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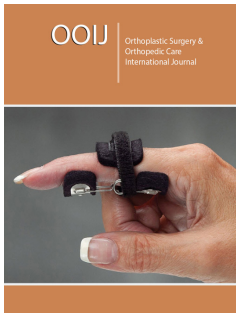
Research Article

Outcome of Upper Trapezius Transfer in Treating Flail Shoulder After Brachial Plexus Injuries

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Abstract

Background: Flail shoulder is a disabling sequela of brachial plexus injury, resulting in loss of shoulder stability and abduction. When nerve reconstruction fails to provide satisfactory functional recovery or patients present late after injury, muscle transfer procedures become important reconstructive options. Upper trapezius transfer is a well-established technique for restoring shoulder function in such patients.

Objective: To evaluate the functional outcomes of upper trapezius transfer using the modified Saha technique in patients with flail shoulder secondary to brachial plexus injuries.

Methods: A cross-sectional study was conducted on 20 patients with post-traumatic brachial plexus injury who underwent upper trapezius transfer between October 2022 and October 2024 in our institute. Data collected included demographic characteristics, mechanism and level of injury, previous reconstructive procedures, interval between injury and surgery, and preoperative and postoperative shoulder range of motion. Functional outcomes were assessed by measuring active shoulder abduction and stability during follow-up.

Results: The mean age of the patients was 27.4 years. All injuries resulted from Road traffic accidents. Pan-brachial plexus injury was the most common pattern observed. Most patients had undergone prior nerve reconstruction procedures before trapezius transfer. Following surgery, all patients demonstrated improvement in shoulder stability and active shoulder abduction. The average gain in shoulder abduction was approximately 45°. No major wound-related complications were encountered. Functional outcomes were satisfactory in the majority of patients, with a smaller proportion achieving good results.

Conclusion: Upper trapezius transfer using the modified Saha technique is a safe procedure for restoring shoulder stability and improving shoulder abduction in patients with persistent flail shoulder following brachial plexus injuries. It remains a valuable salvage procedure when nerve reconstruction fails or delayed presentation precludes successful nerve repair.

Keywords: Brachial plexus injury; Flail shoulder; Upper trapezius transfer; Modified Saha technique; Shoulder reconstruction and Tendon transfer

Introduction

Brachial plexus injuries are devastating injuries that significantly impair upper limb function. Restoration of shoulder stability and abduction is essential for positioning the upper limb in space and improving overall upper extremity function. Although advances in nerve reconstruction have improved outcomes, some patients continue to have persistent flail shoulder due to failed nerve repair or delayed presentation.

Upper trapezius transfer has emerged as an effective salvage procedure for restoring shoulder stability and active abduction. The modified Saha technique utilizes the powerful upper trapezius muscle and its osteoperiosteal attachment to improve shoulder biomechanics [1]. This study evaluates the functional outcomes of upper trapezius transfer in patients with flail shoulder following brachial plexus injuries.

Material and Methods

Twenty patients with post-traumatic brachial plexus injury and inadequate shoulder abduction who underwent upper trapezius transfer between October 2022 and October 2024 were included. Patients who had Failure of previous nerve repair procedures, requiring improved shoulder abduction and enhanced shoulder stability, delayed presentation following brachial plexus injury were candidates for the surgery. Patients with Trapezius muscle power less than M4 on MRC grading, advanced gleno humeral arthritis, Chronic unreduced shoulder dislocation were excluded [2]. Data collected included Age and sex, Mode of injury, Level of brachial plexus injury, Previous reconstructive procedures, Interval between injury and surgery, Preoperative and postoperative shoulder abduction and Postoperative complications. All patients underwent upper trapezius transfer using the modified Saha technique.

Operative technique

In the lateral decubitus position, an S-shaped incision was made extending from the anterior border of the trapezius over the shoulder region. The trapezius insertion along with a segment of acromion and scapular spine was mobilized. With the shoulder maintained at approximately 110° of abduction, the transferred unit was fixed to the proximal humerus using screws. A suction drain was placed and wounds were closed in layers. Drain removal done after significant reduction in drain amount. Suture removal done at 2 weeks. Immobilization in an aeroplane splint for 6 weeks. Graduated active shoulder abduction exercises thereafter. Patient followed up periodically.

Results

The results are presented in Figure 1a-1c and Table 1. The mean age of the patients was 27.4 years (range 20-40 years). All injuries were secondary to road traffic accidents [3]. Pan-brachial plexus injury constituted the majority of cases (18 cases) upper trunk injury in 2 patients. The mean interval between injury and transfer was 4 years (1-13yrs) with an average follow-up of 10 months (6 months to 24 months) Several patients had undergone previous nerve reconstruction procedures including spinal accessory nerve transfer, Oberlin transfer, multiple nerve transfers, and free functional muscle transfer. The average preoperative shoulder abduction was 10 degrees (0-30).

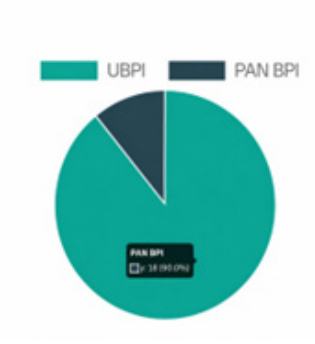


Figure 1a

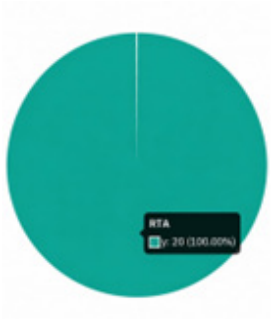


Figure 1b

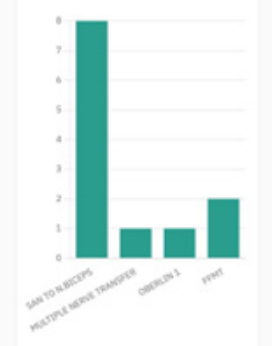


Figure 1c

Table 1

Patient No	Age	Sex	Follow up (Mon)	INT B/W Injury & Surgery	Preop. Shoulder Abduction	Postop Shoulder Abduction	VAS Preop	VAS Post Op
1	29	M	6	3y	10	30	83	33
2	23	M	6	4y	30	60	69	23
3	25	M	12	5y	0	20	62	9
4	28	M	10	1y	0	20	75	39
5	27	M	8	1y	0	30	73	49
6	25	M	8	2y	0	45	77	41
7	22	M	24	2y	0	30	65	51
8	23	M	12	1y	10	45	65	51
9	28	M	11	13y	10	45	78	34

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10	35	M	7	3y 6m	20	30	90	52
11	20	M	6	4y	0	30	78	52
12	22	M	18	1y 6m	20	90	57	40
13	32	M	24	2y	20	45	56	40
14	22	M	24	3y	10	30	78	54
15	38	M	20	1y 6m	10	45	84	54
16	40	M	24	1y 6m	10	30	56	39
17	35	M	12	1y 6m	0	100	56	54
18	30	M	10	2y	0	60	75	43
19	35	M	18	1y	10	70	87	36
20	24	M	10	2y	20	90	66	47

All patients demonstrated an improvement in shoulder mobility and reduced multidirectional instability of the shoulder assessed clinically and individually by the patient. the results were encouraging. Shoulder abduction was measured as the angle between trunk and arm. Our results showed an average gain in shoulder abduction of approximately 45° (20 to 100 degrees). VAS score Mean pre-operative pain 72.5mm (severe) and mean post-operative pain 26.4mm (mild). No wound complications, implant-related complications, or neurovascular injuries were encountered. Passive shoulder movements remained preserved in all patients. Outcomes were categorized according to postoperative shoulder abduction: Satisfactory (30°-80°); Good: (81°-130°); Excellent: (131°-180°) The majority of patients achieved satisfactory outcomes, while a smaller proportion achieved good results (Figures 2a-2g & 3a-3c).



Figure 2a



Figure 2b

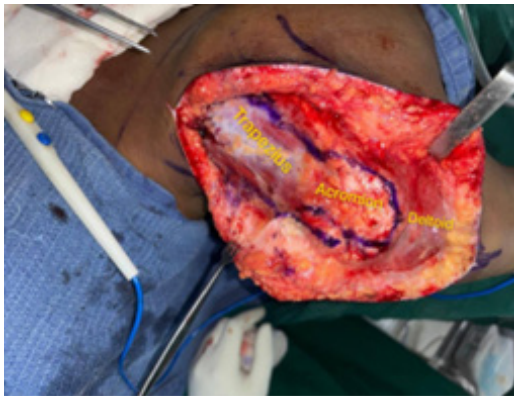


Figure 2c



Figure 2d

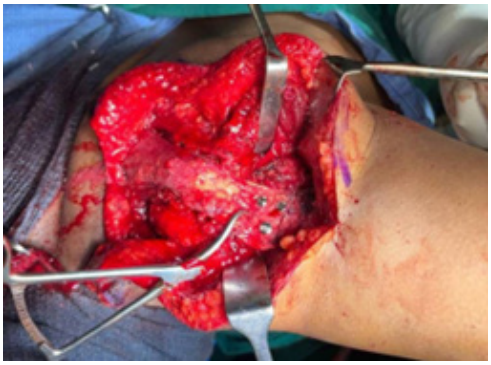


Figure 2e

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Figure 2f



Figure 2g

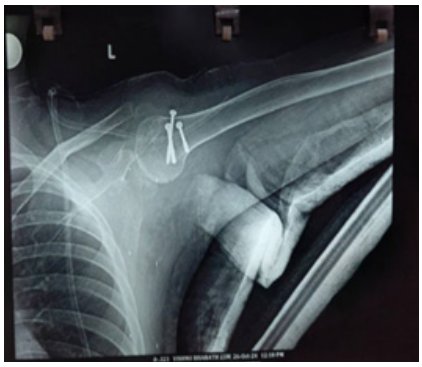


Figure 2h : Post op X-ray.



Figure 2i : Aeroplane splint.



Figure 2j
Figure 2: Showing markings and intra op pictures.



Figure 3a : 30 yr male with Left C5, C6 injury attained post op shoulder abduction of about 100 degrees.

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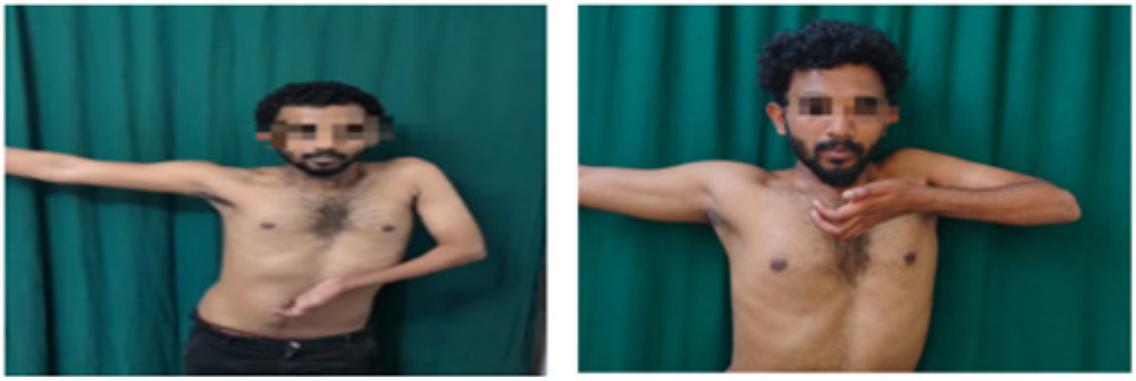


Figure 3b : 24yr old male Left pan brachial plexus injury attained postop shoulder abduction of 90 degrees.

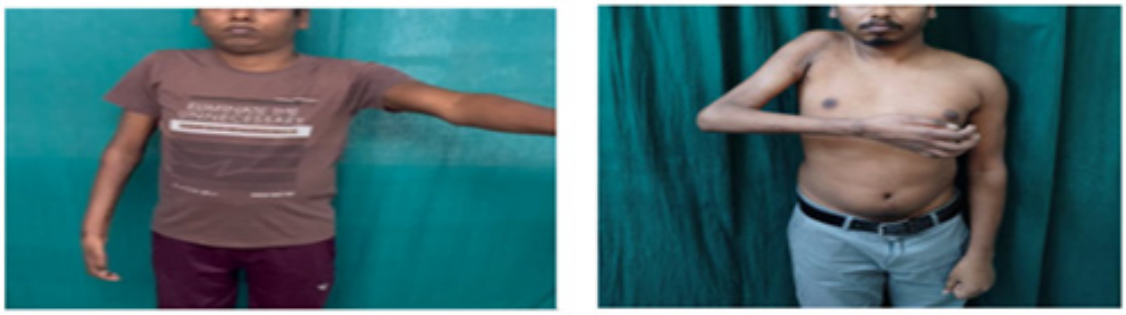


Figure 3c : 26 male Right pan brachial plexus injury attained post op shoulder abduction of 45 degrees.

Discussion

Trapezius transfer was used for Deltoid paralysis by Hoffa in 1891, Lewis in 1910, Lange in 1911, Mayer in 1927, Bateman in 1954 and Saha in 1967. Today trapezius transfer is commonly used for Deltoid paralysis.

Mayer described the technique of trapezius transfer in complete Deltoid palsy [4]. Bateman modified the Mayer technique by osteotomizing the spine of scapula near its base and transferring it laterally along with Trapezius muscle and anchoring the acromion directly to humerus as far distally as possible with two or three screws [5]. Saha modified Bateman's technique. The superior and middle trapezius is completely mobilized laterally from its origin and thus transfer is made 5cm longer without endangering its nerve or blood supply. In his technique the entire insertion of trapezius along with attached lateral end of clavicle, acromioclavicular joint, acromion and adjoining part of scapular spine were anchored to lateral aspect of humerus distal to the tuberosities by two screws [6].

These techniques involved osteotomy of the spine of scapula, acromion and lateral part of clavicle and bone fixation with screws. So, there is technical difficulty longer operating time, longer period of shoulder immobilization, problems of bone healing and sometimes morbidity at the osteotomy site. Problems of bone healing may be due to complications which occurred with loosening of screws, wound infection, earlier humeral fractures in same sites and osteoporosis secondary to inactivity after brachial plexus injury. Ruhmann et al. [7] used technique of Saha in trapezius muscle transfer in 38 patients and reported the complication of loosening of screws in 9.7% patients, wound infection needed revision with early removal of fixation screws in 6.5% patients and bony deformities after fracture with difficulty in fixation in 38.7% patients. Aziz, Singer, and Wolff reviewed 27 patients of brachial plexus injury treated by transfer of Trapezius. They used a modification of the surgical technique described by Mayer and Bateman and amended by Saha. A transverse skin incision over the insertion of the Trapezius, crossed the lateral clavicle and continued round the acromion and along the spine of the scapula.

A vertical extension was made laterally over the mid-Deltoid. Acromion and lateral clavicle were transected and the Trapezius freed from the underlying Supraspinatous muscle. The Deltoid was split longitudinally to expose the proximal humerus. The arm was then abducted to 90 degrees, the acromioclavicular fragment with its Trapezius insertion was fixed to the humerus. Preoperatively an average abduction of 3.5 degrees was noted. The average gain in shoulder abduction was 45.4 degrees with a range of 20 to 120 degrees, the gain in shoulder flexion averaged 35.2 degrees, with a range of 0 to120 degrees [8].

Ruhmann et al. [7] included 31 patients with paralysis of the Deltoid and Supraspinatus and Trapezius transfer was performed according to the method of Saha. Average increase in active abduction was from 7.3 degrees (0-45 degrees) to 39 degrees (25-80 degrees) at the latest review. The mean forward flexion increased from 20 degrees (0-85 degrees) to 44 degrees (20-90 degrees). Twenty-nine of the 31 were satisfied with the

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improvement in function. He performed Trapezius transfer in 54 patients for Deltoid and supraspinatous and found that there was an improvement in shoulder function and stability [9]. Ruhmann et al. [10] demonstrated the correlation of preoperative pattern of paralysis and outcome in 80 patients. Operations were performed according to Saha's technique, with a modification in the last 22 cases.

The mean increase in active abduction was from 6 degrees (0-45) to 34 degrees (5-90). The mean forward flexion increased from 12 degrees (0-85) to 30 degrees (5-90). The best results were achieved in those patients with most preoperative power of the biceps, coracobrachialis and triceps muscles (n=7), with a mean of 42 degrees of abduction and 56 degrees of forward flexion [10]. The modified Saha technique provides reliable fixation and effective transfer of trapezius power to the proximal humerus. The present study demonstrated consistent improvement in shoulder stability and active abduction without significant complications. These findings are comparable to previously published series reporting gains in shoulder abduction ranging from 30° to 70° following trapezius transfer. The procedure offers predictable outcomes with relatively low morbidity and remains an important reconstructive option in the management of flail shoulder.

Conclusion

Upper trapezius transfer using the modified Saha technique is a safe, reproducible, and effective procedure for restoring shoulder stability and improving active shoulder abduction in patients with persistent flail shoulder following brachial plexus injury. It should be considered an important salvage option when nerve reconstruction fails or when patients present beyond the optimal window for nerve repair.

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