

# ULTRASOUND GUIDED CANNULATION: A NOVEL GUIDELINED PRACTICE

G. D'Onofrio

Department of Anaesthesiology

Neurological Institute Carlo Besta, Via Celoria 11, 20133 Milano, Italy

The application of ultrasounds (US) during central venous catheterization (CVC) begins in 1978 when Ullman and Stoelting used an ultrasonic Doppler blood flow detector to locate and mark the internal jugular vein (IJV). In 1981 Bazaral and Harlan studied sonographic images of the right neck recommending a 30 degree head rotation, 15 degree Trendelenburg and a beneficial absence of carotid palpation while inserting the catheter needle. In 1984 Metz studied 15 different techniques for localizing the IJV. In 1986 Yoni first referred to combining real-time ultrasonic imaging and internal jugular catheter placement. In 1990 Mallory first compared conventional and ultrasound guided internal jugular vein catheterization techniques.

The next studies, especially meta-analysis of independent and authoritative institutes and organisms (1-2), have proved that ultrasound central venous cannulation represents a valid alternative, able to improve the security with respect to the traditional method, for access to the internal jugular vein.

## Guidelines

The National Institute for Clinical Excellence (NICE) published in 2002 guidelines for central venous catheterization. NICE recommends that 2-D imaging ultrasound guidance should be the preferred method when inserting of central venous catheters into the internal jugular vein in adults and children in 'elective situations' (not emergency).

In 2003 Hind in order to assess the evidence for the clinical effectiveness of ultrasound guided central venous cannulation, identified 18 trials for this topic: the meta-analysis concluded that evidence supports the use of two dimensional ultrasonography for central venous cannulation. In August 2005, NICE reviewed its original guidance and decided to make it static.

The advantages of this technique are that it allows real-time imaging of the vessel while the catheterization is performed.

US clarifies the relative position of the needle, the vein and its surrounding structures. Compared to landmark Technique, 2-D ultrasound guidance is significantly better in terms of lower technical failure rate (overall and on first attempt), less complications and faster access. Indications for US in central venous line cannulation are:

1. Surface landmarks difficult to identify or use (obesity, local swelling)
2. Limited sites for access attempts (other catheters, pacemaker, local surgery or infection)
3. Previous difficulties during catheterization
4. Previous complications
5. Known vascular abnormality
6. Coagulopathy-uncorrected
7. Unable to tolerate supine position
8. Pediatric patients

## Personal Experience

In 2004 our Department started, after a learning period of 20 procedures, to use routinely ultrasounds during central vascular cannulation and in particular for internal jugular vein. A prospective-observational study was conducted and 300 patients were analyzed (155 female, 145 male) from November 2004 to October 2005. Cannulation was performed when patients were in general anesthesia for neurosurgical procedures and was always successful, despite major or minor complications. Overall rate of complications was 23%. Carotid artery puncture was the only main complication, with an incidence of 2.7%. We registered two main minor complications: neck haematoma (1%) and multiple venous puncture (24%). Ultrasound images showed that internal jugular vein lies mostly in the antero-lateral position (77.85%) with respect to the carotid artery and quite similarly in the lateral and anterior position (22.15% and 20.42%). Internal jugular vein had an average diameter of 13.5 mm and distance between skin and surface of the jugular vein was 11.3 mm.

## Conclusions

Since ultrasound was introduced to aid central venous cannulation, several other uses have been reported: nerve location, screening in abdominal trauma, thoracocentesis, localisation of underlying vessels prior to percutaneous tracheostomy, insertion of peripheral arterial cannula and peripheral venous cannulation, especially in patients with peripheral oedema.

According to NICE recommendations, from 2004 we perform all central venous cannulations using 2-dimensional (2-D) imaging ultrasound guidance: besides lower technical failure rate and complications, NICE states that there is evidence for faster access and net resource saving owing to the need to treat fewer complications. In addition potential benefits for patients arise from reduced discomfort from the procedure: with US the vascular access can be achieved in difficult surface landmarks, in patients unable to tolerate supine position or the lateral position of the neck (ex: trauma). In the future several blind attempts at central vein catheterization using different sites will probably become unacceptable on both clinical and medico-legal grounds.

Finally, in agreement with an editorial of Denny: "evidence aside, it is intuitively *better* and *safer* to perform a procedure under direct vision than blind".

**Bibliography**

1. Evidence Report/Technology Assessment Number 43: Making Health Care Safer: A Critical Analysis of Patient Safety Practices. AHRQ Publication 01-E058. 2001
2. National Institute for Clinical Excellence: Guidance on the use of ultrasound locating devices for placing central venous catheters. September 2002. [www:nice.org](http://www.nice.org).