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ORIGINAL ARTICLE

# OUTCOME OF ANATOMIC ACROMIO-CLAVICULAR JOINT (ACCR) RECONSTRUCTION WITH ANTERIOR HALF PERONEUS LONGUS AUTOGRAFT (AHPLT) AND SUTURE TAP AUGMENTATION FOR TRAUMATIC ACJ DISLOCATION IN ADULT PATIENTS

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## ABSTRACT

**Background**: Acromioclavicular joint (ACJ) dislocations are usually occurred in athletes or person with shoulder injury. Objective of this study was to assess outcome of anatomic ACJ reconstruction using Anterior Half Peroneus Longus autograft and internal bracing in adults with traumatic ACJ dislocations.

**Materials & Methods**: In this prospective case series study, conducted from January 2021 to December 2023 in department of orthopedics, traumatology and sports medicine MTI, LRH on 28 adult patients (25 male, 3 female) of type III-V ACJ dislocations who underwent ACJ reconstruction were included. Post operative x-ray shoulder, Constant-Murley Score and the self-reported Disabilities of the Arm, Shoulder, and Hand (DASH) score, CCD distance on radiology were used to assess functional and radiological results.

**Results**: Shoulder function improved post-operatively in all patients. Mean Constant-Murley Score increased from 32.5 ± 8.2 pre-operation to 87.6 ± 5.5 at the 12-month follow-up; $p < 0.001$. DASH score reduced from 45.2±7.8 to 12.4±4.3, ($p < 0.001$) reflecting disability improvement. CCD decreased from preoperative value of 22.9 ± 5.4 mm to 10 ± 3.0 mm postoperatively. There was no graft failure.2 patients (7%0 had infection that were treated with medication and got well.

**Conclusions**: This study showed that stability, radiological and functional results after ACJ reconstruction using Anterior half Peroneus Longus autograft and suture tap were satisfactory in adults with traumatic dislocations.

**KEY WORDS**: Acromioclavicular joint; Athletes; Dislocation; Peroneus Longus; Reconstruction; Shoulder.

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## INTRODUCTION

Acromioclavicular joint dislocations are common, and affect both the young and the older population.[1] Its prevalence is high among athletes. ACJ injuries constitutes up to 9% of all shoulder injuries, and more frequently patients are young and physically active.[1,2] The most common mechanism of this injury is direct blow on shoulder tip, or fall onto an outstretched hand. This occurs in contact sports like Kabaddi, rugby, and in non-contact sports like cycling, hocky, soccer and other higher activities. Road traffic accidents, and fall from height with impact on shoulder are the common causes of this injury.[2,3]

However, all injuries of this joint don't need surgical intervention; rather a more displaced, high energy trauma injury especially in physically active individual needs surgical intervention. Rockwood classification is the way to quantify this injury and this also guides which patient needs surgical intervention and which needs conservation approach. (Table 1). According to this, Rockwood type I and type II does not need surgeries-VI needs surgical intervention in active individuals to stabilize the joint to regain function.[4,5] Type 111 injury is much debatable, and surgery is reserved for physically active individuals, those with contact sports, and when conservative treatment fails.

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| Table 1: Rockwood Classification for AC Joint Injuries | | | | | | |
|---|---|---|---|---|---|---|
| Type | AC Ligaments | CC Ligaments | Deltopectoral Fascia | Radiographic CC Distance Increase | Radiographic AC Appearance | AC Joint Reducible |
| i | Sprained | Intact | Intact | Normal (1.1-1.3 cm) | Normal | N/A |
| ii | Disrupted | Sprained | Intact | <25% | Widened | Yes |
| iii | Disrupted | Disrupted | Disrupted | 25%-100% | Widened | Yes |
| iv | Disrupted | Disrupted | Disrupted | Increased | Posterior clavicle displacement | No |
| v | Disrupted | Disrupted | Disrupted | 100%-300% | N/A | No |
| vi | Disrupted | Disrupted | Disrupted | Decreased | N/A | No |

In conservative treatment option for type I, II, and some type III, the affected limb is immobilized in poly sling and symptomatic medical treatment, and physiotherapy is the treatment.[6] At the other end, complete ligament disruption seen in Types III through VI usually necessitates operative treatment.[4,5,6] The purpose of surgery is to reduce and stabilize the joint and restore its proper anatomic position, and enable the patient to begin rehabilitation and function. There are several surgical interventions that can be employed in the treatment of ACJ dislocations; these are; Primary ligament repair of CC and AC ligament, reduction and stabilization with the use of hardware such as K wire, screws, hook plates or suture loops, and ligament reconstruction using autograft or allograft.[7] Theses surgical interventions with the use of hardware have its own limitation and complications; Hook plate and K-wire has a complication rate up to (26.3%). theses hardware can cause, acromial erosion, plate / screw loosening, broken and lost migrated k wire and infection and a second surgery to remove this hardware.[8] Likewise, failure and reoperation rates are there in other procedures and according to the research, theses complications of failure and reoperation are 1.2%, 2.8%, 0.9%, 5.4%, and 2.6% in free tendon graft, suspensory devices, synthetic ligament devices, modified Weaver Dunn, and hook plate/K-wires techniques, respectively.[8,9]

Repair of the torn ligament may be a viable option in acute cases, but it has no role in chronic cases. In these cases, ligament reconstruction with autograft or allograft is needed to restore the anatomy and function.[11] So, we have this approach of peroneus longus tendon autograft to reconstruct the damaged coracoclavicular and acromioclavicular ligament. To further strengthen the reconstruction, and to protect the graft from elongation, rupture and any trauma, we used to add internal bracing using synthetic 2 mm fiber tap and this is an approach that further strengthen the repair. The internal brace is a synthetic tape used as reinforcement of the reconstruction-thus gives immediate rigidity and allows for early physical activity, which enhances faster recovery.[12-14] Research shows Peroneus Longus autograft, in combination with internal brace in patients with ACJ dislocations, has increased stability, decreased re-dislocation rates and improved functional outcomes in the short and medium term.[15] We had an extensive literature review using PubMed, Scopus, google scholar and no such study has been done for ACJ stabilization. So, the purpose of the present study was to evaluate the clinical and radiological result of ACJ reconstruction by Anterior Half Peroneus Longus Tendon Autograft (AHPLT) and Suture Tap Augmentation (STA) in adults after traumatic ACJ injury Rockwood type III and type V. The findings of this present study will then serve to further explicate this approach in the management of severe ACJ dislocations. This will add to the existing pool of knowledge, will become a base for further research, and will help to standardize patient care as per standard protocol.

## MATERIALS AND METHODS

This prospective case series study was conducted from January 2021 to December 2023 in department of orthopedics, traumatology and sports medicine MTI, LRH. Ethical approval was taken from the Institutional Research Board and an informed consent was taken from all patients about the surgery and their involvement in research. Keeping in view the inclusion criteria, a total of 25 adult patients with age more than 18 years with traumatic Rockwood Type III and V ACJ dislocations were included, more than three weeks old. All the patients were admitted via OPD and through emergency portal by means of Purposive sampling technique. All patients had a trial of at least three weeks non operative conservative treatment, and if the patient remained symptomatic, or high demand athlete, then operative treatment was chosen. Exclusion criteria included type I, II, IV, VI, and type III injuries in low demand, conservative treatment responded individuals

**Surgical Technique:** First of all, patients were optimized for anesthesia and surgery, and all relevant investigation were done including Xray shoulder Zanca view, Axillary view, and MRI Shoulder. All patients were operated by single surgeon with special experience in shoulder surgery. Patient was positioned in beech chair position (Figure 1 and 2). After

cleaning and draping, ipsilateral Peroneal longus graft anterior half was harvested (AHPLT) and then both ends were whipstitched.

**Figure 1: Beech Chair Position**

**Figure 2: Incision Marking**

A curvilinear incision was made over the affected shoulder (Figure 2), started from the coracoid, centered over the clavicle at about 4 cm from the distal end and then curved over the clavicle and ended about 1 cm distal to the ACJ over the lateral aspect of the shoulder. Cautery was used and deltotrapezial fascia was opened as a single flap. A 4.5 hole was drilled at 4.5 cm medial from the distal end of clavicle for the conoid ligament at the posteromedial part. For the trapezoid ligament, another 4.5 mm hole was drilled at 25 mm distance from the lateral end. In all cases, we ensured a distance of 20-25mm between the tunnels, and a distance of at least 15 mm from the distal end of clavicle. Using 3.2 mm drill, a hole was made in distal clavicle, and a horizontal hole was drilled in acromion ACJ was reduced under fluoroscopy and temporary reduction was maintained by 2 mm K-wire passed through the acromion into ACJ. A 2 mm thick fiber tap was then looped around the coracoid, then both ends were crossed in figure 3 position and then both ends were passed in the clavicle holes, and tied. Then one longer ends of the tap was looped around the holes in the distal clavicle and in acromion, thus a horizontal figure of 8 synthetic reconstruction was done for ACJ. After this, the autograft was passed in the same passion and tied over the top of clavicle; the one lateral end was kept longer and that end was stitched over ACJ capsule to repair and strengthen that capsule.

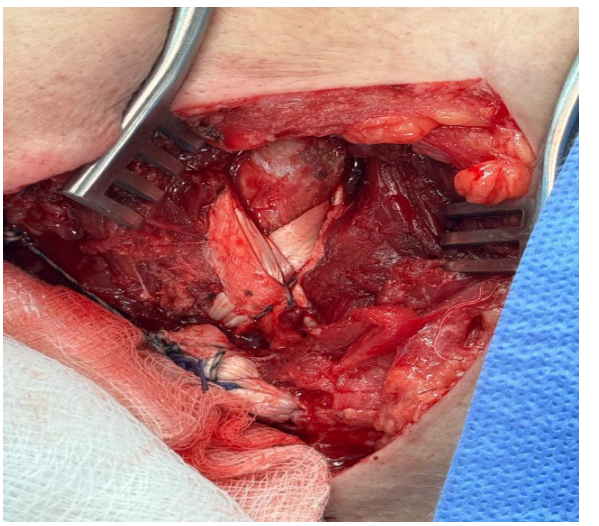


**Figure 3: Graft looping around Coracoid**

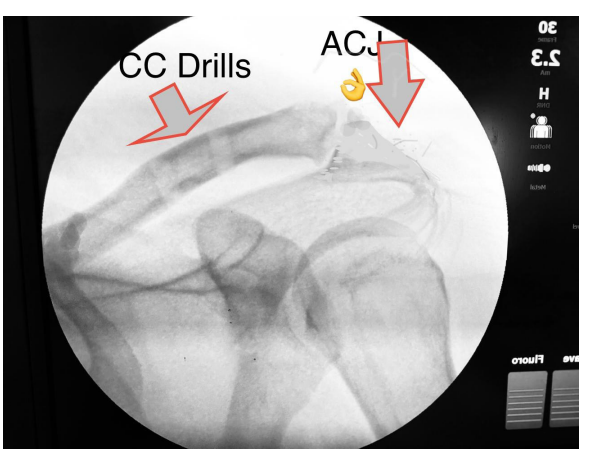



**Figure 4; Post OP Xray**

Limb was kept in sling for 4 weeks. Hand and elbow exercises were started immediately, but shoulder exercises were started after 1 month. Upright exercises started at 8 to 12 weeks. After full physiotherapy, individuals were allowed to work after 4-6 months, and sports activities were allowed after 10-12 months.

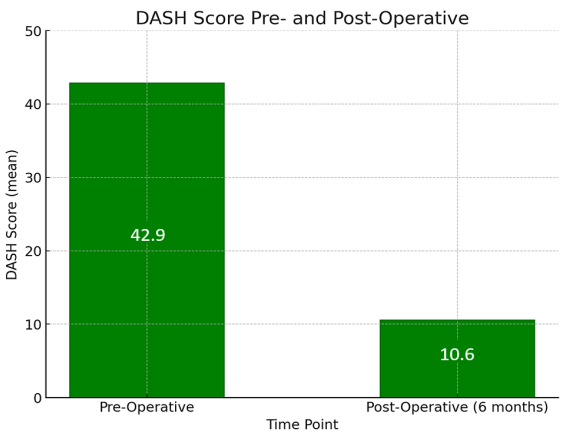
**Clinical analysis;** The primary outcome measure was Disability of Arm, Shoulder and Hand score (DASH), Constant -Muerly Score, and the secondary outcome measures are Complication rate, Coracoclavicular distance (CCD). Theses variables measurements were recorded preoperatively and at follow up of 3 months, 6 months, 12 months.

**Radiological analysis**; For vertical displacement, the preand postoperative coracoclavicular distances (CCD) were measured in mm on unweighted anterior-posterior bilateral Zanca view radiography as the distance between the tip of the coracoid and the inferior cortex of the clavicle. The side-to-side difference in the CCD was obtained in relation to the non-injured contralateral side.

**Statistical Analysis**; All the demographic details were collected and summarized. For categoric variables, Frequency and percentages were calculated, and for the continuous variables, mean and standard deviation were calculated. The preoperative score and post op scores were compared and the differences were evaluated for statistical significance using paired t test. For categoric variables, chi square test was used for comparison of the result. P value less than 0.05 was regarded significant, with 95% confidence interval and 5 % margin of error

## RESULTS

The sample in the study was 28 patients with a mean age of 35 (±7.4) years. Out of 28 patients, 25 patients (90.1%) were male, and 3 patients (9.99%) were female (Table 2). The mean Constant – Murley score increased from 34.8 ± 7.1 pre-operatively to 88.2 ± 5.1 after 6 months follow up ($p < 0.001$) (Table3). The DASH scores were significantly lower at the final follow-up measuring 10.6 ± 3.9 when compared to pre-operatively marks of 42.9 ± 6.7 ($p< 0.001$) (Table 4). Two patients (7%) had superficial surgical site infection and that were treated with debridement, and culture-based medication and both were recovered. In the current study, no severe adverse events or adverse effects including graft failure were reported. Generally, the patients were satisfied, with 92% of them returning to pre-injury activity levels within 1 year (Table 5). X-ray examinations also revealed good reduction of joint malalignment in all patients. The preoperative CCD significantly improved from 22.9 ±5.4 mm ;(17.2-23.8.) with post operative value 10 ±3.0 mm;( 8.9-11.7) at final follow up (Table 6). However, there was no association between the functional outcome and CCD at final follow up.



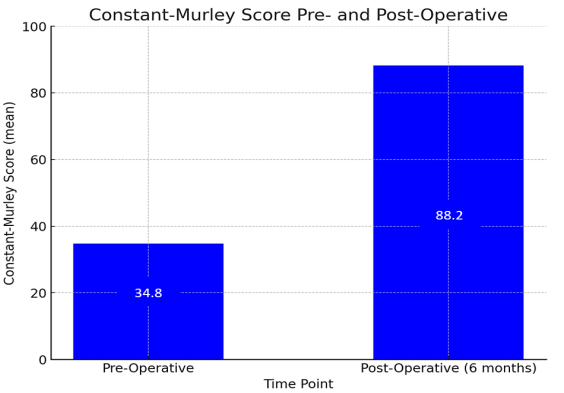




**Table 2: Demographics of the Study Participants**

| Characteristic | Value |
|---|---|
| Mean Age (years) | 35±7.4 |
| Male (%) | 25/90% |
| Female (%) | 3/10% |
| Right Dominant Hand (%) | 85 |
| Left Dominant Hand (%) | 15 |

**Table 3: Pre-Operative and Post-Operative Constant-Murley Scores**

| Time Point | Constant-Murley Score (mean ± SD) |
|---|---|
| Pre-Operative | 34.8 ± 7.1 |
| Post-Operative (6 months) | 88.2 ± 5.1 |

**Table 4: Pre-Operative and Post-Operative DASH Scores**

| Time Point | DASH Score (mean ± SD) |
|---|---|
| Pre-Operative | 42.9 ± 6.7 |
| Post-Operative (12 months) | 10.6 ± 3.9 |

**Table 5: Outcome Findings**

| Outcome | Percentage (%) |
|---|---|
| Return to pre-injury activity levels | 92% |
| Patient Satisfaction | 92% |
| No Graft Failures | 100% |
| Superficial infection | 7.14% |

**Table 6; Coracoclavicular distance /CCD**

| Preoperative | Post operative |
|---|---|
| 22.9 ±5.4mm; (17.2-23.8.) | 10 ±3.0mm; (8.9-11.7) |

## DISCUSSION

This paper points out that Anterior Half of Longus autograft along with internal brace to reconstruct the ACJ yielded favorable results in the present investigation with large significant gain in shoulder function and increased satisfaction among the patients. These results

correlate with prior research done by Mazoka, et al. that has focused on examining resilience of ligament reconstruction in cases of ACJ dislocations. Ligament reconstruction using autografts has become more common in the past few years because of several inherent benefits, including improved biologic properties and increased mechanical strength. More precisely, the Peroneus Longus tendon has emerged as the focus of interest in several works owing to its qualities as an ideal donor graft. Yoo et al supported Peroneus Longus autograft along with an internal brace as achieving superior functional results in treatment of ACJ dislocations with high patient satisfaction and low complication profile.[7] These outcomes were similar to those presented in our study, 92% of patients reported regaining previous level of activity and no serious adverse events were reported. The internal brace is a synthetically applied augmentation and thus provides direct mechanical support which facilitates early mobilization and rehabilitation. Beitzel et al. looked at the issue of internal bracing in ACJ reconstructions, stressing on the increase in stiffness and mechanical strength that comes with the use of the construct thus mitigating the risk for repeated instability[8.] In this case, our study echoes these observations; there were no cases of re-dislocation or graft failure. This was different from earlier methods, for example hook plates, or screw fixation that sometimes needed a longer duration of immobilization and had higher morbidity, counted by implant failure and infection incidences.[9] Comparison of Partial only Anterior Half of Peroneus longus with other grafts, including semitendinosus tendon, shows that biomechanical strength is comparable but the Peroneus Longus autograft is associated with less donor site morbidity, easy to harvest. Millett et al. retrospectively reviewed patients with ACJ dislocations treated with either semitendinosus autograft or synthetic fixation and reported similar concentric reduction and stability, but increased complications in the semitendinosus graft group[10.] This is contrary to what our patients experienced none of them had suffered severe complications from the donor site and all yielded excellent postoperative outcome. This brings to light the benefit associated with the Anterior Half Peroneus Longus tendon in other aspects in both stable reconstruction and so robust and fast rehabilitation. One of the focal concerns addressed in the literature is the matter of the long-term stability of ligament reconstruction surgery. The autograft reconstructions have been previously described as achieving good medium-term results, however, long-term follow-up data are scarce. Hegazy et al. examined the long-term outcomes of patient's candidate to ACJ reconstruction and described that, despite the early positive results, some patient began a slow joint deterioration and have reported pain and dysfunction after a longer follow-up.[11] Our assessment of short- to medium-term follow-up (12 months) highlights the technique's reproducibility and lack of graft rupture or major complications, indicating that this technique is robust in the short term. But, large sample size studies with longer follow up duration is required for evaluating the long-term results of Peroneus Longus autograft and internal brace technique. The result of the patient satisfaction rate observed in the current study of 92% is in agreement with the results of other similar study. In the present study, no statistically significant differences in satisfaction postoperatively were observed; however, patients who underwent reconstruction of the coracoclavicular ligament also had comparable satisfaction rates reported by same authors.[12-15] This is in line with the high satisfaction rate noted in our study due to biological and mechanical stability from the autograft combined with the internal brace, that ensures patients gain full functional mobility without pain. Therefore, we advocate the use of Peroneus Longus autograft along with internal plating for reconstructing traumatic ACJ dislocations. It yields good functional results, low complication rates and high level of patient satisfaction at short term. It still looks like a safe and efficient approach in comparison with other techniques and graft possibilities in adult patients with severe ACJ disorders. Yet, to capture the durability of this strategy more rigorous research employing longer follow-up times is required.

## CONCLUSION

In the traumatic ACJ dislocations, the application of the Peroneus Longus autograft with the internal brace for the reconstruction of the ACJ in adults provides short-term favorable results. The shoulder function of patients enhanced, disability decrease, high satisfaction levels, and low event risks. This technique offers a long-term, stable treatment for ACJ dislocations and offers quick resumption of regular life within a short rehabilitation period.

**Limitations:** The main weakness of the study was however the relatively short period of follow up of 12 months, which yield no information on the longevity of this technique. Also, the number of respondents was still limited because the study uses only a small group of participants carrying out the survey, which had invitational limitations in its application to a larger population. Study design was a case series, which was a weak design.

**Future Findings:** For future work, further investigation should be conducted with substantial follow-up to determine whether the safety and efficacy of this technique will persist throughout several years. So, we wound recommend double blinded randomized controlled trial of long follow up and studies done on a large number of patients are essential to determine the real effectiveness and the safety of the Anterior Half PL autograft and internal brace for ACJ dislocation reconstruction.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.

## AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

| | |
|---|---|
| Conception or Design: | JI, NU |
| Acquisition, Analysis or Interpretation of Data: | JI, NU, SUR, AK, FAS |
| Manuscript Writing & Approval: | JI, NU, SUR, AK, FAS, MAA |

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.