichondrial chondrectomies were carried out and a wedge-shaped transverse sternal osteotomy was performed using an oscillating saw, preserving the posterior lamina. The bone harvested from the osteotomy was minced and reapplied to the defect. Sternal realignment was achieved by securing opposite sides of the osteotomy with two vertical titanium plates

Results: Three patients underwent hybrid technique for PA between January 2020 to June 2022. The mean age was 15 years-old (14-16). None intraoperative complications were encountered. The mean operative time was 200 min. Postoperative radiography showed optimal sternal realignment and stabilization with high patient satisfaction in all cases. The overall hospital stay ranged from four days in all cases.

Conclusion: Hybrid surgery for PA ensures chest wall stability by combining sternal osteosynthesis with the insertion a single pectus bar, enabling surgeons to perform a less aggressive sternochondroplasty with a single osteotomy, which results in a smaller and more esthetic mid-sternal skin incision.

Surgical repair of Pectus Carinatum and mixed deformities: The sandwich technique.

Kwanyong Hyun, Hyung Joo Park.
Seoul St. Mary's Hospital.

Background: Since the technique using only external bar compression has been often suboptimal in asymmetric or pectus carinatum-excavatum complex (PCE complex), the sandwich technique (SWT) was developed to press-mold the deformed chest wall between two bars. SWT readily enables the repair of pectus carinatum and PCE complex. This study aimed to verify the surgical indication, elaborate the detailed of the SWT, and appraise the early results.

Methods: We first introduced SWT in January 2007 and initially for pure PC. We expanded its indication to the PCE complex, concealed carinatum in PE, and pectus arcuatum. The principle is to press-mold the deformed anterior chest wall between internally and externally placed pectus bars. This is the only way to remodel the chest wall into the normal anatomy by utilizing the counter forces, which is proposed to relieve both directional deformities. Two or more bars were placed internally and externally according to the complexity and extent of the deformity. During the study period, we modified bar-fixation technique after a development of bridge plate. In the early study period, each bar was fixed to the chest wall with claw fixator and wires. Later in the study period, all bars were connected together to the bridge plate, enabling more secure chest wall molding.

Results: From 2007 to April 2022, among 95 consecutive cases of SWT, 79 were enrolled in the study (16 patients were excluded due to incomplete deformity data). There were 76 males and 3 females; the median age was 15 years [range: 4–33]; 18 pure pectus carinatum, 31 PCE complex, 29 concealed carinatum after PE repair and 1 pectus arcuatum. Three bar sandwich (58%, 46/79) was the majority of bar configuration and 2 bar sandwich (39%, 31/79) and 4 bar sandwich (3%, 2/79) remained the rest. The external and internal bars were fixated separately with claw fixators and wires up until bridge plate was developed in August 2013, from which bars were exclusively connected with bridge plate and/or wires. SWT achieved symmetricity and near complete resolution of carinatum component in all carinatum varieties (Fig. 1, Fig 2.). The overall complication rate was 8.9% (7/79), which includes 2 pneumothorax, 1 effusion, 3 wound infection and 1 bar dislocation.

Conclusion: The sandwich technique which press-molds the deformed chest wall between the external and internal bars seems effective in treating pure pectus carinatum. SWT is also successfully expanded to the PCE complex and concealed focal protuberance in PE by achieving the post-repair symmetry. SWT plays a crucial role in treating both simple and complex carinatum deformities by remodeling the entire chest wall.

Impact of chest wall resection after neoadjuvant therapy in lung resection patients for non-small cell lung cancer.

Esra Yamansavcı Sirzai, Bahar Agaoğlu Sanlı, Serkan Yazgan, Ahmet Ucvet.
Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital.Turkey

Background: Lung cancer invading the chest wall is treated with concomitant en bloc lung and chest wall resection (CWR). Concomitant CWR may increase the risk of adverse outcomes after lung cancer resection. The postoperative outcomes of CWR following neoadjuvant therapy is unclear. Even lung resections after neoadjuvant treatments require delicate care.
Methods: We collected the data of patients who have undergone enbloc CWR and lung resection following neoadjuvant therapy and are presented in the light of the literature.
Results: In Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital, Thoracic Surgery Department between January 2010 and January 2021, 295 patients were operated after neoadjuvant therapy (chemotherapy/ radiotherapy/ chemotherapy + radiotherapy). CWR was performed in addition to anatomical resection in 25 (8,4%) of these patients. All patients were male. The mean age was 60.6 (43-70) years. Pneumonectomy was performed in 5 (20%) and lobectomy was performed in 20 (80%) patients. Pathology revealed squamous cell carcinoma (n=11, 44%), adenocarcinoma (n=12, 48%), and large cell histology type (n=2, 8%). 16 (64%) patients received neoadjuvant therapy for N status, eight (36%) received neoadjuvant therapy for T status. All of the patients were included in the physiotherapy and nutrition program in the preoperative period. Invasive mediastinal lymph node evaluation (EBUS-mediastinoscopy) was performed before the operation. The pleural tissue of the bronchial stumps was supported with a mediastinal/pericardial fat and/or intercostal muscle flap. Analgesia with epidural catheter was applied for postoperative pain. Operative mortality was detected in 1 (%4) patient due to pneumonia sepsis on the postoperative 35th day. Eight (%36) patients received adjuvant chemotherapy after the operation. 5-year survival was 34%. Mean survival was 56.8+/-9.9 months (Figure 1).
Conclusion: Anatomical resections with chest wall resection after neoadjuvant treatments can be performed in experienced centers with acceptable results.

Sternal cleft: Case series.

Esra Yamansavcı Sirzai, Mustafa Yuksel, Salih Cüneyt Aydemir, Ilhan Ocakcioglu, Oğuzhan Özyurtkan. Health Sciences University Dr.Suat Seren Chest Diseases and Chest Surgery Training and Research Hospital.Turkey

The sternal cleft develops as a result of the failure of the sternum to join at the midline. It is a congenital anomaly defined as a defect of different sizes. It is a benign disease when not accompanied by cardiac anomalies. Surgical repair is recommended to protect the heart and great vessels from injury, to improve respiratory dynamics, and to eliminate cosmetic concerns. The first-line treatment is surgical reconstruction of the defect in the neonatal period. Preoperative examination should pay attention to associated malformations, particularly cardiac defects. Surgical repair performed at an early age gives better results. Surgery is more difficult as the chest hardens at older ages and may require more complex repair methods. Autologous bone grafts, patches, or titanium plates can be used for reconstruction if the defect is large or in adult patients. Eight patients with sternal cleft are presented because of its rarity.

Single-stage approach for correction of Pectus Excavatum and open-heart surgery: Multicenter data.

Nezih Onur Ermerak, Firas Abu-Akar, Murat Akkus, Dawn Jaroszewski, Vladimir Kuzmichev, Tunc Lacin, Esra Sirzai, Mustafa Yuksel.
Marmara University, Department of Thoracic and Esophageal Surgery, Istanbul,Turkey

Background: Pectus Excavatum (PE) and congenital/acquired cardiac anomalies may present together. Optimum time and approach for the minimally invasive repair of PE (MIRPE) and surgery for cardiac pathology is controversial. We hereby present multi-center data of patients who underwent single-stage surgery for simultaneous treatment of PE and cardiac disorder.
Methods: A retrospective study was conducted, and data were collected from five different centers internationally. Data regarding demographics, co-morbidities, type of pathology/surgery, length of hospital and ICU stays, morbidities and mortality were entered into a database.
Results: Thirteen patients (2 female, 11 males with median age 21 (5–63) years) were enrolled into the study. 4 of the PE deformities were asymmetrical and 9 were symmetrical. Indications for cardiac surgery were atrial septal defect for 4 patients (30.7%), aortic root aneurysm for 3 patients (23.1%), severe mitral valve regurgitation for 3 patients (23.1%), double aortic arch for 1 patient (7.7%), bicuspid aortic valve for 1 patient (7.7%) and myxoma for 1 patient (7.7%). 4 patients (30.7%) had Marfan Syndrome, 1 patient had Holt-Oral syndrome (7.7%) and 1 patient had chronic atrial fibrillation (7.7%) as co-morbidities. MIRPE was performed with 1 bar in the treatment of 9 patients (69.2%). On the other hand, 2 bars used in 4 (30.7%) patients while 1 patient (7.7%) needed 3 bars for the correction. Median duration for the surgery was 260 minutes (90-607). Median length of floor and ICU stays were 1 day (1-3) and 5 (0-20), respectively. Major early complications were atrial fibrillation (3 patients – 23.1%), pneumothorax (1 patient – 7.7%) requiring chest tube and pleural effusion (1 patient – 7.7%) requiring chest tube. On the other hand, one patient had peri-operative ventricular fibrillation (VF) with cardiopulmonary resuscitation (CPR). Thus, surgery was performed with only MIRPE, and cardiac surgery was postponed due to high risk. For long term complications, 2 patients (15.4%) needed removal of one bar of the two bars due to intractable pain. We did not experience mortality in the whole series. Median follow-up was 30 months (2-65) and only five of the bars were removed. All the patients are satisfactory with cosmetic results and have no complaints related to MIRPE.
Conclusion: This multi-center data presents the largest series of patients in the literature who underwent simultaneous MIRPE and open-heart surgery. It demonstrates the safety and effectiveness of single-approach surgery for the treatment of both PE and cardiac disorder. It must be kept in mind that; outcomes of MIRPE are not different than the other MIRPE patients and severeness of the cardiac pathology determine the postoperative course.

Minimally invasive repair of Pectus Excavatum.

Tunc Lacin, Esra Yamansavci Sirzai, Nezih Onur Ermerak, Sezer Aslan, Gamze Gul Tiryaki, Jeyhun Pashayev, Reyhan Ertan, Mohamad Kenan Atasi.
Marmara University, Department of Thoracic Surgery, Istanbul, Turkey.

Background: Pectus excavatum (PE) is the most common type of anterior chest wall deformities. Although most commonly the prominent symptom is cosmetic which causes psychosocial symptoms, cardiopulmonary symptoms such as palpitations, early fatique, exercise intolerance can be the cause of the outpatient visit. This study presents the surgical results of our prospective pectus excavatum database.

Methods: Between September 2018 and August 2022, 229 patients (188 M, 41 F, mean age: 18,1 , range 9-46) underwent minimally invasive repair of pectus excavatum. Preoperative assessment included physical examination, posteroanterior and lateral chest X-rays and ECG. Only patients with deep PE had a chest computed tomography. Patient demographics, presenting symptoms, type of deformity, previous surgery data, number and length of the inserted bars, operation duration and hospitalisation duration were evaluated. All patients underwent single lung ventilation with carbondioxide insufflation. Analgesia control was achieved by intercostal nerve block and iv PCA.

Results: PE deformity was asymmetric in 15 (6.5%) patients. 5 of the patients had prior Ravitch surgery. Ten patients had cardiac symptoms (mitral regurgitation in 2, sinus tachycardia in 3, right ventricule compression in 3, arythmia in 2) and 5 had dyspnea. In 214 (93.4%) patients, symptom was only cosmetic deformity. Single bar was placed in 122 (53.3%) patients, two bars in 101 (44.1%) and three in 6 (2.6%). Mean operation duration was 69,6 minutes (range: 30-180), mean hospitalisation was 4,17 days (range:2-11). Peroperative complications included diaphragm laceration (n=2), postoperative complications included venous insufficiency in both hands (n=1) (solution: revision with a shorter bar), brachial plexus injury due to arm stretching (n=1) (treatment:physical therapy) and incision infection (n=4). Two patients (9 years old and 19 years old) needed early bar removal due to overcorrection resulting in pectus carinatum. 9 years old patient is undersurveillance, 19 years old patient received a carinatum bar for correction. In 72 patients, bars were removed at a mean of 26 months. Four patients (1.7%) were not satisfied with the result.

Conclusion: In clinics where videothoracoscopic applications were performed with successful results, minimally invasive repair of pectus excavatum can be applied with short operation duration, minimal blood loss, short hospitalisation, low morbidity and high patient satisfaction. The decision for appropriate bar length and number of bars during the surgery can be provided easily after reaching a certain experience.

Surgical management of Pectus Excavatum and pulmonary bula via single port. A rare congenital association.

Emmanuel Peña Gomez Portugal, Dra. Peiro Osuna R. P, Dr. Hernández Arguelles E. Dr. Solorzano Campos L.M. Dr. Casillas Enríquez J. D. Dr. Montiel Bravo G. Dr. Posadas Trujillo O.E. Dr. Olaya López E. Dra. García Villalvazo S. L.
Salvador Zubirán National Institute of Medical Sciences and Nutrition. Mexico Vall d'Hebron Hospital. Barcelona General Hospital of Pachuca Hidalgo.

Background: PE without a clear etiology but that can be present in up to 1:400 births, associated with Marfan's Sx, Ehlers Danlos, marfanoid hypermobility sx or any connective tissue disease; There is no direct relationship with bullous disease, however, congenital bullae are related to pulmonary airway malformations, pulmonary lymphangiectasia, and congenital bronchomalacia. And in these cases, the widening of the air spaces can predispose to the formation of bullae, which can be the cause of pneumothorax in patients with congenital abnormalities of the connective tissue in up to 4% to 11%. The association of Marfan's Sx with lung conditions such as pneumothorax and pulmonary emphysema; with abnormal lung tissue elasticity and alterations in signaling by growth factors generating abnormalities in alveolar septation. The formation of bullae and pulmonary cysts in relation to abnormalities in the collagen fibers causing local flaccidity and reduction of the tensile strength of the wall of the terminal bronchioles, generating air trapping. The case that we present had both pathologies and the surgical approach was planned through a single incision to resolve both pathologies. The pathology report of the pulmonary segment established the dx of bullae without any other alteration in the pulmonary parenchyma and the correction of the pectus could be performed under thoracoscopic vision without any complication.

Case presentation: M 18 years old. Dx of right primary spontaneous pneumothorax + pectus excavatum + pulmonary bulla in LSD.He was admitted to the emergency department with a pneumothorax, he was treated in the shock room and SEP was placed, resolving the acute condition, observing grade 2 inspiratory air leak, recurrence when suction was removed from the pleurevac despite management with intermittent suction after 5 days of HIE with pneumothorax refractory to treatment and tomographic finding of bulla and present a pectus excavatum. Approach is completed with evaluation by ophthalmology, genetics, cardiology with ECOTT, pulmonology with spirometry. No evidence of genetic alterations or apparent cardiopulmonary alterations. Surgical planning AGB left one-lung selective intubation, incision in 5th EICD from LAM to LAA of 8cm length, vision with 30º 10mm long instrument thoracoscope, bulla in LSD apical segment resection with stapler of lung segment with bulla. Next, correction of the PE is performed with the NUSS technique, due to the patient's age group with complete ossification and the impossibility of thorax mobility and safe release of pericardio-sternal adhesions as well as impossibility of vision towards the hemithorax contralateral, it was decided to make 2 incisions parallel to the sternum and lift with traction the area of greatest sternal collapse, thus allowing the passage of the dissector and the contralateral approach for the correction, which was achieved using 1 bar and rib stabilizer. We verified hemostasis and aerostasis and performed chemical pleurodesis with povidone-iodine. Follow-up for 3 years, with pulmonary and physical rehabilitation exercises. Removal without recurrence, with good cosmetic results and patient satisfaction.

Chest wall reconstruction with prosthetic materials.

Tunc Lacin, Nezih Onur Ermerak, Esra Yamansavci Sirzai, Sezer Aslan, Gamze Gul Tiryaki, Jeyhun Pashayev, Reyhan Ertan, Mohamad Kenan Atasi, Bedrettin Yıldızeli.
Marmara University, Department of Thoracic Surgery, Istanbul, Turkey.

Background: Chest wall resections are complex and challenging procedures as this surgery may cause respiratory failure. Thoracic defects can be covered using prosthetic and/or nonprosthetic materials. Prosthetic materials include meshes, methyl methacrylate, titanium plates and osteosynthesis systems. This study presents our chest wall reconstruciton techniques using rigid and nonrigid prosthetic materials.
Methods: The records of all patients undergoing chest wall resection and reconstruction were reviewed. Patient demographics, type of the underlying disease, the location and size of the chest wall defect, the type of prosthesis and postoperative complications were recorded.
Results: Between October 2018 and August 2022, 62 patients (42M, 20F, mean age 36.6 years, range: 1-85 years) underwent chest wall resection and reconstruction for tumor in 22 (35.5%), congenital chest wall deformity in 26 (42%), acquired chest wall deformity from accidents in 11 (17.7%) and sternal dehiscence in 3 patients (4.8%). In the tumor group, lung resection was performed in 10 patients and four patients underwent sternal resection. Congenital chest wall deformity group included 16 pectus arcuatum, 7 pectus carinatum and 3 patients with Jeune syndrome. Acquired deformities included flail chest wall in 6, sternal fractures in 3 and multiple rib fracture in 2 patients. Three patients with sternal dehisence had occured following osteomyelitis of the sternum after cardiac surgery. Rigid prosthetic reconstruction (polypropylene mesh+methylmethacrylate or polypropylene mesh+titanium plate) was used in 55 patients, non-rigid reconstruction technique (polypropylene mesh+muscle) was used in 7 patients. 30-day mortality was 1.6% (n=1). None of the patients had postoperative respiratory failure due to chest wall instability.
Conclusion: Large chest wall resections and reconstructions can be performed with ease in current daily practice with the help of different forms of prosthetic materials.

Fluid collections complications after Nuss procedure in paediatric patients: Can we predict them?

Alejandra Castrillo, Ana Laín, Laura García, Carlos Giné, Rodrigo Maluje, Haider Ali Khan, Manuel López.
Hospital Universitario Vall d´Hebron , Barcelona,Spain

Background: Fluid collections anytime following Nuss procedure, such as pleural effusions, wound seromas and pericardial effusions, are already well described but the causes promoting them and the risk factors, along with their treatment and outcome, lack of detailed analysis up to date.
The aim of our study is to evaluate these complications in a series of paediatric patients and search for possible risk factors, which could be related to their appearance.
Methods: This is a review of a cohort of paediatric patients who benefited from a Nuss procedure for Pectus Excavatum (PE) between 2011 and 2022 in a single center. The following variables were analyzed: age, gender, severity of the deformity and symmetry, use of a sternal elevation technique, number of bars and their disposition, width of the retrosternal dissection and instruments employed, type of collection, moment at diagnosis, intraoperative complications, comorbidities and need for redo surgery. To study the rate of complications in relation to the PE severity a cut point was defined for the Haller Index (greater o smaller than 5) and Correction Index (above or under 40%). We defined the "collection complication" as the appearance of a pleural, pericardial effusion or wound seroma between the surgery and the removal of the bars.
Results: Ninety-two patients (72 male, 20 female) with a medium age of 14.9 (+/- 3.1) years-old were included. The average HI was 5.7 (+/- 2.4) and the average CI was 44.5% (+/- 12.2). HI above 5 was found in 46 (50%) patients and CI above 40% in 55 (59.8%), being the deformity asymmetrical in 35 (38.0%). Sternal elevation was performed in 70 surgeries (76.1%) and dissection of a retrosternal window in 67 (72.8%). In 24 (26.1%) patients a single bar was placed, and 68 (73.8%) had two or three: 58(63.0%) parallel, 8(8.7%) crossed and 2(2.2%) sandwich techniques. Five (5.4%) procedures were redo interventions. Collection complication was found in 19 cases (20.7%): 13(14.1%) pleural effusions, 7(7.6%) wound seromas, and no pericardial effusions. Pleural effusions were mainly right sided (61.5% right, 15.4% left, 23.1% bilateral). None of these collections was diagnosed in the immediate postoperative period (first week after operation). Three patients with this complication had a negative metal allergy test preoperatively.
Applying crosstabs and Chi2 Test with the SPSS software, none of the variables reached statistical significance ($p<0.05$), although placement of more than 1 bar ($p=0.07$) and dissection of a retrosternal window ($p=0.06$) showed a trend to statistical significance.
Conclusions: We did not find statistical differences among the risk factors for collection complication after Nuss procedure but there was a tendency suggesting that multiple bar placement and retrosternal dissection may be predisposing factors. The fact that these complications appear relatively separated from the surgery suggest a progressive inflammatory aetiology. Larger series studies are necessary to confirm those tendencies.

Management of fluid collections after Nuss procedure in pediatric patients: A single center experience.

Khan Riaz Haider Ali, Laín A, García L, Giné C, Maluje R, Castrillo A, López M.
Pediatric Surgery Department. Hospital Universitario Vall d´Hebron, Barcelona,Spain

Background: Fluid collections following Nuss procedure have already been described. However, a detailed analysis of the different types, their therapeutic management and outcome are still lacking up to date.
The aim of our study is to evaluate these complications in a tertiary pediatric center, their incidence, characteristics, different treatment options and outcome.
Methods: This is a descriptive study of a cohort of pediatric patients who benefited from a Nuss procedure for Pectus Excavatum (PE) between 2011 and 2022 in a single center. The following variables were analyzed: age, gender, PE severity Indexes (Haller Index & Correction Index), type of fluid collection, onset, symptoms, comorbidities, preoperative metal allergy testing, treatments and outcome.
Results: A total of 92 patients underwent a Nuss repair for PE in this time period. Collection complications were detected in 19 (20.7%): 13 (14.1%) pleural effusions and 7 (7.6%) subcutaneous seromas. No pericardial effusion was observed. Of these 19 patients 79% were male. The average age was 15.8 years (+/- 1.3). The malformation was mostly severe, mean HI of 6.4 (+/- 3.8) and mean CI of 44% (+/- 14.8). Sixty-three % of these 19 patients had pleural effusion, 32% seroma and only 5% (1 case) had both pleural effusion and seroma. Pleural effusions were mostly right sided (62%), being 15% left and 23% bilateral. They were all detected in the first 6 postoperative months (medium onset on the 24th day after surgery, range 10-61), but not in the immediate postoperative period (first week). Patients referred the following symptoms: progressive dyspnea (54%), pain (31%) and fewer (46%). Most of the cases (85%) could be managed conservatively. In 15% effusions were small and resolved spontaneously, the rest required oral corticotherapy (2-week course) (46%) with a good response and antibiotics in 23%. Only 2 patients needed a thoracic drain and all the cases resolved without removal of the implants, bridges or stabilizers.
Seven patients (100% male) had subcutaneous seromas: 67% unilateral, 33 % bilateral. In 4 cases (57%) these seromas appeared in the first 6 months (medium onset 38.25 days after surgery, range 26-47) and in the other 3 later (medium onset 8.4 months postoperatively, range 180-514 days). These patients referred pain in 50 % and none fever. In one case the seroma appeared after a mild thoracic trauma. The seromas resolved with antibiotics, oral/topical corticosteroids and puncture without recurrence in the 4 cases with early appearance, but the other (3) of late debut required removal of part of the implanted metal material for their complete resolution. No patients who developed fluid accumulating complications in our series had a history of allergic reaction to metals and 15% had a confirmed negative test.
Conclusions: PE repair using Nuss procedure is a safe technique but some fluid accumulating complications, even though rare, can occur. The results we obtained in terms of incidence of complications, characteristics and treatment differ between pleural effusion and seroma. Majority of pleural effusions appear in the early postoperative period and have a good response to oral corticosteroids. Seromas, on the other hand, can appear early or late postoperatively. The ones occurring early have a good course with conservative measures but those that happen later on may require prosthetic material extraction for resolution.

The perfect shape of the pectus bar for the Nuss procedure.

Ivan Schewitz, Nil.
Netcare Waterfall City Hospital.Pretoria, South Africa

Background: The Romans built bridges and structures based on the curve of a circle. These bridges have stood for at least 2000 years. Bridges have two basic designs, a beam bridge, which is a straight bridge with the weakest point the middle, and an arch bridge in which no point of an arch is weaker than any other. An arch bridge is stronger than a beam bridge, simply because the beam has a weak point in the center where there is no vertical support while arches press the weight outward toward the support. The weakest point of the beam bridge is always the center which is the furthest away from the supports. The longer the beam the stronger the material required to support the structure or the increase in the underlying supports.

The beauty of Arch bridges is that weaker material can be utilized in the design with the supports only at the ends. Weakest point is the middle. An arch bridge supports loads by distributing compression across and down the arch. The structure is always pushing in on itself. Strongest point is the middle.

Discussion: The discussion will compare the materials used for the present bars as compared to the possibility of smaller thinner absorbable bars in the future. Many materials have been used for absorbable implants. Many studies have been performed looking at the various properties including the time to degradation. Further work needs to be performed assessing the strength of the absorbable Nuss bar at the various periods. Is there any support after one year, sufficient to support the sternum. Intuitively one would expect that the strength of the bar would be less as the period approaches the three years normally required. This is an ongoing study.

Pectus Up new generation: Extrathoracic technique for Pectus Excavatum treatment.

Juan José Fibla Alfara.
Hospital Universitari Sagrat Cor de Barcelona,Spain

Background: Pectus Excavatum is the most common congenital deformity of the chest cavity, characterized by a concave depression of the sternum. This condition can affect the quality of life of patients, both children and adults, causing exertion fatigue, skeletal and systemic complications if the deformity is not corrected. The psychological damage that aesthetic malformation can cause can be very relevant. Beyond a good physical appearance, corrective surgery is essential and Pectus Up Technique offers an ultimate solution, with a minimally invasive technique, to all types of Pectus Excavatum.

Methods: Pectus Up Technique is the extrathoracic and painless procedure for correcting Pectus Excavatum. The innovative and minimal invasive technique involves a short period of convalescence and is free of serious complications. The technique consists of placing an implant above the sternum at the subpectoral level to definitively correct the deformity by using an external elevation system. The surgery is a low complexity procedure that requires a minimum incision of about 4 cm.

Results: Since starting of implementation in 2015, nowadays achieves to be a definitive solution for the patient: more than 90 professionals have been involved in more than 200 surgeries performed in more than 20 countries around the world. Based on continuously improving design criteria, the Pectus Up New Generation ensures a simplified surgery, a quick learning curve and an easy execution of the technique. Its revolutionary innovative solution commits that patients' safety is not compromised, from the fact that the technique allows for CPR as it also implies a low cost to the health system.

The Pectus Up New Generation enables successfully targets children and adults. The innovative design of its corrective system allows treating patients affected by Pectus Excavatum with a greater degree of asymmetry and sternal rotation. It is a great no-risk solution for patients with a previous history of heart surgery, relapsing patients of other techniques such as Ravitch and Nuss, and even facing purely aesthetic treatment failures. Fostering the high satisfaction of the patients and surgeons themselves, the Pectus Up New Generation becomes, for a wide range of cases, the best corrective surgical option currently in existence.

Discussion: How important is it to introduce technological innovation in Pectus excavatum repair techniques that promote minimal pain and no-risk for the patient? Can this extrathoracic technique be one of the best alternatives to guarantee safety in professional practice? Moreover, can it meet the patient's expectations regarding the correction of their Pectus Excavatum? How can tailored support to the surgeon drive a good way for successful results?

Conclusion: this extrathoracic minimal invasive solution stablish a new paradigm for Pectus Excavatum treatment: an easy technique that has been already welcomed with the backing and more than 90 surgeons well experienced around the world who trust the Pectus Up with more than 200 surgeries performed worldwide. Pectus Up implant is currently leading the corrective surgery of the Pectus Excavatum, increasing its interest in clinical research to a worldwide level due to its simplicity, efficacy, and safety of the surgery.

POSTERS

Severe complications after reconstructive chest wall surgery.

Marco N Andreas, Julia Strauchmann, Johann Pratschke, Jens-Carsten Rückert, Elsner Aron.
Charité - Universitätsmedizin Berlin, Germany

Background: Thoracic trauma to the rib cage is associated with high morbidity and mortality. Indications for chest wall reconstruction surgery diverge due to missing guidelines. Materials and tools have improved over the last years so that reconstruction of every traumatic injury could be indicated to restore respiratory mechanics and to avoid chronic pain with consecutively impaired quality of life.
Case Presentation: After a motorcycle accident a 65-year-old male suffered from multiple adjacent rib fractures of the left hemithorax, which led to pseudo arthrosis and chronic pain. A partial rib resection was performed. The postoperative lesion of the osseous thorax gave room for a lung hernia, that incarcerated under the patient's scapula. Indication for extended thoracic reconstruction was made. The thoracic wall was stabilized with a Mesh-graft and Costae IV to VII were fixated with rib clips with rotatable connectors, that decrease the risk of material failure. After the operation the patient's condition improved significantly reducing his level of pain to a minimum. A 39-year-old woman with Marfan's Syndrome and aneurysm had thoracoabdominal aortic repair surgery. The thoracic cavity was inadequately reconstructed, leading to a yearlong suffering from chronic pain. The injury to the rib cage resulted in pseudo arthrosis and the deformation of the left costal arch, that compressed spleen and stomach which led to heavy pain attacks and constant nausea. Partial costal resection was conducted twice with aggravation of the patient's condition because of a newly developed lung herniation that caused additional pain. Finally thoracic reconstruction was performed. During the operation the abdominal cavity had to be opened to fully resect all abundant costal fragments and was afterwards restored with ParietexTM-Mesh and FiberWire® (Covidien). Costae VIII to X were bypassed with screw free rotatable rib clips. Importantly, due to the patient being cachectic, the rib clips were placed intrathoracic to avoid compression induced tissue necrosis.
Conclusion: We presented two cases of thoracic trauma, that led to long and burdening courses of chronic pain and lung herniation. Chest wall reconstruction surgery benefited both patients crucially. Therefore, we suggest that after thoracic trauma a primary reconstruction should be favored to improve the patients' pulmonary function and quality of life. We propose to promote further research on chest wall repair surgery to improve clinical decision-making processes and to develop guidelines to standardize procedures.

Chest Wall School.

Ashley Johnstone, James Andrews, Carl Davis, Graham Bell, Kay Reilly, Kath Sharp.
Royal Hospital for Children, Glasgow, Scotland

Background: It was acknowledged from feedback and discussion with patients and their families attending the Scottish National Chest Wall Service for surgical correction of anterior chest wall deformity, that they felt unable to take an active role in managing their recovery due to limited pre-operative education and understanding of the recovery process.

Aim: To establish if a multidisciplinary group session is an optimal method to enable patients and their families to access preoperative education in preparation for chest wall surgery.

Method: In response to the feedback from our patients, since summer 2019, all patients listed for chest wall surgery and their families have been invited to attend either a virtual or face to face information session, 'Chest Wall School', at least 4 weeks prior to their surgery. At each session an informal presentation is delivered by the Consultant Surgeon, Consultant Anaesthetist, Pain Clinical Nurse Specialist, Respiratory Physiotherapist, Tissue Viability Clinical Nurse Specialist and Ward Staff Nurse. Previous patients who have had chest wall surgery and their family have also attended to share their first-hand experience. The themes covered in each session are shown in Figure 1 and have been developed in collaboration with our patients and their families.

Results: The sessions have been well received by patients and their families who value the opportunity to meet with the wider multidisciplinary team prior to their surgery and feel reassured by having the opportunity to listen and share their thoughts and questions. "I was blown away as a parent. It was incredible. Well thought out and delivered brilliantly" "It was very interesting and informative to hear from all the professional team". A key theme from the feedback is the benefit of having the opportunity to listen to the experience of a previous patient and their family. "Found it all really useful but in terms of helping to put my mind at ease a bit I found hearing from X and his Mum super helpful" "X and his mum were fantastic at giving solid aftercare advice from their own experience" "Hearing X's story and being able to see the result of the Nuss procedure. It was good to hear it from X's and his mother's perspective"

Conclusion: Chest Wall School is an effective method of delivering multidisciplinary pre-operative information to ensure patients and their families are prepared for their surgery and the recovery process. The patients and families found it extremely beneficial to have the opportunity to engage with patients who have experience of the surgery and recovery.

A 16-year-old with severe Pectus Excavatum, kyphoscoliosis and Marfan syndrome.

Paul Burns, C Davis, A Johnstone.
Royal Hospital for Children, Glasgow, Scotland.

Background: This 16-year-old male had previously presented to the chest wall clinic in 2017, at 12 years old. He had a history of Marfan syndrome, kyphoscoliosis and symmetrical pectus excavatum. He had a mildly dilated aortic root on echocardiograph but was deemed stable from a cardiac point of view. At this point he was too young for Pectus surgery but he did undergo scoliosis correction in 2018. He was re-referred to the chest wall team in early 2020 and said he was keen for surgery. He reported a very poor exercise tolerance: short of breath simply walking on flat ground. Work-up was commenced and he was referred for a CT scan, pulmonary function tests (PFTs) and cardiopulmonary exercise test (CPET).

Case Presentation: The CT scan showed severe symmetrical pectus excavatum with an estimated Haller index of 8, and a possible defect in the ventricular septum. The CPET was delayed due to patient non-attendance and the ensuing COVID-19 pandemic. The PFTs and CPET were performed in October 2020 and showed a moderate restrictive ventilatory defect with significant cardiovascular impairment, gas exchange abnormalities and a significantly reduced aerobic capacity (see table 1 for pre and post measures.) This prompted a referral for a cardiac MRI which showed significant ventricular impairment with a dyskinetic left and right ventricles with an ejection fraction of 36 and 26.5% respectively. Surgery was expedited and a thoracoscopic assisted Nuss procedure with two pectus bars was performed.

PFTs and CPET were repeated 1 year post surgery and there was marked improvements in the VO2peak, peak oxygen pulse and gas exchange. There was no significant change in his resting pulmonary function. The patient also subjectively reported an improved exercise tolerance after his surgery.

Discussion/Conclusion: Although there is still ongoing debate around physiological improvement post-surgery to repair pectus excavatum, this case illustrates that in selected patients with significant impairment prior to surgery, there can be a marked improvement in physiological function as shown by CPET.

Chest wall reconstruction with no visible bone callus in complex ribs fractures.

Emmanuel Peña Gomez Portugal, Hernández Arguelles E, Solorzano Campos L, Peiro Osuna P, Casillas Enríquez J. D, Bolaños Morales F, Zavala Vázquez S, Sánchez Pereda D, Ceballos Villalva C, Montiel Bravo G, Posadas Trujillo O.E.

Salvador Zubirán National Institute of Medical Sciences and Nutrition. Mexico Vall d'Hebron Hospital. Barcelona General Hospital of Pachuca Hidalgo.

Background: Trauma-associated rib fractures can lead to chronic sequelae even after chest wall reconstruction in relation to the speed of remodeling and the number of sites with porosity or lack of bone, which can lead to bone loss and greater fragility. Reducing bone porosity will prevent microdamage by reducing fragility and restore bone strength, thus avoiding the risk of fracture during treatment and allowing biomechanics and function of the chest wall. We analyze the surgical management of 2 cases of blunt and open chest trauma with deceleration trauma kinematics in the case of blunt trauma and gunshot injury in open trauma. A brace technique was used for reconstruction, achieving intercortical symmetry with pre-established angulation of the costal arch in relation to the unaffected or remaining rib segment. Our objective is to keep the cortices aligned without perceiving a ridge between them, to seal any visible bone bridge site with demineralized bone matrix, and to maintain an open intercostal space, avoiding contraction of the chest wall due to the healing process. We divided the management of patients with blunt trauma and those with open trauma into two groups.

Case reports: We present two representative cases. Clinical case 1 M 28 years Armed attack with a firearm projectile in the hemithorax, open chest trauma, multiple fractures with loss of bone tissue, lung laceration, loss of chest wall integrity, diaphragmatic laceration. Clinical case 2 M 72 Fall from a height of 3 meters, direct trauma against the edge of the street, hemopneumothorax, rib fractures with displacement between cortical bones greater than 50%, presence of a 3rd fragment, chest intrusion with pleural tear.

Discussion: Our considerations were based on the reconstruction technique keeping the anterior cortical fixed and the posterior mobile, thus favoring the rehabilitation and mobility of the rib cage, the age group, life expectancy for function and work activity, the degree of bone loss to consider reconstruction and bone integrity if the affected area is a load-bearing site and its ability to contract. Thus, maintaining the integral surface of the bone, a minimum debridement of the periosteum, maintaining the intrafracture hematoma and releasing the vascular bundle and nerves to avoid being trapped within the healing tissue. The follow-up of the patients was carried out for one year with surveillance at one month, 4 months and one year after reconstruction, with chest X-ray and respiratory function tests. With adequate recovery and satisfaction as well as reintegration into their personal, work and recreational activities without noticeable limitation

Costochondral synostosis case report and surgical management.

Emmanuel Peña Gomez Portugal, Peiro Osuna R.P, Hernández Arguelles E, Solorzano Campos L.M.M, Bolaños Morales F, Zavala Vázquez S, Sánchez Pereda D, Ceballos Villalva C, Casillas Enríquez J. D, Posadas Trujillo O. E.

Salvador Zubirán National Institute of Medical Sciences and Nutrition. Mexico Vall d'Hebron Hospital. Barcelona General Hospital of Pachuca Hidalgo.

Background: The prevalence of congenital rib abnormalities is low and of unknown causes, being between 0.27% and 0.74% in the asymptomatic population. Costochondral synostosis is even rarer and can be 0.26% and is related to congenital malformations in most cases, and may also occur secondary to trauma. The symptoms 'can be variable depending on the topographic location on the chest wall, and can generate thoracic outlet syndrome, associated compensatory deformities and respiratory restriction

Case presentation: 16-year-old female with a history of esophageal atresia, premature birth 31 SDG, relatives for diabetes and hypertension, Hispanic, weight 35 kg, height 149 cm, BMI 15.8, first orthopedic approach for thoracic scoliosis with finding of right rib synostosis of the 3rd to 8th, clinically with chest wall deformity and decreased volume of the DTH, right basal condensation Sx, ambulation with tilting of the pelvis, claudication gait and visible scoliosis. Approach with imaging and PFR is completed; Spirometry with moderate obstructive pattern, FVC 75% predicted, FEV 1 51% predicted, ratio 67%. Chest CT showing fusion of the 3rd to 8th costal arches in the posterior region, accompanied by deformity of the thoracic spine at the same level of costal fusion. These findings consider synostosis as the cause of the thoracic spine deformity, as well as the functional and structural condition at the pulmonary level, with high growth rate by Risser of III, so prior authorization from the parents is considered surgical management to release the rib synostosis.

Measurement of the rib synostosis area was performed by CT for planning of the rib section of the fused area in a symmetrical way compared to the contralateral side. Surgical technique. Under balanced general anesthesia, a posterolateral thoracotomy is performed at the 5th EICD level, dissection by planes with preservation of the serratus, exposure of the rib arches, longitudinal osteotomy with a saw, freeing the rib arches with symmetry between the segments and the chest wall, maintaining low lung volume and high frequency; He was extubated with spontaneous ventilation and a swallowing reflex. The release of the chest wall was carried out without incident, maintaining an endopleural catheter for 5 days and a hospital stay of 7 days, satisfactory radiographic control, maintaining the intercostal spaces. Subsequently, he joined a physical and pulmonary rehabilitation program. Follow-up for one year without complications with partial recovery of the position, maintaining stabilization of the chest wall and recovering physical activities with good lung function.

Surgical treatment of Pectus Excavatum: Mini invasive repair of Pectus Excavatum vs sternal prosthesis implantation.

Flavio Facchini, Antonio Messineo, Alessandra Martin, Roberto Lo Piccolo, Fabio Dell'Otto, Valentina Gatti, Antonino Morabito.
Meyer Children's Hospital, Florence, Italy.

Background: In our Pectus Center we performed 2 different techniques to treat patients with severe Pectus Excavatum (PE): the Mini Invasive Repair of Pectus Excavatum (MIRPE) and the rubber silicone implants obtained from patient's CT using a 3D Computer Aided Designed (CAD).
Materials and method: We retrospectively reviewed the charts of 55 consecutive PE patients (aged between 12 to 24 years) with Haller Index > 3.25 treated in our Center between January 2018 to December 2021 with one of those two techniques. The surgeons' decision was based on thoracic CT, cardiac MRI and cardiopulmonary exercise testing evaluation. Thirty PE patients were treated with MIRPE and 25 with CAD implants.
Conclusion: This study has 2 biases: not only it was retrospectively performed but also the type of operation was not randomized and chosen on case severity. This considered, CAD was associated with less operative time, short hospital stay and less complications ($p<0,01$). We conclude that when MIRPE is not strictly required by clinical conditions, the alternative of CAD implants should always be kept in mind.

Resection and reconstruction of a chest wall hamartoma in a 13 month-old.

Tunc Lacin, Esra Yamansavci Sirzai, Gamze Gul Tiryaki, Sezer Aslan.
Marmara University, Department of Thoracic Surgery, Istanbul, Turkey.

Introduction: Chest wall hamartomas are rare benign lesions that usually occus in infants and children. Prognosis is very good following surgical resection. The clinical presentation and imaging are not enough to differentiate from malignant tumors. We present a case with a large mesenchymal hamartoma of the right chest wall.

Case report: A 13-month-old boy presented to our outpatient clinic with a swelling on the anterior side of right chest wall. Chest X-ray showed a mass on the right side. Chest computed tomography showed a large mass lesion orginating from the 2nd rib. Incisional biopsy revealed a mesenchymal tumor proliferation producing cartilage. The patient underwent enbloc removal of the mass and the 2nd rib. 2nd rib was replaced by the STRATOS™ system. Patient was discharged on postoperative day 4. Histopathology confirmed a mesenhymal hamartoma.

Conclusion: Chest wall hamartoma is a rare benign lesion of the infancy that may destruct bony tissues. The prognosis is excellent after complete surgical resection of the chest wall.

habdomyolysis following Nuss procedure: A prospective study in children.

Carlos de la Torre Ramos, K. Estefanía, C. Fernández.
Hospital Infantil La Paz. Madrid, Spain

Background: Postoperative rhabdomyolysis (RML) has been document in several types of surgery in adults. Anatomical remodeling after pectus excavatum (PE) correction could cause RML. We evaluate the incidence of RML and renal function after the Nuss procedure in children.
Methods: All patients undergoing Nuss procedure with only one bar were enrolled in this prospective study during a 3-year period. Preoperative demographic characteristics and clinical data, as well total duration of surgery, complications, and length of hospitalization. To investigate the occurrence of RML and renal function, serial assessment of serum creatine kinase (CK) and creatinine, urea, glomerular filtration rate. RML was defined as postoperative creatine kinase (CK) >1000 U/L.
Results: In total 46 patients were included: 40 men and 6 women with mean age of 15.09 ± 1.39 years. The mean of duration of surgery was de 74 ± 28.17 minutes, and the length of hospitalization was 4.57 ± 1.57 days. No reported complications. After surgery, RML was diagnosed in 29.4%, 84.6%, y 88.2% patients at 6, 24, y 48 postoperative hours, respectively. The mean CK value was 181.11 ± 142.63 UI/L (range 67-610) preoperative, 863.26 ± 302.62 UI/L (range 352-1273) at 6h, 1651.69 ± 561.38 UI/L (range 707-2654) at 24h, and 1675.18 ± 561.01 UI/L (range 707-2654) at 48h postoperative, with statistically significant differences (p=0,002). The renal function remained stable during follow up (p=0,55). No correlation was found between the presence of RML, anthropometric data and surgical time.
Conclusions: The Nuss technique produces RML. This data should be considered in patients at increased risk of developing acute renal failure to prevent complications of this condition.

Dermatofibrosarcoma protuberans: An agressive thoracic tumor managed with a combined technique.

Maíra Kalil Fernandes, Camilla Matos Pedreira, Ricardo Lopes de Moraes Oliveira, José Dias Andrade Neto, Caio Diniz Chalhoub Coelho Lima, Sérgio Tadeu Lima FortunatoPereira.
Hospital Santa Izabel.Brazil

Background: Dermatofibrosarcoma protuberans (DFSP) is a local aggressive superficial soft tissue tumor. Usually it is a low-grade sarcoma, but sometimes it has a different behavior, in which case it is denominated an **i**ntermediary or high-grade sarcoma. This kind of tumor has a very high local recurrence rate, but metastasis is not common, occurring in less than 5% of cases.
This case report is about an aggressive thoracic DFSP, resulting in a large free resection margin, but that developed metastasis despite the surgery result.
Case report: Patient, 75-year-old, with a history of left mastectomy and radiotherapy in 2019 secondary to high-grade thoracic dermatofibrosarcoma. In 2021, the patient developed superficial and hardened subcutaneous nodules in the left hemithorax. (Figure 1) Due to the suspicion of recurrence, the patient underwent a chest tomography, which suggested recurrence in the left rib arches and a subcutaneous nodule in the 4th intercostal space on the right. (Figure 2 and 3) Physical examination showed indurated, irregular, brownish nodular lesions. There was no palpable lymphadenopathy. The case was discussed in a multidisciplinary meeting and a surgical resection was chosen, with wide excision of the lesion. The patient underwent *en bloc* thoracectomy covering the tumor, previous incision, left remaining breast and right parasternal region. An incision was made with margins of approximately 3cm, irregularly shaped to preserve subcutaneous tissue. The 2nd, 3rd and 4th ribs on the left and a segment of the 3rd rib on the right were resected. (Figure 4 and 5) Chest wall reconstruction was performed with a 30x30cm polypropylene mesh in a double layer with an angle of 45 degrees between them on the right and left thoracectomy region. (Figure 6) Two plates with 12 screws were used in the 2nd and 4th left ribs and sternum. Then, a "tunnel" of mesh was performed over the plate to avoid the "bucket handle" effect. (Figure 7 and 8) In this case, the complex reconstruction involves both thoracic and plastic surgeons. The plastic surgeon prepared a *latissimus dorsi* flap and a "Z" myocutaneous flap to protect the chest wall. (Figure 9 and 10) Almost four months after the thoracectomy, the patient developed a new tumor on the right breast and another mastectomy had to be done. Radiotherapy completed the treatment, but five months later the disease returned with metastasis in distant subcutaneous tissues, bone and lymph nodes.
Discussion: The most common location of dermatofibrosarcoma is in the thoracic region (50 to 60%), extremities (25%), head and neck (10 to 15%) and, on rare occasion, in the genital region.
The lung is the site most affected by metastases, followed by the brain, bones and heart. The prognosis of metastatic patients is poor, with survival of less than 2 years. Most relapses occur in the first three years (80%). MRI is useful in determining the depth of the tumor, particularly with large or recurrent lesions. Tomography is recommended when bone involvement, or pulmonary metastasis is suspected. The standard treatment is excision with wide margins, since Mohs micrographic surgery is not currently performed in most institutions. The local recurrence rate after resection with 3cm margins is 20%, while for 5cm margins it is less than 5%. Despite the lack of randomized trials demonstrating benefit, adjuvant RT is commonly recommended in conjunction with extensive local resection of large tumors, or when surgical margins are close or positive, and further surgery is not feasible. DFSP has a good prognosis as long as it is diagnosed early and with adequate treatment. The most important risk factor for local recurrence is the status of surgical margins. In addition, being over 50 years of age appears to be a risk factor for local recurrence and lower survival. Tumor size does not appear to have a significant influence on recurrence or survival.

Barcelona

THANK YOU