EXCHANGE TRANSFUSION
Supporting information

What are the indications for exchange transfusion (i.e. haemoglobin level in haemolytic disease of the newborn (HDN); bilirubin level in haemolytic disease jaundice/non-haemolytic disease jaundice)?

The neurodevelopmental risks associated with high total serum bilirubin levels in newborns are “not well defined” (Newman, 2006). The most recent sliding scale for exchange transfusion in infants >/= 35 weeks’ gestation is provided within a clinical practice guideline from the American Academy of Pediatrics (Anon, 2004). Although the general level of total serum bilirubin (TSB) at which exchange transfusion is recommended is 25 mg/dL (428 mol/L), this may be lower in younger infants (as little as 15 mg/dL (257 mol/L) at 24 hours of age) with more risk fa.ctors.

A study of 41 infants with HDN (Gottvall, 1994) found that a foetal haemoglobin value below 95 g/L was a valid indication for exchange transfusion.

A retrospective cohort study of all infants receiving ET (n=51) in an Australia hospital between 2000 and 2010 found that 96% of patients had Hyperbilirubinaemia, 71% had rhesus haemolytic disease of the newborn and 12& had ABO incompatibility (Chitty, 2013).

Anon. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics 2004;114: 297-316
http://pediatrics.aappublications.org/content/114/1/297.long

Gottvall T, Hilden JO, Selbing A. Evaluation of standard parameters to predict exchange transfusions in the erythroblastotic newborn. Acta Obstet Gynecol Scand 1994;73:300-6

Newman TB, Liljestrand P, Jeremy RJ, et al. Outcomes among newborns with total serum bilirubin levels of 25 mg per deciliter or more. New Engl J Med 2006;354:1889-900
http://www.nejm.org/doi/full/10.1056/NEJMoa054244#t=articleTop

Chitty HE, Ziegler N & Savioa H et al. Neonatal exchange transfusions in the 21st century: A single hospital study. Jnl Paediatrics & Child Health 2013: 49;825–832

Evidence Level: V

Is the umbilical venous route superior to umbilical artery/vein or peripheral artery/vein?

The umbilical venous route has been associated with portal vein thrombosis in infants with co-existent umbilical infection or traumatic damage resulting from catheterisation (Guimaraes, 1998). Other recorded complications include cardiac arrest or pronounced bradycardia (Rubaltelli, 1978), bladder rupture (Sayan, 1996), bacterial infection (Anagnostakis, 1975), necrotising enterocolitis (Livaditis, 1974), and intestinal perforation (Sommerschild, 1971; Corkery, 1968, Orme, 1968).

This route has, however, been shown to be safer than the umbilical artery route, and the majority of adverse events are laboratory abnormalities that are asymptomatic and treatable (Patra, 2004).

A study of exchange transfusion using the peripheral vessels, in 201 infants over a 5.5 year period (Fok, 1990), found this route to be safe and effective, with few complications.

Recent reviews (Murray, 2004) suggest that there is little or no evidence for one route over another, but that “individual units should maintain a standard practice”.

A retrospective review (Chen, 2008) of 123 exchange transfusions at a single hospital (24 via umbilical vein and 99 via peripheral vessels) found both approaches equally effective in reducing serum bilirubin. The peripheral approach was associated with fewer severe adverse events.

A retrospective cohort study in 109 neonates (Weng, 2011) analysed 128 exchange transfusion (ET) procedures: 33 via femoral vein (FV), 35 via umbilical vein (UV) and 60 via umbilical artery/vein (UA/V) routes. There was no significant difference in the decline of total serum bilirubin between each group. When compared with the UA/V group, the transfusion rate was slower in the FV and UV groups ($p < .001$). Adverse events with clinical significance were more common in ET via the UA/V route than ET via the FV and UV routes ($p < .05$; OR 2.4; 95% CI 1.2-5.0). Neonates with ET via the UA/V route tended to have more asymptomatic laboratory aberrances ($p < .01$; OR 2.5; 95% CI 1.3-4.6). There were no significant differences in the transfusion rate ($p = .498$) and adverse events ($p = .822$) between the FV and UV groups. The authors concluded that ET through the FV route was “an effective and secure method for the treatment of neonatal hyperbilirubinemia when the UV route is unavailable.”

Anagnostakis D, Kamba A, Petrochilou V, et al. Risk of infection associated with umbilical vein catheterization. A prospective study in 75 newborn infants. J Pediatr 1975;86:759-65

Chen HN, Lee ML, Tsao LY. Exchange transfusion using peripheral vessels is safe and effective in newborn infants. Pediatrics 2008;122:e905-10

Corkery JJ, Dubowitz V, Lister J, et al. Colonic perforation after exchange transfusion. BMJ 1968;4:345-9
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1912639/pdf/brmedj02109-0039.pdf

Fok TF, So LY, Leung KW, et al. Use of peripheral vessels for exchange transfusion. Arch Dis Child 1990;65:676-8
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1590202/pdf/archdisch00896-0036.pdf

Guimaraes H, Castelo L, Guimaraes J, et al. Does umbilical vein catheterization to exchange transfusion lead to portal vein thrombosis? Eur J Pediatr 1998;157:461-3

Livaditis A, Wallgren G, Faxelius G. Necrotizing enterocolitis after catheterization of the umbilical vessels. Acta Paediatr Scand 1974;63:277-82

Murray NA, Roberts IA. Neonatal transfusion practice. Arch Dis Child Fetal Neonatal Ed 2004;89:F101-7
http://fn.bmj.com/content/89/2/F101.long

Orme RL, Eades SM. Perforation of the bowel in the newborn as a complication of exchange transfusion. BMJ 1968;4:349-51
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1912604/pdf/brmedj02109-0043.pdf

Patra K, Storfer-Isser A, Siner B, et al. Adverse events associated with neonatal exchange transfusion in the 1990s. J Pediatr 2004;144:626-31

Rubaltelli FF, Zanardo V, Saia OS, et al. Umbilical vessel catheterization; the immediate risks with the venous route. Padiatr Padol 1978;13:39-43

Sayan A, Demircan M, Erikci VS, et al. Neonatal bladder rupture: an unusual complication of umbilical catheterization. Eur J Pediatr Surg 1996;6:378-9

Sommerschild HC. Intestinal perforation in the newborn infant as a complication in umbilical vein infusion or exchange transfusion. Surgery 1971;70:609-13

Weng YH; Chiu YW. Comparison of efficacy and safety of exchange transfusion through different catheterizations: Femoral vein versus umbilical vein versus umbilical artery/vein. Pediatr Crit Care Med 2011;12:61-4

Evidence Level: III

What investigations/monitoring procedures are required when performing exchange transfusion?

Although there is general agreement that the rate of adverse events associated with exchange transfusion is high (Patra, 2004; Jackson, 1997), no evidence-based guidance currently exists on investigations or monitoring procedures.

Jackson JC. Adverse events associated with exchange transfusion in healthy and ill newborns. Pediatrics 1997;99:e7
http://pediatrics.aappublications.org/content/99/5/e7.long

Patra K, Storfer-Isser A, Siner B, et al. Adverse events associated with neonatal exchange transfusion in the 1990s. J Pediatr 2004;144:626-31

Evidence Level: V

Last amended September 2015
Last reviewed December 2021

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