Supraclavicular Approach to the Subclavian Vein – One Well Forgotten Technique with Impressive Results

**ABSTRACT:**

**Purpose:** Insertion of temporary and tunneled catheters for hemodialysis in the internal jugular vein is a “gold standard”. On the other hand, the supraclavicular approach to the subclavian vein was described by Yoffa in 1965. Despite its old invention, the latter technique has been well forgotten for unknown reasons. The aim of this study is to present our experience with the usage of the supraclavicular approach for insertion of temporary and tunneled catheters as vascular access for hemodialysis treatment.

**Material and Methods:** We provide our experience on the insertion of 506 temporary and 501 tunneled catheters within a five-year period (from 1st January 2010 to 31st December 2014). We use 8 (eight) different places for catheters’ insertion, including the subclavian vein via supraclavicular approach following the techniques of D. Yoffa and J. Gorchynski. The collected data include age, sex, reasons for hemodialysis, number of attempts for successful cannulation, number of acute (AC) and chronic (CC) complications, and dependence on the catheter insertion location.

**Results:** The gender distribution shows 463 (46%) women and 544 (54%) men with a median age of 60.0 (+/- 13.2) years. In the cases of temporary catheters: 104 (20.5%) are inserted in the subclavian vein via supraclavicular approach (SCVSC), 70 (13.8%) – in the internal jugular vein (IJV); in the cases of tunneled ones – SCVSC – 281 (56%), and IJV – 207 (41%) catheters, respectively. We found a significant statistical correlation (p < 0.05 and r = 0.23) between acute complications and the insertion position – AC are more for IJV insertion, than in SCVSC. We did not find a significant correlation between the insertion place and the chronic complications. Even central vein stenosis is more frequent in the IJV than in the SCVSC, but this is not significant (p > 0.05). Primary catheter patency of temporary and tunneled catheters is higher when they are inserted in the left veins.

**Conclusion:** We conclude that the supraclavicular approach to the subclavian vein is an easier, safer and practically more convenient method than cannulation of the IJV. The revisit of this approach demonstrates that it should be used more widely.

**KEYWORDS:**

complication, internal jugular vein, subclavian vein, supraclavicular approach, vascular access

**INTRODUCTION**

From a historical point of view, the first catheterization of the subclavian vein was made by Robert Aubaniac in 1952, who used the infraclavicular access [1]. In 1965, David Yoffa described supraclavicular access to the vein [2]. Several variants of the two main accesses have been described in the recent years, but in clinical practice the subclavian approach is used more often [3].

Following the authoritative study by S. Schwab et al. from 1988 [4], which was conducted on 47 patients, and the subsequent publications [5, 6, 7] reporting of post-catheterization stenosis of the subclavian vein after infraclavicular cannulation in 42–50% of cases, its use in hemodialysis practice has become taboo. This study shows our experience with the use of supraclavicular access to the subclinical vein.

**MATERIAL AND METHODS**

We present our experience on the insertion of a total of 1007 catheters (of which 506 – temporary and 501 – tunneled) within a five-year period (from 1th January 2010 to 31th December 2014). We use 8 (eight) different places for temporary and 6 (six) for tunneled catheters insertion, including the subclavian vein via supraclavicular approach following the techniques of D. Yoffa and J. Gorchynski [3].

All patients participating in this study signed an informed consent and the study was approved by the ethics committee at the Medical University, Pleven, Bulgaria.

Acute complications were observed in all tunneled and temporary catheters, while chronic complications were only observed in the tunneled and part of the temporary ones. We excluded those temporary catheters that were used in patients with acute renal failure, exogenous intoxications, preoperative obstructive uropathy, and those transferred to treatment with peritoneal dialysis because the catheters’ placement in these cases was as short as possible.

All catheterizations of the internal jugular and subclavian vein as well as over ¾ of the femoral vein were performed by one operator with more than 250 temporary and cuffed catheter insertions yearly. In some emergency situations, catheterization is performed by anatomical landmarks (blind technique). In almost all cases, however, permanent ultrasound control was used during the procedure. If we cannot have permanent ultrasound control, we use a “seeking needle” – 20 G, which helps us navigate the direction and depth of the target vein.
RESULTS

The gender distribution shows 463 (46%) women and 544 (54%) men with a median age of 60.0 (+/- 13.2) years. In the cases of temporary catheters: 104 (20.5%) are inserted in the subclavian vein via supraclavicular approach (SCVSC), 70 (13.8%) – in the internal jugular vein (IJV); in the cases of tunneled ones – SCVSC – 281 (56%), and IJV – 207 (41%) catheters, respectively (Fig. 1., 2.).

Out of 1007 hemodialysis catheters, 385 (38%) were placed via supraclavicular approach to the subclavian vein and 277 (27.5%) in the internal jugular vein.

Acute complications at the insertion of the temporary catheters were found in 8 cases (1.6%); in 6 there was an arterial lesion: in 4 cases there was femoral vein puncture, and in 2 cases – internal jugular vein; in the other two cases of complications it concerned catheter malposition – all of these were found in the insertion of catheters in the left subclavian vein via subclavicular approach.

We found a significant statistical correlation (p < 0.05 and r = 0.23) between acute complications in the insertion of tunnel catheters – they are more frequent in the cases of insertion in IJV, than those in SCVSC (Fig. 3.). We did not find a significant correlation between the insertion place and chronic complications. Even central vein stenosis is more frequent in the IJV (6 cases) than in the SCVSC (4 cases), but this is not significant (p > 0.05). Primary catheter patency of temporary and tunneled catheters is higher when they are inserted in the left veins (Fig. 4., 5.).

The difference between the pair SCVSC/RIJV is significant (p = 0.0007). The differences are significant between the pairs LIJV/RIJV and LIJV/RSCVSC (p = 0.0001), but they are not significant (p > 0.05) between the pair RIJV/RSCVSC.

In eighty-five (85) patients with temporary catheters and 376 patients with tunnel catheters, we constructed native, primary and reconstructive (secondary) arterio-venous anastomoses. In 396 (86%) of them on the left hand and in 65 (14%) on the right.

In our study, we did not find a statistically significant difference neither between the catheter insertion place and fistula failure nor between the catheter insertion place and the primary and one-year patency of the anastomosis (p > 0.05).

DISCUSSION

The interest in SCV cannulation by surgeons and anesthesiologists is due to the fact that because of its anatomical closeness to the clavicle and the first rib, it rarely collapses in conditions of dehydration and shock, unlike the internal jugular vein [8]. At the same time, the use of ultrasound does not contribute significantly to the improvement of puncture results of this vein, as opposed to its positive effect on the puncture of the internal jugular vein [9, 10].

We rarely use infraclavicular approach to the subclavian vein, in which case the anatomical marker is deltoid tuberosity [11, 12].

In our daily practice, we most often use supraclavicular approach, which is preferred by many authors [13, 14, 15]. Wen-Hsien Lu et al. (2006), in a study comparing the successful cannulation of central veins in neonates, conclude that supraclavicular approach, even under urgent conditions and without the use of permanent...
ultrasound control, is superior to the other methods of catheterization, both subclavian and internal jugular vein [16].

This method is also preferred in the cases of central vein catheterization in obese patients whose detection of anatomical landmarks is difficult [17]. The advantages of the supraclavicular approach, proven by different authors, are simple anatomical features, such as:

- shorter distance between the skin and the vein,
- larger target area,
- almost straight path from the puncture site to the upper vein,
- lateral position of the pulmonary dome and the eponymous artery [14, 18, 19, 20, 21, 22].

As anesthesiologist Tomasz Czarnik and co-authors (2009) say: “In conclusion, subclavian venous catheterization via the supraclavicular approach is an excellent method of central venous access in anesthesia. The procedure success rate and the significant complication rate are comparable to other techniques of central venous catheterization, especially to jugular access, which is regarded by most physicians as the safest one. Mechanical ventilation is not a risk factor associated with significant complications. The supraclavicular approach should be considered, especially in neuroanesthesia, where the right jugular approach could be associated with cerebral perfusion pressure reduction, intracranial pressure elevation, and venous stasis. The supraclavicular approach seems to be more comfortable than the jugular approach in a conscious patient. This method can be successfully and relatively safely used as a primary or alternative technique when other catheterization sites are not available to augment the spectrum of catheterization possibilities, even in mechanically ventilated patients” [21].

Twelve years earlier (1997) intensive care specialist Manfred Muhm et al. said: “We conclude that the supraclavicular route is an easy and safe first approach for large-bore catheters, as well as a useful alternative to traditional puncture sites for precatheterized and anatomically problematic patients” [22]. On the other hand, anatomical variations of the position of the internal jugular vein relative to the carotid artery [23, 24] and the large proportion of cases with hypoplasia of the IJV [25] often make it difficult to use this “gold standard”, even with ultrasound guidance.

In the review of literary data, it is remarkable that supraclavicular approach was discussed more than 20 years ago in articles by Western authors, while in the Eastern literature it has been widely discussed over the last 10–15 years.

Our results show that there is no statistically significant difference in the acute (r = 0.23) and chronic (p > 0.05) complications between the catheters inserted into the internal jugular vein and those introduced in the subclavian vein via supraclavicular approach. The Pearson correlation coefficient at P values of 0.00 to 0.30 indicates that the established dependence is very low positive and can be neglected. Regardless of mathematical credibility, we share T. Vesely’s opinion that the occurrence of arrhythmias depends on the placement of the metal guide and/or the catheter itself, not on the place of its insertion [26]. In relation to the difference in patency of the catheters placed on the left side, we noticed a discrepancy with the data from the C. Renaud et al. study [27], which requires a correct explanation. In our opinion a possible reason is that most people are right-handed so they talk and eat with their heads turned to the right during dialysis sessions, which can cause contamination of the catheter and the area around it.

CONCLUSIONS

We conclude that the supraclavicular approach to the subclavian vein is an easier, safer and practically more convenient method than the cannulation of the IJV. The revisit of this approach demonstrates that it should be used more widely.

LIMITATIONS

The credibility of these results is limited by the fact that we have considered acute and chronic complications only when they have been clinically manifested. Phleograms were performed in only 12 cases after supraclavicular cannulation of the subclavian vein, but we constructed an arteriovenous anastomosis of the homolateral arm in 79 patients with such vascular access, which provided sufficient blood flow (841 ± 123 ml/min).
REFERENCES:


