CARDIAC SURGERY IN INFANCY

PERCUTANEOUS CATHETERIZATION IN INFANTS AND NEWBORNS

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Seldinger technique for percutaneous insertion of catheters for heart catheterisation and angiocardiography in adults is a well established procedure. Looking at the first slide one can see that percutaneous catheterization is rather seldom used in children[1] especially in children up to 2 years of age.[2,3,4,5,6,7,8] Numbers of catheterisations performed in this group are given in red colour. The successful ones and their percentage in green. Scarcity of usage and conflicting opinion about the applicability of percutaneous catheterization (P.C.) in this age group stimulated us to present our experience (see the lowest line on the side) with percutaneous catheterization in 83 consecutive cases catheterised 1966-1971. Purpose of P.C. was heart catheterisation in 62 cases and exchange transfusion in 21.

METHOD

Instruments needed are shown in the next slide consisting from the thin walled Cournand needle No. 20 which accepts the guide wire 0.57 mm of external diameter. We found the small part of canula projecting backward from the hub useful because the proper placement of the needle tip within the arterial lumen is clearly indicated by pulsatile sprinkling of the blood. For arterial catheterisation in children the radio-opaque polyethylen tubing or ultra-thin wall teflon tubing well tapered to fit simply over the guide wire were used. Teflon tubing (external diameter 0.96 mm and 12 cm long) was used for pressure recording, blood sampling and dye dilution studies. For retrograde left ventricular angiography or aortography in infants up to 5 kg of weight and the radioopaque polyethylen tubing 60 cm long external diameter 1.2 mm (B-D RPX 031) was selected. For cases in which contrast dye injection of 15 ml and more was suggested B-D RPX 037 tubing was used.

For venous catheterisation short dilating catheter was introduced to facilitate the insertion of Desilets—Hoffman catheter introducer[9] through which the manipulation and exchange of catheters is a matter of seconds. Sizes of catheters used in infants up to 5 kg were 4F for pressure recording and 5F for angiocardiography. In children's group from 5-10 exceptionally 6F catheters were needed.

All catheterisations were performed under general anaesthesia (ketamine).

Seldinger technique of P.C. is well known and it is superfluous to be described, but we like to stress some points essential for successful insertion of catheters in infants.

1. Positioning of the patient[5] which represents:
   (a) Elevation of pelvis.
   (b) Stretching of the leg.
   (c) Mild external rotation of the leg.
2. Careful localisation of femoral artery and exact knowledge of its direction using two or three finger tips palpation.
3. Adequate stabbing of the skin to facilitate the catheter penetration.
4. Abdominal (vena cava) compression dilates the femoral vein making the puncture easier.
5. During puncture the angle between skin and needle should be less than 30°.
6. Withdrawal of the needle after puncture before sufficient blood flow appears must be very slow.
7. Blood flow manifested either by pulsating jet of flow in arterial puncture or free suction by syringe in vein puncture is prerequisite for successful insertion of guide wire.
8. No force is to be used during insertion of guide wire or during manipulation of catheter.
9. Precise tapering of dilators and catheters.[5]
10. If one of both vessels is already catheterised the second can be punctured if usual method fails using X-ray method because both vessels are parallel to each other and direction of the already punctured vessel is visualised.

RESULTS

In our series of 83 patients P.C. was successful in 80 cases. Of 3 cases in which we failed one was in group below 3 kg of weight, second 3.5 kg (case of exchange transfusion) and third one 10 kg. Distribution according to the age is seen on next slide. Exchange transfusion case was in newborn. It is to be mentioned that the child was in terminal stage and died few hours after unsuccessful puncture (pulse of the femoral artery was absent). The age of remaining two were 7 and 12 months respectively. In the last one only the femoral vein puncture was unsuccessful. Arterial catheter insertion was easily accomplished. All unsuccessful attempts were from a period of insufficient experience during which the method was in development.

Right femoral vein was used as an entry in 64 cases, left femoral vein only in 5, right femoral artery was punctured in 48 cases and left femoral artery in 23 patients. Both artery and vein were catheterised during one session in 44 children and in 5 cases the catheterisation was repeated after a period of 4 days to 3 months using the same vessels for catheter insertion.

No complications were observed in any of our patients. In no single case did the arterial pulse disappear. Also hematomas were not a problem inspite of routine heparinisation of the patient. We feel that prevention of complications is conditioned by following few basic principles:

1. Good condition of instruments.[5]
   (a) sharp needles with smooth surface.
   (b) Guide wires (not kinked)
   (c) Ideal tapering of catheters and dilators.
2. Ratio of catheter and vessel size should be reasonable.[2]
3. Lubrication of catheters with silicone oil.
4. No usage of dilators for arterial catheterisation.
5. Any force during manipulation of guide wire or catheter should be avoided.
6. Heparinisation of the patient (1mg/kg).
7. Frequent flushing.
8. No neutralisation of heparine by protamine after procedure. There was no trouble in haemostasis.

If the P.C. is compared with cut down technique the advantages are apparent:

1. Reduced risk of infection.
2. Patency of vessels after catheterisation, which can be used for next catheterisation.[8]
3. Reduced incidence of vascular complications[8,10]
4. No reconstruction of vessels is needed.

Only drawbacks of P.C. which are to be mentioned are:

1. Method is not suitable for Rashkind's septostomy.

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2. Rather complicated instrumentation.
3. Definite skill and training is needed.

In conclusion the P.C. is now routine procedure in our laboratory without any age limit and in our hands it is a successful, short, versatile and safe method.

REFERENCES

1. Rudolph, A. M.: "Complications occurring in infants and children in cooperative study on cardiac catheterisation." Edited by E. Braunwald and H. J. C. Swan. Circulation, 37, (suppl 111), 111-59, 1968.
2. Nebesar, R. A., Fleischli D. J. Pollard, J. J. and Griscom, N. T.: "Arteriography in infants and children with emphasis on the Seldinger technique and abdominal diseases." Am. J. Roentgenol, Rad. Therapy and Nuclear Med., 106, 81, 1969.
3. Bron, K. M., Riley, R. R. and Girdany, B. R.: "Pediatric arteriography in abdominal and extremity lesions." Radiology, 92, 1241, 1969.
4. Newton, T. H. and Gooding, C. A.: "Catheter technique in pediatric cerebral angiography." Am J. Roentgenol, Rad. Therapy and Nuclear Med., 104, 63, 1968.
5. Takashashi, M., Petry, E. L., Lurie, P. R., Kirkpatrick, S. E. and Stanton, R. E.: "Percutaneous heart catheterization in infants and children." 1. Catheter placement and manipulation with guide wires. Circulation, 42, 1037, 1970.
6. Lurie, P. R., Armer, R. M. and Klatte, E. C.: "Percutaneous guide wire catheterisation: Diagnosis and therapy." Am. J. Dis. Child., 106, 189, 1963.
7. Hohn, A. R., Craenen, J. and Lambert, E. C.: "Arterial pulses following percutaneous catheterization in children." Pediatrics, 43, 617, 1969.
8. Kirkpatrick, S. E., Takahashi, M., Petry, E. L. Stanton, R. E. and Lurie, P. R.: "Percutaneous heart catheterization in infants and children." II. Prospective study of results and complications in 127 consecutive cases. Circulation, 42, 1049, 1970.
9. Desilets, D. T. and Hoffman, R.: "A new method of percutaneous catheterization." Radiology, 85, 147, 1965.
10. Vlad, P., Hohn, A. and Lambert, E. C.: "Retrograde arterial catheterization of the left heart." Experience with 500 infants and children. Circulation, 29, 782, 1964.