cystography would be performed, and reflux, if present, could be treated.

Bailey (1973) and MacGregor and Freeman (1975) have proposed that cystography is not necessary in children over 5 years old if the IVU is normal. We would suggest extending this policy and deferring cystography in all children with a UTI until a second infection occurs, providing the IVU is normal.

Summary

Fifty-one children with a bacteriologically proven urinary tract infection had both an intravenous urogram (IVU) and a micturating cystogram. The IVU was normal in 35. Only 6 of these children showed reflux in the cystogram, affecting 7 of the 70 ureters at risk. Since reflux on its own does not cause renal damage, which occurs only with super-added infection, detection of reflux is not important providing the urine is kept sterile. We suggest that cystography be deferred providing the IVU is normal until recurrent infections occur while under hospital care, and, with this policy this unpleasant and sometimes hazardous investigation could be avoided in many children with a single urinary tract infection.

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Percutaneous angiocardiology for diagnosis of persistent ductus arteriosus in the preterm infant

The diagnosis or exclusion of a haemodynamically significant persistent ductus arteriosus (PDA) in preterm infants with respiratory distress syndrome, by single film aortogram via an umbilical arterial catheter, has been described by Thibeault *et al.* (1975). Difficulty arises, however, where there is no umbilical arterial catheter in the aorta, as small preterm infants may not develop signs of a PDA until long after the umbilical arterial catheter has been removed after the respiratory distress syndrome (RDS). We describe a successful percutaneous angiocardiology technique used in this situation on an infant weighing 2 kg.

Case report

A male infant born at 28 weeks' gestation, birthweight 1400 g, required intubation and intermittent positive pressure ventilation (IPPV) for birth asphyxia. Spontaneous respiratory effort was poor and he required 10 days IPPV by Dräger ventilator using oxygen concentrations of up to 95%. He also was treated for metabolic acidosis, hypercapnia, and pulmonary infection. At 2 months he developed cardiac failure, and a loud systolic murmur appeared at the upper left sternal border which was thought to be due to a persistent ductus arteriosus. He responded to digoxin, diuretics, and ventilation in a Dräger Negative Pressure Box ventilator.

At 4 months he rapidly deteriorated with a return of cardiac failure, and a loud systolic murmur reappeared at the upper left sternal border. His chest x-ray showed an enlarged heart and gross pulmonary parenchymal changes. Electrocardiogram showed sinus rhythm, right axis deviation, and right ventricular hypertrophy. As he was critically ill it was felt that cardiac catheterization should be carried out in order to exclude a persistent ductus arteriosus which might have been contributing to his poor lung function.

Cardiac catheterization. A modified percutaneous technique was used. A number 18 G short bevel, thin wall, disposable needle on a 5 ml syringe was inserted into the femoral artery at the right groin over the point of maximal pulsation. The needle was passed through the artery, and slowly withdrawn and adjusted until a free flow of arterial blood into the syringe was obtained. The syringe was then disconnected and an 0.032 'Cordis' guide wire, soft end foremost, was passed up the femoral artery and aorta to the diaphragm in order to confirm that it was in the arterial system. The needle was then removed, and the skin incision slightly enlarged by opening the points of a pair of fine mosquito forceps inserted alongside the wire. A number 5 Gensini catheter was passed over the wire, and into the artery, being rotated constantly as it was inserted.

FIG.—Percutaneous left ventricular angiogram in an infant weighing 2 kg, showing aortic arch and absence of persistent ductus arteriosus.

Once the catheter was in the aorta the guide wire was withdrawn and heparin (1 mg/kg) was given through the arterial catheter (Freed, Keane, and Rosenthal, 1974). The catheter was subsequently passed to the left ventricle using a 'J' guide wire to traverse the aortic arch.

A left ventricular angiogram (Fig.) showed a normally contracting left ventricle and excluded mitral incompetence from transient myocardial ischaemia (Rowe and Hoffman, 1972) and a ventricular septal defect. There was no gradient at the aortic valve and the aortic arch was well visualized, the ductus arteriosus was shown to have closed. A subsequent right heart catheter through the femoral vein via the same incision showed a 60 mm pulmonary valvular stenosis. The heparin effect was subsequently reversed with protamine sulphate given slowly via the venous catheter, 1 mg for each mg heparin given. At the end of the procedure all leg pulses were normal. The child died one week after operation and necropsy was refused; however, an operative lung biopsy showed extensive bronchopulmonary dysplasia.

Discussion

Percutaneous angiocardigraphy allows a per-

cutaneous aortogram to be performed on small infants (under 2 kg) who have had RDS in order to diagnose PDA. The large volume femoral pulses and lack of subcutaneous tissue make the percutaneous insertion of an arterial catheter easier. However, now we would advise the use of a small (no. 22) needle and an 0.021 guide wire. Subsequent leg growth may be impaired by arterial thrombosis and the incidence of arterial thrombosis is less after percutaneous than cut-down techniques (Freed, Rosenthal, and Fyler, 1974). Previously this has been a major factor contributing to the use of the axillary rather than the femoral artery cut-down for the left heart studies in the neonate if the foramen ovale cannot be crossed.

This technique can be performed in the special care baby unit of a maternity hospital using obstetric screening facilities and either a single film of videotape for the aortogram. It can thus save the transfer of a sick neonate to a cardiac catheterization laboratory which may be in another hospital. We suggest that a percutaneous single film aorto-

gram may facilitate better diagnosis of PDA in infants with RDS so that the relative merits, indications, and timing of medical and surgical treatments can be evaluated (Lees, 1975).

Summary

Details are given of a percutaneous arterial technique for angiocardiology, suitable for application to small infants in whom the diagnosis or exclusion of persistent ductus arteriosus is indicated.

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Addendum

Since this report was written we have performed percutaneous catheterization on 2 other preterm infants (one in a maternity hospital) and confirmed the presence of haemodynamically significant PDA requiring ligation. An 0.021 guide was easier to manipulate via a no. 22 needle with the inside of the hub smoothed using a no. 16 scalpel blade. Passage of the catheter over the wire was eased by the prior insertion of a disposable no. 18 gauge Argyle Medicut cannula as suggested by Gay (1975).