Comparison of the Splanchnic Circulation in Patients with Idiopathic Scoliosis and Cerebral Palsy Undergoing Posterior Spinal Fusion and Lower Extremity Surgery

B. Randall Brenn, Ziaoping He
Departments of Anesthesia and Critical Care, Department of Research, Alfred I. DuPont Hospital for Children, Wilmington DE

Introduction: Posterior spinal fusion (PSF) is one of the major orthopedic surgeries performed on children. We have demonstrated that when PSF is associated with the massive blood loss, there is subsequent cytokine release and increased postoperative complications such as acute pancreatitis and infections (1). We hypothesize that splanchnic ischemia (caused by hypoperfusion) might possibly play an important role in these postoperative complications. In this pilot study, we attempt to investigate splanchnic ischemic states in children undergoing posterior spinal fusion surgery with cerebral palsy and idiopathic scoliosis and other multi-level lower extremity orthopedic surgeries including hip and pelvic osteotomies.

Objective: To analyze whether splanchnic hypoperfusion is associated with intraoperative blood loss, length of surgery, the type of the surgery and cerebral palsy.

Methods: A Gastric tonometer was used to assess splanchnic ischemia. The catheter of the TONOCAP™ (Datex-Ohmeda, Tewksbury, MA) was inserted to the stomach after the anesthesia induction. Gastric PgCO$_2$ was compared to the end-tidal PeCO$_2$ value to determine the GAP (PgCO$_2$-PeCO$_2$)/7.76. In normally perfused mucosa, the PgCO$_2$ is close to PeCO$_2$, with a gap of 1.1 Kpa reported (2). An elevated and prolonged GAP is associated with tissue ischemia. The tonometer record was started from prior to the beginning of the operative procedure until the end of the surgery.

Results: In this ongoing study, 28 patients had been enrolled in the study including cerebral palsy (n=12) and idiopathic scoliosis (n=8) undergoing spinal fusion and cerebral palsy undergoing other lower extremity orthopedic surgeries (n=8). A GAP value above 2.0 Kpa (2) lasting over 60 minutes was used as a cutoff for significant hypoperfusion. The average GAP was 0.94 Kpa, 95% had GAP <2.0. Six of cerebral palsy PSF patients had GAP >2.0 Kpa, >60 minutes, comparing with two idiopathic patients (P>0.05, NS) and none in other orthopedic surgeries (P<0.05). There was no difference between the idiopathic patients and the CP not undergoing PSF. The average blood loss was significantly different (P<0.05) among the three groups with 2810 ml in cerebral palsy spinal fusion, 1189 ml in idiopathic patients and only 246 ml in the other orthopedic surgeries. Although the length of the surgery had no difference between the cerebral palsy and idiopathic spinal fusion, it was significantly longer than that in other orthopedic surgeries.

Discussion: Hypoperfusion as monitored by gastric CO2 was commonly found in children with cerebral palsy undergoing posterior spinal fusion, while less common in idiopathic undergoing the same surgery and none in CP undergoing other orthopedic surgeries. Hypoperfusion is associated with PSF, particularly the amount of blood loss. A larger sample size is needed to assess whether having CP or length of surgery is an independent risk factor. In this limited sample size, we found that the normal range of GAP in pediatric surgery is similar to adults, at 0.95 Kpa.

References: