

Functional outcome of a patient with upper type brachial plexus injury treated by Saha and Steindler procedure: a case report



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ABSTRACT

Background: Upper type brachial plexus injury represents a major functional handicap. Secondary reconstruction was performed in neglected cases (>1 year without any attempt for reconstruction). The Saha procedure was commonly used for the reconstructive option for shoulder abduction, while the Steindler procedure for the reconstructive option for elbow flexion. We report a case in a patient with upper type brachial plexus injury treated by Saha and Steindler procedure.

Case Presentation: We report a case presentation of an upper type brachial plexus injury in a 50-year-old man with a history of trauma when the patient climbed the roof and fell down with his right shoulder and hit the floor first. The patient underwent Saha procedure for shoulder abduction and Steindler for elbow flexion. Both of these operations were successful. After a follow-up of six months, the patient can perform the daily living activity.

Conclusion: The Steindler procedure is one of the most common procedures and remains a powerful reconstructive option to restore elbow flexion. The Saha procedure was safe, easy, and significantly improved functional activity in a patient with upper-type brachial plexus injury.

Keywords: Brachial Plexus Injury, Saha Procedure, Steindler Procedure.

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INTRODUCTION

Upper type brachial plexus injury represents a major functional handicap. As we know, upper limb extremities play an important role in activities of daily living such as using hands to eat, buttoning clothes, writing, and other activities.¹ There are several treatments for brachial plexus trauma, and the time between the trauma and the surgical intervention is an important factor and determines a functional outcome.² Salama et al., in their study, found a correlation between pre-operative duration and recovery.³

The reconstruction performed earlier, less than four months, showed a better functional performance than reconstruction 8-12 months after trauma. In trauma between 3-6 months, primary reconstruction measures can be carried out in the form of nerve repair and exploration. In cases of brachial plexus trauma that occurs for more than one year

or is neglected, secondary reconstruction can be carried out, including tendon or muscle transfer, arthrodesis, tenodesis, or functional free muscle transfer.⁴⁻⁶

In this case report, muscle transfer was performed to reconstruct shoulder and elbow function. Several techniques can be used to restore movement function and stability of the shoulder after brachial plexus palsy, including trapezius to deltoid transfer to restore abduction of the shoulder, latissimus dorsi transfer to improve the external rotation.^{5,6} In impaired elbow flexion function due to traumatic brachial plexus palsy, several techniques can be used, including transfer of the common origin of the flexor forearm muscles to a proximal section (the Steindler procedure), transfer of latissimus dorsi muscle to the tendon of the bicep's brachialis, transfer of the pectoralis major brachial branch tendon to brachial bicep's, and transfer of triceps tendon to

bicep's.⁶⁻⁸ According to a literature study, the Saha procedure was commonly used for a reconstructive option for shoulder abduction, and the Steindler procedure for a reconstructive option for elbow flexion.^{9,10} Based on the background above, this case report aims to present a case of a patient with upper type brachial plexus injury treated by the Saha and Steindler procedure.

CASE PRESENTATION

We reported a case of a 50-year-old man that came with a chief complaint of being unable to abduct his upper right arm since one year ago. When the patient climbed the roof using a ladder, he suddenly slipped and fell from a height approximately 4 meters to the ground, with his right shoulder hitting the floor first. There was a history of loss of consciousness. The patient is right-handed dominant. He works as a government employee.

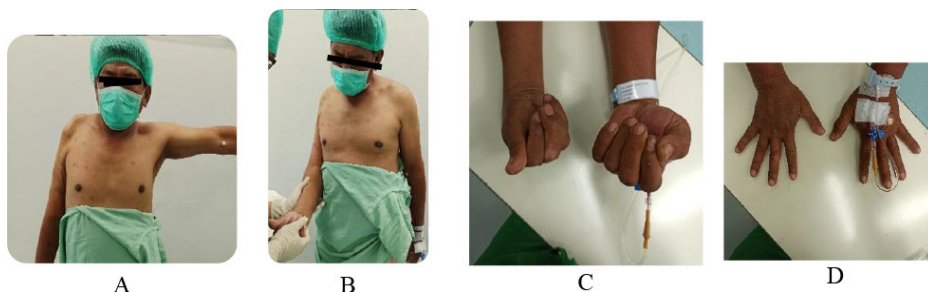


Figure 1. Clinical Examination, Pre-operative patient motoric evaluation. (A and B) The patient could not move his right shoulder and elbow; initial strength was graded as M0. (C and D). The patient was able to flex his fingers, abduction, and adduction his fingers; initial strength was graded as M5.

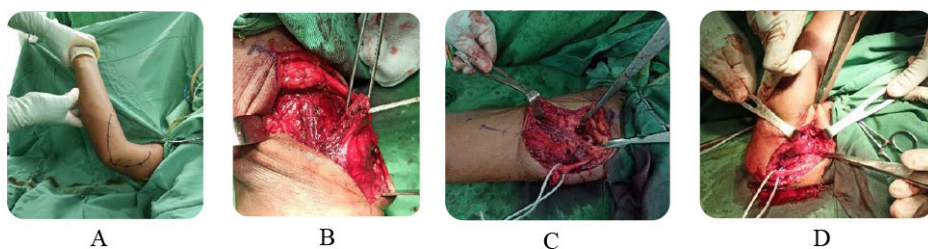


Figure 2. Steindler procedure. A) Planned incision for muscle transfer common flexors to distal humerus; B) Release a common flexors muscle from its origin; C) Measure and drill distal humerus about 5 cm proximal from elbow joint; D) Fix the medial epicondyle to the anterior distal humerus with cortical screw 3.5 mm.

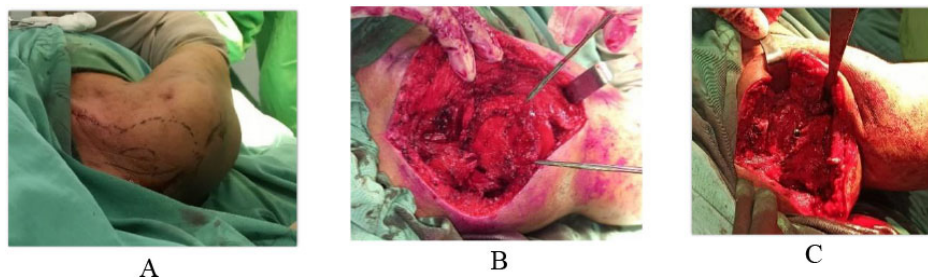


Figure 3. Saha Procedure. A) Planned incision for muscle transfer from trapezius muscle to deltoid; B) Cut the acromion, 1-2 cm from distal clavicle; C) We attached the trapezius muscle to the greater trochanter using screw 4.5 mm.

From the physical examination, the vital sign was within the normal limit. We found the patient unable to abduct his shoulder from the local examination at the right shoulder and flexed his elbow joint. But still able to move his right fingers (Figure 1). The local examination on the left shoulder was within the normal limit.

We performed the Steindler procedure for restoration in elbow flexion and the Saha procedure for management shoulder abduction inpatient with incomplete brachial plexus injury upper type. Before we were treated with the Saha procedure,

this patient was treated by Steindler Procedure. Steindler procedure was done by moving the medial epicondyle, the origin of the common flexor-pronator group, to the anterior distal humerus about 5 cm from the elbow joint in 90-degree elbow flexion. We use a 3.5 mm cortical screw for fixation (Figure 2).

After Steindler, we perform the Saha procedure by detaching the upper trapezius from the spine of the scapula and clavicle, osteotomy of the acromion, distal 1-2 cm of the clavicle. We transfer the acromion to the greater tuberosity

of the humerus in 90-degree abduction and 20-degree external rotation. We use two 4.5 mm cancellous screws to do the fixation (Figure 3). Postoperatively, we immobilized the shoulder with an abduction splint at 90 degrees for six weeks (Figure 4).

We evaluated functional outcomes after six months post-operative. Before the operation, the patient was unable to abduct his right shoulder, but active shoulder abduction was 30 degrees after the procedure. Before the operation, the patient can not adduction his right shoulder, but active shoulder adduction is 10 degrees after the operation. Before the operation, the patient cannot flex his right elbow, but after the operation, the active flexed elbow is 90 degrees (Figure 5).

After the operation procedure, there are several improvements in the patient's range of movement. The patient can perform active shoulder abduction 30 degrees, active shoulder adduction at 10 degrees, and elbow flexion at 90 degrees, as seen in Table 1.

DISCUSSION

There are many techniques available for the restoration of elbow function.² The armamentarium of options include nerve transfers to restore function to the biceps and brachialis and muscle transfers, including Steindler flexorplasty, unipolar or bipolar pectoralis transfers, and free functioning muscle, latissimus transfer, and triceps to biceps transfer.² The Steindler flexorplasty is used to restore elbow flexion for patients lacking active elbow flexion. The "Steindler" effect is the ability to slightly flex the elbow with forearm pronation and wrist flexion. This effect is magnified when the flexor-pronator origin is transferred proximally. Ideally, wrist flexion and digital flexion of M5 and maintained passive elbow flexion are prerequisites for performing this transfer.²

Several muscle transfers have been advocated to restore movement and stability of the shoulder after brachial plexus palsy. Including trapezius to deltoid, transfer to restore abduction of the shoulder, trapezius to deltoid transfer to restore abduction of the shoulder, trapezius to deltoid transfer



Figure 4. Patient clinical picture postoperatively. The patient can do an abduction pillow at 90 degrees.

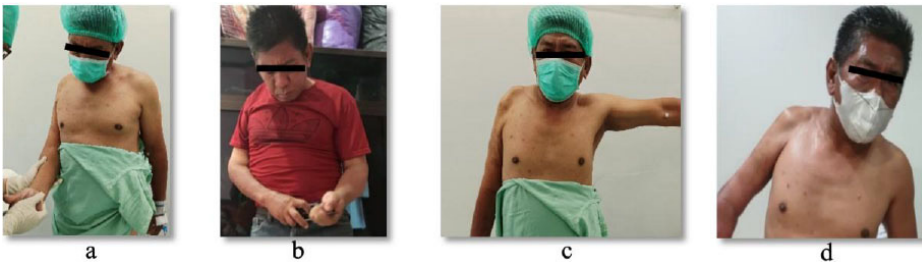


Figure 5. A) Pre-operative condition of the patient, right elbow motoric evaluation is graded M0; B) Post-operative condition of the patient, can actively flex the elbow with ROM 90 degrees; C) Pre-operative condition of the patient, he cannot abduct right shoulder; D) Post-operative condition of the patient, he can actively abduct his right shoulder with ROM 30 degrees.

Table 1. The result after the operative procedure for shoulder and elbow function.

Motion	Pre-Operative	Post-Operative
Shoulder Abduction	-	30°
Shoulder Adduction	-	10°
Elbow Flexion	-	90°

to restore abduction of the shoulder.¹⁰⁻¹² Trapezius transfer can provide satisfactory functional improvement, and it is better than arthrodesis for paralysis of the shoulder after brachial plexus injury.^{11,12} We perform the Steindler procedure for

the elbow flexion and the Saha procedure for the shoulder function.

Some studies state differences in determining the type of muscle transfer to be carried out. Eggers et al. stated that the latissimus dorsi transfer was superior to

the Steindler procedure for elbow flexion restoration.¹³ However, we prefer to use the Steindler procedure in this patient because it is more familiar, simpler, and does not cause extensive surgical wounds. But Chen et al., in their study, reported weaknesses in this Steindler procedure, including flexion contracture of the elbow, a pronation contracture of the forearm, and flexion contracture of the wrist.⁸ In this study, we also found a flexion contracture on the elbow about 10 degrees.

In shoulder restoration function, we prefer to use the Saha procedure compared to other muscle transfer techniques because several studies recommend trapezius muscle transfer for shoulder restoration. Aziz et al. stated that trapezius transfer for flail shoulder after brachial plexus palsy is a simple procedure with minimal blood loss, which provided functional improvement.¹⁴ However, there are some complications from this trapezius transfer. Ruhmann et al. reported that from 38 patients, there were several complications, including loosening of screws in 9.7% of patients, wound infection in 6.5% of patients, and bony deformities after fracturing with difficulty in fixation in 38.7% of patients.¹⁵ At six months after the surgery, we calculated the QuickDASH score to measure the upper extremity condition of the patient. We got 26 points from the QuickDASH measurement in the patients, and we can conclude that the patient's upper extremity conditions were classified as satisfactory. The patient was also satisfied with the surgery result.

CONCLUSION

The Steindler procedure is one of the most common and remains a powerful reconstructive option to restore elbow flexion. This procedure should be strongly considered an option to restore active elbow flexion. The Saha procedure was safe, easy, and significantly improved functional activity in a patient with upper-type brachial plexus injury.

CONFLICT OF INTEREST

The authors declare that there is no competing interest regarding the manuscript.

ETHICAL CONSIDERATION

This case report was conducted based COPE and ICMJE guidelines based on the publication ethics protocols as well as received informed consent from the patient and his family prior to the study being conducted. This case report also has been permitted to publish by Orthopedic and Traumatology Department, RSUP Dr. Wahidin Sudirohusodo, Makassar with No. 057/SMF.ORTO/XI/2021.

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AUTHOR CONTRIBUTION

All of the authors contributed to the study from the conceptual framework, data gathering, and data analysis until interpreted the study results on publication.

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