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Original Research Article

A Retrospective Observational Study to Compare Surgical and Non-surgical Treatment of Lateral Clavicle Fractures

Gopabandhu Patra[1], Sidhartha Nayak[2], Sambit Ku Panda[3], Rabi Narayan Dhar[4], Prabhat Kusum Mohapatra[5]

[1]Assistant Professor, Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India

[2]Assistant Professor, Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India

[3]Associate Professor, Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India

[4]Professor, Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India

[5]Senior Resident, Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India

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Corresponding author: Dr. Sambit Kumar Panda

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Abstract

Background: As per Craig's (1990) modified Neer classification system, lateral clavicle fractures accounts for approximately 30% of all clavicle factures. The physical examination of the lateral clavicle injury involves identification of pain, deformity, vascular, neurological, and respiratory as well as mediastinal contents. In addition to this, the radiographic assessment for the injury involves X-rays, CT scan, EMG, and nerve condition studies. The surgical treatment approaches are used for the type 2 lateral clavicle fracture that have higher rate of non-union compared to type 1 and 3. The surgical treatment process involves open reduction internal fixation (ORIF) with plate and screws.

Aim: To compare surgical and nonsurgical treatment of lateral clavicle fractures on the basis of functional outcomes and compare patient-reported outcome measures (PROMs).

Method: All clavicle fractures in patients older than 15 years, treated at Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India, between April 2018 and March 2020 were evaluated for fracture location (n = 593). All 150 lateral clavicle fractures were further reviewed for inclusion. 25 lateral clavicle factures were excluded after which 125 lateral clavicle fractures remained. The surgical procedure was performed under general anaesthesia in the beach chair position with image intensifier control, as a day case. The skin was typically incised horizontally, after administration of antibiotic prophylaxis

Results: A total of 26 patients got surgical treatment and 99 underwent non-surgical treatment. As per results, 24 patients from surgical treatment group had type 2 or 5 injury due to fall and transportation accident. Similarly, 40 patients from nonsurgical group had type 2 or 5 facture. Dash score showed more disability among the surgical group as compared to non-surgical group. Further, results of the PROM subgroup show patients treated surgically had poor constant score with infraclavicular sensory deficits, and thus were less satisfied with the cosmetic results as compared to the patients treated non-surgically.

Conclusion: From the study it can be concluded that many patients from surgical group had to reoperated whereas few patients from the non-surgical group had to went for delayed surgery. It suggests that patient with surgical patients with lateral clavicle fractures should prefer non-surgical treatment over surgical treatment.

Keywords: Lateral Clavicle Fracture; Neer; Treatment; Surgery; Complications

Background

There are various injuries that affect the physical and mental health of the people and influence the functions of the body. To manage these injuries and for better recovery, different types of surgical and non-surgical treatment approaches are used according to the condition of the patients[1]. Clavicle fractures are one of the most common injuries that account for 8-15% of all fractures in children and adults. This kind of injury is caused by the direct trauma, fall on the shoulder, or fall onto an outstretched arm. This type of injury occurs at three different locations. Firstly, at mid-shaft clavicle fracture,[2] which accounts for 85% of all clavicle fracture. Second is lateral clavicle fracture that involves 10-15% cases. Third is medial clavicle fractures which are rare and occur in <5% cases[3]. As per Craig's (1990)[4,5] modified Neer classification system, lateral clavicle fractures accounts for approximately 30% of all clavicle factures[6].

The lateral clavicle fracture may present similar to AC joint separation injuries that have a superior displacement of the proximal fragment. The extent of deformity depends on the amount of displacement at the fracture site. In this case, it is important to examine the entire affected extremity and assessment of the neurovascular status of the limb and look for the associated injuries[7]. The physical examination of the lateral clavicle injury involves identification of pain, deformity, vascular, neurological, and respiratory as well as mediastinal contents. In addition to this, the radiographic assessment of the injury includes X-rays, CT scan and EMG nerve condition studies[8].

The treatment of lateral clavicle injury is done using surgical and non-surgical approaches. The care professionals select the method of treatment based on the condition of the individual, age, functional demand, and type of lesion. The clavicle is first bone in the human body to begin inframembranous ossification from mesenchyme during the fifth week of fetal life[9]. The non-surgical treatment option is chosen for the patients who have higher risk of surgical complications such as high sugar, smokers, and drug users. The patients with minimal symptoms are considered for non-surgical treatment process for better recovery of lateral clavicle fracture. On the other hand, the surgical treatment approaches are used for the type 2 lateral clavicle fracture that have higher rate of non-union compared to type 1 and 3[10]. The surgical treatment process involves open reduction internal fixation (ORIF) with plate and screws. Apart from this, hook plats and pre-contoured lateral clavicle plats are also used for treating patients. These hook plats are needed for the later removal after the fracture healing[11].

Till date, limited work has been performed on comparing functional and patient-reported outcome measures (PROMs) between surgical and non-surgical treatment of lateral clavicle fractures. Thus, this work is an attempt to determine which treatment approach gets an over the other for treating lateral clavicle fractures, and whether non-surgical treatment can be a better alternative for treating lateral clavicle fractures to avoid unnecessary surgery.

Aim

To compare surgical and nonsurgical treatment of lateral clavicle fractures on the basis of functional outcomes and compare patient-reported outcome measures (PROMs).

Method and Material

All clavicle fractures in patients older than 15 years, treated at Department of Orthopaedics, B.B Medical College, Bolangir, Odisha, India, between April 2018 and March 2020 were evaluated for fracture location (n = 593). All 150 lateral clavicle fractures were further reviewed for inclusion. 25 lateral clavicle fractures were excluded after which 125 lateral clavicle fractures were considered for the study. All study patients were assessed by reviewing patient records and anteroposterior and 45 degrees tilted cephalic radiographic images, at a minimum of 6 months after the injury. Patient records were examined for epidemiology and baseline characteristics, fracture classification according to treatment, complications in the form of infections, late skin penetrations or subsequent peri-implant fractures, as well as reoperations and polytrauma. Non-unions were classified as fractures with a lack of bone bridging if seen in the outpatient clinic ≥3 months postinjury, which was the limit used by the operating surgeon in each case of diagnosed non-union or as an unexpected finding after plate removal. At the follow-up, Constant score[12], Disabilities of the Arm, Shoulder and Hand (DASH) score[13], and Visual Analog Scale[14] was recorded through questionnaire-based interview to determine the satisfaction with the cosmetic results and presence of any sensory deficits. Only 12 patients from surgical group and 20 patients from non-surgical group accepted the invitation of follow-up.

Treatment methods

The surgical procedure was performed under general anaesthesia in the beach chair position with image intensifier control, as a day case. The skin was typically incised horizontally; after administration of antibiotic prophylaxis (cloxacillin 2 g, singular or double dose), the fracture was reduced and secured with one of 3 implants (an anatomical lateral clavicle plate with or without supplementary fixation to the coracoid process or a hook plate) chosen by the operating orthopaedic surgeon based on the surgeon's preference and the fracture pattern. Postoperatively, active assisted range of motion below shoulder level with <1 kg of load was allowed during the first 6 weeks after surgery and a sling was used for comfort. Follow-up, comprising radiographic and clinical assessment, typically occurred 6–8 weeks after treatment.

Nonsurgical treatment consisted of a sling for comfort and free movement as tolerated. When fracture stability was questionable, clinical and radiographic follow-up was performed after 7–10 days. If further displacement had not occurred, nonsurgical treatment was continued without further follow-up.

Statistical method

Data was summarized by treatment groups using means, medians, first and third quartiles, confidence intervals, and SDs, where applicable. The Wilcoxon rank-sum test was used to compare means and medians of nonnormally distributed data. The χ^2 test was used to examine differences between categorial variables.

Results

Table 1: Demographic of study population

Characteristics	Surgical treatment	Non-surgical treatment
Patients	26	99
Mean age	42 (SD = 17.25)	60 (SD = 23.65)
Sex		
Male	12	57

Female	14	42
Injury type		
Fall	3	58
Transport accident	**19**	**24**
Bicycle	11	21
Motorcycle	4	1
Car	3	0
Horse riding	1	2
Sports injury	1	2
Other	0	4
Concurrent fracture	3	11
Side		
Left	15	50
Right	11	49
Open fracture	0	0
Fracture type		
1	1	57
2	**17**	**29**
2A	11	14
2B	6	15
3	1	2
5	7	11

Table 1 provides information related to 26 patients who underwent surgical treatment and 99 patients who underwent non-surgical treatment. There were 12 males and 14 females in surgical treatment and 57 males and 42 females in nonsurgical treatment. Further, 19 patients for surgical and 24 patients for nonsurgical treatment had injuries caused by transportation accidents.

Table 2: Demographics of Neer Type II and V Fractures

Characteristics	**Surgical**	**Non-surgical**
Patients	24	40
Mean age	42 (SD = 17.65)	63 (SD = 19.28)
Sex		
Male	12	23
Female	12	17
Injury type		
Fall	3	20
Transport accident	**20**	**16**
Bicycle	11	13
Motorcycle	4	1
Car	3	0
Horse riding	2	2
Other	0	3
Sports injury	1	1

Table 2 represents demographics of type 2 and 5 level lateral clavicle injury patents. According to analysis, 24 patients from surgical treatment group had type 2 or 5 injury due to fall, transportation accident and sports injury. Similarly, 40 patients from nonsurgical group had type 2 or 5 facture. The classification of group involves 12 males and 12 females in surgical group and 23 males and 17 females in nonsurgical group.

Table 3: Initially Surgically Treated Fractures by Fracture Classification Including Surgical Method

Classification	Total, n (%)	Anatomical lateral clavicle plate	Plate and suture anchor	Hook plate
1	1 (3.8)	1	0	0
2 2A 2B	**17 (65.3)** 11 (64.70) 6 (35.29)	**10** 8 2	**4** 2 2	**3** 1 2
3	1 (3.8)	1	0	0
5	7 (26.9)	2	2	3
Total	**26**	**14**	**6**	**6**

Table 3 shows classification of the surgical treatment patients who has received different surgical processes for recovery. There were 26 such patients, out of which 14 were treated with Anatomical lateral clavicle plate, 6 with Plate and suture anchor, and 6 with Hook plate.

Table 4: Complications and Reoperations in Initially Surgically and Non-surgically Treated Patients

Outcome	Surgical treatment (n=26)	Outcome	Non-surgical treatment (n=99)
Implant failure	3	Malunions	4
Non-union	1	Non-union	3
Reoperations	6	Delayed surgery	3
Other complications	0	Other complications	0

Table 4 shows outcome of both treatment groups using the distinct classification. According to analysis, out of 26 patients from surgical treatment group, 3 patients had complications related to implant failure, 1 patient had Non-union complication, and 6 patients had to be Reoperated. On the other hand, out of 99 patients from nonsurgical group, it has found that 4 patients had issues related to Malunions, 3 patients had Non-union, and 3 patients had to undergo Delayed surgery

Table 5: Functional and Patient-Reported Outcome Measures in Patients with Neer Type II and V Lateral Clavicle Fractures in the Subgroup of Patients on follow-up

Outcome	Surgical treatment (N=11)	Nonsurgical treatment (N=9)	P-value
DASH score, mean (SD)	8.4 (9.4)	1.6 (2.2)	0.27
Constant score, mean (SD)	82 (13.8)	96 (5.4)	0.01
Persistent infraclavicular sensory deficit	6	0	0.08
VAS cosmetic satisfaction	5.9 (3.0-8.4)	9.4 (8.8-9.8)	0.05

Only 12 patients from surgical group and 20 patients from non-surgical group accepted the invitation of follow-up. As per the analysis, one of these 12 patients was the only patient in the study who had received surgical treatment for a Neer type I fracture. The other 11 had fracture types IIA (n = 4), IIB (n = 3), or V (n = 4). Of the 20 non-surgically treated patients, 10 had type I fractures and 1 had a type III fracture, whereas the remaining 9 had type IIA (n = 3), IIB (n = 3), or V (n = 3) fractures. There was no significant difference in DASH score between the groups. However, Constant score of non-surgically treated patients was significantly better as compared to surgically treated patients. Also, many patients from surgical group experienced Persistent infraclavicular sensory deficit and were also not satisfied with the cosmetic results.

Discussion

Main findings and demographics

The lateral clavicle fracture may present similar to AC joint separation injuries that have a superior displacement of the proximal fragment. In addition to this, the extent of deformity depends on the amount of displacement at the fracture site. In this case, it is important to examine the entire affected extremity and assessment of the neurovascular status of the limb and look for the associated injuries[15].

The non-surgical treatment option is chosen for the patients who had higher risk of surgical complications such as high sugar, smokers, and drug users. Whereas patients with minimal symptoms were considered for non-surgical treatment for the better recovery of the lateral clavicle fracture. The surgical treatment approaches were used for type 2 lateral clavicle fracture that have higher rate of non-union compared to type 1 and 3. The study had considered total 125 patients divided in two groups, surgical and nonsurgical treatment. There were 12 males and 14 females in surgical treatment and 57 males and 42 females in nonsurgical treatment. Further, in this study, many of the injuries were due to transportation accidents; 19 patients form surgical and 24patients form nonsurgical treatment group[11].

Initial treatment

Further, study shows that 24 patients from surgical treatment group had type 2 and 5 injury due to fall and transportation accident. Similarly, 40 patients from nonsurgical group had type 2 and 5 facture. As per the study of Kuner et al., (2019)[16], the only type I fracture that was treated surgically had a large posterior translation causing a subluxation of the AC-joint. Our rate of initial surgical treatment of Neer type II fractures of 65% and Neer type V of 27% was low compared with a rate close to 100%[17,18,19].

Reoperation and delayed surgery

According to outcome of current study, out of 26 patients from surgical treatment group

3 patients had complications related to implant failure, 1 had Non-union, and 6 had to Reoperated. On the other hand, out of 99 patients from nonsurgical group, 4 patients had issues related to Malunions, 3 patients had Non-union, and 3 patients had the Delayed surgery. In the study by Wiesel et al., (2018)[20] on Neer type II lateral clavicle fractures, 22 fractures were treated with hook plates, 16 fractures with superior locking plates with suture augmentation. There was 1 non-union in each of the 2 treatment modalities[21,22,23]. Because of the absence of late routine follow-up, we could not assess the malunion frequency [24,25,26].

Measures of PROM subgroup

According to analysis, the nonsurgical treated patients with Neer type 2 and 5 fracture has the better constant score compare to initially surgical treated patients. The analysis has shown the differences in constant score between surgical and nonsurgical treated patients but there was no significant difference in the DASH score between the groups. In addition to this,[27] of the 20 non-surgically treated patients, 10 had type I fractures and 1 had a type III fracture, whereas the remaining 9 had type IIA (n = 3), IIB (n = 3), or V (n = 3) fractures. The study of Li et al., (2019) has found that clavicle fracture is largely reported in the patients as per the outcome 19% to 55% patients were treated with surgical approach for better recovery[1,2].

Conclusion

From the study outcome and analysis, it can be concluded that surgical patients with Neer type 2 and 5 fracture had worse constant scores and complained of infraclavicular sensory deficits and less satisfied with the cosmetic results compare to nonsurgical treatment patients. Dash score showed more disability among the surgical group as compared to non-surgical group. Further, results of the PROM subgroup show patients treated surgically had poor constant score with infraclavicular sensory deficits, and thus were less satisfied with the cosmetic results as compared to the patients treated non-surgically. Thus, the study concludes that nonsurgical treatment of Neer type 2 and 5 fracture can be a better alternative of the surgical approach for better recovery.

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