

## Functional outcome after surgical release of patients presented with post-traumatic elbow stiffness

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### Abstract

**Introduction:** Trauma to the elbow is an ordinary source of joint stiffness that might require surgical release. Release of the stiff elbow can be done by open or arthroscopic approach. There is no high-level evidence for the best surgical treatment modality for post-traumatic elbow stiffness.

**Objective:** Objective of this study is to assess the percentage improvement in range of motion after surgical release for management of patients of post-traumatic stiff elbows.

**Material and Methods:** This Quasi experimental study was done at Ghurki Trust Teaching Hospital, Lahore from January 2018 to December 2018. Total 95-patients fulfilling the selection criteria were included in this study from Orthopedic Ward of Department of Orthopedic and Spine Surgery, Ghurki Trust Hospital, Lahore. An informed consent was obtained. Demographic profile was obtained. Then ROM at baseline was noted. Then all patients underwent surgical release under general anesthesia by a single surgical team. Bone resection procedure was used to release the stiffness. Patients were followed-up in OPD after 4-weeks, 12-weeks and then 24-weeks. Then after 24-weeks, ROM was noted and percentage improvement was calculated.

**Results:** In this study percentage improvement in ROM after surgical release for management of patients of post-traumatic stiff elbows was  $59.83\% \pm 8.39$ . Minimum and maximum percentage of improvement in ROM was 43% and 74.14% respectively. However age, gender, duration of disease and body mass index of patients was not significantly associated with percentage improvement in ROM after surgical release.

**Conclusion:** In this study patients undergoing surgical treatment of post traumatic stiffness of the elbow had good percentage improvement in ROM. This shows the effectiveness of surgical release in post-traumatic stiff elbows. However age, gender, duration of disease and body mass index did not establish any significant changes in the prognosis regarding release of the elbow stiffness.

**Keywords:** Post-traumatic, stiff elbows surgical release, range of motion, percentage improvement

### Introduction:

Elbow motion is essential for upper extremity function to position the hand in space. Unfortunately, the elbow joint is prone to stiffness following a multitude of traumatic and atraumatic etiologies.<sup>1</sup> Elbow stiffness may result after trauma in 10-15% of all patients.<sup>2</sup> In a recent review of 32,708 elbow injuries in New York State over a 12-year period, 270-patients required surgical

release (1.4%).<sup>3</sup>

Elbow joint stiffness is a significant problem after elbow trauma, in degenerative and arthritic elbow joint disease, and following surgery to the elbow joint.<sup>4</sup> The stiff elbow is challenging to treat, and thus, its prevention is of paramount importance. When this approach fails, non-operative followed by operative treatment modali-

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ties should be pursued.<sup>5</sup>

Traumatic elbow fracture is a common problem in our country due to rampant RTAs specially motor bike accident which lead to fracture upper limb, lower limb and also spinal injuries. Fracture around elbow joints like, supra-condylar fracture, inter-condylar fracture of distal humerus, fracture of proximal radius ulna and fracture of olecranon are very common. These are high velocity injuries and most of them are open fractures which are managed with AO External Fixator. Scaring and tissue remodeling lead to stiffness of elbow.

Over the last 50 years there are various conservative, arthroscopic & open methods used to treat post traumatic stiff elbow like, static and dynamic splinting, serial casting, continues passive motion, occupational and physical therapy and manipulations. Surgical release of a stiff elbow can result in satisfactory restoration of ROM in most patients.<sup>6</sup>

J Gelinas et al treated 22-patients with an elbow contracture using a static progressive turnbuckle splint for a mean of  $4.5 \pm 1.8$  months. All had failed to improve with supervised physiotherapy and splinting. The mean range of flexion before splinting was from  $32 \pm 10^\circ$  to  $108 \pm 19^\circ$  and afterwards from  $26 \pm 10^\circ$  ( $p=0.02$ ) to  $127 \pm 12^\circ$  ( $p=0.0001$ ). A total of 11-patients gained a 'functional arc of movement,' defined as at least  $30^\circ$  to  $130^\circ$ . In 8-patients movements improved with turnbuckle splinting, but the functional arc was not achieved. 6-of these were satisfied and did not wish to proceed with surgical treatment and 2-had release of the elbow contracture. In three patients movement did not improve with the use of the turnbuckle splint and one subsequently had surgical treatment.<sup>7</sup>

Most of them are labour class and good function is of paramount importance for them. Literature has reported that after surgical release of traumatic elbow may have better improvement than conservative management.<sup>8</sup> Chandrabose et al, found that after surgical intervention in post-traumatic stiff elbow, the mean pre-operative

ROM was  $33.9^\circ (\pm 24.0)$  which was improved to  $105^\circ (\pm 19.47)$  at last post-operative follow-up, indicating a percentage gain of 67.7% in the ROM.<sup>8</sup> Another study showed that after surgical release, percentage improvement in ROM was 54.5%.<sup>9</sup> But another study has reported that after surgical release, percentage improvement in ROM was 21.2% cases.<sup>10</sup> The reported percentage improvement in post-surgical release of stiff elbow was ranged from 21.2-64%.(10-15). Compared with arthroscopic release, open release is more commonly used for the treatment of stiff elbow.<sup>15</sup>

The purpose of the study was to assess the percentage improvement in range of motion after release for the management of patients of post-traumatic stiff elbows. We conduct to this study to confirm the effectiveness of surgical release in post-traumatic stiff elbows as there is no local evidence available in literature and International data for ROM is variable. Moreover our population demographics, literacy level and patients compliance are also different. If the results are found to be favorable new protocol can be established for managing post-traumatic stiff elbows in our population.

#### Material and Methods:

This Quasi experimental study was done at Ghurki Trust Teaching Hospital, Lahore from January 2018 to December 2018. The Sample size of 95 cases is calculated with 95% confidence level and 9.5% margin of error and taking expected percentage of improvement in ROM i.e. 67.7%. After surgical release of post-traumatic stiff elbows, non-probability, consecutive sampling technique was used. Patients of age 15 to 45-years of either gender planned to undergo surgical release for post-traumatic stiff elbows (as per operational definition) for >2 months were included in the study while diabetic patients to rule out neuropathic pain ( $BSR > 186\text{mg/dl}$ ,  $HbA1c > 8\%$  for >1 year), repeat trauma (as per history and medical record), Bilateral trauma and Neurological deficit (on clinical examination) were excluded. Total 95 patients fulfilling the selection criteria were included in this study from Orthopedic ward of Department of Ortho-

Table 1: Descriptive statistics for ROM

	Base Line	24 Weeks	Improvement	% Improvement
Mean	44.46	111.01	66.55	59.83%
SD	9.095	6.220	10.776	8.39%
Min	30	100	43	43.00%
Max	60	120	88	74.14%

Table 2: Descriptive statistics for improvement in ROM in terms of age of patients

Age	40-50%	51-60%	61-70%	>70%	Total
15-25	7(53.8%)	14(38.9%)	9(28.1%)	7(50%)	37
26-35	2(15.4%)	10(27.8%)	11(34.4%)	3(21.4%)	26
36-45	4(30.8%)	12(33.3%)	12(37.5%)	4(28.6%)	32
Total	13	36	32	14	95

Chi-Square Test=3.862,

p-value=0.695

Table 3: Descriptive statistics for improvement in ROM in terms of gender of patients

Gender	40-50%	51-60%	61-70%	>70%	Total
Male	6(46.2%)	19(52.8%)	18(56.3%)	7(50%)	50
Female	7(53.8%)	17(47.2%)	14(43.8%)	7(50%)	45
Total	13	36	32	14	95

Chi-Square Test=0.426

p-value=0.935

Table 4: Descriptive statistics for improvement in ROM in terms of duration of disease of patients

Duration	40-50%	51-60%	61-70%	>70%	Total
3-7	5(38.5%)	19(52.8%)	12(37.5%)	7(50%)	43
8-12	8(61.5%)	17(47.2%)	20(62.5%)	7(50%)	52
Total	13	36	32	14	95

Chi-Square Test=1.968

p-value=0.579

pedic and Spine Surgery, Ghurki Trust Hospital, Lahore. An informed consent was obtained. Demographic profile (name, age, gender and duration of stiff elbow) was obtained. Then ROM at baseline was noted. Then all patients undergone surgical release under general anesthesia by a single surgical team. Bone resection procedure was used to release the stiffness. Patients were followed-up in OPD after 4-weeks, 12-weeks and then 24 weeks. Then after 24 weeks, ROM was noted and percentage improvement was calculated (as per operational definition). All the information was collected through a specially designed proforma. All the data was entered and analyzed through SPSS version 21. The quantitative variables like age, duration of stiff elbow, baseline and post-surgical ROM was presented as mean + standard deviation. The qualitative variable like gender was presented as frequency

and percentage. Percentage improvement in ROM was calculated (as per operational definition). Data was stratified for age, gender, BMI and duration of stiff elbow. Post-stratification, chi-square was applied to compare percentage improvement in stratified groups. P-value $\leq$ 0.05 was taken as significant.

### Results:

Average age of patients was  $29.53\pm 9.45$  years. Minimum and maximum age of patients was 15 and 45 years respectively. Among 95-patients there were Male-50 (52.63%) & Female-45 (47.37%) with male to female ration of 1.11:1. Average duration of disease was  $7.85\pm 2.75$  months. Minimum and maximum duration of disease of patients was 3 and 12 months respectively. Average height and weight of patients was  $1.68\pm 0.11$  meter and  $60.76\pm 9.15$  kg. However mean body mass index of patients was  $21.78\pm 4.76$ .

At base line average ROM of patients was  $44.46\pm 9.09$ . However after 24 weeks post treatment it was  $111.01\pm 6.22$ . Average percentage improvement in ROM of patients from base line till 24<sup>th</sup> week post-treatment was  $59.83\pm 8.9$  respectively. At this point minimum and maximum percentage improvement in ROM was 43% and 74.14% respectively. (table-1)

No statistically significant association was seen between age groups of patients and improvement in ROM i.e. p-value=0.695. (table-2)

In male and female patients percentage improvement in ROM was statistically same i.e. p-value=0.935 w (table-3)

Duration of disease of patients was also not significantly associated with percentage improvement in ROM i.e. p-value=0.579 (table-4)

### Discussion:

Trauma to the elbow is a common cause of joint stiffness. Despite advances in the management of injuries around the elbow, approximately 12% of elbow injuries (fractures, dislocations, and biceps tendon ruptures) result in contractures re-

quiring surgical release. It remains unclear why the elbow is prone to contracture and which patient characteristics are related to post-traumatic elbow stiffness; although, it is assumed that capsule contractures can be prevented by early active mobilization following any trauma of the elbow.<sup>16</sup>

Non-operative treatment such as physiotherapy, dynamic splinting, and static progressive splinting are advised and should be continued for at least 6 months, according to many authors.<sup>17-23</sup> Surgical arthrolysis can be indicated for those patients with persistent impairment of the functional range of motion despite adequate conservative treatment. Prior to surgery, it is essential to assess the origin of the contracture by radiographs and/or computer tomography scan.

Furthermore, the patient must be prepared and motivated to complete an extensive post-operative rehabilitation program. Release of the stiff elbow can be done by an open or arthroscopic arthrolysis depending on the surgeon's expertise level with elbow arthroscopy, status of the ulnar nerve, formation and location of heterotopic ossifications, extent of the contracture, and articular surface damage.<sup>16,21</sup>

Arthrolysis will suffice in most cases, except for cases of extensive articular involvement that require interposition arthroplasty or total elbow arthroplasty.<sup>24</sup> Since the introduction of open arthrolysis for post-traumatic elbow contractures by Wilson et al in 1944,<sup>25</sup> numerous different operative techniques are described,<sup>26-28</sup> however, as all reports consist of level III or IV evidence, there is no high-level evidence for the best surgical treatment modality for post-traumatic stiff elbows.

In this study percentage improvement in range of motion after surgical release for management of patients of post-traumatic stiff elbows was  $59.83\% \pm 8.39$ . Minimum and maximum percentage of improvement in range of motion was 43% and 74.14% respectively. However age, gender, duration of disease and body mass index of patients was not significantly associated with

percentage improvement in range of motion after surgical release.

Surgical treatment for elbow stiffness in adults is well established, with good results in most patients. It has been reported that 90% of the patients present gains in ROM and that more than 50% return to a functional range of motion.<sup>29,30</sup>

Alberto Naoki Miyazaki and his team members evaluated the results from surgical treatment of post-traumatic stiffness of the elbow in skeletally mature patients. As per their findings the evaluation of the variables showed that patients with an initial flexion arc greater than  $90^\circ$  achieved a greater final flexion-extension arc, and those with an initial extension less than or equal to  $60^\circ$  gained greater range of motion.<sup>31</sup>

Chandrabose et al., found that after surgical intervention in post-traumatic stiff elbow, the mean pre-operative ROM was  $33.9^\circ (\pm 24.0)$  which was improved to  $105^\circ (\pm 19.47)$  at last post-operative follow-up, indicating a percentage gain of 67.7% in the ROM.<sup>8</sup> In this study mean ROM at base line was 44.46 which after 24 weeks post-treatment was 111.01 the mean percentage gain in ROM in between base line ROM and ROM after 24 weeks was 59.83%. These results is line with the findings reported by Chandrabose et al. However mean percent improvement in ROM was a bit lower as that of reported by Chandrabose et al.

Marti RK in his study showed that after surgical release, percentage improvement in ROM was 54.5%.<sup>9</sup> Percentage improvement in ROM in this study was a bit higher as that of reported by Marti RK.

Kelly EW study showed that after surgical release, percentage improvement in ROM was 21.2% cases.<sup>10</sup> However percentage improvement in ROM in this study was much more higher as that of reported by Kelly EW.

Miyano reported significantly improved range of motion at the elbow with the use of medial approach for operative release following trauma. They obtained a mean increase of  $64^\circ$  in the arc

of motion of their patients.<sup>32</sup>

Ring et al also did not find that age, sex, trauma mechanism or initial treatment had any relationship as factors that might change the results on the DASH, MEPS and ASES scales.<sup>33</sup>

Alberto Naoki Miyazaki also reported that factors such as age, sex, dominance, time elapsed between injury and treatment, implementation of treatment for the initial trauma, type of lesion and presence of contracture in flexion or extension, did not establish any changes in the prognosis regarding release of the elbow stiffness.<sup>31</sup>

All studies on the surgical release of post-traumatic stiffness of the elbow have shown an improvement in movement regardless of the surgical approach or specific technique. However, the outcome and post-operative range of movement may vary according to the underlying pathological condition.

In the setting of failed non-surgical treatment of the stiff elbow, surgical release can yield to sustained improvement of ROM and patient quality of life. Adequate patient selection, a clear understanding of the involved anatomy, careful surgical dissection with preservation of the elbow stabilizers, and structured post-operative rehabilitation are paramount to achieve optimal results.

#### **Conclusion:**

In this study patients undergoing surgical treatment of post traumatic stiffness of the elbow had good percentage improvement in range of motion. This shows the effectiveness of surgical release in post traumatic stiff elbows. However age, gender, duration of disease and body mass index did not establish any significant changes in the prognosis regarding release of the elbow stiffness.

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#### **Role and contribution of authors:**

Dr Kaleem Ullah, collected the data, references

and did the initial writeup.

Dr Ejaz Ali Chaudhry, collected the data and helped in introduction writing.

Dr Saad Ilyas, collected the data and helped in interpretation of data.

Dr Ashfaq Ahmed, collected the references and helped in methodology writing.

Dr Nida Shahid, collected the references and helped in result writing.

Dr Muhammad Latif, collected the data and helped in interpretation of data and result writing.

Dr Rizwan Akram, critically review the article and made useful advices.

Dr Naeem Ahmed, critically review the article and made useful correction in discussion and in result.

Dr Amer Aziz, critically review the article and made the final changes.

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