Pre-operative Hypercarbia and Length of Hospital Stay at the Time of Growing Device Implantation and Spine Fusion in Early Onset Scoliosis

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Background

- Children with EOS often have restrictive lung disease, respiratory muscle dysfunction, and hypoxemia during sleep.
- Pre-operative risk assessment for post-operative respiratory complications in this group of patients is not standardized.
- Specific pulmonary measures that correlate with post-operative hospital length of stay are limited to forced vital capacity (FVC); FVC values <40% predicted are associated with longer hospital stay for patients with AIS.

Published EOS/TIS LOS is longer than with AIS with FVC <40%

N	Age	FVC	*Procedure*	LOS	*% Pulm* Comp
EOS Patients					
20	38mo	-	VEPTR implant	11 (5-29)	-
10	12y	-	VEPTR	-	4/10
29	8yr	-	VEPTR implant	6.7	6/32
AIS Patients					
183	6-62	60-80%	FUSION	-	3/110
		40-60%		-	4/54
		<40%			6/19

Ramirez 2010, Sandami 2010, Gadipalli 2011,Zhang 2005

Questions & Metrics

1. What are the pre-operative attributes of children with TIS/EOS as defined by:
   - Increased hospital stay due to pulmonary reasons
   - Increased ICU stay due to pulmonary reasons

2. Can patients with longer LOS be identified pre-operatively by assessment of hypercarbia, as measured by capillary PCO2 or metabolic compensation for chronic CO2 retention, i.e. serum total CO content, obtained with electrolytes?

Methodology

- Retrospective chart review of 52 children with EOS undergoing either initial Growing Device implantation and/or Spine Fusion
- Pre-operative documentation of CO2 status; type of surgery, hospital LOS, ICU LOS, pulmonary complication
- No primary lung disease, e.g. asthma, known pulmonary hypoplasia
- No history of surgery for congenital heart disease

Results

- 20/41 (49%) patients with EOS had CO2 assessments pre-operatively at the time of device insertion.
- 10/18 (56%) had pre-op CO2 assessments at the time of spine fusion.
- 21 (13 implant + 8 fusion) had PCO2 measurements; 17 (9 implant + 8 fusion) had total CO2 content (electrolyte) measures.

Results (cont'd)

- Pcap CO_2 was normal (<45 mmHg) in all children pre-operatively at device implantation; but elevated in 4/8 (50%)at the time of fusion.
- Total serum CO_2 content was high (>25 meq/dl) in 5/10 (50%) at device implantation and 7/8 (88%) at time of fusion.

Results (cont'd)

- Hospital LOS for device implantation was median of 6.5 days (range 4-37 days); for fusion, LOS was 7 days (range 5-16 days)
- ICU LOS for device implantation was a median of 2 days (range=1-14 days); for fusion ICU LOS was 2 days (range 1-6 days).
- Neither Pcap CO_2 nor serum CO_2 content correlated with ICU or hospital LOS.

Conclusions

- Serum CO_2 content is more often abnormal than PcapCO_2 values pre-operatively, reflecting chronic CO_2 retention, perhaps during sleep.
- Hospital LOS and ICU LOS were similar for device implantation and spine fusion.
- CO_2 measurements have not been included routinely in pre-operative assessments in our center.

Conclusions (cont'd)

- Pre-operative measures that predict post-operative outcomes for children with EOS at the time of device implantation and at the time of spine fusion remain to be determined.
- Pre-op CO2 status did not correlate with LOS in this single-center review.
- Serum CO2 content seems more likely to be useful that PcapCO2 but will require greater numbers to determine its utility.