work and revising it critically for intellectual content; EMS: Substantial contributions to the design of the work and the acquisition of data; drafting the work and revising it critically for intellectual content; ARSN: contributions to the design of the work and the acquisition of data; CTC: Interpretation of data and revising the manuscript critically for intellectual content. All authors approved the final manuscript.

Funding: Instituto Federal Goiano – Campus Ceres;
Competing interests: None stated.

***M NOLL, PRS NOLL, EM SANTOS, AR SILVA NETO AND CT CANDOTTI**
Universidade Federal do Rio Grande do Sul (ESEF/UFRGS). Instituto Federal Goiano – Campus Ceres.
**matias.noll@pq.cnpq.br*

REFERENCES

1. Womersley L, May S. Sitting posture of subjects with postural backache. J Manip Physiol Ther. 2006;3:213-8.
2. Smith A, O'Sullivan P, Straker L. Classification of sagittal thoraco-lumbo-pelvic alignment of the adolescent spine in standing and its relationship to low back pain. Spine. 2008;19:2101-17.
3. Auvinen JP, Tammelin TH, Taimela SP, Zitting PJ, Järvelin MR, Taanila AM, *et al*. Is insufficient quantity and quality of sleep a risk factor for neck, shoulder and low back pain? A longitudinal study among adolescents. Eur Spine J. 2010;4:641-9.
4. Vidal J, Borras PA, Ortega FB, Cantallops J, Ponseti X, Palou P. Effects of postural education on daily habits in children. Int J Sports Med. 2011;4:303-8.
5. Noll M, Candotti CT, Vieira A, Loss J. Back Pain and Body Posture Evaluation Instrument (BackPEI): development, content validation and reproducibility. Int J Public Health. 2013;4:565-72.
6. Lis AM, Black KM, Korn H, Nordin M. Association between sitting and occupational LBP. Eur Spine J. 2007;2:283-9.
7. Wilke J, Neef P, Caimi M, Hoogland T, Claes LE. New in vivo measurements of pressures in the intervertebral disc in daily life. Spine. 1999;8:755-62.
8. Robbins M, Johnson IP, Cunliffe C. Encouraging good posture in school children using computers. Clin Chiropractic. 2009;12:35-44.
9. Noll M, Candotti CT, Vieira A. Tools for evaluation the dynamic posture: applicability to the school environment. Fisiot Mov. 2013;1:203-17.
10. Vidal J, Borràs PA, Ponseti FJ, Cantallops J, Ortega FB, Palou P. Effects of a postural education program on school backpack habits related to low back pain in children. Eur Spine J. 2013;4:782-7.

Oral Paracetamol for Closure of Patent Ductus Arteriosus in Selected Preterm Neonates

We prospectively studied the effect of oral paracetamol in closing hemodynamically significant Patent ductus arteriosus in preterm infants (gestational age <32 weeks) where Ibuprofen was contraindicated. 29 of 40 neonates (72.5%) showed successful response while 11 (29.5%) failed to show any response. No major complications were seen.

Keywords: *Paracetamol, Patent Ductus arteriosus, Prematurity.*

A hemodynamically-significant Patent ductus arteriosus (PDA) may cause cardiovascular instability, exacerbate respiratory distress syndrome and also prolong the requirement for assisted ventilation in preterm neonates. The options available to close the duct are pharmacological (Ibuprofen or indomethacin) and surgical. Recently, paracetamol has been shown to be an alternative treatment for closure of PDA [1-4]. We aimed to analyze the efficacy of paracetamol in closing PDA in preterm neonates where ibuprofen was contra-indicated.

This observational study was performed at a tertiary Level IIIB Neonatal Intensive Care Unit in Southern India. The study was approved by Institutional ethics committee. Preterm neonates with hemodynamically-significant PDA where ibuprofen was contraindicated-platelet count < 60,000/mm^3, serum creatinine >1.5 mg/dL, necrotizing enterocolitis and bleeding diathesis [4,5], were included. Hemodynamically significant PDA was defined as transductal size >1.5 mm with Left atrium to Aortic root diameter >1.4 mm or reversal of diastolic flow in descending aorta causing increased fraction inspired oxygen (FiO_2 of >40% or oxygenation index of >10 on invasive ventilation). Neonates with major congenital abnormality, elevated liver enzymes (AST >55 U/L or ALT >23 U/L) [6], and those with perinatal asphyxia were excluded. An informed consent was obtained from the parents. Echocardiography was performed by the same Pediatric Cardiologist. Oral paracetamol (Crocin drops 100 mg/mL, GlaxoSmithKline Asia), 15 mg/kg/dose every 6 hourly (gestational age >30 weeks) or 8 hourly (gestational age <30 weeks), was administered. There were 192 preterm neonates (gestational age <32 weeks) admitted in the unit during study period, of which forty were given paracetamol. Mean (SD) birth weight and gestation were 1186 (289) grams and 29 (1.9) weeks, respectively. All the neonates had PDA size of more than

1.5 mm and Left-atrium to aortic ratio of more than 1.4 mm; five had reversal of blood flow in descending aorta. The contraindications for ibuprofen were coagulopathy (*n*=25), suspected necrotizing enterocolitis (*n*=12), thrombocytopenia (*n*=7), Intraventricular hemorrhage (*n*=5), and oliguria (*n*=3). Of 40 neonates, 29 (72.5%) showed successful response while 11 neonates (29.5%) failed to show the response. PDA was found to be closed on day 3 in 10 cases (25%), day 4 in 17 cases (42.5%) and day 5 in 1 case. There was mild elevation of liver enzymes in 22 cases (55%) which returned to baseline spontaneously. No major complication pertaining to treatment was observed. Eleven neonates (28.5%) failed to show response; of which, two underwent ligation, four responded to repeat oral ibuprofen, one was lost to follow-up, and the remaining four responded to repeat doses of oral paracetamol.

Earlier observational studies [7,8] and randomized controlled trials [1,9,10] have also documented successful closure of hemodynamically significant PDA in preterm neonates. Our study adds to the evidence that oral paracetamol may be used as an alternative for PDA closure in preterm infants where ibuprofen is contra-indicated. The limitations of our study were lack of pharmacokinetic data (*i.e.*, optimal dosage, time to start therapy and route of administration), no control arm and lack of external validity. Spontaneous closure of PDA could also have confounded the results. We conclude that oral paracetamol is an alternative treatment for PDA closure where oral ibuprofen is contraindicated.

Contributors: KN: conceptualized and designed the study; PK: collected the data; AR, PK: written the manuscript and analyzed the data; KN: reviewed and approved the final manuscript.
Funding: None; *Competing interests*: None stated.

PANKAJ KUMAR MOHANTY,
***KARTHIK NAGESH N AND ABDUL RAZAK**
Department of Neonatology,
Manipal Hospital, Bangalore, India.
**drkarthiknagesh@gmail.com*

REFERENCES

1. Dash SK, Kabra NS, Avasthi BS, Sharma SR, Padhi P, Ahmed J. Enteral paracetamol or intravenous indomethacin for closure of patent ductus arteriosus in preterm neonates: A randomized controlled trial. Indian Pediatr. 2015;52:573-8.
2. Hammerman C. Patent Ductus Arteriosus. Clinical relevance of prostaglandins and prostaglandin inhibitors in PDA pathophysiology and treatment. Clin Perinatol. 1995; 22:457-79.
3. Hammerman C, Bin-Nun A, Markovitch E, Schimmel MS, Kaplan M, Fink D. Ductal closure with paracetamol: A surprising new approach to patent ductus arteriosus. Pediatrics. 2011;128:e1618-21.
4. Oncel MY, Yurttutan S, Uras N, Altug N, Ozdemir R, Ekmen S, *et al*. An alternative drug (Paracetamol) in the management of patent ductus arteriosus in ibuprofen-resistant or contraindicated preterm infants. Arch Dis Child Fetal Neonatal Ed. 2013;98:F94.
5. Bagnoli F, Rossetti A, Messina G, Mori A, Casucci M, Tomasini B, *et al***.** Treatment of patent ductus arteriosus (PDA) using ibuprofen: renal side-effects in VLBW and ELBW newborns. J Matern Fetal Neonatal Med. 2013;26:423-9.
6. Melkiel M, Yigeremu M, Nigussie P, Asrat S, Gebreegziabher T, Teka T, *et al.* Robust reference intervals for Liver function test (LFT analytes in newborns and infants). BMC Research Notes. 2012;5:493.
7. Terrin G, Conte F, Scipione A, Bacchio E, Conti MG, Ferro R, *et al*. Efficacy of paracetamol for the treatment of patent ductus arteriosus in preterm neonates. Italian J Pediatr. 2014;20;21.
8. Ozdemir OM, Dogan M, Kucuktasci K, Ergin H, Sahin O. Paracetamol therapy for patent ductus arteriosus in premature infants: A chance before surgical ligation. Pediatr Cardiol. 2014;35:276-9.
9. Dang D, Wang D, Zhang C, Zhou W, Zhou Q, Wu H. Comparison of oral paracetamol versus ibuprofen in premature infants with patent ductus arteriosus: A randomized controlled trial. PLoS One. 2013;8:e77888.
10. Oncle MY, Yurttutan S, Erdeve O, Uras N, Altug N, Oguz SS, *et al*. Oral paracetamol versus oral ibuprofen in the management of patent ductus arteriosus in preterm infants: A randomized controlled trial. J Pediatr. 2014; 164:510-4.