**Technical Report**

**Two different techniques and outcomes for insertion of long-term tunnelled haemodialysis catheters**

M. J. Kumwenda

Glan Clwyd Trust Hospital, Bodelwyddan, Rhyl, Clwyd

Abstract

**Background.** Renal Units employ different techniques for insertion of long-term haemodialysis catheters into jugular veins, and we decided to ascertain the success rate and peri-insertion complications of two percutaneous methods in a District General Hospital.

**Method.** Results of venous cannulation from two studies using different techniques were obtained and compared. Both studies were prospective and the procedures were performed by the same Clinician in patients with end stage renal failure. Patients were divided into two groups. Group A had venous catheters inserted under ultrasonographic guidance using a Site Rite portable machine and Group B were inserted ‘blind’. The aseptic percutaneous Seldinger technique was used for catheterizations in both groups.

**Results.** The first attempt/pass venous cannulation success rate was 88.6% in Group A compared to 61.4% in Group B. Complications rate was significantly lower in Group A ($P = 0.0048$) than in Group B.

**Conclusion.** In this study the ultrasonographic guided technique was better than the blind technique in jugular venous cannulations.

**Key words:** haemodialysis catheters; Site Rite; ultrasonographic guidance

**Introduction**

Central venous access is used in patients with end-stage renal failure (ESRF) who have inadequate or no arteriovenous fistulae (AVF) for haemodialysis. AVF remains access of first choice in these patients, however up to 60% of them will require central venous dialysis [1] during their renal replacement therapy duration.

The right internal jugular vein is recommended [2] for this purpose to reduce the risk of long-term complications, and cannulation is done using three different techniques: (1) surgical cut down technique—this requires special skills and is the recommended technique because of the lower risk of peri-insertion complications [3,4]; (2) percutaneous Seldinger technique—this is preferred by most non-surgical clinicians and is performed ‘blind’ (e.g. nephrologists) [1,5] or ultrasonographically (e.g. radiologists) [6].

We decided to compare results of our ‘blind’ versus ultrasonographic techniques in our unit done by the same physician using a Site Rite [7] portable machine for the ultrasonographic technique.

**Method**

**Jugular cannulation.** The success rate for this and associated perioperative complications were obtained from the Prospective Study of Long Term Haemodialysis catheters from our unit (August 1994 to June 1995) [1]. The cannulations were performed using anatomical landmarks (blind) for localization of the internal jugular vein by one clinician in this study.

The same clinician learnt the ultrasonographic guided technique using the Site Rite machine and performed 44 venous cannulations. The success rate and perioperative complications were recorded prospectively and compared with those in the first study [1].

**Site Rite characteristics** (Figure 1). The Site Rite machine [7] is a portable lightweight real-time medical ultrasound system for imaging and assessing jugular, subclavian, and femoral veins.

**Internal jugular cannulation.** In our unit this procedure is done in the Pacemaker theatre under fluoroscopy guidance. The patient was laid down on a theatre table as flat as possible with one pillow, and all the skin from the right side of the neck to just above the ipsilateral nipple was cleaned with Betadine and the Stelldot triangle (area just above the clavicle and between the two heads of the sternoclavicular muscle) was exposed. The Site Rite probe (Figure 2) was fitted with a 1.5-cm depth needle guide, ultrasound gel applied and was covered with sterile sheath. The operator stood behind the patient’s head, the Stelldot triangle was wetted with saline. The probe was held between the first two fingers of one hand with the needle guide to the palm side facing the operator.
placing the thumb immediately the above the needle guide for comfortable support. The window of the probe was placed on the patient’s skin and moved until the vein was viewed on the screen as far away from the artery as possible, making sure the dotted line on the screen went through the centre of the vein. Local anaesthesia was applied at this point on the skin and a small incision made using a blade. An 18-gauge needle was fitted to a syringe filled with saline and applied to the groove of the needle guide, trapping the needle with the ball of the thumb. The needle point was placed perpendicular (Figure 2) to the skin and advanced slowly until the arterial wall of the vein on the screen was deformed and invaginated, blood was then aspirated on venepuncture. This process may be made easier if the patient performs a Vasalva manoeuvre when the vein is distended with blood. The needle and the syringe was supported by the other hand, the probe was laid down and syringe removed and J shaped wire inserted into the needle, angling the needle a little to make is easier for the wire to be directed into the right atrium as seen on fluoroscopy.

Construction of a catheter tunnel and venous catheterization have been described elsewhere [1,5,8] and will depend on the type of catheter being inserted percutaneously. For this study period we used a single lumen and a single cuff Francis catheter using a 16F Peel Away introducer (Kimal Ltd, UK.)

Statistical analysis
A chi-squared test was used to compare (1) the success rate of first-attempt/pass of venous cannulation of the two groups, and (2) total number of complications of the two groups.

Results
See Tables 1 and 2.
In both studies a total of 87 catheters were inserted into the right internal and one in the external jugular

<table>
<thead>
<tr>
<th>Table 1. Success rate and venous cannulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of attempts</td>
</tr>
<tr>
<td>--------------------</td>
</tr>
<tr>
<td>One</td>
</tr>
<tr>
<td>Two</td>
</tr>
<tr>
<td>Three</td>
</tr>
<tr>
<td>More than three</td>
</tr>
<tr>
<td>Unsuccessful</td>
</tr>
</tbody>
</table>

*P=0.0067, Group A better than Group B.
we feel that using the Site Rite machine is cost-effective when perioperative morbidity and the requirement of chest X-rays is considered. This equipment makes it convenient and safe enough for the nephrologist to perform percutaneous insertions of central venous dialysis catheters without having to refer the patient to another colleague in a different specialty for catheter insertion surgically or radiologically [13]. A high success rate of the blind technique in our experience was at the cost of multiple venous cannulation attempts and this would certainly be the problem for clinicians during their ‘learning curve’ period. The ultrasonographic assisted technique has been described as superior to the blind technique in other series [14], but a large multicentre prospective study comparing the two techniques is required, to define precisely the learning curve period for beginners and assess adequately and comparable perioperative complications between the two techniques. We recommend, however, that trainee nephrologists learn the ultrasonographic technique to maintain their expertise of catheter insertion for haemodialysis within their renal unit, which makes it convenient for all parties. This technique could also be used in other specialities where catheterization of central venous veins is required for management of their patients.

Conclusion

In this study the Site Rite ultrasonographic technique was safer and more successful than the blind technique in percutaneous jugular venous cannulations.

Acknowledgements. The author’s thanks are extended to Miss Elaine Jones for secretarial help, to Mrs D. J. Haybittle for collecting data, and to Dr F. K. Wright, Consultant Physician for help and guidance.

References

3. Gibson GP, Mosquara D. Five years experience with Quinton the Site Rite ultrasonographic technique than the blind technique, thereby reducing complications rate perioperatively significantly (Tables 1 and 2). Accidental arterial puncture in uraemic patients may lead to significant bleeding; two of our patients in Group B were hospitalized for 3 and 4 days each following development of haematoma around the neck after arterial puncture. Thirty-three uneventful venous catheterizations were done in patients in Group A compared to 19 in Group B. Doing a chest X-ray was considered an event.

Our unit policy is to do chest X-rays only in those patients who require more than one attempt at cannulating the internal jugular vein to exclude a pneumothorax, whereas if successful with one attempt we assume a pneumothorax would be unlikely, and therefore a chest X-ray is not requested. From this study


13. Denys BG, Uretsky BF, Reddy SP. Ultrasound-assisted cannulation of the internal jugular vein—a prospective comparison to the external landmark guided technique. Presented in part at the 63rd Scientific Session of the American Heart Association Dallas, November 1990


Received for publication: 29.7.96
Accepted in revised form: 19.1.97