Acta Orthopaedica et Traumatologica Turcica xxx (2017) 1–5

Contents lists available at ScienceDirect

Acta Orthopaedica et Traumatologica Turcica

journal homepage: https://www.elsevier.com/locate/aott

Appropriate excision time of heterotopic ossification in elbow caused by trauma

Shu-Kun He, Min Yi, Gang Zhong, Shi-Qiang Cen, Jia-Lei Chen, Fu-Guo Huang*

Department of Orthopedics, West China Hospital, Sichuan University, Sichuan, PR China

ARTICLE INFO

Article history:
Received 14 September 2016
Received in revised form
23 November 2017
Accepted 24 November 2017
Available online xxx

Keywords:
Elbow
Heterotopic ossification
Trauma
Timing of excision

ABSTRACT

Objective: The aim of this study was to investigate the optimal timing for the resection of heterotopic ossification (HO) of the elbow.
Methods: We retrospectively reviewed 42 patients who were treated operatively for heterotopic ossification of the elbow from March 2010 to December 2014 at our institution. The patients were divided into early (before 12 months) and late (after 12 months) excision groups. In the early excision group (17 patients), the average time from the initial injury to HO excision was 7.4 (3–11) months, and in the late excision group (25 patients), the average time was 33.5 (12–240) months. Every patient was evaluated by range of motion (ROM), the Mayo Elbow Performance Score (MEPS), postoperative complications and HO recurrence.
Results: The preoperative mean ROM in the late excision group was greater than that of the early excision group, suggesting that the ROM is expected to increase even without surgery. Both early and late surgery increased ROM and MEPS, but early surgery improved ROM and MEPS more than late surgery did ($p < .05$).
Conclusions: Early excision of HO can provide better elbow function, as indicated by ROM and MEPS. Considering that there were no notable differences in postoperative ROM and MEPS, HO recurrence, or postoperative complications, we concluded that early excision is safe and that the time from an elbow injury to surgery may be shortened.
Level of Evidence: Level III, therapeutic study.

Introduction

Compared with other joints, the elbow commonly shows growth of a heterotopic ossification (HO), a generally acknowledged complication following an elbow injury. The specific cause of post-traumatic HO may be multifactorial, but it remains unclear,[1,2] requiring further study. The development of HO around the elbow may impair the range of motion (ROM) and even lead to complete loss of movement.[3,4] If non-operative treatment cannot result in a functional ROM, surgery becomes the effective method to restore elbow function. Many authors have reported that the time from initial injury to surgical release is always more than one year until the maturation of HO occurs in order to avoid recurrence.[5–10] However, as time goes by, the elbow function becomes worse as a result of soft tissue contracture and muscular atrophy.[11] The purpose of this study was to compare the improvements of ROM and the Mayo Elbow Performance Score (MEPS)[12] after surgery between the early excision group and the late excision group. In addition, we investigated whether the time from an elbow injury to surgery might be shortened.

Methods

Patients

After obtaining institutional review board approval, we retrospectively analyzed all patients who were treated with open surgical release at our institution between March 2010 and December 2014. Inclusion criteria: (1) post-traumatic stiff elbow with an ROM

* Corresponding author. Department of Orthopedics, West China Hospital, Sichuan University, No. 37 Guo Xue Xiang, Chengdu, Sichuan, 610041, PR China.
E-mail addresses: dkdkdkhsk@163.com (S.-K. He), yeemean@163.com (M. Yi), zg730927@163.com (G. Zhong), ahsir7201@126.com (S.-Q. Cen), dino1219@163.com (J.-L. Chen), huang-f-g@163.com (F.-G. Huang).
Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

https://doi.org/10.1016/j.aott.2017.11.008

less than 100°; (2) preoperative X-ray images were observed in HO and were confirmed during surgery; and (3) imaging of bone and joint development in good condition with no deformity. Exclusion criteria: (1) elbow stiffness caused by skin or muscle contracture; (2) HO caused by burns or central nervous system injury; and (3) limited ROM in patients with trauma history before the injury. Fifty-one patients satisfied the inclusion criteria and eight patients were excluded after checking the medical records and plain films. In December 2015, we investigated 43 patients who were treated; we were unable to contact one patient. Overall, 42 patients received telephone interviews with more than 12 months of medical records; the average follow-up time was 37 (12–65) months. To avoid HO recurrence and postoperative complications and to compare the outcome between early surgical excision of HO and late surgical excision, we established a time limit of 12 months to define early (<12 months) and late (>12 months) surgical excision.[8,13] In the early excision group, 17 patients had an average time of 7.4 (3–11) months before surgery; the late excision group, 25 patients had surgery after an average time of 33.5 (12–240) months.

Surgery

The indication of surgical excision was at least three months after injury and continual loss of elbow flexion of the upper limb in daily activities. All surgeries were performed with the patient in the supine position and under general anesthesia with a tourniquet. While protecting and preserving important structures, surgical approaches were individualized considering the location of the HO, previous incisions, and skin condition. In the early excision group, medial and lateral approaches were utilized in 14 patients, a medial approach in two, and a lateral approach in one. In the late excision group, medial and lateral approaches were utilized in 13 patients, a medial approach in four, a lateral approach in five, an anterior approach in one, and a posterior approach in two. With the release of contracted capsular structures, HO excision, and ligament reconstructions, we achieved our goal in all patients (i.e., obtaining >130° of flexion and <10° of flexion contracture by passive motion intraoperatively).[14] Intraoperative ROM measured with a sterile goniometer in the flexion–extension arc of all patients was recorded. In addition, the ulnar nerve was released in 37 patients with ulnar nerve symptoms and transferred anteriorly into the subcutaneous layer.

Aftercare

A unilateral hinged external fixator was applied for protection on all patients for as long as four weeks (4–6 weeks) postoperatively. Physical therapy consisted of active assisted and mild passive flexion and extension exercises and was initiated on the second postoperative day continuing until the ROM was no longer changed by the flexion and extension exercises. The exercise was tailored to each patient's individual conditions and usually continued for 4–6 months. All of the patients received indomethacin for 4 weeks at a dose of 25 mg three times a day to prevent HO recurrence. No radiotherapy was used for any patient.

Data measures and evaluation

Data from all patients regarding sex, age, involvement of dominant elbow, type of injury, surgical approach, and initial treatment were collected. Preoperative biplanar radiographs were obtained to assess the location of heterotopic ossification as medial, lateral, anterior, or posterior. Computed tomography (CT) with 3-dimensional reconstruction was not routinely utilized to evaluate HO; quantitative analysis of HO was not done. The elbow flexion and flexion contracture arc was measured with a goniometer, and the MEPS was evaluated before the surgical excision of HO. In addition, ulnar nerve palsy was assessed by electrophysiological studies only when ulnar nerve dysfunction was suspected prior to surgery. The final ROM and MEPS were assessed at the final follow-up. Medical records covering more than 12 months were available for 13 patients. Twenty-nine patients who did not visit after one year postoperatively were interviewed by telephone; these patients stated that the final ROM was essentially unchanged from the time of discharge. Therefore, we defined the final ROM of those patients as the joint activity measured at the last visit. Postoperative complications and recurrence of HO were also reviewed.

Statistical analysis

All independent variables were coded as continuous or categorical data. The ROM and MEPS were assessed by the independent sample T test. Fisher's exact test was used to assess categorical variables. The level of significance was predetermined at P values < .05. Statistical analysis was performed using SPSS 22 software (IBM, Armonk, NY, USA).

Results

Comparison of ROM and MEPS after surgery between the early excision group and the late excision group

The comparison of clinical characteristics of patients showed no significant difference between the two groups regarding sex, age, involvement of dominant elbow, type of injury, location of HO, surgical approach, initial treatment, follow-up time, postoperative complications, or recurrence of HO (Table 1). The ROM and MEPS of the two groups before surgery and at the final follow-up were summarized in Table II. In the early excision group, the average postoperative flexion was 114°(50°–135°), which had improved from 63°(10°–100°) preoperatively with an average improvement of 51°(−5° to 105°). The average flexion contracture decreased from 47°(5°–90°) preoperatively to 16°(0°–50°) postoperatively with an average improvement of −31°(−70° to 0°). The average total arc of motion increased from 16°(0°–70°) preoperatively to 98°(20°–125°) postoperatively, with an average improvement of 82°(15°–120°). In the control group, the average postoperative flexion was 112°(80°–135°), which had improved from 81°(5°–120°) preoperatively with an average improvement of 31°(0°–105°). The average flexion contracture decreased from 45°(0°–95°) preoperatively to 19°(0°–70°) postoperatively with an average improvement of −26°(−80° to 10°). The average total arc of motion increased from 35°(0°–90°) preoperatively to 93°(50°–130°) postoperatively, with an average improvement of 57°(0°–120°). The average MEPS increased from 37 (20–55) preoperatively to 91 (60–100) postoperatively with an average improvement of 54 (5–80) in the early excision group, and the average MEPS increased from 47 (20–70) preoperatively to 85 (55–100) postoperatively with an average improvement of 38 (15–80) in the late excision group. In all clinical variables, the preoperative flexion ($P = 0.045$), total arc of motion ($P = 0.013$) and MEPS ($P = 0.027$) had significant differences between the two groups (Table 2). Additionally, the preoperative mean ROM in the late excision group is greater than that of the early excision group; thus, it can be concluded that as time passes, the ROM increases even if no procedure is done. In addition, differences of improvement in flexion ($P = 0.042$), total arc of motion ($P = 0.024$) and MEPS ($P = 0.001$) between the two groups were significant (Table 2), suggesting that early or late surgery both increased ROM

Please cite this article in press as: He S-K, et al., Appropriate excision time of heterotopic ossification in elbow caused by trauma, Acta Orthop Traumatol Turc (2017), https://doi.org/10.1016/j.aott.2017.11.008