



Correlation between surgical site infection(SSI) and Classification of early onset scoliosis(C-EOS) in patients managed by rib-based distraction instrumentation (VEPTR)

Mahmoud A. H. Mahmoud, MD ; Patrick J. Cahill, MD; Aaron
Tatad, MPH ; Robert M. Campbell, MD ; John M. Flynn, MD

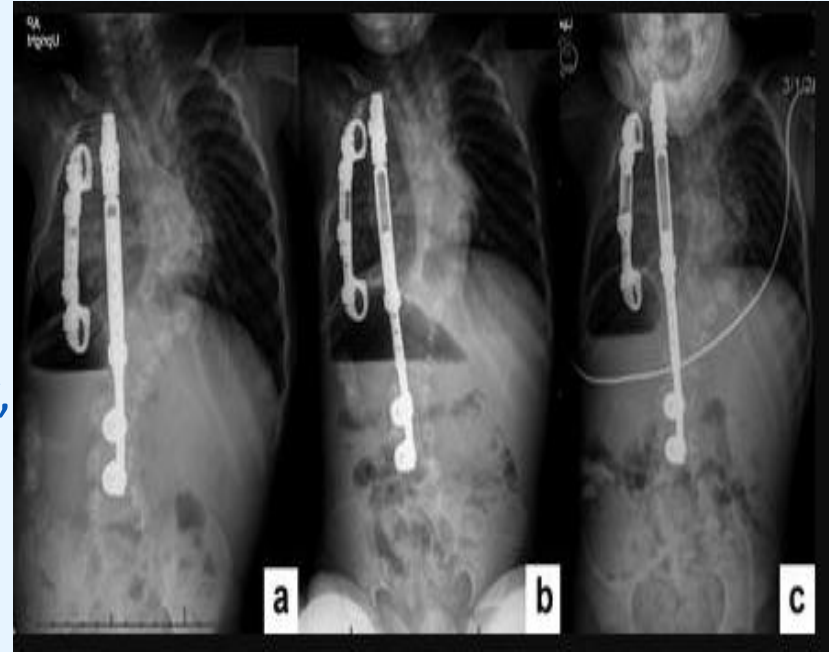
The Children's Hospital of Philadelphia, Division of Orthopedics
The Perelman School of Medicine, University of Pennsylvania



Please address correspondence to John M. Flynn, MD at:
orthoresearch@email.chop.edu

Background

- Classification systems can be useful tools for surgeons to recommend treatment and compare outcomes.
- Williams et al described the **Classification for Early Onset Scoliosis (C-EOS)** and schemed it according to etiology, Major curve, kyphosis and annual progressing ratio.
- The interobserver and intraobserver reliability for C-EOS was proved to be excellent (Cyr, M., et al).



VEPTR lengthening

Methods

- **Single institution** retrospective study between 2013 - 2017
- Infection was defined on the basis of the **center for Disease Control (CDC)** guidelines
- Recorded patients' major categories of Early Onset Scoliosis classification (**etiology, major curve and kyphosis**), BMI, height, weight, procedure type, site of procedure, tracheostomy and diaper use



VEPTR implantation in index Chest: AP(a)
and Lat(b)

Results

- 156 EOS patients underwent 843 VEPTR procedures
- 35(42 procedures) of 156 (22.4%) patients developed infection
- Neither C-EOS categories (etiology, major curve, kyphosis), BMI nor tracheostomy use were associated with infection rate.
- Neuromuscular etiology had the highest infection rate. Hyper kyphotic patients ($>50^{\circ}$) experienced infection rate more than normo and hypokyphotic ones. High scoliotic curve ($>90^{\circ}$) showed infection rate higher than the other curves. Table (1)



- Type of procedure was significantly associated with infection rate, with implantation in index chest having the highest incidence (P=0.006).
- Diaper use approached significance (p=0.051). Infection rates were higher in shorter and lighter children (P=0.001 and 0.03; respectively).
- Neuromuscular /hyper kyphotic class had infection rate higher than Neuromuscular / normo kyphotic curve; regardless the scoliotic curve (8.3%, 3.9%).
- Congenital/hyper kyphotic class showed infection rate higher than norm kyphotic or hypo kyphotic respectively; regardless scoliotic curve (8.7% vs 4.6% and 5.6%; respectively).
- Hypo kyphotic /syndromic class experienced higher infection rates than hyper or normo kyphotic respectively; regardless of scoliotic curve (50% vs 7.5% and 7.7%; respectively).Table(2)

Table(1)

1-C-EOS etiology					0.86
Congenital	19	365	384	4.9	
Idiopathic	1	38	39	2.6	
Neuromuscular	12	197	209	5.7	
Syndromic	10	201	211	4.7	
2-C-EOS major curve (degree)					0.11
1	7	95	102	6.9	
2	11	252	263	4.2	
3	20	429	449	4.5	
4	4	25	29	13.8	
3-C-EOS kyphosis (degree)					0.10
+	17	209	226	7.5	
N	20	438	458	4.4	
-	5	154	159	3.1	

Table(2)

Class		Infection group(n=42)	No infection group(n=801)	%	
+NM1	3		5	37.50	+NM =8.3%
+NM2	1		14	6.67	
+NM3	3		74	3.90	
+NM4	2		7	22.22	
NNM2	1		21	4.50	NNM=3.9%
NNM3	2		53	3.64	
NC1	2		12	14.29	NC=4.6%
NC2	2		58	3.33	
NC3	7		168	4.00	
+C3	3		37	7.50	+C=8.7%
+C4	1		5	16.67	
C1	1		17	5.56	C=5.6%
C2	2		31	6.06	
C3	1		19	5.00	
NS2	3		38	7.32	NS=7.7%
NS3	2		22	8.33	
+S1	1		0	100	+S=7.5%
+S2	1		23	4.17	
+S3	2		26	7.14	
S4	1		1	50.0	S4=50%
NI2	1		25	3.85	NI2=3.6%
Total	42		656		

Conclusions

- Neuromuscular etiology, high major curve and high kyphotic angle, are at increased risk of infection.
- Special considerations should be taken to specific subtypes like:
 - ❑ Syndromic/ 20° - 50° scoliosis/hyperkyphosis (S1+) – 100% (1/1)
 - ❑ Syndromic/ $>90^{\circ}$ scoliosis/hypokyphosis (S4) – 50% (1/2)
 - ❑ Neuromuscular/ $<20^{\circ}$ scoliosis/hyperkyphotic (NM1+) – 37.5%(3/8)
 - ❑ Neuromuscular/ $> 90^{\circ}$ scoliosis/ hyperkyphosis(NM4+) –22.2%(2/9)
 - ❑ Congenital/ $> 90^{\circ}$ scoliosis/ hyperkyphosis(C4+) –16.7%(1/6)
 - ❑ Congenital/ $< 20^{\circ}$ scoliosis /normal kyphosis (C1N) –14.3%(2/14).
- Such information potentiate the usefulness of C-EOS in surgical decision making and in the informed consent process.