50. Chest wall, diaphragm and pleura

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Pectus excavatum, small lungs or small chest cavity?

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Introduction: It is accepted that a pectus it is primary deformation of the chest. An alternative explanation is that the lung is underdeveloped and the small lung retracts the chest wall. According to this hypothesis, the small lung to chest volume ratio augment the negative intrapleural pressure thereby deforming the chest wall. With surgical correction of the supposed chest deformity the chest cavity volume is increased and these small lungs are stretched even more than they were stretched. This traumatizes the lungs, further impairs their function.

Patient's studied: 27 patients with Pectus Excavatum without surgical correction and 5 patients after surgical correction of the chest.
Methods: Body-plethysmography, Cardio-Pulmonary Exercise test, mathematical modeling.
Results:

Table 1. Spirometric functions before and after surgical correction

	TLC (% of pred)	RV (% of pred)	VC (% of pred)	FRC (% of pred)
Before	91.8%± 3.9%	155.3% ± 12.3%	72.9% ±4.6%	119.7% ±10.2%
After	60.5% ±7.9%	123.8% ±19.8%	56.1% ±7.4%	76.8% ±9.8%

Table 2. Cardiac functions before and after surgical correction

	CO (% of pred)	SV (% of pred)	HR (% of pred)
Before	94.3%± 3.0%	102.9% ± 6.7%	94.4% ±4.2%
After	72.5% ±7.2%	76.6% ±5.9%	98.1% ±5.3%

Discussion: The preoperative TLC and VC were almost normal, but FRC and RV was significantly increased in the 27 patients. Central hemodynamic parameters were also within normal limits. Hence, the chest deformity is a secondary effect caused by this "Little Lung Syndrome".
After surgery, all lung volumes and hemodynamic functions decreased.
Conclusion: It is probable that we need to change the surgical technique to not only correct the chest wall defect but also to reduce the intra-thoracic volume, so as not to stretch the lungs.

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Evaluation of the effects of surgical correction of left mediastinal displacement in children with pectus excavatum on pulmonary perfusion, using minimal radiation exposure
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The pulmonary perfusion (PP) in pectus excavatum (PE) patients after surgery hasn't been objectively assessed.
Objectives: To investigate the effects of surgical repaire of left mediastinal displacement in children with PE on PP, using easily performed and minimally invasive methods which minimize radiation exposure.
Methods: We prospectively evaluated 34 consecutive patients with PE pre- and post-Nuss procedure using chest radiography (CXR), echocardiography (UCG), and PP scintigraphy. CXR was used to calculate the vertebral index (VI) and left displacement index (LDI, ratio between the distance from the left border of the mediastinum to the left border of the thorax and the transverse thoracic dimension on posteroanterior CXR). PP scintigraphy was visually interpreted and left-to-right count ratio (Ls/Rs) was measured. Pre-ejection period, acceleration time (AcT), and ejection time (ET) of the right pulmonary artery (RPA) and left pulmonary artery (LPA) were measured by pulse Doppler UCG.
Results: VI and LDI improved postoperatively ($P<0.001$). Preoperatively, left PP was impaired. Postoperatively, Ls/Rs increased ($P=0.001$) and AcT/ET changed (LPA: $P<0.001$; RPA: $P=0.008$). Evaluation of the usefulness of CXR showed that LDI correlated with Ls/Rs ($R=0.411$, $P<0.001$) and LPA-AcT/ET ($R=0.50$, $P<0.001$), and that VI did not correlate with Ls/Rs and correlated poorly with LPA-AcT/ET ($R= -0.28$, $P<0.05$).
Conclusions: The imbalance of PP improves after the Nuss procedure. The degree of leftward displacement of the mediastinum correlates with decreased left PP. Follow-up can be achieved with minimal radiation exposure.

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Minimally invasive repair of pectus excavatum: A single institution experience
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Minimally invasive repair of pectus excavatum (MIRPE) has become the treatment of choice in many centers in the recent years due to the successful surgical outcomes. The aim of this study was to investigate the results of MIRPE at our institute.
Two hundred and fifty cases who had had MIRPE between August 2005 and February 2012 were included in the study and they were evaluated retrospectively according to the demographics, form of the deformity, number of retrosternal bars, operation duration, perioperative and postoperative complications, length of hospital stay, reoperations, bar removal and patient satisfaction.
Two hundred and three of the patients were male, 47 were female and the median age was 16.5 (range: 6-36). The deformity was symmetric in 180 and asymmetric in 70 cases. One pectus bar was used in 157 cases, two in 87, three in 6 cases for the correction of the deformity. The median operation duration was 60 minutes (range: 20-180) and the median duration of hospital stay was 5 days (range: 2-10). Thirteen patients were reoperated due to inefficient correction of the deformity. Bars of the 30 patients have been removed on planned date without any recurrence in all but one patient. According to the evaluation of the quality-of-life questionnaires 95% of the patients were satisfied with surgical outcome.
Minimally invasive repair of pectus excavatum is a successful surgical technique and can be preferred for the short operating time, low morbidity and high levels of patient satisfaction.

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Stabilization of sternum using absorbable copolymer plate in the open surgery for pectus deformities
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Minimally invasive repair of pectus deformities have become the treatment of choice in recent years yet open surgery is still being widely performed for deformities such as mixed deformities or pectus arcuatum, where minimally invasive techniques are not feasible. Various materials such as steel wires can be used for stabilizing the sternum during open surgery. Absorbabale copolymer plates have been in use for the stabilization of bony structures. The aim of this study was to investigate our results of open surgery for pectus deformities using absorbable copolymer plates for sternal stabilization.
Eighteen patients who had had open surgery for pectus deformities using absorbable copolymer plates between November 2008 and January 2012 were included in the study and they were evaluated retrospectively according to the demographics, type and form of the deformity, operation duration, perioperative and postoperative complications, and recurrence.
Twelve patients were male and the median age was 19,5 (range: 14-31). Seven patients had pectus arcuatum, 7 had pectus carinatum and 4 had mixed deformity. Deformity was symmetric in 13 patients. All patients had open surgical correction with the principals of modified Ravitch sternoplasy and the sternum was stabilized by screwing a 42x42x2mm absorbable copolymer plate on sternal osteotomy line. The median operation duration was 120 minutes (40-210). One patient had seroma in the postoperative period. No recurrence was seen.
Absorbable copolymer plates can be used for the stabilization of sternum in open surgery for pectus deformities with low morbidity rates, as it is a safe, durable and easy-to-use material.

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Surgery for sternal tumors: Extent of resection, reconstruction and survival
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Objective: To evaluate the postoperative results after different sternal resections for malignances.
Methods: A total of 15 patients (mean age 48.9 years) were operated on during a 7 years period. There were 8 sarcomas (4 chondrosarcomas, 3 radiation-induced sarcomas, 1 osteosarcoma), 1 recurrent desmoid tumor, 3 local breast tumor recurrences, 1 plasmocytoma, and 2 metastases of other tumors. Four cm free margins on each side were achieved in all patients with total sternectomy (4), subtotal sternal resection (9), and partial resection (2). Concurrent en bloc resection included anterior ribs (4), clavicle (3), pericardium (2), brachiocephalic vein (2), and diaphragm (1). The chest was reconstructed with Marlex mesh and myocutaneous flap in 8 (53.3%) patients or omentum in 1 (6.7%) patient, only double layer Marlex mesh with breast mobilization in 4 women (26.7%), and a combination of Marlex mesh and a metal bar in 2 patients (13.3%).
Results: There was no 30-day operative mortality. Mechanical ventilation for 5 days was needed in a 78 years old female after total sternectomy. Local suppuration was found in 1 patient. The mean in-hospital stay was 11.4 days. After a median follow-up of 51 months the overall 5-year survival was 48%, with a median survival of 57 months. Local recurrence occurred in 1 patients, who underwent a repeat resection. Metastases developed in 2 patients.
Conclusion: Wide sternal resection is a safe and effective treatment of sternal malignances. The chest wall reconstruction depends on the size and site of the resection, and should be planed with plastic surgeons.

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Our experience in the surgery of the chest wall tumors
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Introduction: The tumoral pathology of the chest wall is extremely interesting and wide, and still today it rises a great amount of problems related to the diagnosis and surgical treatement. That is why the purpose of this article is to share our department's experience confronting this type of pathology.

Material and method: We analysed a series of 154 patients that underwent surgery in our department in ap 10 years period (2001 – 2011), with ages between 21 and 74 years old. 43 of the patients had benign pathology, the rest of 111 had primary, secondary or contiguous malignancies of the chest wall. The surgical procedures applied were chest wall resection followed by reconstruction with several types of synthetic materials such as Thoratex mesh, "Spider Web" suture or the use of methylmetacrylate in 25.4% of the cases and chest wall resection without stabilisation. In 74.6% of the patients. The mean hospital stay was 8 days.
Results: In all the cases the perioperative mortality and morbidity was zero. The immediate postoperative outcome off the patients was good in 150 cases, 3 cases developed wound seroma that was managed with conservative treatment and one patient underwent a second surgery with muscular flap after stabilisation with methylmetacrylate.
Conclusions: The tumoral pathology of the chest wall still raises a series of problems of surgical treatment, some cases are indeed a chalange for the surgeon, but the continuous developement of the surgical techniques and of the meterials for reconstruction along with the developement of experienced surgical teams lead to obtaining optimal results without complications that require further surgical attention.

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Eventration surgery of the diapragm via trans-thoracic aproach

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Eventration of the diaphragm is a rare anomaly due to congenital or acquired etiology. Congenital eventration of the diapragm is probably a true congenital defect acquired during the fetal period. Eventration of the diaphragm also occurs in adults is thought to be caused by an acquired complete or in complete paralysis of the diaphragmatic leaf. Operative repair is indicated for older patient who has symtoms. A transthoracic approach and diapragmatic plication is preferred.
We performed 32 diaphragma plication at our instution between 2005-2011. Six of the cases on the right, 26 on the left. All operation performed under laterally decubitis position and one lung ventilation. The classical approach was a postero-lateral thoracotomy through 7th intercostal space. The thinned diaphragmatic leaf was repaired with plication. We had no postoperative mortality or any other major complication.
The eventration of the diaphragm need to surgically repair to take away symtoms and respiratory relieve.

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Neural networks analysis of spontaneous pneumothorax development

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Spontaneous pneumothoraces (SP) tend to cluster. Correlations between SP and atmospheric variations were reported by previous studies. In our work SP correlation with meteo variables and air pollutants in Cuneo County was analyzed.
2004-2010, 451 SP patients were prospectively evaluated. For each day of analyzed period, meteo parameters and pollutants were recorded. Statistics on SP evaluated distribution characteristics, spectral autocorrelation and spectral analysis; multivariate regression techniques were performed using artificial neural networks. Analysis of seasonal distributions showed no significant correlation. Spectral analysis showed that SP events were not random. Correlations between meteo-environmental variables were analyzed through linear tests.

Table 1. Linear tests on meteo variables and pollutants

Variables	*t*	Kolmogorov-Smirnov	Mann-Whitney
Temperature (T)	0.003	0.073	0.037
Humidity (H)	0.046	0.015	0.089
Pressure (P)	0.090	0.034	0.083
Wind (W)	0.037	0.415	0.070
NO_2	0.022	0.165	0.050
O_3	0.027	0.092	0.044

Neural networks showed some variables may predict SP insurgence.

Multivariate regression

	r_s	FAR	FP	FN	DP	EF	HSS
O_3+NO_2+W+P+T							
Neural network	0.15	0.75	0.52	0.30	0.70	0.34	0.11
Regression	0.04	0.78	0.32	0.64	0.36	0.25	0.03
NO_2+W+P+T							
Neural network	0.13	0.74	0.39	0.45	0.55	0.34	0.12
Regression	0.01	0.79	0.27	0.79	0.28	0.21	0.01
O_3+NO_2+W+P							
Neural network	0.18	0.73	0.48	0.30	0.70	0.36	0.14
Regression	0.01	0.80	0.62	0.38	0.63	0.24	0.01

r_s: correlation. Best performance: ↑Heidke's Skill Statistics (HSS); ↓false alarm ratio (FAR) + false negative (FN); ↑detection probability (DP) + efficiency (EF).

SP occurrence significantly increases in warm windy days with high atmospheric pressure and high NO_2 concentration. These data don't affect SP treatment; nevertheless, they add information on SP tendency to cluster.