EXCHANGE TRANSFUSIONS VIA PERIPHERAL VESSELS

R.H. Merchant
V.S. Sakhalkar
S.B. Rajadhyaksha

ABSTRACT

During a 15 month period, partial exchange transfusions (ET) were done in 40 neonates with polycythemia, and double volume ET attempted in 7 neonates with hyperbilirubinemia via peripheral vessels. The procedure was effective and not associated with any complications for partial ET. During double volume ET minor complications were noted in 2 cases, both of whom recovered and subsequently successfully underwent supraumbilical ET. Of the 5 cases who had uneventful double volume exchanges, there was a significant drop in indirect serum bilirubin following the procedure. The mean pre-ET serum indirect bilirubin in these 5 cases was 334 μmol/L and mean post-ET level was 179 μmol/L with a mean drop of 155 μmol/L (46% drop). Technical difficulties in catheterization may be overcome with greater expertise and use of heparin to flush arterial catheters.

Key words: *Exchange transfusions, Peripheral vessels.*

From the B.J. Wadia Hospital for Children and Nowrosjee Wadia Maternity Hospital Parel, Bombay 400 012.

Reprint requests: Dr. R.H. Merchant, Divison of Neonatology, B.J. Wadia Hospital for Children, Parel, Bombay 400 012.

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In order to avoid complications of umbilical venous exchange transfusion (ET) done by conventional technique, an alternate method using peripheral vessels has been successfully attempted in selected neonates(1,2). Situations wherein an alternate route for ET may be necessary are omphalitis, inability of umbilical vein catheterization, and other serious gastrointestinal disorders such as necrotizing enterocolitis (NEC)(3). This report deals with our experience utilizing the peripheral vessels for ET.

Material and Methods

From November 1989 to February 1991, a total of 40 neonates with polycythemia underwent partial exchange, and double volume peripheral vessel ET attempted in 7 neonates with hyperbilirubinemia. Indications for partial ET was venous packed cell volume (PCV) >75% in asymptomatic, or PCV between 60-75% in symptomatic neonates. Indications for resorting to use of peripheral vessels for double volume ET were omphalitis in three, inability to cannulate umbilical vein in two, NEC in one, and as a procedure of choice in one.

Partial ET: We aseptically cannulated radial artery (n = 38), and post-tibial artery (n = 2), using scalp vein needle gauge 23 or 24 and slowly aspirated the calculated volume(4) of blood. Through a 24 gauge scalp vein, equal volume of saline was simultaneously infused at the same rate of withdrawal, through a peripheral vein of another extremity. Pre and postprocedure PCV was estimated. Saline was used in preference to plasma in view of cost and easy availability.

Double Volume ET: The radial artery

was percutaneously cannulated with a 24 gauge neoflon (Helsingborg-Viggo Spectramed, Sweden). A syringe with a three-way tap was connected to withdraw and discard blood in aliquots of 5-10 ml, while simultaneously replacing equal volume of warmed donor blood through a peripheral vein, using a 22 gauge neoflon and the catheters withdrawn immediately on completing the ET. In the last 5 cases, as a measure to prevent blockage of catheters, the arterial line was intermittently flushed with 1 ml of heparinized saline (5 units/ml) after withdrawal of every 50 ml of blood. Before every catheterization Allens test(5) was done to confirm adequacy of collateral circulation of the cannulated limb.

Results

Over a 16 month period, 40 neonates underwent partial ET using peripheral vessels. Their gestational age ranged from 28-41 weeks (mean 33.4 weeks), and birth weights from 900-3600 g (mean 1570 g). Five babies had PCV <75% all of whom were symptomatic. Among others in whom the PCV range from 60-75%, 12 had symptoms which could be attributed to polycythemia namely plethora in all, jitteriness in 10, hypoglycemia and limpness in five. Of these babies, 16 (40%) were small for gestation and 24 (60%) were appropriate for gestation. Three babies had birth asphyxia. Pre-ET packed cell volume (PCV) ranged from 0.60 to 0.76 (mean 0.67) and dropped by 0.08 to 0.16 (mean drop 0.12). The two cases in whom posterior tibial artery was used were successfully completed. The posterior tibial artery was cannulated in these two, as radial artery had earlier been punctured in one and could not be catheterized in the other.

Of seven neonates in whom an attempt was made for double volume ET using the peripheral vessels five were successfully completed. The gestational age of these five cases ranged from 28-40 weeks (mean 33.6 weeks) and birth weight from 1060-2700 g (mean 1630 g). The mean pre-exchange indirect serum bilirubin concentration of these five cases was 334 μmol/L (range 289-459 μmol/L), while the mean post-exchange level was 179 μmol/L (range 90-272 μmol/L). The mean drop in indirect bilirubin was 155 μmol/L which was 46% of pre-exchange concentration.

The duration of procedure ranged from 55 to 170 minutes (average time 80 minutes) and none required repeat ET. Problems were encountered in two cases which necessitated abandoning of the procedure. The arterial catheter blocked in one, while the hand of another blanched and became cyanosed beyond the site of arterial catheterisation, this recovered after catheter removal and warming the limb. Supraumbilical ET were successfully completed in both these cases. There were no complications on the venous side, and there was no procedural mortality. All five neonates successfully exchanged via peripheral vessels continued to be fed according to their routine schedule and none developed any abdominal symptomatology.

Discussion

Although umbilical ET has been associated with various complications(3,6,7), careful attention to technique reduces the incidence of some of these, however, avoidance of NEC is difficult, particularly in sick preterms. Fluctuations in circulatory volume resulting from conventional technique has been associated with cardiovascular complications(8,9).

A significant fall in PCV was observed following partial ET in this series, an

observation also noted by others(10). Of those who underwent double volume exchange, two developed problems. In the five cases in whom the procedure was successfully completed there was satisfactory drop in serum bilirubin, comparable to that following umbilical ET(11).

Due to simultaneous withdrawal and replacement of blood the procedure involves no 'dead space', and decreases risk of cardiovascular complications that occur due to sudden volumetric changes in the umbilical 'push pull' technique. Since the procedure involves the extremities, temperature maintenance is easier, with lesser risk of infection and intra abdominal complications. Unlike the umbilical route the peripheral route can be used in neonates of any age including those in whom the umbilicus has healed.

Success in carrying out peripheral vessel exchange depends largely on successful placement of arterial catheter(12), which may sometimes be difficult in term vigorous newborns. Signs of impaired circulation such as blanching of skin indicates a complication and requires immediate catheter removal. Our experience shows that peripheral vessel ET are safe, simple and practicable with few complications. After we encountered difficulties in two cases, who required double volume ET we started intermittent flushing of arterial lines with heparin to improve catheter patency(2).

This technique should be the method of choice in neonates requiring partial exchange(13), and for double volume exchanges in small sick neonates, at risk of NEC and in those having omphalitis. Its recommendation as a routine procedure to replace umbilical double volume ET requires confirmation following larger controlled systematic studies.

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For futher information, please contact:

Dr. P.V. Rai,
General Secretary,
"Zuriberg",
No. 127, R.M. Vilas II Stage,
Ist Block,
Bangalore 560 094.
Phone: (0812) 334583, (0812) 261115.