# Childhood neurodevelopmental outcome in low birth weight infants with postligation cardiac syndrome after ductus arteriosus closure: 5-years follow up

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**Background**
Post-ligation cardiac syndrome (PLCS), characterised by hypotension requiring cardiovascular support and ventilation or oxygenation failure, is a common complication of patent ductus arteriosus (PDA) surgical closure in low birth weight infants. It has been associated with mortality, but there is a lack of information about the neurodevelopmental outcome of the survivors.

**Objective**
We aimed to explore the prevalence of PLCS and to assess whether this clinical condition is a risk factor for neurodevelopmental impairment or cerebral palsy at the age of 5 years.

**Methods**
We retrospectively reviewed the medical charts of all the infants <30 weeks of gestation who underwent ductus arteriosus ligation at our unit from 2005–2009. *Statistics*: the Mann-Whitney U test and Fisher's exact test. A binary logistic regression model was used to test for the association between PLCS and the outcome at 5 years of age (neurodevelopmental impairment and CP), adjusted for potential confounders as the gestational age and the ductus category (according to *Teixeira et al, 2008* clasification).

**Results**
During the study period, 39 preterm infants at 26.4 (2) weeks of gestation underwent surgical closure of the ductus arteriosus at 25.3 (2.3) days of postnatal age. PLCS was observed in 26% of the study population. Follow-up to the age of 5 years was accomplished with 24 infants (70% of the survivors). Neurodevelopmental impairment [OR 11.6 (1.1-119.5), p=0.033] and cerebral palsy [OR 1.6 (0.9-2.7), p=0.028] were more frequently observed in the infants who presented PLCS than in those who did not. The linear logistic regression model showed that neither gestational age nor ductus category I was associated with neurodevelomental impairment or CP.

| Perinatal and pre-ligation variables | PLCS (n=10) | No PLCS (n=29) | p |
|---|---|---|---|
| Gestational age, wks (SD) | 25.6 (1.8) | 26.6 (1.9) | 0.1 |
| Birth weight, g (SD) | 822 (124) | 884 (253) | 0.3 |
| SGA, n (%) | 0 (0) | 3 (10) | 0.5 |
| Male, n (%) | 7 (70) | 20 (69) | 1 |
| Multiple birth, n (%) | 4 (40) | 10 (34) | 1 |
| Antenatal steroids, n (%) | 6 (60) | 17 (59) | 0.9 |
| Caesarean section, n (%) | 6 (60) | 20 (69) | 0.7 |
| Advanced resuscitation, n (%) | 8 (80) | 21 (72) | 1 |
| Apgar 5 min (SD) | 7.2 (1.2) | 6.9 (1.2) | 0.5 |
| Cord pH (SD) | 7.27 (1.4) | 7.31 (0.04) | 0.5 |
| HMD, n (%) | 10 (100) | 25 (86) | 0.5 |
| IVH grade III or PVHI, n (%) | 1 (10) | 4 (14) | 1 |

**Table 1. Perinatal and pre-ligation variables**

| Perioperative variables | PLCS (n=10) | No PLCS (n=29) | p |
|---|---|---|---|
| PDA medical treatment, n (%) | 9 (90) | 24 (83) | 1 |
| Postnatal age at surgery, days (SD) | 22 (12) | 26 (25) | 0.4 |
| Ductus diameter, mm (SD) | 2.5 (0.7) | 2.6 (1) | 0.8 |
| Ductus category I, n (%) | 4 (40) | 3 (10) | 0.057 |
| Ductus category II, n (%) | 5 (50) | 10 (34) | 0.4 |
| Ductus category III, n (%) | 1 (10) | 15 (52) | 0.03 |
| IS before surgery (SD) | 10.2 (12) | 3.6 (5) | 0.1 |
| IS 1 h after surgery (SD) | 11.8 (14) | 3.9 (5.7) | 0.1 |
| IS 8 h after surgery (SD) | 13 (10.7) | 3.2 (5.2) | 0.02 |
| IS 12 h after surgery (SD) | 12.3 (12.3) | 2.8 (5) | 0.052 |
| IS 24 h after surgery (SD) | 16 (13.4) | 1.5 (3) | 0.008 |

**Table 2. Perioperative variables**

| Outcome variables at term equivalence and at 5 years | PLCS (n=10) | No PLCS (n=29) | p |
|---|---|---|---|
| Mortality, n (%) | 1 (10) | 4 (14) | 1 |
| Laser therapy for ROP, n (%) | 5 (50) | 10 (34) | 0.2 |
| BPD, n (%) | 6 (85) | 14 (64) | 0.4 |
| WMD, n (%) | 1 (10) | 10 (34) | 0.3 |
| Survivors followed at 5 years, n (%) | 8/9 (89) | 16/25 (64) | 0.3 |
| CP, n (%) | 3/8 (37) | 0/16 (0) | 0.007 |
| Neurodevelopmental impairment, n (%) | 6/8 (75) | 7/16 (44) | 0.017 |

**Table 3. Outcome variables at term equivalence and at 5 years**

**Conclusions**
Preterm infants undergoing surgical ductus arteriosus ligation who fulfil the criteria of PLCS according to this study are at higher risk of long-term neurodevelopmental impairment.

**Conflicts of interest:** None.
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**Abbreviations**: IS, inotropic score; IVH, Intraventricular haemorrhage; PVHI, periventricular haemorrhagic infarction; WMD, white matter damage; CP, cerebral palsy; SGA, small for gestational age.



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