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Personal practice

Percutaneous insertion of central venous feeding catheters

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Since 1968 when Wilmore and Dudrick described normal growth and development in a child receiving all nutrients intravenously,[1] the practice of total parenteral nutrition in infants and children has become established as a life saving procedure.[2] Maintaining the infusion of hypertonic feeding solutions by the use of peripheral veins over anything but short periods is unpleasant for the patients and becomes increasingly technically difficult, especially in small babies. An alternative approach that employs central venous catheterisation is convenient for the patient but depends upon the availability of skilled surgeons and theatre facilities. In addition, it carries with it certain risks, particularly serious infection. In 1973 Shaw described a simple way of inserting central feeding lines percutaneously when administering total parenteral nutrition to sick low birthweight babies on special care baby units,[3] where it has since become an established practice.[4] The same technique has also been advocated for use in older children.[5] We have found this method well suited to small babies under 1 year of age recovering from gastrointestinal surgery or with other indications for total parenteral nutrition.

In our hospital all patients receiving total parenteral nutrition are initially referred to a nutritional care team for assessment and daily supervision of fluid and nutritional requirements. In addition, one member of this team (JP) has inserted a central venous feeding line if requested, using the technique described by Shaw.[3] The patient is thereby spared a surgical procedure and anaesthetic, while pressure of work on busy surgical colleagues and theatre staff is reduced. The whole process is less labour intensive than surgical insertion and therefore considerably cheaper.

Methods

The procedure is performed on the ward with the child left in his incubator or cot. As the technique is little different to siting a drip as far as the patient is concerned parental consent is not requested; sedation is unnecessary. The operator identifies a suitable vein: in the scalp one running in front of the ear is preferable and in the arm a median cubital vein. The long saphenous vein or one on the hand may also be used. The distance from the chosen vein to the right nipple is measured and this gives the approximate length to which the line must be inserted to place the tip within the right atrium.

A stainless steel trolley is laid up with a cut down set from theatre. The operator wears cap, mask, gown, and gloves. The latter should be powder free if possible or otherwise washed in sterile water to prevent powder contaminating the feeding line when handling. A sterile no touch technique is used throughout the following procedure; a nurse assistant is needed to hold the baby still.

The skin is cleaned with chlorhexidine 5% in 70% methylated spirit; sterile towels are used to drape the surrounding area. The Silastic feeding line (0·30 mm internal diameter, 0·64 mm external diameter)* is removed from the packet in which it has been autoclaved and cut to a length roughly 15 cm longer than that required for insertion into the vein. This is most conveniently measured using a sterile paper tape measure autoclaved together with the line. Next, a 5 ml syringe is filled with heparinised saline (5 units in 5 ml 0·9% saline) and attached to a 25G Butterfly needle,* the cutting edge of which is first blunted using the ridged surface of a needle holder from the cut down pack. The cylindrical plastic

*Silastic feeding line (0·3 mm internal diameter, 0·64 mm external diameter) (Catalogue Number 602·105) is available from Dow Corning, ABCO House, Reading, Berks.

*19G and 25G Butterfly needles are available from Abbott Laboratories, Hospital Products Division, Queenborough, Kent ME11 5EL.

guard removed from the Butterfly is retained for later use.

A 19G Butterfly needle* with the plastic tubing cut off is used to enter the vein. The assistant brings up the vein, if a limb is being used, by gentle squeezing around the proximal part. For a scalp vein, finger pressure distally will distend the vein adequately. Blood flowing back through the needle can be controlled by light pressure over the needle tip. The Silastic feeding line is grasped with fine forceps and inserted into the needle and up the vein several millimetres at a time. If an arm vein is cannulated, the line may stick at the shoulder. This is more likely to happen the more lateral the vein, but abduction or other movement of the arm will often allow the line to be further advanced. Similarly, if the long saphenous vein is used progress may be obstructed at the groin; this can be overcome by manipulating the leg while pushing on the line. Insertion from a scalp vein may be interrupted as the line reaches the neck only to continue if the shoulders are rotated.

The line once inserted to the desired distance is held firmly in place by taping to the skin. The 19G Butterfly is now discarded and the retained plastic needle guard threaded over the end of the Silastic line. Once the 25G Butterfly is inserted for its full length into the line the guard can be slipped back into place on the needle and thus protect the Silastic from damage by movement against the bevel. The blunting of the needle reduces the risk of perforating the line while being inserted. The guard is held in position by sandwiching between two pieces of Elastoplast on the dorsal and ventral surfaces of the Butterfly, extending from just beyond the guard tip to the wings of the Butterfly (Figure). The line can now be flushed through with heparinised saline, and, if in a large blood vessel, gentle suction on the syringe will immediately cause the line to fill with blood. If blood cannot be aspirated the line is almost certainly in a small vessel unsuitable for hypertonic fluid administration. The position must always be checked radiographically using a 1 ml injection of Hypaque 25%. Ideally, the line tip should be sited just within the right atrium to allow maximum dilution of feeding fluids. If it has not been possible to advance beyond a peripheral vein the line may be used as a peripheral drip, but thrombophlebitis usually ensues within a few days.

The excess line is coiled up on the skin and covered with a small piece of sterile gauze held in place by Elastoplast tape. If insertion is from the scalp spraying the surrounding skin before applying the Elastoplast with Nobecutane Aerosol provides a sticky resin that will help hold the tape in place for weeks if necessary. For arm or leg insertions,

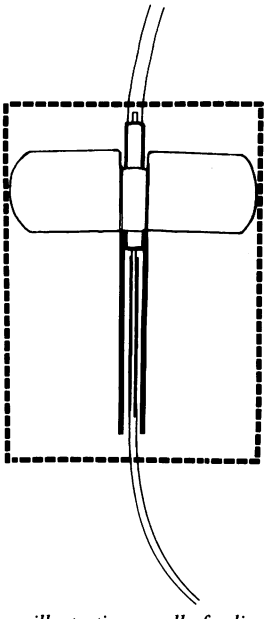

Figure *Diagram illustrating needle feeding line assembly, with position of elastoplast indicated by dotted line.*

circumferential Elastoplast strapping should be wound around the limb, starting distally until the whole butterfly and line assembly are covered together with the insertion site. We do not routinely disturb these dressings, but suspected sepsis at a later date would warrant inspection of the line entry site. Limbs should be splinted if the feeding catheter is running across a joint.

Patients and results

From March 1984 to August 1985, 138 patients were referred to the nutritional care team for total parenteral nutrition, 37 together with the request that a percutaneous central venous feeding line be inserted. Twenty two patients weighed more than 3000 g and 15 less than 3000 g, with a range of 1000–7000 g.

In 31 patients catheter insertion to the right atrium was successfully accomplished. Several babies required more than one catheter during their course of total parenteral nutrition: in all, 41 were inserted. The site of entry was scalp vein in 19, antecubital vein in 19, and the long saphenous vein in three. The procedure from start to finish averaged about one hour. The mean line survival was 17 days, with a range of 6–45 days. The reasons for line removal were as follows: 25 electively at completion of total parenteral nutrition, seven occluded, four

became infected, four were associated with limb swelling (including the three inserted from the leg), and one pulled out by the patient.

Failures

In six patients (16% of referrals) it was not possible to insert a line. In each case this was due to difficulties finding a suitable vein in sick babies who had already had a number of peripheral infusions. It is a useful rule for junior staff not to use antecubital veins for peripheral drips where possible if central venous feeding using this technique is anticipated. Quite a number of successfully catheterised babies had undergone repeated venepuncture, however, and careful inspection for unused veins is well worth while even in these circumstances.

Complications

Sepsis is the most common major complication seen with central venous feeding and occurred in four of our 31 patients. In each case the child became feverish and unwell without signs of localised infection. Positive bacterial cultures were subsequently obtained from both blood and the line once removed. The infecting organisms were *Staphylococcus aureus, Staph. albus, Streptococcus faecalis,* and *Klebsiella* species. These four patients all made an uneventful recovery after removal of the feeding line and treatment with antibiotics. We have compared patients with similar indications for total parenteral nutrition, underlying condition, and weight but fed either by surgically inserted central venous catheter or percutaneous line: the only significant difference in line performance with regard to days of use, blockage, sepsis, and accidental removal was a lower incidence of line associated sepsis in those patients with percutaneously inserted catheters.

Discussion

Percutaneous Silastic catheters are most suitable for small babies who are relatively immobile, less likely to pull on their lines, and with a total fluid requirement that can be accommodated by the flow restriction imposed by a 25G Butterfly (about 50 ml per hour). Clearly, their usefulness extends beyond the special care baby unit where they have been tried and tested. Central as opposed to peripheral feeding confers the advantages to the patient of not having painful, repeated, and increasingly difficult venous cannulation. Septic complications can be minimised by obsessive sterile nursing care.[6] The infusion system is changed daily by nurses who wear cap and mask; the disconnected Butterfly hub is soaked in 70% isopropyl alcohol together with the terminal attachment of the new system for three minutes before connection, a no touch technique being used throughout. Lines are dedicated to intravenous feeding fluids and cannot be used for giving drugs or taking blood.

To minimise the risk of producing limb oedema from constriction of venous return care should be taken when applying a circumferential Elastoplast dressing to start distally and work proximally, at the same time ensuring that the strapping is not tight. If a line is in place for some weeks and growth is taking place Elastoplast originally loose may become tight enough to cause foot or hand swelling. This will often resolve if the old strapping is replaced by fresh, loose tape. Tube gauze might be used as an alternative method of dressing to circumvent this problem.

Several advantages are apparent when comparing percutaneous insertion as described above with other methods of central venous catheterisation, not least the fact that it may be done at the bedside, without anaesthetic or surgical incision. The technique is simple to learn and, with practice, often quick to perform. Should the Silastic catheter be accidentally pulled out or disconnected, blood loss is unlikely to be severe due to its small bore. Line removal is simple, unlike with cuffed catheters (Broviacs, Hickmans), which become fixed by fibrosis and merit general anaesthesia for removal.

In our experience percutaneous insertion of Silastic central venous feeding catheters offers a simple and acceptable alternative to surgical line insertion in neonates and infants requiring total parenteral nutrition.

References

1. Wilmore DW, Dudrick SJ. Growth and development of an infant receiving all nutrients exclusively by vein. *JAMA* 1968;**203:**140–4.
2. Candy DCA. Parenteral nutrition in paediatric practice. *J Hum Nutr* 1980;**34:**287–96.
3. Shaw JCL. Parenteral nutrition in the management of sick low birthweight infants. *Paediatr Clin North Am* 1973;**20:**333–58.
4. McLain BI, Skinner J, Mann NP. The placement of central venous feeding lines in the newborn. *Br J Parent Ther* 1985;**6:**152–3.
5. Panter-Brick M, Wagget J, Dale G. Intravenous nutrition in paediatrics. Dorchester: Dorset Press, 1977.
6. Keohane P, Jones BJM, Attrill H, *et al.* Effect of catheter tunnelling and a nutrition nurse on catheter sepsis during parenteral nutrition. *Lancet* 1983;ii:1388–90.

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