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Central venous catheters in children and neonates (Part 2) – Access via the internal jugular vein

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Abstract

Central venous access via the internal jugular vein (IJV) is safe, relatively easy and very commonly used in infants and children undergoing cardiac surgery for congenital heart disease. Because of the wide range of anatomical variations an ultrasound-guided technique is advantageous in many cases, in particular in patients who have had previous punctures or those in whom difficulties are anticipated for various reasons. The right internal jugular vein is the preferred vein for central venous access as it offers straight access to the superior vena cava. The rate of complications - insertion-related as well as long term - are lower compared to the femoral and the subclavian access.

MeSH: Heart Catheterization, Central venous pressure

Introduction

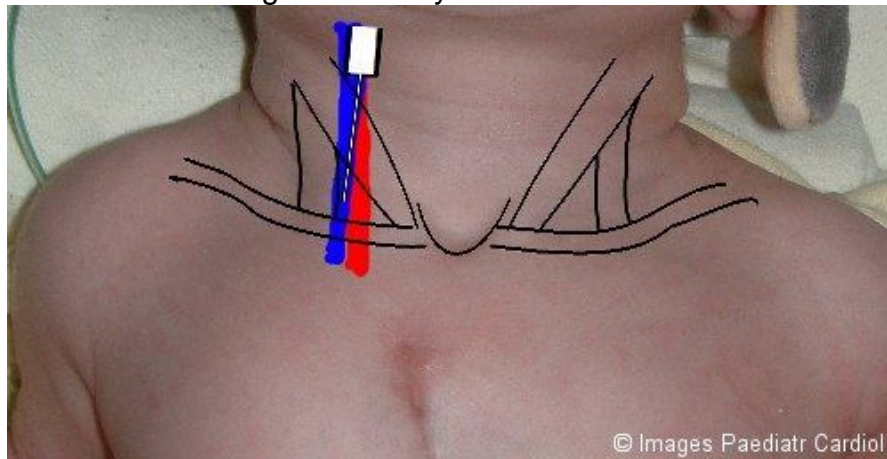
Central venous access is an essential part of perioperative management for infants and children undergoing cardiac surgery for congenital heart disease. For general aspects of central venous lines we refer to part 1 of this series of papers describing the various approaches to venous access.¹ A detailed discussion of complications of central venous catheters in critically ill children may be found in recently published studies and reviews.^{2–4} The access via the internal jugular vein (IJV) is one of the most commonly used, in particular in cardiac surgery as the catheter (when using the right IJV) goes straight down to the superior vena cava (SVC).

Landmarks

The position of the IJV in relation to the carotid artery shows high variability.⁵ In the majority of the patients the IJV lies lateral to the carotid artery; as one moves more cranially it comes closer and sometimes even anterior to the carotid artery. In up to 5% the position might even be medial to the carotid artery.

The classical landmarks are the cricoid ring, the sternocleidomastoid muscle with its two inferior fixation points, the clavicle, the sternal notch and the ipsilateral nipple (fig. 1).

Fig. 1 Anatomy and landmarks



Classical puncture technique

The carotid artery is palpated with one hand, then the skin is usually punctured at the level of the cricoid ring just lateral to the carotid artery. The needle is advanced at a 30-40° angle to the skin towards the ipsilateral nipple.

Positioning

A shoulder roll provides an appropriate degree of neck extension. With a slight contralateral head rotation more space for handling and slight stretching of the vein is achieved. However, attention should be paid not to overdo the degree of contralateral rotation, as this may cause compression of the vein. Good venous filling is a prerequisite. This is achieved by adequate hydration of the patient via existing peripheral lines and a head down Trendelenberg position (fig. 2). Alternatively, gentle manual pressure in the subcostal region by an assistant can be helpful, as it causes the hepatojugular reflux, with increase in superior caval and jugular pressure.

Fig. 2 Positioning



Risks and complications

Central venous access via the internal jugular vein has a low overall complication rate compared to the access via the femoral and subclavian veins.²⁻⁴

Difficulties and complications during insertion:

The major risk is accidental injury to the carotid artery. Very rarely, a haematoma causing tracheal compression can occur.

Damage of the phrenic nerve is rare.

The risk of causing pneumothoraces or hemothoraces is extremely low, in particular when compared to the subclavian access.

Malpositioning occurs more often when the left IJV is used. The guidewire may form a bow and end up in the right IJV.

Maintenance Problems:

The risks of thrombosis, obstruction and infection are similar to the subclavian catheter and lower than for a femoral catheter.

Ultrasound

Ultrasound can be used to visualise the diameter and position of the IJV in relation to the carotid artery. In particular in patients with expected difficulties or with previous central lines in that position an ultrasound improves the likelihood of a successful puncture. In addition obstruction of the vein can be excluded.

Another option is the real-time observation of the puncture under ultrasound guidance. For this, the ultrasound probe is kept in a sterile glove. The position of the needle can be observed. The compression of the vein by the tip of the needle is usually very clearly seen. While direct entry of the needle into the vein is not always seen, but it is sufficient to observe the needle in the correct direction towards the vein and not hitting the artery (figs. 3 and 4).

After successful puncture has been verified by easy aspiration of dark venous blood the guidewire is advanced. Then the typical Seldinger technique (including dilation and a small skin incision) is performed. A central venous line should be fixed with a suture.

Fig. 3 Localisation of the IJV (blue)

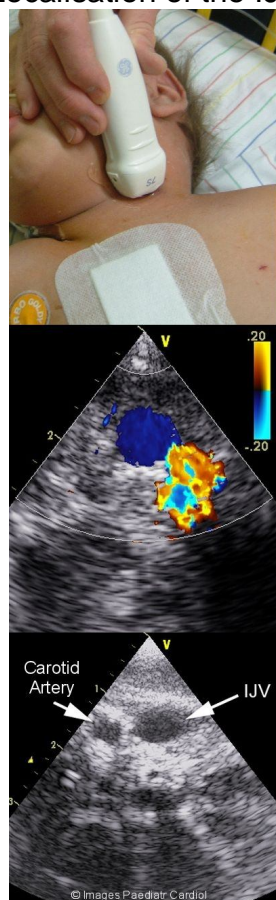
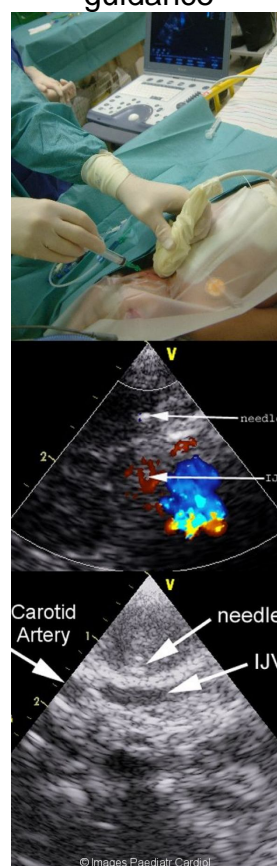


Fig- 4 Puncture under ultrasound guidance



Discussion

The access via the IJV for placement of a central venous line is easy and therefore this is often the preferred site. Two problems that have received attention in the literature include: a) the usefulness of the ultrasound guided technique and b) the risk of infection.

The 'Guidance on the use of ultrasound locating devices for placing central venous catheters guideline'¹⁶ published by the National Institute for Clinical Excellence (NICE) in the UK in 2002 recommends the routine use of ultrasound for IJV puncture. These guidelines however have been criticised as there is no clear evidence that routine use of ultrasound is mandatory. A recent survey in the UK showed that most anaesthesiologists agree that ultrasound is a useful tool and that all pediatric anaesthesiologists should have access and training in the use of this technology.^{7,8} The few prospective studies that have been performed do show lower rates of mechanical complications and higher success rate but further larger studies are necessary for clear evidence.⁵

The infection rates in adults are lowest for the subclavian access and highest for the femoral site. In children these findings have not been substantiated. In

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general, the rate of infection seems to depend mainly on the duration of central venous cannulation and younger age.⁹

Conclusion

The IJV approach for central venous access is easy. The main complication is that of injuring the carotid artery. In difficult cases, a higher success rate can be achieved with an ultrasound-guided technique.

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