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Original article

Simple and stable elbow dislocations: results after conservative treatment

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Summary. *Background and aim of the work:* In adults, elbow dislocations are second in frequency after shoulder dislocations. They are often the result of a trauma due to accidental falls on the palm of the hand with the elbow flexed. In most cases this mechanism produces a posterior dislocation of the radius and ulna with respect to the humerus. The therapeutic approach was usually conservative in the past and it was characterized by manual reduction and plaster immobilization. More recently, as consequence of biomechanic and pathophysiology studies, the management of these injuries has gradually changed. The current trend is to immobilize the elbow only for few days and to evaluate its stability several times. In case of instability surgery may be indicated. The aim of this study was to assess the outcomes of simple stable elbow dislocations treated conservatively between january 2012 and december 2018. *Methods:* Twenty-six patients were included. All subjects underwent to a follow-up visit, in which clinical functional tests were performed in order to evaluate any stiffness in flexion-extension, prono-supination and instability in varus-valgus. In addition, patients were asked to complete three questionnaires (DASH, MEPS, SF-36) to evaluate how much the pathology interfered with ADL's. *Results:* Outcomes showed that prolonged immobilization increased stiffness in flexion and extension with the need of longer reabilithation. The recovery of prono-supination was instead always optimal. ADL's migth be influenced by the traumatic event and its management. *Conclusions:* Results of conservative treatment of simple elbow dislocation are generally satisfactory. A precise flow-chart of the patient management after trauma is essential in order to detect unstable lesions and to plan the correct therapy. This is the basis for the prevention of joint stiffness and long-term insatbility.

Key words: elbow, dislocation, stiffness, instability.

Introduction

In adults traumatic elbow dislocation are second in frequency only to shoulder dislocation in large joints and they occur at an approximate rate of 6-13/100000 per year (1-4). The most common injury mechanism is a falls onto an outstretched hand with the elbow in flexion. About 60% of dislocations occur in the non-dominant limb. The primary stability of the elbow is maintained by bone and ligament structures; the first are represented by the coronoid and the olecranon, the second by the lateral and medial collateral ligaments. The secondary stabilizers are represented by the radial capitellum, the joint capsule and the muscles, with a lesser role than the primary ones. Before proceeding with the manual reduction of the dislocation it is nec-

essary to perform an X-ray to confirm the suspected clinical diagnosis and make sure that there are no associated fractures. The reductive maneuver is usually performed in general anaesthesia or deep sedation. It is essential to evaluate the stability of the joint complex, by carrying out specific tests (varus-valgus stress, "postero-lateral pivot-shift test"). Actually, most simple dislocations do not require surgery and are managed conservatively with early range of motion. If the elbow remains unstable and the joint continues to dislocate, surgery should be indicated (5-7).

The aim of this study was to assess the outcomes of 26 simple stable elbow dislocations treated conservatively between january 2012 and december 2018 at the Orthopaedic Clinic of the University Hospital of Parma.

Materials and methods

Twenty-six patients with simple elbow dislocation treated at the University Hospital of Parma between January 2012 and December 2017 were enrolled. This study was conducted in accordance with the principles of Declaration of Helsinki. All patients signed informed consent about the treatment they were subjected and the processing of their personal data.

Patients younger than 18 years of age and those with fracture-dislocations were excluded. Treatment was the same described in the introduction for reduction and acute evaluation of the stability followed by plaster application with elbow at 90° degrees of flexion for seven days. After seven days the plaster was removed and a clinical visit was made to check again the stability of the elbow. If the joint was stable a specific articulated brace was then applied (-40° to full flexion from day 7 to 14 and -20° to full flexion from day 15 to 21). In 6 out of 26 patients a non articulated plaster was applied for three weeks. Each patient was contacted by telephone, inviting him to return to the Orthopaedic Clinical to carry out a check-up visit. Furthermore, it was asked to bring the previous documentation with regards to the patient's diagnostic and therapeutic process. During the visit the patient was asked to tell their own experience, focusing on the dynamics of the trauma, on the attempt to manual reduction, on the duration of maintenance of the plaster cast, on any symptoms present before and after the removal of the plaster and on the duration of rehabilitation treatment. After collecting these informations, the patient underwent a clinical visit, during which with a protractor the degrees of movement in flexion-extension and prono-supination were assessed. Joint stability was also evaluated by subjecting the elbow to varus-valgus stress and through the "milking maneuver". In addition, a clinical examination was performed to assess any nervous alterations, focusing on the innervation territories of the ulnar, median and radial nerve. All assessments were compared to those of the contralateral limb. Ultimately the patient was asked to fill in three questionnaires (MEPS, DASH and SF-36), through which it was possible to evaluate how much the pathology influenced the subject's normal daily activities (ADL's).

This study aimed to evaluate the outcome of subjects treated for elbow dislocation with reference to the optimal functioning of the contralateral limb. Based on these considerations, it was likely to assume that the performance of the affected limb was worse than the contralateral, more formally the following hypotheses were formulated:

- H1: The DASH score is higher in subjects who had an elbow dislocation compared to the optimal limb performance.
- H2: The working DASH score is higher in subjects who had an elbow dislocation compared to the optimal limb performance.
- H3: SF36 physical activity is less in subjects who had an elbow dislocation compared to optimal performance.
- H4: the SF36 physical role limitations is less in subjects who had an elbow dislocation than the optimal performance.
- H5: SF36 physical pain is less in subjects who had an elbow dislocation than optimal performance.
- H6: SF36 general health is lower in subjects who had an elbow dislocation compared to optimal performance.
- H7: SF36 vitality is less in subjects who had an elbow dislocation compared to optimal performance.
- H8: the SF36 social activities is less in subjects who had an elbow dislocation than the optimal performance.

- H9: the SF36 emotional role limitations is less in subjects who had an elbow dislocation than the optimal performance.
- H10: SF36 mental health is less in subjects who had an elbow dislocation than the optimal performance.
- H11: MEPS pain is less in subjects who had an elbow dislocation than the optimal limb performance.
- H12: the MEPS movement is less in subjects who had an elbow dislocation than the optimal limb performance.
- H13: the MEPS stability is lower in subjects who had an elbow dislocation compared to the optimal performance of the limb.
- H14: MEPS activity is lower in subjects who had elbow dislocation compared to optimal limb performance.

Statistic Analysis

The experimental sample consisted of 26 subjects (18 males and 8 females with an average age of 43 years). The data analysis was carried out with the IBM SPSS statistical analysis software (ver. 23). To test the experimental hypotheses, the Mann-Whitney nonparametric U test was used for the comparison between means. Significance was accepted at a p-value level < 0.05.

Results

The mean follow-up was 40 months (range 12-96). All patients had an initial conservative treatment for 3 weeks. Twenty-one patients out of 26 recovered full ROM in comparison to contralateral elbow (figure 1 and 2). Five on 26 showed a mean deficit in extension of 20° (range 10-30°) despite more intense and lasting rehabilitation (mean rehabilitation time 60 days). All these five cases did not do early range of motion as they had a fixed plaster for all the duration of the treatment. Prono-supination movements were complete and similar in both sides. The mean rehabilitation time was 40 days (range 25-80). Joint stability was maintained at follow-up as already demonstrated at the moment of injury and 7 days later. As well, there was no impairment of radial, ulnar and median nerve.

Table 1 shows the averages of the parameters analyzed.

Hypotheses H1, H3, H6, H7, H8 and H10 were

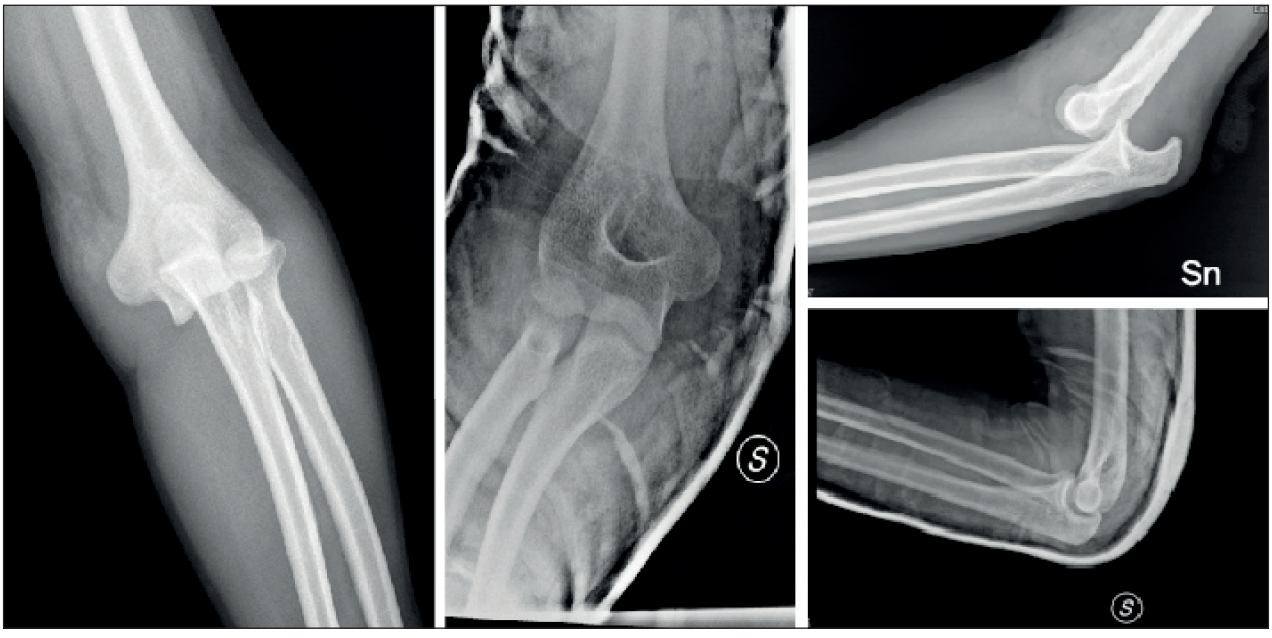

Figure 1. Simple dislocation of the left elbow. X-rays before and after reduction

Figure 2. One year follow-up. X-ray and clinical evaluation with full recovery

Table 1. Value of the scores.

	Minimum	Maximum	Average	Std. Deviation
DASH	1,00	2,73	1,3023	,51098
Working DASH	1,00	2,75	1,2500	,50000
Physical Activity	50,00	100,00	90,7692	14,55538
Physical role limitation	,00	100,00	78,8462	33,61261
Physical pain	32,00	100,00	82,5385	25,49057
General Health	47,00	100,00	76,8462	17,44442
Vitality	20,00	100,00	69,2308	21,09958
Social activities	62,00	100,00	91,1538	11,99893
Emotional role limitations	,00	100,00	87,0769	29,07021
Mental health	28,00	100,00	76,6923	19,32781
MEPS Pain	15,00	45,00	41,5385	8,98717
MEPS Mouvment	20,00	20,00	20,0000	,00000
MEPS Stability	10,00	10,00	10,0000	,00000
MEPS Activity	15,00	25,00	24,2308	2,77350

supported; conversely, the hypotheses H2, H4, H5, H9, H11, H12, H13 and H14 were not supported.

- The data showed that the DASH score regarding the limb that underwent elbow dislocation was greater than the contralateral limb (H1). The difference between the optimal score and that of the affected limb was significant (p-value = 0.006) and was equal to 0.3023. Therefore, there was a slight residual disability. This data was reinforced by the fact that the H2 hypothesis was null (p-value = 0.186); in fact, there were no significant differences between the working DASH of the diseased limb and that of the healthy contralateral limb.
- Patients diagnosed with elbow dislocation had a lower SF36 physical activity than optimal performance (H3). The difference was 9.2308 (p-value = 0.019); therefore it could be considered a difference of moderate level.
- The data regarding the SF36 general health (H6) showed a significant difference between the patient and the optimal performance, with a value of 23.1538 (p-value = 0.000).
- Patients with elbow dislocation had a SF36 vitality (H7) of 30.7692 lower than the optimal performance (p-value = 0.000).
- By examining the data regarding the SF36 social activities (H8) they were lower than the optimal performance. The difference was 8.8462 (p-value = 0.044).
- Sick subjects had a lower mental health SF36 than optimal performance (H10), with a difference of 23.3077 (p-value = 0.000).
- Patients with elbow dislocation did not show significant differences in terms of performance compared to the optimal condition with reference to:
  - working DASH (H2); p-value = 0.186
    SF36 physical role limitations (H4); p-value = 0.101
  - SF36 physical pain (H5); p-value = 0.101
    SF36 emotional role limitations (H9); p-value = 0.336
  - MEPS pain (H11); p-value = 0.511
  - MEPS movement (H12); p-value = 1,000
  - MEPS stability (H13); p-value = 1,000
  - MEPS activity (H14); p-value = 0.762.

Discussion and conclusion

The study results suggest that, although patients generally report favorable long-term functional out-

comes after a simple elbow dislocation, these lesions are not entirely benign.

The data analyzed by the DASH questionnaire show that a slight deficit remains after the treatment of elbow dislocations, although this is more correlated with the daily activities of high difficulty (lifting weights, making intense efforts) but does not interfere with the work activities of the patient. The impact of this slight deficit could be further investigated in the future, with the aim of verifying the existence of differences according to specific work activities. More specifically, it may be useful to assess the existence of difficulty about work activities that require a more intense use of the upper limb, and in particular of the elbow.

The results of SF36 physical activity also show that patients with elbow dislocation have a significant reduction in performance compared to optimal values. This evidence provides further support for the results obtained from the analysis of the DASH score, noting the persistence of consequences on the patient's long-term activity.

The results of the MEPS are, on the contrary, in the normal range, and therefore appear in contrast to those obtained from the two aforementioned questionnaires. However, it should be noted that the MEPS analyzes the activity parameter through parameters that concern basic activities that require minimal efforts (combing, personal hygiene, feeding, wearing a shirt, putting on shoes) in a general way. On the contrary, DASH investigates even more complex actions, such as pushing a heavy door, gardening, carrying a heavy object. The contradiction between the two questionnaires is therefore only apparent and confirms that the impact of elbow dislocation over time only detects certain activities.

As regards the data about the general health of the patient, vitality, social activities and mental health, it has been possible to highlight that patients suffering from elbow dislocations have significantly lower values than what would be optimal performance. This evidence requires an in-depth analysis which can be carried out through a research design between groups; one consisting of patients diagnosed with elbow dislocation and an equivalent control group (by age, sex, lifestyle, etc.) with subjects who have not had an elbow dislocation. A study of this type will allow to assess if there is a correlation between the pathology and the state of vitality, mental health, etc.

During the study, it was found that patients have no long-term residual pain. This was assessed through remote and near pathological anamnesis collected during follow-up visits. This evidence was confirmed by the data obtained from the SF36 physical pain and the MEPS pain ($M = 41.5385$; p-value $= 0.511$). However, all patients reported experiencing severe pain after removing the plaster cast and during rehabilitation treatment. During the study it also emerged that, at the removal of the plaster splint, the elbow was completely blocked and it was necessary for the patients to carry out a long rehabilitation therapy with active and passive physiokinesis to unlock the joint. The recovery time was shorter for patients who had been immobilized for less time and underwent early range of motion.

According to the most recent studies, conservative treatment remains the one of choice in this type of injury. Reports (8-12) that compared a group of patients with simple elbow dislocation treated conservatively with a group treated surgically at the same clinic, underlined that the outcome was better in terms of residual pain, ROM, complications and recovery of motility in the group of patients treated conservatively, with the same clinical lesion.

Collecting the data in the literature regarding the treatments (9-12), it emerged that there is a lot of heterogeneity in the timing of maintenance of the plaster cast and the resumption of movements. Current trends indicate that the elbow, if stable, should be immobilized in a brace with joint release as soon as possible (2). The literature is clear that the outcome is all the better the earlier the elbow is mobilized (13).

Therefore, given the same condition, it would be appropriate to standardize a treatment for all patients, also supported by the fact that those who receive early mobilization have a fast and safe recovery and return to work early without an increased risk of complications (14).

The clinical evaluation of the stability of the elbow immediately after reduction and 7 days after the trauma also remains fundamental. Chronic instability could be particularly disabling and in older patients may require elbow replacemente (15-18).

If the elbow is stable, full flexion and extension down to -40 degrees for the first 7 days and then down to -20 degrees 15 days after the first immobilization is granted. If the elbow is unstable, an articulated elbow brace is placed, + 110 ° of flexion is allowed but the extension is limited to -70 ° for 7 days. After this time, the varus-valgus stress is re-evaluated and, if the elbow is still unstable, MRI is performed to evaluate any lesions of the primary and secondary stabilizers of the elbow and surgery is indicated (figure 3).

By evaluating the patients of the study, it was noted that some were immobilized for twenty one days, others for seven, regardless of the year in which the elbow was immobilized. The plaster cast maintained at 90 ° of flexion for all 3 weeks period is not without consequences, the main of which is rigidity, which requires longer rehabilitation (12).

As regards the clinical evaluation of the patients it emerged, that especially in these cases, it was not possible to fully recover the flexion-extension, while maintaining minimum deficits, varying between 5 and 10 degrees, which do not compromise daily activities (as demonstrated by the fact that the average MEPS movement for the patients analyzed is 20, compatible with the normal range). The recovery of prono-supination is instead optimal. The varus-valgus stress tests and the milking maneuver were negative, demonstrating a good stability of the elbow after the therapeutic treatment.

In conclusion, the clinical findings agree with the data of the questionnaires in indicating that the pathology has a satisfactory outcome and that it has limits only in the presence of heavy activities.

There are some limitations in this study: 1) the sample size was small; 2) it was a single centre investigation. Nevertheless, our results are similar to those in the literature and they confirm that conservative treatment is indicated in stable elbow dislocations.

Authors believe that satisfactory results depends on a correct management (from diagnosis to therapy) of these patients which aims to detect unstable lesions and to plan the correct therapy. This is the basis for the prevention of joint stiffness and long-term instability.

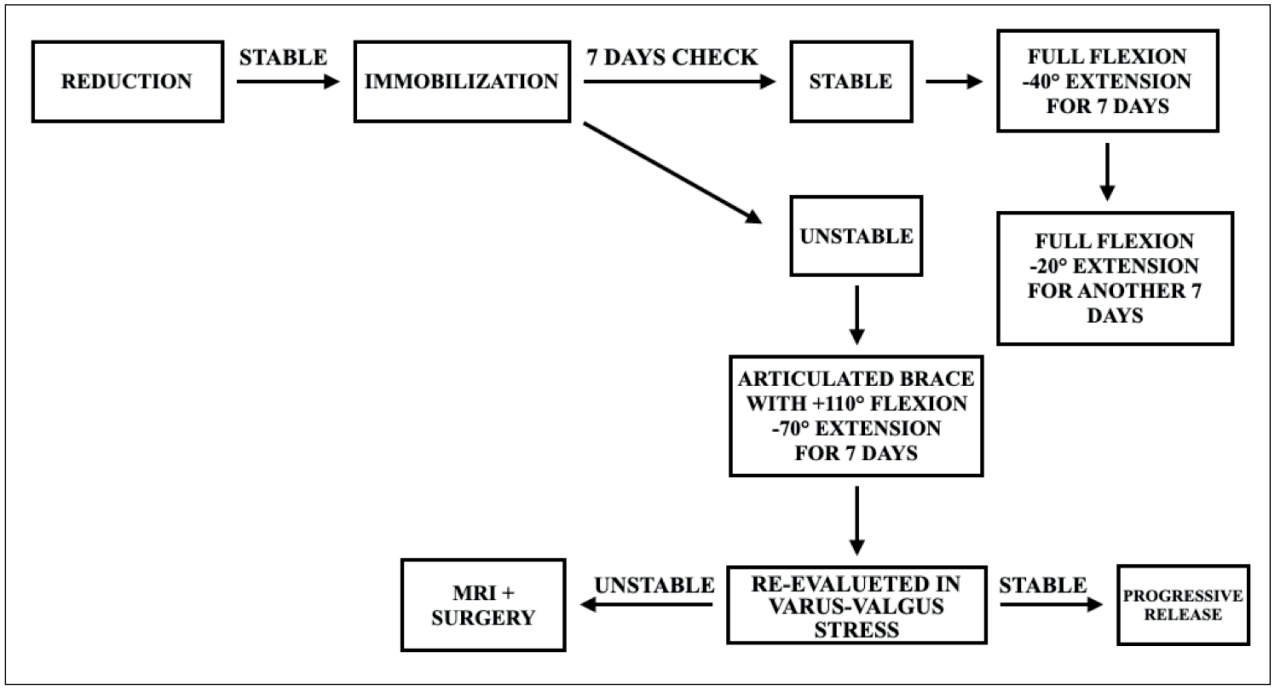

Figure 3. Flow-chart of treatment in elbow dislocation

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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