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Original Research Article

A Prospective Study on Outcome of Clavicle Fracture Osteosynthesis Done Under Clavipectoral Fascial Plane Block

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Abstract

Background: Surgical management of clavicle fractures conventionally requires general anesthesia, which carries inherent risks and potential complications. The clavipectoral fascial plane block (CPB) has emerged as an alternative regional anesthetic technique for clavicle fracture osteosynthesis. This study evaluates the efficacy and safety of CPB in providing adequate anesthesia for clavicle fracture surgery.

Aim: To assess the therapeutic efficacy and safety of CPB in delivering surgical anesthesia for clavicle fracture osteosynthesis procedures.

Materials and Methods: This prospective cohort study was conducted at DR S.N.Medical College and attached Hospitals, enrolling 40 patients undergoing clavicle fracture osteosynthesis. Sociodemographic data, fracture classification, surgical procedure details, intraoperative parameters, fentanyl requirements, need for conversion to general anesthesia, rescue analgesia demands, clinical outcomes (NRS, Quick DASH, Constant Murley scores), radiological outcomes, complications, and patient satisfaction were evaluated.

Results: The mean age of participants was 38.25 years, with male predominance (80%). Fracture types included Allman type I (32.5%) and type II (67.5%). Most patients (57.5%) underwent open reduction and internal fixation with plating. Intraoperatively, 90% maintained stable vital signs without significant blood pressure or pulse rate changes. Similarly, 90% did not require fentanyl or conversion to general anesthesia. Postoperatively, 70% did not require rescue analgesia. Clinical outcomes improved significantly over 12 weeks: NRS pain scores decreased, Quick DASH functional scores improved, and Constant Murley shoulder scores increased. Radiological assessment confirmed callus formation and fracture union in all patients by 12 weeks. Most participants (72.5%) experienced no complications, with high levels of patient satisfaction reported.

Conclusion: CPB is an effective and safe alternative to general anesthesia for clavicle fracture osteosynthesis. It provides stable intraoperative conditions, effective postoperative analgesia, facilitates fracture healing, improves functional outcomes, and results in high patient satisfaction. Incorporating CPB into clinical practice may optimize perioperative management and enhance patient outcomes.

Keywords: Clavipectoral fascial plane block, CPB, clavicle fracture, osteosynthesis, regional anesthesia, pain management, functional outcomes, patient satisfaction.

Introduction

Clavicular fractures are commonly encountered injuries in the general population, accounting for approximately 2.6–4% of all adult skeletal fractures, with a marked predominance in young males under 25 years of age. Male incidence has been reported to reach approximately 70% [1–2]. The clavicle is particularly susceptible to injury due to its subcutaneous position, thin midshaft morphology, and the biomechanical forces transmitted across it. The most frequent mechanism of injury involves falls onto an outstretched hand. Midshaft fractures constitute the most common clavicle fracture pattern (69–82%), followed by lateral-end fractures (12–26%), with medial-end fractures being the least frequent (5%) [2]. Overall, clavicular fractures represent approximately 30–40% of all shoulder girdle injuries [3]. While non-operative management, such as figure-of-eight bandaging, may suffice in select cases, displaced midshaft fractures managed conservatively are

associated with higher rates of nonunion and functional deficits. Operative management is indicated in cases of nonunion, malunion, imminent or established neurovascular compromise, gross fragment displacement, floating shoulder, or risk of skin perforation. Surgical fixation in such cases promotes pain relief, early shoulder mobilization, and restoration of shoulder biomechanics, particularly in the presence of associated scapular fractures [4–5].

Clavicle osteosynthesis can be performed under regional anesthesia (RA) with or without general anesthesia (GA). The clavipectoral fascial plane block (CPB) is a widely employed RA technique that provides effective intraoperative anesthesia and postoperative analgesia. CPB involves infiltration of local anesthetic beneath the clavipectoral fascia. Sensory innervation to the overlying skin of the clavicle, shoulder, and upper chest is provided by the supraclavicular nerve of the superficial cervical plexus, which may be blocked in conjunction with CPB for optimal analgesia. This technique avoids potential complications associated with interscalene blocks, such as ipsilateral phrenic nerve palsy, vocal cord paralysis, vertebral artery injection, total spinal anesthesia, and pneumothorax [6].

The objective of this study is to prospectively evaluate the efficacy of CPB for intraoperative and postoperative pain management in patients undergoing clavicle fracture osteosynthesis, while also assessing radiological union and functional outcomes in this patient population.

Materials and Methods

This prospective study was conducted in the Department of Orthopaedics, DR S.N.Medical College and attached Hospitals, from February 2023 to October 2023. Patients scheduled for clavicle osteosynthesis who met predefined eligibility criteria were enrolled.

Inclusion Criteria: Participants were eligible if they had:

- Displaced clavicle fractures within two weeks of injury.
- Displacement exceeding 2 cm or shortening >2 cm.
- Comminuted fractures with more than three fragments or segmental fracture patterns.
- Age between 19 and 65 years.
- Failure to maintain fracture reduction through conservative management.
- Stable polytrauma status.
- Fractures classified as OTA 15.1A through 15.3C.

Exclusion Criteria: Patients were excluded if they had:

- Refusal of surgery or regional blockade.
- Allergies to local anesthetics.
- Coagulopathies or injection site infections.
- Compound fractures or associated neurovascular injuries.
- Opioid dependence.
- Body weight <50 kg.
- Head injuries or additional injuries requiring alternative anesthesia.

Ethical approval was obtained from the Institutional Ethical Committee. Written informed consent was obtained from all participants, followed by comprehensive clinical evaluation.

Clavipectoral Fascial Plane Block (CPB) Technique: Patients were positioned supine with a towel beneath the scapula. Standard monitoring (non-invasive blood pressure, ECG, pulse oximetry) was applied. Intravenous access was established with a 20 G cannula, and sedation was maintained with propofol to achieve a Ramsay Sedation Score (RSS) of 3–4. CPB was performed under ultrasound guidance, infiltrating 30 ml of 0.25% bupivacaine at three points along the fracture line. Sensory blockade was confirmed prior to incision; additional local infiltration with lignocaine was administered if required.

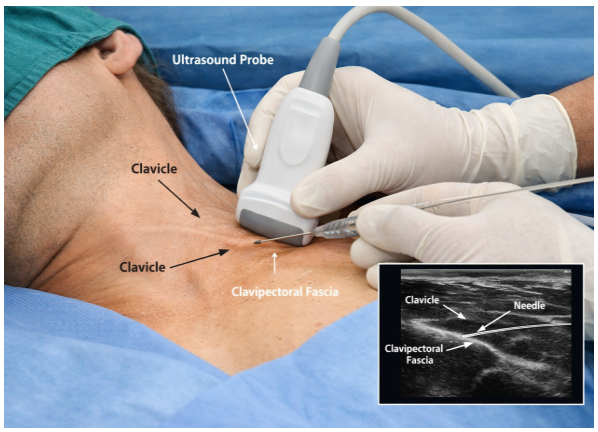

Figure 1:

Clavipectoral Fascial Plane Block (CPB) Technique: Blind Technique: The clavipectoral fascial plane block was performed using a landmark-based (blind) technique under aseptic precautions. Patients were positioned supine with the head turned to the contralateral side. The clavicle was palpated, and the injection point was identified along the inferior border at the fracture or surgical site. After skin infiltration, a 22-gauge needle was inserted perpendicular to the skin until contact with the inferior surface of the clavicle was achieved, then withdrawn slightly to enter the clavipectoral fascial plane. Following negative aspiration, the local anesthetic was injected incrementally.

Additional injections were administered medially and laterally as required. Block adequacy was assessed clinically prior to incision.

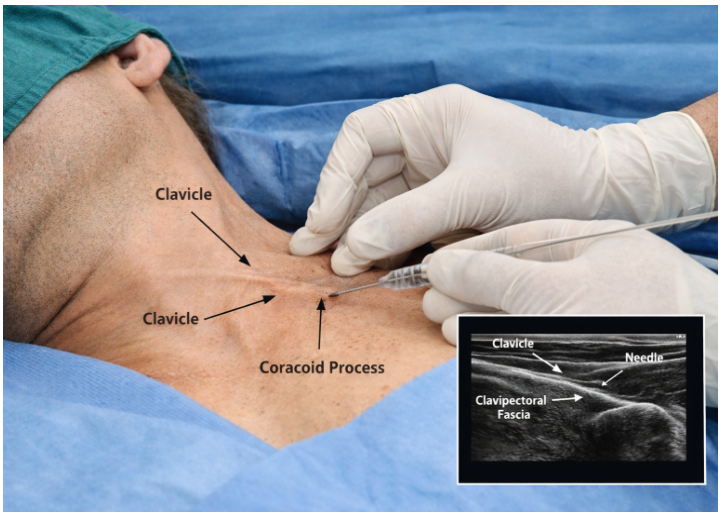

Figure 2:

Plate and Screw Fixation Technique: After sterile preparation and draping, a 7–9 cm incision was made along the anterior clavicle to expose the fracture site. An appropriate plate (locking compression or reconstruction plate) was positioned on the superior clavicle and secured using 2.7 mm locking screws and 3.5 mm cortical screws. Layered wound closure was performed with meticulous hemostasis. Surgical duration was recorded from anesthesia initiation to completion of closure.

Intraoperative Monitoring: Heart rate and systolic blood pressure were continuously monitored. Fentanyl was administered if vital parameters increased >20% from baseline. General anesthesia was available as a backup.

Postoperative Management: Patients were monitored in the post-anesthetic care unit (PACU), with pain assessed using the Numerical Rating Scale (NRS). Postoperative analgesia included oral paracetamol, with supplemental tramadol as required. Patients remained NPO for 4 hours postoperatively, followed by intravenous fluids and antibiotics. Elbow mobilization began on postoperative day one, with gradual shoulder rehabilitation over six weeks. Follow-up radiographs were obtained immediately postoperatively and at regular intervals to assess fracture alignment and consolidation.

Data Collection and Outcomes: Data collected included intraoperative fentanyl use, hemodynamic changes, NRS pain scores, postoperative analgesia requirements, complications, and functional outcomes. Functional assessments were performed using the Quick DASH score, Constant-Murley score, and NRS at 2, 6, and 12 weeks postoperatively. Radiological outcomes were evaluated for fracture union and callus formation.

Statistical Analysis: Data were recorded in MS Excel and analyzed using SPSS version 23. Normality was assessed using the Shapiro-Wilk test. Categorical variables were analyzed with Chi-square or Fisher's exact tests. Continuous variables were compared using independent t-tests or ANOVA; non-normal distributions were assessed using the Wilcoxon Mann-Whitney U test. A p-value <0.05 was considered statistically significant.

Results

The study included 40 participants with a mean age of 38.25 years. The majority were male (80%). Fracture patterns comprised Allman Type II (67.5%) and Type I (32.5%). Surgical approaches included open reduction with plating in 57.5% of cases, hook plating in 22.5%, and interfragmentary lag screw fixation in 20% (Table 1).

Intraoperative Parameters: Mean intraoperative systolic blood pressure (SBP) was 123.15 mmHg,

diastolic blood pressure (DBP) 74.25 mmHg, and average pulse rate 85.3 beats per minute. Intraoperative movements averaged 9.15. Ten percent of participants experienced ≥20% elevation in SBP or pulse rate.

Similarly, 10% required intraoperative fentanyl, conversion to general anesthesia, or additional rescue analgesia (Table 2).

Pain and Functional Outcomes: Significant improvements were observed in all clinical outcome measures over 12 weeks. NRS pain scores decreased progressively from postoperative day (POD)-0 through 12 weeks. Quick DASH scores showed substantial improvement, reflecting enhanced upper limb function, while Constant-Murley shoulder scores demonstrated significant functional recovery ($p < 0.05$ for all comparisons) (Table 3).

Radiological Outcomes: At 6 weeks, 57.5% of participants showed fracture reduction without visible callus, whereas 40% demonstrated early callus formation. By 12 weeks, all participants exhibited radiological evidence of callus development and fracture consolidation.

Complications: The majority of participants (72.5%) experienced no complications. Conversion to general anesthesia occurred in 10% of cases. Other complications included infection (7.5%), painful shoulder (7.5%), and paraesthesia (2.5%) (Table 4).

Patient Satisfaction: High patient satisfaction was reported, with 75% of participants rating their experience at level 4, and 12.5% at the highest level of 5. Only 12.5% rated satisfaction at lower levels, indicating generally positive perceptions of the procedure and outcomes (Table 5).

Table 1: Demographics and Clinical Characteristics

Variable	Mean (SD)	Frequency (%)
Age (years)	38.25 (10.42)	-
Gender		
Female	-	8 (20.0%)
Male	-	32 (80.0%)
Diagnosis		
Allman Type I	-	13 (32.5%)
Allman Type II	-	27 (67.5%)
Procedure		
Open reduction with plating	-	23 (57.5%)
Open reduction with hook plating	-	9 (22.5%)
Plating with interfragmentary lag screw	-	8 (20.0%)

Table 2: Intraoperative Vitals and Measures

Variable	Mean (SD)	Frequency (%)
Systolic Blood Pressure (SBP, mmHg)	123.15 (10.28)	-
Diastolic Blood Pressure (DBP, mmHg)	74.25 (6.73)	-
Pulse Rate (per minute)	85.3 (8.42)	-
Intraoperative Movements	9.15 (3.78)	-
Increase in BP ≥20%	-	4 (10.0%)
Increase in PR ≥20%	-	4 (10.0%)
Fentanyl Requirement	-	4 (10.0%)
Conversion to GA	-	4 (10.0%)
Rescue Analgesia Requirement	-	12 (30.0%)

Table 3: Postoperative Pain, Functional, and Radiological Outcomes

Time Interval	NRS Score Mean (SD)	Quick DASH Mean (SD)	Constant Murley Score Mean (SD)
POD-0	3.48 (1.65)	-	-
2 Weeks	2.03 (0.89)	20.15 (9.87)	76.25 (8.36)
6 Weeks	1.45 (0.61)	13.18 (8.82)	83.42 (7.58)
12 Weeks	1.21 (0.49)	7.12 (6.95)	89.58 (5.87)
p-value (ANOVA)	<0.0001	<0.0001	<0.0001

Table 4: Radiological and Complication Outcomes

Outcome	Frequency (%)
Radiological Outcome (6 Weeks)	
Fracture reduction, no callus	23 (57.5%)
Fracture reduction with callus formation	16 (40.0%)
No reduction, no callus	1 (2.5%)
Radiological Outcome (12 Weeks)	
Callus developed, fracture uniting	40 (100.0%)
Complications	
No complications	29 (72.5%)
Conversion to GA	4 (10.0%)
Infection	3 (7.5%)
Painful shoulder	3 (7.5%)
Paraesthesia	1 (2.5%)

Table 5: Patient Satisfaction

Satisfaction Level	Frequency (%)
Level 2	1 (2.5%)
Level 3	4 (10.0%)
Level 4	30 (75.0%)
Level 5	5 (12.5%)

Discussion

This study evaluated the efficacy and safety of the clavipectoral fascial plane block (CPB) for clavicle fracture osteosynthesis, with findings that are consistent with and expand upon existing literature. The demographic profile of our cohort, with a mean age of 38.25 years and male predominance (80%), aligns with previous studies. Yan et al.'s meta-analysis of 3,094 patients reported a comparable mean age of 36.7 years [7], while Robinson's epidemiological study confirmed higher incidence in males, largely attributable to increased participation in high-risk activities [8].

The predominance of Allman type II fractures (67.5%) over type I (32.5%) is consistent with prior findings that diaphyseal fractures occur more frequently and are associated with higher complication risks. This underscores the importance of appropriate surgical strategies for managing more complex type II fractures.

In terms of surgical technique, our study employed open reduction with plating (57.5%), hook plating (22.5%), and combined plating with interfragmentary screws (20%), consistent with literature supporting the biomechanical and functional advantages of plate fixation. Zhang et al.'s meta-analysis demonstrated significant functional benefits of plate fixation compared with conservative management [9].

The effectiveness of CPB in our study is evidenced by stable intraoperative hemodynamics in 90% of cases and limited supplemental fentanyl requirements (10%). These results compare favorably with alternative regional anesthetic techniques. Rosales and Aypa [10] reported excellent anesthesia with CPB lasting up to 16 hours. Our 10% conversion rate to general anesthesia falls within acceptable limits reported for upper limb regional anesthesia. Functional outcomes improved progressively over 12 weeks, with Quick DASH scores decreasing from 20.15 to 7.12 and Constant-Murley scores increasing from 76.25 to 89.58. These findings parallel those of Kukreja et al. [11], who reported similar functional improvements following surgical fixation under regional anesthesia. The slightly superior early functional recovery in our cohort may be attributed to effective pain management provided by CPB.

Radiological outcomes demonstrated 100% fracture union at 12 weeks, comparing favorably with previously reported union rates of 92–97% in surgically managed clavicle fractures [9]. The high union rate in our study may reflect the combination of stable fixation and effective pain control, enabling early mobilization.

The overall complication rate was 27.5%, consistent with published literature. Asadollahi et al. [12] reported complication rates of 24–36% in clavicle fracture surgery. Notably, most complications in our study were minor and self-limiting, with infection occurring in 7.5%, similar to previously reported rates of 4.4–7.8%. Patient satisfaction was high, with 87.5% reporting elevated satisfaction, exceeding satisfaction rates of 75–80% reported in studies using traditional anesthetic approaches [13]. This likely reflects the combined benefits of effective intraoperative analgesia, stable hemodynamics, and early functional recovery facilitated by CPB. The need for rescue analgesia in 30% of cases highlights opportunities for technique refinement. Recent

studies have explored adjuvants and modified CPB techniques to prolong analgesia, reporting lower rescue analgesia requirements of 15–20% [9,12]. These findings suggest potential avenues for improving postoperative pain control and optimizing CPB outcomes.

Conclusion

This study demonstrates that clavipectoral fascial plane block (CPB) is an effective and safe anesthetic technique for midshaft clavicle fracture management with open reduction and internal fixation.

CPB facilitated successful fracture consolidation by 12 weeks, provided effective intraoperative anesthesia, and ensured adequate postoperative analgesia, as evidenced by progressively decreasing Numeric Rating Scale (NRS) scores.

Functional outcomes, assessed by Quick DASH and Constant-Murley scores, showed significant improvements, reflecting enhanced upper extremity function and shoulder-specific recovery. The technique also ensured stable intraoperative conditions, minimal need for conversion to general anesthesia or rescue analgesia, and high patient satisfaction.

These findings support the integration of CPB into clinical practice as a patient-centered approach that optimizes perioperative management and improves overall outcomes in clavicle fracture surgery.

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