Comparison of results of surgical treatment of congenital spinal and thorax deformities in skeletally immature patients using two different „growing" implants

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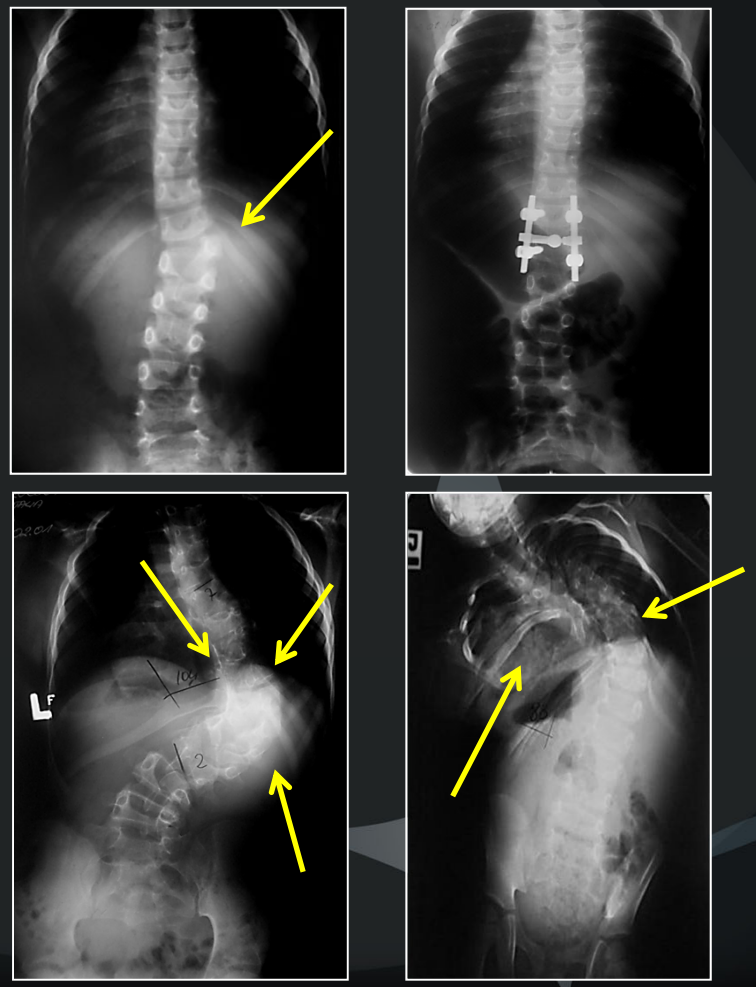
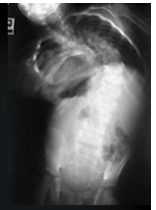
Introduction

- Treatment of progressive, multiple congenital spinal and thoracic deformities poses a challenge
  - In case of single level deformities resection and local fusion are method of choice[1-3]
  - Multiple defects are characterized by severe, unpredictable progression[4,5]

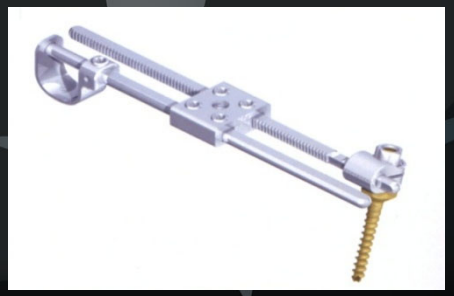


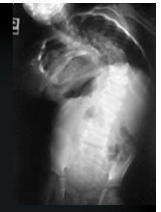
Introduction



- The main aim of treatment is to allow growth of the spine and what is of greater importance to expand the thorax and prevent respiratory dysfunction
  - To assure this during the procedure both structures should be addressed: spine and thoracic cage
    - Campbell introduced the term thoracic insufficiency syndrome[6]
    - VEPTR was initially designed to adress patients with TIS by means of a thoracostomy and thorax expansion[6,7]
      - Specific complications of VEPTR procedure include: skin problems (bulky implants), upper or lower hook dislodgement or even rod breakage and eosaphageal rupture[8-10]

- Therefore new desings are being introduced, one of them is Growing Spine Profiler (GSP™)





Aim of study

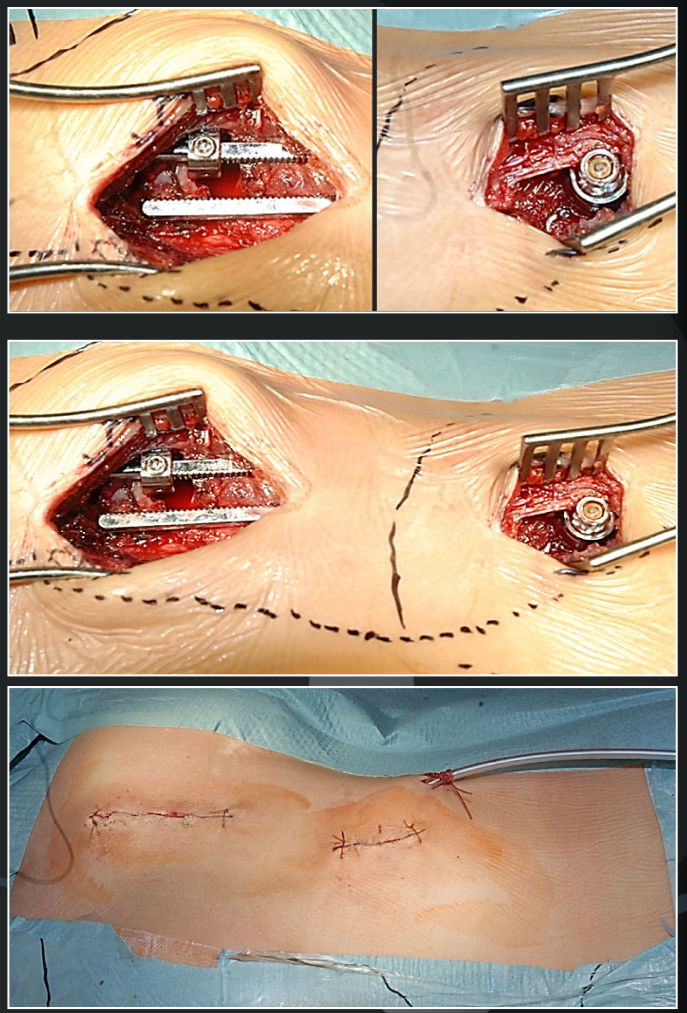
- Aim of paper is to compare the results of surgical treatment of patients with progressive congenital malformations of the spine and thorax treated with two types of rib-spine expandable constructs, VEPTR and GSP

Material

- Material consists of 25 patients with severe progressive congenital spine and thorax deformities treated with two types of rib-spine expandable constructs
- Mean age at surgery was 6.6y (3-11)
- Mean Cobb angle preoperatively was 83° (50-125)
- Mean follow-up 19.8months (9-56)

GSP - operative procedure

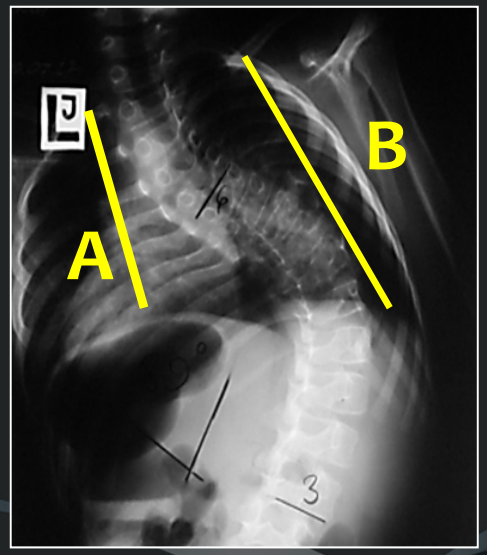
- Initial surgery was performed using two incisions, above the upper and lower end of the construction
- Following that the connector and rods were passed under the fascia, then distraction was performed and finally the nuts were tightened
- Screws were inserted using a paramedian approach preserving the perisoteum
- Lengthening procedures were performed every 6 months using a stab incision located over the rod connector
- No external support was used



Methods

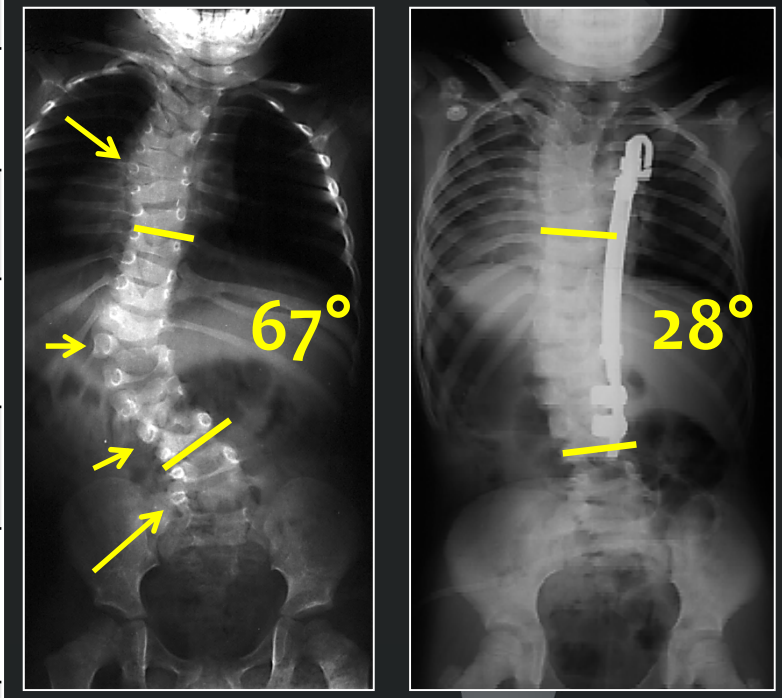
- Following data was evaluated:
  - Course of surgery (blood loss, time of surgery)
  - Number of lengthening and additional procedures
  - Complication rate
  - Curve magnitude, T1-S1 length, apical vertebral translation (AVT), apical vertebral height, space available for lungs ratio (SAL) – pre- and postoperatively and at final follow-up
    - SAL ratio is calculated by taking the ratio of the distance from the apex of the most cephalad rib to the highest point of the concave side divided by the convex side[11]
    - A/B*100% = SAL ratio
  - Resluts were analyzed indenpendantly

    in groups with VEPTR (gr.A) and GSP (gr.B)



Results (1)

	Gr. A (VEPTR)	Gr. B (GSP)	All patients
No of patients	11	14	25
Age at surgery	6.1 years (3-7)	7.7 years (4-13)	6.6 years (3-11)
Follow-up	21 months (16-32)	11.2 months (6-19)	19.1 months (3-52)
Time of surgery	141 min (60-250)	77 min (50-140)	87 min (50-170)
Blood loss	77 ml (30-150)	60 ml (40-150)	59 ml (30-150)
No of lengthening procedures	26	13	39
No of additional procedures*	4	5	9

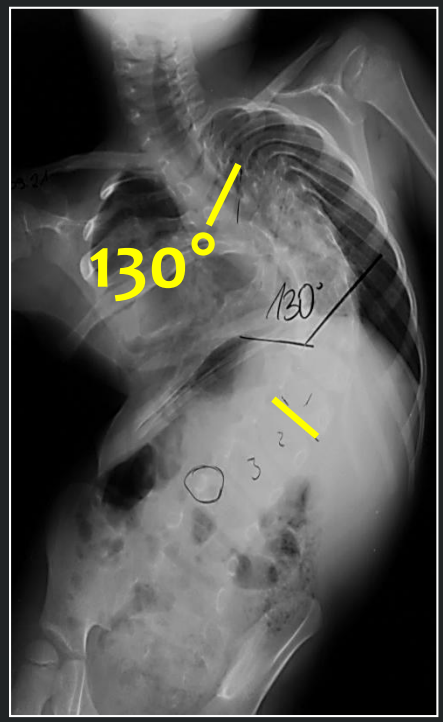


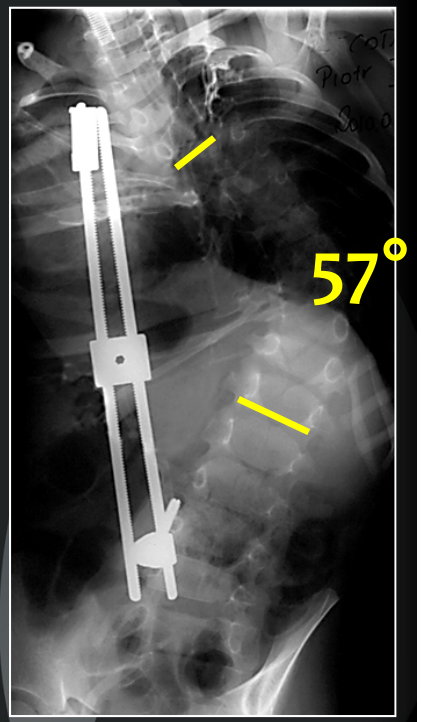
Patient, girl, multiple hemivertebrae, age at 1st surgery 4, VEPTR device, follow-up 29 months
4 lengthening procedure

*rib block osteotomy, vertebral block osteotomy, opening wedge thoracostomy, spinal cord untetherig

Results (2)

	Gr. A (VEPTR)	Gr. B (GSP)
Cobb angle pre-op	81.4° (60-95)	90.8° (65-125)
Cobb angle follow-up	65.8° (60-72)	59.1° (38-78)
AVT pre-op	69.6mm (47-84)	71.2mm (53-94)
AVT f-up	50mm (11-94)	48.6mm (20-85)
T1-S1 length pre-op	221.0mm (185-326)	240.9mm (182-319)
T1-S1 length f-up	237.1mm (200-326)	296mm (211-357)
SAL ratio pre-op	79% (66-89)	79% (65-89)
SAL ratio f-up	87% (67-100)	90% (82-99)



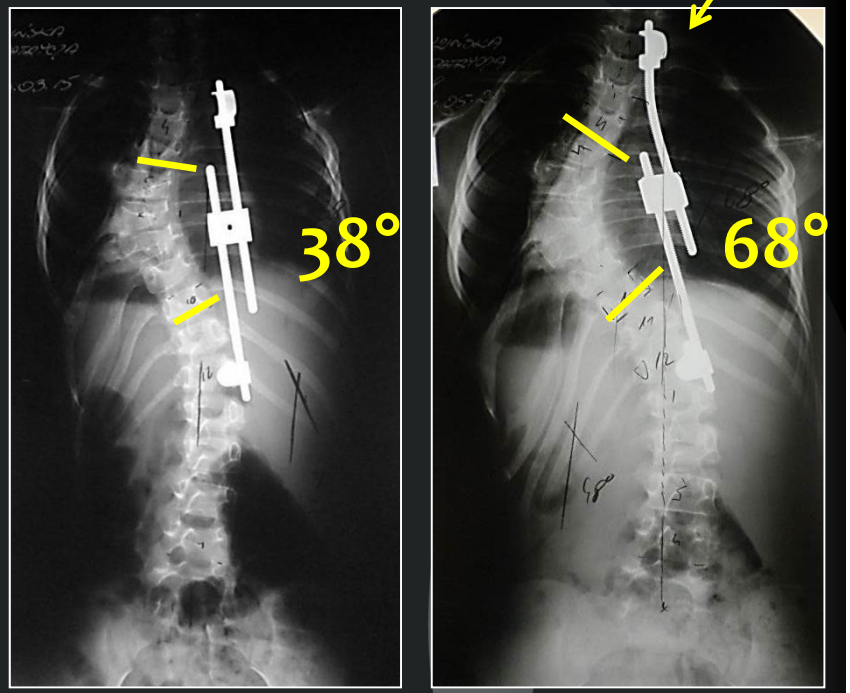


Patient, boy, rib blocks,
age at 1st surgery 4, VEPTR device,
follow-up 21 months
3 lengthening procedure

Results (3)

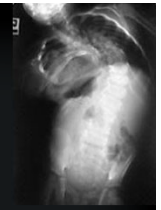
	Gr. A (VEPTR)	Gr. B (GSP)
Cobb correction at f-up	17.7% (3-24)	33% (13-51)
SAL change at f-up	10.4% (6-15)	11.4% (1-26)
Increase in T1-S1 length	12.3% (2-20)	11.6% (2.6-27)
No of unplanned procedures	2 (18%)	1 (7%)
No of rib clamp cx	0	2 (14%)
No of distal clamp/screw cx	3 (27%)	1 (7%)
Wound problems	1 (9%)	0
Total rate of complications*	36.6%	14.3%

*requiring surgical intervention



Patient, girl, rib blocks, hemivertrebrae,
age at 1st surgery 6, GSP device,
follow-up 9 months,
1 lengthening procedure
Rib clamp dislodgement

Conclusion



VEPTR vs GSP

- Both systems are of value in the treatment of severe congenital spinal and thorax deformities in terms of curve control, although GSP procedure results in much higher correction — 17.7% vs 33%
- Both systems preserve further growth of the spine (T1-S1 length) — 12.3% vs 11.6%
- GSP procedure resulted in a slightly higher correction of SAL ratio — 10.4% vs 11.9%
- The complication rate was lower in the GSP group — 30% vs 14%
- The most common site of complications in GSP patients is the upper rib clamp, while in VEPTR patients – distal hook
  - GSP system posed no wound problems, is less protruding compared with VEPTR
  - Complication rate is acceptable considering the nature of deformity

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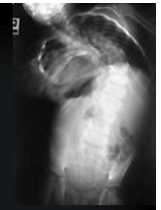

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