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Original Research Article

Comparison of Perineural versus Perifascial Approach to USG Guided Axillary Block for Upper Limb Orthopedic Procedures

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Abstract:

Introduction: Numerous nerve block techniques are available for upper limb procedure. Axillary brachial plexus block is relatively easy to perform. It is used in elbow forearm and arm surgeries. The classic approach is perineural approach wherein the median, ulnar, radial and musculocutaneous nerves are anaesthetized individually. This study concentrates on a newer approach called perifascial approach wherein the drug is deposited along latissmus dorsi and superficial Axillary fascia. This study compares the efficacy of both the block techniques.

Methods: 50 patients who were admitted for upper limb orthopaedic procedures and who had ASA physical status 1 and 2 and were selected according to inclusion and exclusion criteria were divided into group PN to receive perineural approach to Axillary block and group PF to receive perifascial approach to Axillary block. Parameters like time taken for successful block, number of needle passes, hemodynamic parameters, patient satisfaction via VAS, rescue analgesic requirements, post-operative adverse events were observed in both the groups.

Results: It was observed that the perifascial approach was easier to perform, performancetime was comparatively less, reduced incidence of vascular puncture and provides similar analgesia as in perineural approach. Hence it can be considered an alternative to perineural approach for first time users.

Conclusion: It can be thus concluded that the perifascial plane technique is simpler and more time saving than the perineural procedure.

Keywords: Perineural, Perifascial. Axillary Block, Analgesia.

Introduction

With the introduction of newer and safer local anaesthetics,regional anaesthesia has emerged as a better alternative to general anaesthesia. There are many advantages of regional anaesthesia over general anaesthesia, namely effective analgesia with good motor blockade awake patient extended post-operative analgesia and early ambulation. Nerves of the upper extremity can be approached at every anatomic division of the brachial plexus from the nerve roots to the terminal branches. Based on the level along thebrachial plexus where the needle is placed, the various approaches are, interscalene, supraclavicular infra-clavicular and the axillary approach.

The integral part of peripheral nerve blockade is to localize the needle close to the nerve to ensure adequate neural blockade but not so close as to injure the nerve. Initially peripheral nerve blockade was performed based on landmark technique by eliciting paresthesia. This technique had high failure rates and injury to neurovascular structures leading to the invention of peripheral nerve stimulator.

Real-time ultrasound-guided peripheral nerve blockade revolutionized the field of regional anaesthesia by enhanced visualization of the neural target and the surrounding structures, spread of the local anesthetic agent, identification of the anatomical anomalies. Ultrasound improved the quality of blocks and is a safe and better alternative to the conventional methods; It has allowed the anaesthesiologists to practice peripheral nerve blocks with higher success rate and more safety. Axillary brachial plexus block is most effective for surgical procedures distal to theelbow. This block is appropriate for hand and forearm surgery; thus it is often the most appropriate technique for hand surgeries. Ultrasound guided Axillary brachial plexus block involves identifying the individual nerve and depositing 5 to 8 ml of local anesthetic around each nerve. [1] This technique involves expertise in ultrasound orientation and also carries risk of arterial puncture and nerve injuries. Hence a newer perifascial approach is being studied wherein it is easier to perform and the risk of arterial

puncture and nerve injuries are very minimal. This study hence compares the perineural and perifascial approach to ultrasound guided Axillary brachial plexus block for upper limb orthopedic procedures.

Materials and Methodology

This study was done in 50 patients aged 18 to 60 years of either sex, belonging to ASA Physical Status 1, 2 and 3 posted for upper limb surgeries. Patients were assigned with a computer generated random sequence and sealed envelopes in a 1:1 ratio to receive either a perifascial plane or a perineural technique for USG-guided Axillary block. All blocks were performed by two anesthesiologists with full expertise in both techniques. Group 1 received 20ml of Bupivacaine 0.5%, around radial, ulnar, median and musculocutaneous nerve, whereas Group 2 received 20ml of Bupivacaine 0.5% along Latissmus Dorsi and superficial Axillary fascia Patients with known hypersensitivity or contraindications to the study drugs, Infection at the site of block, Patients with severe renal, hepatic, respiratory or cardiac diseases, Patients with severe coagulopathy and pregnant patients were excluded. Detailed pre anesthetic evaluation was done on the evening before the surgery. All the patients were explained about the block procedure and an informed consent was obtained. Esoate My Lab 25 Gold Ultra sonogram Machine model 7340 with high frequency (10 –18 MHz) linear array probe was used. The Ultrasound machine was powered on and the linear array probe was covered with sterile dressing after applying sterile ultrasound gel. The ultrasound setting used to visualize was at a frequency of 18 MHz and a depth of 5 cm.

The "imaging time" as the time necessary to identify injection locations, the "needling time" as ranging from skin puncture to the end of the injection. The "performance time" was the sum of "imaging time" and "needling time." The number of needle passes was also noted. Any occurrence of intravascular needle placement, paresthesia and local anesthetic systemic toxicity signs was recorded Block performance time was recorded by the anesthesia assistant with an electronic stopwatch. Total anesthesia time is the sum of block performance time and the onset time.

The time for first request for analgesia was taken as the duration of the Post-Operative analgesia and the time for the resumption of flexion and extension of wrist joint was taken as the duration of motor blockade. Immediately after the block placements, patients were assessed for sensory onset every minute by pinprick method. Pain was assessed using 10-point visual analogue scale. Sensory assessment was documented based on a pin prick test comparing the pin prick sensation of the contralateral limb. Cases in which general anesthesia is administered due to pain intraoperatively were also included in block failure. Accidental vessel puncture was identified by the appearance of blood in the syringe. Features of local anesthetic toxicity was suspected in patients with symptoms like dizziness, restlessness, anxiety, numbness, blurred vision or tremors. Surgeon satisfaction was assessed by three point score.

The collected data were analysed with SPSS Statistics software 23.0 Version. Continuous variables are presented as the mean [SD] and analyzed using a Mann-Whitney test for independent variables. To find the significant difference between the bivariate samples in Independent groups the unpaired sample t-test was used. To find the significance in categorical data Chi-Square test and Fisher's exact test was used. In all the above statistical tools the probability value of $<0.05$is considered as significant.

Results

The mean age of patients in perineural group was 42.44 with S.D of 11.565. In perifascial group the mean age of patients was 41.04 with S.D of 11.066. The age group p value is 0.664 which is statistically not significant. In perifacial group 10 patients were less than 40 years of age and in perineural group 9 were less than 40 years of age.

The number of male patients in group PF and group PN were 11 and 16 respectively. The number of female patients were 14and 9 in group PF and group PN respectively. The p value of sex distribution was 0.256 which was not significant. The mean weight of the patients in perineural group was 60.4 with the SD of 6.782 and the mean weight in perifascial group was 66.12 with the SD of 8.59. On analyzing the data p value was found to be 0.570 which is not statistically significant.

The mean duration of surgeries was 57 minutes in Group Perifascial with a standard deviation of 7.36 minutes. The mean duration of surgery in group Perineural was 64.6 minutes with the standard deviation of 14.062 Minutes. The 'p' value for duration of surgery is 0.021 which is statistically significant.

It can be seen that 15 patients of ASA 1 and 8 patients of ASA 2 were selected to receive perifascial approach to Axillary block.17 patients of ASA1 and 5 patients of ASA 2 received the perineural approach to Axillary block. 2 patients of ASA3 received perifascial approach whereas 3 patients of ASA3 received perineural approach.

Since, both procedures were regional anesthesia technique, there was stable vitals throughout the (HR, BP, SpO2) procedure. There was a fall in systolic blood pressure 5 minutes after the block was performed and remained stable throughout the procedure. While there was a fall in diastolic blood

pressure 5 minutes after the procedure was performed. The diastolic blood pressure was also comparable between the groups and remained stable throughout the procedure. There was no difference in the pulse rate between two groups and was remained stable throughout the procedure. The saturation was comparable between both the groups and stable throughout the procedure.

Coming to block performance time, the time taken by perifascial approach was 6.48 ± 0.51minutes which significantly decreased when compared to perineural approach where it was 13.36 ± 1.186 minutes, which is statistically significant.

The Mean number of needle passes in perifascial group was 2.48 ±0.51 and was significantly less when compared to perineural group with mean of 4.48±0.51. The mean time of performance of perifascial group was 7.324 minutes and was significantly lower than the perineural group with mean duration of performance of block was around 8.349 minutes. There was no evidence of vascular puncture or neurological deficits between the groups.

Pain during procedure is assessed using the visual analogue scale. It is a validated subjective measure for pain. It is based on self-reported measures of symptoms that are recorded on a 10cm line that represents a continuum between two ends of the scale with no pain on the left end (0cms) and worst pain on the right end of the scale 10 cms. The visual analogue score is comparable between both the groups and not statistically significant.

The mean duration of analgesia is 9.96 hours± 1.904 hours in perifascial group compared to 10.48 hours ±1.584 hours in perineural group which was not statistically significant. One patient required rescue analgesic in the perifascial group. There was no need for rescue analgesia in perineural group as it targets the individual nerves. Similarly 4%of patients needed sedation in perifascial group whereas 5% needed sedation in perineural group. The need for sedation is thus comparable between both the groups

Patient satisfaction is recorded as the patient's reaction consisting of a "cognitive evaluation" and "emotional response" to the anesthetic care they receive. It is formulated as a likert questionnaire and assessed in both the groups. Patient satisfaction was similar in both the groups.

Table1: Comparative results between groups

	Perineural	**Perifacial**
Procedure Performance Time	6.48±0.51	13.36±1.186
Number of Needle Passes	6±1	3±1
Visual AnalogueScale	13.36	6.48
Ease of Performance	8.349	7.324
Imaging Time	23 Sec	11 Sec
Need For ResuceAnalgesia	-	+
Complications	-	-

Discussion

Brachial plexus block has emerged as a better alternative to general anesthesia for upper limb surgeries. It also known as "spinal anesthesia of upper limb". Which avoids unwanted polypharmacy and its adverse effect, laryngoscopy, and intubation? The various approaches to brachial plexus block include interscalene, supraclavicular, infraclavicular and axillary. On account of its easy technique and higher success rate, axillary brachial plexus block is one of the preferred techniques in upper limb procedures.

A study conducted by Lucet C et al [2] compared the Different Learning Curves for Axillary Brachial Plexus Block: Ultrasound Guidance versus Nerve Stimulation. It was concluded that ultrasound permits higher success rates after fewer blocks, especially for residents with no previous training in nerve stimulation.Inadvertent vascular punctures are markedly reduced when using ultrasound guidance, thus, when they do occur they indicate a further need for needle guidance training. The perineural technique anaesthesia radial, median, ulnar and musculocutaneous nerves individually whereas perifascial approach involves drug deposition along latissimus dorsi and superficial axillary fascia it can be seen that the perifascial approach is easier to perform, performancetime is comparatively less, and learning curve is easy, lesser incidence ofvascular puncture and provides similar analgesia as in perineural approach.The analgesia provided is similar in both approaches.to Axillary block the main objective of the study is to compare efficacy of perineural versus perifascial approach to USG guided Axillary block for orthopedic procedures.

In our study all demographic variables like age, sex, BMI, ASA characteristics and site of surgery was comparable between both the groups. The mean age in perineural group is 42.44+/-11.56 and is found comparable to the perifascial group with mean age being 41.04+/- 11.06.The mean weight In perineural group is 60.4+/-6.7 and was comparable to

perifascial group with mean weight being 66.12+/-8.59.

The mean duration of surgery in Group PF is 57+/-7.36 minutes and was comparable to group PF with mean duration of surgery being 64.6+/-14.06. Parameters like ASA characteristics and sex were comparable between both groups. A study by Uday ambi et al [3] and Francisca bernucci et al [4] compared also showed that demographic variables like age, sex, BMI, ASA characteristics were comparable in both perivascular and perineural group.

In this study systolic blood pressure, Diastolic blood pressure, pulse rate and oxygen saturation were measured at baseline, 5min, 10min, 15min, 30min, 45min and hourly thereafter. Since both procedures are regional anesthetic techniques intraoperative vitals were stable throughout.

In our study the block performance time in PN group was 13.36+/-1.186 minutes when compared to 6.48+/- 0.51 minutes in Group PF which is statistically significant. A study by Rania maher Hussain et al [5] compared ultrasound guided Axillary brachial plexus versus supraclavicular block in emergency handsurgery showed the block performance time in supraclavicular group was 6.1+/-2.4 when compared to Axillary block 9.5+/-3.2. This study also showed that Axillary block was associated with longer needling time 477.5 sec when compared to supraclavicular block 292sec which was significantly less.

A study by Nalini et al [6] also compared costoclavicular versus Axillary brachial plexus block showed that the block performance time was less in costoclavicular group 5.3+/-1.9 minutes versus 8.0+/- 3.0minutes in Axillary group). A study by López MS et al [7] comparing Ultrasound-guided axillary vs infraclavicular block for upper extremity surgery also showed reduction in block performance time in infraclavicular group 622+/-139sec versus 789+/-131sec in Axillary group which was statistically significant. Hence newer approaches to Axillary block was developed to reduce the block performance time.

A prospective randomized study conducted by Padmini et al [8] comparing perivascular and perineural ultrasound guided axillarybrachial plexus block for upper limb surgeries showed that Ultrasound-guided perineural technique of axillary block has relatively faster onset of blockade, longer duration of blockade and increased success rates compared to perivascular technique of ultrasound guided brachial plexus block.

A study by Trabelsi walid et al [9] showed the occurrence of Horner's Syndrome following Ultrasound-Guided Infraclavicular Brachial Plexus Block. It also occurs in 100% of the patients with an interscalene block of the brachial plexus and can also occur in patients with other types of supraclavicular blocks. This study showed the Horner's syndrome after performing an ultrasound-guided infraclavicular brachial plexus block with 15 mL of bupivacaine 0.5%.

The mean number of needle passes in perifascial group was 2.48+/-0.51 which was significantly lower compared to 4.48+/- 0.51 in perineural group. A study by Francisca bernucci et al [4] compared perivascular versus perineural ultrasound guided Axillary block showed fewer needle passes in perivascular technique 3.5+/-1.0 versus 8.2+/-2.2 in perifascial group. Imasogie N et al [10] compared of ultrasound-guided axillary brachial plexus blocks using 2 versus 4 injections. It was concluded that the 2-injection technique was slightly faster to administer (8 vs 11 minutes, $P = 0.003$). The mean nerve block score was slightly higher for the 4-injection group but the cumulative percentages of blocks having taken effect were not significantly different among both groups.

The anaesthesiologist found the perifascial approach easy to perform when compared to perineural group which involves good ultrasound knowledge and ultrasound anatomy and relatively good expertise in block performance. A study by Pier francesco et al [11] also showed that number of needle passes and procedural pain was less in perifascial group with same clinical efficacy being achieved.

In our study there was no Incidence of vascular puncture or paresthesia in either of the groups (perineural and perifascial group). A study by Bigeleisen PE et al [12] Nerve puncture and apparent intraneural injection during ultrasound-guided axillary block does notinvariably result in neurologic injury. A study by Gupta K et al [13] showed that despite using the correct technique and latest devices like the ultrasound, while performing the brachial plexus block, one should keep a high index of suspicion of pneumothorax. In our study the probe was positioned perpendicular to the skin at the intersection of the biceps brachii and pectoralis major. Then, with the traceback technique, we identified the area where the latissimus dorsi is isolated, up to the confluence of the latissimus dorsi tendon and teres major muscle. A study by Berthieret et al [14] showed the importance of anatomical knowledge for identifying all structures and also in cases of anatomical variations. Pier francesco et al [11] states that the novel perineural technique has high success rate but long performance time, perivascular technique had faster performance time but high incidence of vascular puncture. Our study did not report any incidence of vascular puncture and nerve injuries the perifascial plane approach has easy learning curve, less incidence of vascular puncture, less incidence of procedure performance time.

Conclusion

It can be thus concluded that the perifascial plane technique is simpler and moretime saving than the perineural procedure. The only limitation is that the perifascial approach was performed by Anaesthetists who were also familiarwith perineural group. Hence ease of perifascial approach could not be assessed efficiently.

References

1. Youssef MS, Desgrand DA. Comparison of two methods of axillary brachial plexus anaesthesia. Br J Anaesth. 1988 Jun; 60(7):841-4.
2. Luyet C, Schüpfer G, Wipfli M, Greif R, Luginbühl M, Eichenberger U. Different Learning Curves for Axillary Brachial Plexus Block: Ultrasound Guidance versus Nerve Stimulation. Anesthesiol Res Pract. 2010; 2010:309462.
3. Ambi U, Bhanupriya P, Hulkund SY, Prakashappa DS. Comparison between perivascular and perineural ultrasound-guided axillary brachial plexus blocks using levobupivacaine: A prospective, randomised clinical study. Indian J Anaesth. 2015; 59:658-63.
4. Bernucci F, Gonzalez AP, Finlayson RJ, Tran DQ. A prospective, randomized comparison between perivascular and perineural ultrasound- guided axillary brachial plexus block. Reg Anesth Pain Med. 2012 Sep- Oct; 37(5):473-7.
5. Rania Maher Hussien Ultrasound Guided Axillary Brachial Plexus Block Versus Supraclavicular Block In Emergency Crushed Hand Patients : A Comparative Study The Open Anesthesia Journal 2018 : 12: 34-41
6. Nalini KB, Bevinaguddaiah Y, Thiyagarajan B, Shivasankar A, Pujari VS. Ultrasound-guided costoclavicular vs. axillary brachial plexus block: A randomized clinical study. J Anaesthesiol Clin Pharmacol. 2021 Oct- Dec; 37(4):655-660.
7. López, Morales S.; Moreno, Martin A.; Morgado, Muñoz I.; Fernandez, Carrión J.M.; Rodriguez, Huertas F. Ultrasound-guided axillary vs infraclavicular block for upper extremity surgery: Preliminary results: 8AP2-9. European Journal of Anaesthesiology. June 2011; 28: 113.
8. Padmini, Sevagamoorthy, Rajaprabhu. A prospective randomized comparison between perivascular and perineural ultrasound-guided axillary brachial plexus block for upper limb surgeries. Indian J Clin Anaesth. 2018; 5(4):512-517.
9. Trabelsi Walid, Belhaj Amor Mondher, Lebbi Mohamed Anis, Ferjani Mustapha, A Case of Horner's Syndrome following Ultrasound-Guided Infraclavicular Brachial Plexus Block, Case Reports in Anesthesiology, vol. 2012, Article ID 125346, 3 pages, 2012.
10. Imasogie N, Ganapathy S, Singh S, Armstrong K, Armstrong P. Aprospective, randomized, double-blind comparison of ultrasound-guided axillary brachial plexus blocks using 2 versus 4 injections. Anesth Analg. 2010 Apr 1; 110(4):1222-6.
11. Fusco P, Scimia P. the paradox of the axillary block: from Hirschel's approach towards new future perspectives. Minerva anestesiol 2020;86:1-3
12. Bigeleisen PE. Nerve puncture and apparent intraneural injection during ultrasound-guided axillary block does not invariably result in neurologic injury. Anesthesiology. 2006 Oct; 105(4):779-83.
13. Gupta K, Bhandari S, Singhal D, Bhatia PS. Pneumothorax following ultrasound guided supraclavicular brachial plexus block. J Anaesthesiol Clin Pharmacol. 2012 Oct; 28(4):543-4.
14. Berthier F, Lepage D, Henry Y, Vuillier F, Christophe JL, Boillot A, Samain E, Tatu L. Anatomical basis for ultrasound-guided regional anaesthesia at the junction of the axilla and the upper arm. Surg Radiol Anat. 2010 Mar; 32(3):299-304.