LONG LINE INSERTION (PERIPHERALLY SITED)
Supporting information

This guideline has been prepared with reference to the following:

British Association of Perinatal Medicine. Use of Central Venous Catheters in Neonates - A Framework for Practice. 2018. BAPM

https://www.bapm.org/resources/10-use-of-central-venous-catheters-in-neonates-revised-2018

What are the advantages and disadvantages of these lines?
Silastic catheters are much finer than, for example, Broviac catheters and are less likely to occlude veins, especially when inserted peripherally (Anon, 1991). Silastic is more likely than polyurethane to cause thrombus formation or sepsis (Wheeler, 1991), but is softer and thus more suitable for use in neonates (Goutail-Flaud, 1991). Silastic is less thrombogenic than the older type of PVC catheter (Boros, 1975).

Anon. Central venous access in children. Lancet 1991;338:1301-2

Boros SJ, Thompson TR, Reynolds JW, et al. Reduced thrombus formation with silicone elastomere (silastic) umbilical artery catheters. Pediatrics 1975;56:981-6

Goutail-Flaud MF, Sfez M, Berg A, et al. Central venous catheter-related complications in newborns and infants: a 587-case survey. J Pediatr Surg 1991;26:645-50

Wheeler RA, Griffiths DM, Burge DM. Retrograde Tunnel: A Method for the Fixation of Long-Term Pediatric Central Venous Catheters. JPEN J Parenteral Enteral Nutr 1991;15:114-5

Evidence Level: V

What is the optimum position and the best way of determining the position once placed?
The tip of silastic catheters should be placed just behind the confluence of the superior-inferior vena cava and the right atrium (Hausdorf, 1987), or alternatively in the superior vena cava (Anon, 1991). There is an increased risk of systemic air and fat embolism if the tip is in or close to a patent foramen ovale (Hausdorf, 1987). Ultrasonography accurately confirms positioning of even the thinnest catheters, and reduces the need for radiography (Soong, 1991; Hausdorf, 1987, De Carvalho 2012).

Anon. Central venous access in children. Lancet 1991;338:1301-2

Hausdorf G, Bitzan M, Commentz J, et al. Intra-atrial malpositions of silastic catheters in newborns. Crit Care Med 1987;15:308-9

Soong WJ, Hsieh KS, Tiu CM, et al. Central venous silastic catheters in newborns and children: localization by sonography and radiology. Zhonghua Yi Xue Za Zhi (Taipei) 1991;48:97-102

De Carvalho, OPS, Da Luz, GPM, Peterlini, MA. Placement of peripherally inserted central catheters in children guided by ultrasound: a prospective randomized, and controlled trial.
2012; 13:282-7.

Evidence Level: V

How should any infections be managed? When should the lines be removed?
Catheter infection is more than twice as common in neonates than in older children (Mulloy, 1991), and infection rates as high as 45% have been recorded (Puntis, 1990; Grisoni, 1986). Exit-site infections can be treated with antibiotics, but tunnel infections usually require the catheter to be removed (Anon, 1991). A prospective study of 35 patients (Klein, 1992) included 4 with bacteraemia. Two of these needed catheter removal to clear their infections, but the other 2 were cured by the administration of antibiotics through the catheter. Prophylactic vancomycin or teicoplanin reduces the incidence of catheter-related infection in neonates (Moller, 1995). However, a Cochrane review (Jardine, 2008) found that antibiotic prophylaxis had no effect on overall mortality (RR 0.68, 95% CI 0.31 – 1.51).

A 2018 systematic review of RCTs found there was no trial data to guide practice regarding early planned removal versus expectant management of PICCs in newborn infants (Gordon, 2018).

Anon. Central venous access in children. Lancet 1991;338:1301-2

Gordon A, Greenhalgh M, McGuire W. Early planned removal versus expectant management of peripherally inserted central catheters to prevent infection in newborn infants. Cochrane Database Syst Rev. 2018 Jun 25;6:CD012141
https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD012141.pub2/full

Grisoni ER, Mehta SK, Connors AF. Thrombosis and infection complicating central venous catheterization in neonates. J Pediatr Surg 1986;21:772-6

Jardine LA, Inglis GD, Davies MW. Prophylactic systemic antibiotics to reduce morbidity and mortality in neonates with central venous catheters. The Cochrane Database of Systematic Reviews 2008, Issue 1. CD006179
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006179.pub2/full

Klein JF, Shahrivar F. Use of percutaneous silastic central venous catheters in neonates and the management of infectious complications. Am J Perinatol 1992;9:261-4

Moller JC, Reiss I, Schaible T. Vascular access in neonates and infants: indications, routes, techniques and devices, complications. Intensive Care World 1995;12:48-53

Mulloy RH, Jadavji T, Russell ML. Tunneled central venous catheter sepsis: risk factors in a pediatric hospital. JPEN J Parenteral Enteral Nutr 1991;15:460-3

Puntis JW, Holden CE, Smallman S, et al. Staff training: a key factor in reducing intravascular catheter sepsis. Arch Dis Child 1990;65:335-7
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1792884/pdf/archdisch00652-0071.pdf

Evidence Level: V

What are the most common complications and how can they be avoided?

The most common serious complications of vascular access are infection (Moller, 1995) and catheter occlusion secondary to thrombus formation at the catheter tip (Sherman, 1983). The first prospective study of silastic catheters in neonates, using only peripheral veins of the scalp and extremities (Durand, 1986), found an overall incidence of mechanical complications of 26.4%. These consisted of blockage of the catheter or accidental displacement. Of 53 catheterisations, 4 (7.5%) were complicated by infections.

A study of 535 catheterisations with an average indwelling time of 23 days (Neubauer, 1995) noted one complication for every 153 indwelling catheter days. The most common complication was sepsis, on 22 occasions (4.1%).

A large Chinese study of 1,318 catheterisations (Soong, 1995) found a lower rate of sepsis (2.7%), which was still the most common complication.

The jugular vein route is particularly associated with thrombosis, which was detected in 8 of 24 patients receiving a silastic catheter in a study of 40 neonates (Rand, 1994).

Lines in infants needing total parenteral nutrition or multiple intravenous infusions are particularly susceptible to infection and their use “should be avoided if possible” (Mulloy, 1991). Broviac catheters may be more suitable in these patients (Anon, 1991).

A prospective study of catheter sepsis (Puntis, 1991) found that education of staff in appropriate practice and the utilisation of specialist nurses reduced the rate of infection from 45% to 8% over a 12 month period.

A randomised, controlled, double-blind, single-centre trial in 210 infants (Birch, 2010) compared TPN with heparin (n=102) to TPN without heparin (n=108). There was a statistically significant reduction in all episodes of culture-positive, catheter-related sepsis in those infants with heparin added to the TPN, compared with those without heparin (p=0.04; RR 0.57, 95% CI 0.32 to 0.98; NNT 9, 95% CI 4.6 to 212.4).

A Cochrane review of 2 trials in 267 neonates (Shah, 2008) found some evidence for the prophylactic use of heparin in prevention of thrombotic complications; treatment was associated with a reduced risk of catheter occlusion (RR 0.28, 95% CI 0.15 – 0.53; NNT 5, 95% CI 3 – 8). The only previous systematic review (Randolph, 1998) was not confined to infants.

Anon. Central venous access in children. Lancet 1991;338:1301-2

Birch P; Ogden S; Hewson M. A randomised, controlled trial of heparin in total parenteral nutrition to prevent sepsis associated with neonatal long lines: the Heparin in Long Line Total Parenteral Nutrition (HILLTOP) trial. Arch Dis Child Fetal Neonat Ed 2010;95:F252-7
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Durand M, Ramanathan R, Martinelli B, et al. Prospective evaluation of percutaneous central venous silastic catheters in newborn infants with birth weights of 510 to 3,920 grams. Pediatrics 1986;78:245-50

Moller JC, Reiss I, Schaible T. Vascular access in neonates and infants: indications, routes, techniques and devices, complications. Intensive Care World 1995;12:48-53

Mulloy RH, Jadavji T, Russell ML. Tunneled central venous catheter sepsis: risk factors in a pediatric hospital. JPEN J Parenteral Enteral Nutr 1991;15:460-3

Neubauer AP. Percutaneous central i.v. access in the neonate: experience with 535 silastic catheters. Acta Paediatr 1995;84:756-60

Puntis JW, Holden CE, Smallman S, et al. Staff training: a key factor in reducing intravascular catheter sepsis. Arch Dis Child 1991;66:335-7
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1792884/pdf/archdisch00652-0071.pdf

Rand T, Kohlhauser C, Popow C, et al. Sonographic detection of internal jugular vein thrombosis after central venous catheterization in the newborn period. Pediatr Radiol 1994;24:577-80

Randolph AG, Cook DJ, Gonzales CA, et al. Benefit of heparin in peripheral venous and arterial catheters: systematic review and meta-analysis of randomised controlled trials. BMJ 1998;316:969-75
http://www.bmj.com/content/316/7136/969.long

Shah PS, Shah VS. Continuous heparin infusion to prevent thrombosis and catheter occlusion in neonates with peripherally placed percutaneous central venous catheters. The Cochrane Database of Systematic Reviews 2008, Issue 2. Art. No.: CD002772
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD002772.pub3/full

Sherman MP, Vitale DE, McLaughlin GW, et al. Percutaneous and surgical placement of fine silicone elastomer central catheters in high-risk newborns. JPEN J Parenteral Enteral Nutr 1983;7:75-8

Soong WJ, Jeng MJ, Hwang B. The evaluation of percutaneous central venous catheters: a convenient technique in pediatric patients. Intensive Care Med 1995;21:759-65

Evidence Level: V

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