



SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR ARTERIOVENOUS FISTULA CREATION

Anaesthesiology

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ABSTRACT

Background and Aims: Among the different modalities of anaesthesia, ultrasound-guided brachial plexus block has been reported to achieve better vasodilation and improve operating conditions. The aim of the present study was to study the efficacy of Supraclavicular brachial plexus block for arteriovenous fistula creation.

Methods: This prospective, observational study included 220 patients undergoing AV fistula surgery under isolated supraclavicular brachial plexus block.

The diameters of the vessels both before and after the block, and the patency of the AV fistula in the immediate postoperative period and after 3 months were assessed using ultrasound Doppler.

Results: The mean brachial artery diameter increased by 0.07 mm ($P = 0.001$), and cephalic vein diameter at elbow, radial artery, and cephalic vein at wrist diameters increased by 0.4 mm ($P < 0.002$), 0.07 mm ($P = 0.04$), and 0.36 mm ($P < 0.001$), respectively.

Overall, 91.15% had immediate patency, 89.51% had primary, and 45.19% had functional patency at 3 months.

In the brachiocephalic group, 95.14% had immediate patency, 84.61% had primary, and 21.06% had functional patency at 3 months.

Among the radiocephalic group, 93.15% had immediate patency, 81.51% had primary patency, and 70.30% had functional patency at 3 months.

Conclusion: The current study findings prove that ultrasound-guided brachial plexus block results in good vasodilatation in the distal arm. The functional patency is maintained after 3 months.

KEYWORDS

INTRODUCTION

Percutaneous transluminal angioplasty (PTA) is a well-established treatment for dysfunctional arteriovenous fistulas (AVFs) and arteriovenous grafts (AVGs). [1-3] and improve operating conditions [4] and postoperative fistula functioning. [5]

Standard recommendations have not evolved to guide the choice of anaesthesia in these patients due to a scarcity of studies. The current study was conducted to assess the operative conditions, vascular patency, and complication rate following brachial plexus block in end-stage renal disease (ESRD) patients undergoing AV fistula surgery.

METHOD

This was a prospective observational study conducted in the department of anaesthesia of a hospital in North India. The study population included all adult patients aged above 18 years, of both genders, ASA physical status III, ESRD stage II to IV, and on dialysis who underwent AV fistula surgery under supraclavicular brachial plexus block. All ESRD patients with comorbidities such as diabetes, hypertension, and ischemic heart disease (IHD) were included in the study. Patients who had a history of coagulation disorders, patients who did not have ideal vessels to perform AV fistula surgeries, and patients with a history of failed fistula were excluded from the study.

The diameters of brachial artery, radial artery, and cephalic vein were measured before the block, with the help of ultrasound Doppler. Supraclavicular approach was used for brachial plexus block. GE LOGIQ e (12 Linear probe) (GE medical systems (China) Co. Ltd, Jiangsu, P. R. China) was used for ultrasound guidance. The anaesthetic medication used for the block was Inj. lignocaine 2% with adrenaline (15 ml), combined with 15 ml of bupivacaine (0.5%). Subsequently, sensory and motor blockade of the hand, forearm, and distal arm was monitored. Onset of anaesthesia was assessed using the pin prick method. Onset of motor block was clinically assessed by assessing the motor power. Vasodilatation was noted immediately in the arm and forearm by visual inspection. Heart rate, blood pressure, respiratory rate, and oxygen saturation were monitored with GE multiparameter monitor (GE medical systems (China) Co. Ltd, Jiangsu, P. R. China). After successful block, which was defined as absence of pain on pin prick as well as absence of voluntary movement,

the vessel diameters were measured again using the ultrasound Doppler. After positioning the patient, with strict aseptic precaution, through a transverse incision at the elbow region, brachial artery and cephalic vein were identified looped and controlled. Inj. Heparin 2500 U IV Stat given. Through an arteriotomy wound, end to end anastomosis was done with 7/0 prolene. After attaining of perfect haemostasis wound was closed in layers and dressing done.

Fistula was then palpated for thrill, compressibility, pulsatile/no pulsatile. Graft was then auscultated for the presence of bruit. A continuous low-pitched bruit was considered normal, whereas a high-pitched bruit or whistling sound was considered as an indication of stenosis. The patency of the AV fistula in the immediate postoperative period was also assessed by ultrasound Doppler. A vascular surgeon inspected the graft to check for the presence of any infection, bruising, or hematoma along the incision line, as well as for the presence of dilated veins over the fistula before discharge. During the postoperative follow-up, graft was assessed for maturation and presence of any complications. Complications such as thrombosis, bleeding, infection, stenosis, aneurysm, and failure of maturation were immediately addressed. Patients were advised to perform isometric exercises to improve blood flow and thus to make the vein more prominent. All patients were followed for 3 months to assess the patency of the fistula using ultrasound Doppler.

All quantitative variables were checked for normal distribution using visual inspection of histograms and normality Q-Q plots. The Shapiro-Wilk test P values were also analysed. Descriptive analysis of normally distributed quantitative variables was done by mean and standard deviation. The categorical variables were summarised by frequency and proportion. The mean change in the vessel diameter before and after the block was assessed by independent-sample t -test. P value < 0.05 was considered statistically significant.

The sample size was calculated assuming the expected proportion of 3 months patency of the fistula as 84%, according to the study by Aitken *et al.*, [6] with 5% absolute precision and 95% confidence level.

RESULTS

A total of 220 patients undergoing AV fistula surgery were included in

the final analysis. The demographic profile, distribution of patients, and comorbidities are described in Table 1.

Table 1 Baseline characteristics and type of fistula in study population (n=220)

Parameter	N (%) or mean±SD
Age	67.0±13.0
Male	144 (65.45)
Female	76 (34.54)
Etiology	
DM	63 (28.63)
Hypertension	29 (13.18)
Interstitial nephritis	32 (14.54)
Multiple etiologies	46 (20.90)
Glomerulonephritis	31 (14.09)
Drug and toxin	19 (8.63)
Site of AV fistula	
Bronchiocephalic	156 (70.90)
Radiocephalic	64 (29.09)

The mean brachial artery diameter increased by 0.07 mm ($P = 0.001$), and cephalic vein diameter at elbow, radial artery, and cephalic vein at wrist diameters increased by 0.4 mm ($P < 0.002$), 0.07 mm ($P = 0.04$), and 0.36 mm ($P < 0.001$), respectively. Overall, 91.15% had immediate patency, 89.51% had primary, and 45.19% had functional patency at 3 months.

In the brachiocephalic group, 95.14% had immediate patency, 84.61% had primary, and 21.06% had functional patency at 3 months. Among the radiocephalic group, 93.15% had immediate patency, 81.51% had primary patency, and 70.30% had functional patency at 3 months. Primary patency levels at 3 months were also very high in both the brachiocephalic and radiocephalic groups.

DISCUSSION

This was a prospective observational study conducted in the department of anaesthesia and vascular surgery of a hospital. The study population included all adult patients aged above 18 years, of both genders, ASA physical status III, ESRD stage II to IV, and on dialysis who underwent AV fistula surgery under supraclavicular brachial plexus block. A total of 220 patients undergoing AV fistula surgery were included in the final analysis.

The current study has reported the immediate change in the vessel diameter, blood flow, and postoperative fistula patency at 3-month follow-up in a group of Indian ESRD patients undergoing fistula surgery under brachial plexus block.[7] The regional block, most commonly performed as ultrasound-guided brachial plexus block, has been reported to achieve better vasodilation [2,3] and better postoperative fistula functioning[5] compared to local anaesthesia.[8] In the Present study, we have observed statistically significant increase in vessel diameter both at the elbow and at the wrist immediately following the block. The blood flow also increased significantly in the brachial artery.

Comparing brachial plexus block through axillary approach using 5 ml ropivacaine 1% and 10 ml of saline (0.9% NaCl) and local anaesthesia using lidocaine 2%, the authors have reported considerable venous dilatation and 48.7% decline in pulsatility index (PI) with brachial plexus block when minimal alteration was noted in local anaesthesia group.[9]

Even though the functional patency was very high in the radiocephalic fistulas, but less than one-third of the brachiocephalic functional patency at 3 months. In a study that compared brachial plexus block through supraclavicular approach group [using 1:1 mixture of 0.5% L-bupivacaine and 1.5% lidocaine with epinephrine (1 in 200,000)] with local anaesthesia, 84% of the subjects in the brachial plexus block group showed graft patency at 3 months, but this proportion was only 62% in the local anaesthesia group.[6]

The primary and functional patency rates reported in this study were comparable to the current study, along with the higher functional patency levels of radiocephalic fistulae were in line with current study findings. Another study comparing regional anaesthesia and general anaesthesia could not find any significant differences between both groups regarding early failure of AV fistula (14% in regional

anaesthesia vs 11% in general anaesthesia, $P = 0.80$), and have specified regional anaesthesia have no major advantages over general anaesthesia in terms of fistula functioning. The early graft failure rates of the current study were comparatively higher than those reported by this study.[10] Primary patency levels reported by following regional block by few other studies were approximately 80% and were comparable with the current study findings.[11] Regional anaesthesia by supraclavicular or axillary approaches has been proved to have better vein diameter and postoperative graft patency compared to local anaesthesia or general anaesthesia by few other published studies on the subject.[3,12]

We recommend in future there is a need to conduct large-scale, scientifically designed, randomised controlled trials to enhance the quality of available evidence on the subject.

CONCLUSION

The current study findings prove that ultrasound-guided brachial plexus block results in good vasodilatation in the distal arm, and thereby create optimal operable conditions for AV fistula surgery. In about half of the subjects, the functional patency is maintained after 3 months. The functional patency is considerably better with brachiocephalic fistulas compared to radiocephalic fistulas.

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