Management of the Patent Ductus Arteriosus (PDA)

The ductus arteriosus is a normal fetal conduit which usually closes in term babies by 3 days of age. Similarly in preterm neonates most patent ducts will close spontaneously by 60 hours of age.

Occasionally, the duct can persist in preterms with 30% of neonates born <30 weeks gestation developing a clinically significant PDA. PDAs are associated with an increased risk of chronic lung disease (CLD), intra ventricular haemorrhage (IVH) and necrotising enterocolitis (NEC). However, a Cochrane review and a large meta analysis of 47 trials by Benitz et al have shown that despite this association there is no statistically significant evidence that ductal closure reduces the rates of CLD and or NEC. Ductal closure does reduce the rate of intra ventricular haemorrhage (IVH) of Grade 2 and above; however, this short term benefit has not yet translated into improved long term neuro-developmental outcomes. There is no long term evidence to support treating an asymptomatic PDA.

Neonates who are ventilator dependant and/or have cardiac failure can be considered for ductal closure. This decision is always a consultant decision.

Diagnosis:
Clinical features usually appear 48 hours later than echocardiographic findings. A combination of a murmur and abnormal pulse volume has a positive predictive value of 77%. Echo findings of; >1.5mm ductus diameter has a sensitivity of 70% in predicting that the duct is haemodynamically significant: and a LA:Aorta ratio of >1.5 correlates with a clinically significant duct.

Management:
If a significant PDA is diagnosed the following management options can be considered:

Fluid restriction:
Fluid restriction does improve lung physiology in the short term and therefore can be considered as a management tool. A small study of 30 pre term infants showed 100% ductal closure by fluid restriction only. However, there is no evidence to support fluid restriction once a clinically significant PDA is present. Nutritional deprivation can occur with fluid restriction and thus calorie input should be optimised.

Diuretics:
Diuretics are not helpful for duct closure. Diuretics may be useful to reduce the left ventricular volume overload by reducing the pre-load, but do not alter the course of the patent ductus arteriosus. Moreover, Furosemide augments the production of prostaglandins and hence may be counter productive.

Ibuprofen:
Ibuprofen has an early ductal closure rate similar to Indomethacin; however, to date there is no long term outcome data to support its use. There is no evidence to support prophylactic Ibuprofen and prophylactic use may be associated with an increased incidence of pulmonary hypertension.
Normal anatomical closure of the duct is expected by 3 - 4 weeks of age. The optimal time to administer Ibuprofen is at 3 - 4 weeks of age.

Ibuprofen is given by slow IV injection via central line, preferably undiluted.
Dose:

Initial dose of 10mg/kg followed by
2nd dose 5mg/kg 24 hours later and a
3rd dose 5mg/kg 24 hours later.

If the duct remains open or re-opens following the Ibuprofen course, a second
course can be considered.

Do not start a second course until at least 48 hours after the last dose of the first
course.

If anuria or oliguria occurs during the course withhold the next dose until renal output
is satisfactory (usually more than 1ml/kg/hour).

Check platelets before each dose.

Adverse effects:
Renal impairment/ acute renal failure.
Thrombocytopenia.
Gastrointestinal and or Intra Ventricular Haemorrhage.
NEC & gastrointestinal perforation.

Contraindications:
Severe sepsis.
Active bleeding.

Thrombocytopenia - Aim for platelets >100 x10^9/l prior to starting treatment. Exclude
sepsis as a cause of the thrombocytopenia. If treatment with Ibuprofen still indicated
transfuse with platelets and then give Ibuprofen. Monitor platelets during the course.
Marked unconjugated hyperbilirubinaemia or severe liver impairment - as Ibuprofen
may displace bilirubin and increase the risk of Kernicterus.

Surgical ligation:
Surgical ligation of a PDA occurs in Bristol. The decision to refer patients for surgery
is a consultant and/or MDT decision.

Please see the agreed guidance policy in the guideline folder on the unit, on how to
refer patients to Bristol.

There is no difference in mortality or short term morbidity whether Ibuprofen or
surgery is used as the initial intervention for a PDA. However, mortality may be
higher in infants whose duct remains open despite medical management; therefore
infants that have not responded to Ibuprofen can be considered promptly for surgical
ligation.

References:

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Does echocardiography facilitate determination of haemodynamic significance attributable to the ductus

Dr P Bendapudi and Dr Sybil Barr February 2014. Guideline to be re-evaluated by February 2017.