

Elizabeth Fonseca Escalante  
Dr.med

## **The Impact of the Early Surgical Closure of Patent Ductus Arteriosus on Clinical Outcomes, Morbidity and Mortality in Preterm Infants Weighing Less than 1501g**

Promotionsfach: Chirurgie

Doktorvater: Priv. – Doz. Dr. med. Tsvetomir Loukanov

**Introduction:** In premature infants, a hemodynamically relevant PDA is a common and potentially life-threatening condition especially in those weighing  $\leq 1500\text{g}$ . These patients are exposed to a higher risk of complications such as prolonged intubation, failure to thrive, higher incidence of ARF, BPD, IVH and NEC, associated with poor growth and development, prolonged stay in NICU and mortality. Management of PDA remains a challenge in the most immature infants. Common treatment of a PDA is a stepwise escalation that begins with cyclooxygenase inhibitors, although protocols in centers vary strongly concerning to patient selection and at what time and in what way to treat them. Frequently, PDA can be closed only by surgery. Surgical ligation in these patients has been shown to be a definitive PDA closure with minimal complications.

**Materials and Methods:** We retrospectively studied the medical records of 41 infants weighing  $\leq 1500\text{g}$  with less than 32-week gestational age, who underwent surgical closure of DA in the University Hospital, Heidelberg, between January 1988 and December 2009. Infants were divided into two groups: (1) the early surgical closure of PDA, who had surgery  $\leq 21$  days of age; and (2) the late surgical closure of PDA, who had surgery after 21 days of age.

Surgical closure of PDA was realized in case of failed pharmacologically therapy or when this treatment was contraindicated, in patients with symptomatic PDA.

The aim of this study was to assess the effects of early and delayed surgical closure of the ductus arteriosus on respiratory, renal, cardiovascular, digestive outcome and neurological development in preterm infants weighing  $\leq 1500\text{g}$ .

Patients characteristics analyzed were gestational age in weeks, body weight in grams at birth and at the time of surgery, age at PDA surgical ligation in days, pharmacological treatment with indomethacin or ibuprofen. We also analyzed presence of systemic hypotension, length of stay in NICU, time of mechanical ventilation, hospital mortality, intraventricular hemorrhage (IVH), acute renal failure (ARF), retinopathy of prematurity (ROP), Bronchopulmonary dysplasia (BPD), necrotizing enterocolitis (NEC)

**Results:** This study presents the results and follow-up of 41 preterm infants with surgical PDA closure in the Pediatric Cardiac Surgery Department in University Hospital, Heidelberg, referred from 7 different hospitals, from January 1988 to December 2009.

In our study, patients with late surgical PDA closure ( $>21$  days of age) received more often treatment with indomethacin or ibuprofen and also presented a higher incidence of complications associated with the repeated use of cyclooxygenase inhibitors compared with patients who had early surgical PDA closure ( $\leq 21$  days of age). The surgical closure of PDA in our patients proved to be a safe treatment, with short duration and without complications, even in critically ill patients, unable to be mobilized or transported to the operating room, in which case the surgical closure of PDA was performed at the bedside in the NICU of the referring hospital.

Patients with surgical PDA closure in 21 days or less, who received < 3 cycles of pharmacological treatment were considerably related with lower incidence of BPD, ARF, IVH and symptomatic hypotension they had shorter time on mechanical ventilation and shorter length of stay in the NICU. Likewise, these patients had lower incidence of neurological developmental impairment, especially in the neuromotor domain.

**Conclusions:** Considering that in our study, patients with early surgical PDA closure appear to have lower perioperative complications and better perioperative outcomes as well as reduced long-term incidence of neurological impairments; we can suggest that patients with low body weight and failure or contraindications for pharmacological treatment, should be considered candidates for early surgical PDA closure (< 21 days of life). The implementation of this treatment strategy can prevent and diminish the negative consequences on adaptative functioning, cognitive performance and learning abilities present in low weight preterm infants with symptomatic PDA. The risk of neurological developmental impairment should be considered an important factor in making decisions regarding the timing for surgical closure of PDA.