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Outcomes of nonoperative management of displaced olecranon fractures in medically unwell patients

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Background: Surgical treatment of displaced olecranon fractures in the elderly has a high rate of complications, including wound breakdown and fixation failure. The purpose of this study was to assess the clinical, radiographic, and functional outcomes of nonsurgical management of displaced olecranon fractures in low-demand elderly and medically unwell patients.

Methods: A retrospective review of 28 patients with displaced closed olecranon fractures was performed with an average follow-up of 11 months. The mean age at the time of injury was 79 ± 10 years. The average Charlson Comorbidity Index was 6.4 ± 2.6. Treatment modalities were at the discretion of the treating surgeon. A sling alone was used in 3 cases, an extension circumferential cast in 9, or a plaster or thermoplastic splint in 16. The mean period of immobilization was 5 ± 1 weeks. Outcomes included range of motion, ability to perform active overhead extension, as well as radiographic and functional outcomes.

Results: At final follow-up, the mean elbow range of motion for the cohort was from 28° ± 21° extension to 127° ± 15° flexion. Active overhead elbow extension against gravity was noted or documented in 24 (86%) patients. Two patients (7%) were unable to perform active extension. No pain was noted in 18 elbows, severe pain was present in 1 elbow, and the remainder reported mild occasional pain. All olecranon fractures in this cohort were displaced on the initial lateral radiograph. The mean displacement was 11 ± 7 mm. Nonunion at final radiographic outcome was observed in 23 (82%) elbows. Two (7%) patients developed skin complications related to posteriorly placed splints; one of which was severe.

Discussion: This study adds to the growing literature that supports nonoperative management of displaced olecranon fractures in elderly and medically unwell patients with low upper extremity demand. Patients can be counseled that they have a good chance of obtaining overhead extension, with minimal pain. Posteriorly based splints should not be used to minimize skin complications.

Fractures of the olecranon are common, accounting for approximately 10% of all elbow trauma.[5,20] These injuries predominantly occur in middle-aged and elderly patients. Outcomes after surgical treatment for displaced olecranon fractures are generally favorable, irrespective of the surgical technique.[1,7,9-11,14,18,19] Operative modalities include tension band wiring, plating, and intramedullary nailing. In addition, in the elderly population, proximal olecranon excision with triceps tendon advancement is another option.[10] Nonetheless, several studies have reported a complication rate of up to 30% after surgical treatment of displaced olecranon fractures in the elderly, including wound breakdown, and fixation failure.[6,7,16]

Several recent studies have advocated for nonsurgical treatment of displaced olecranon fractures in the elderly with reasonable outcomes and limited complications.[2,4,6,8,13,15,21] The purpose of this study was to assess the clinical, radiographic, and functional outcomes of nonsurgical management of displaced olecranon fractures in low-demand elderly and medically unwell patients.

This study was approved by the REB Ethics Committee University of Western Ontario (approval: 113118).

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Methods

After ethics board approval, a retrospective review between 2007 and 2018 was performed to identify patients diagnosed with a displaced olecranon fracture treated nonsurgically at our institution. Inclusion criteria included all patients with a displaced olecranon fracture treated without surgical management. Exclusion criteria included any acute surgical management, associated osseous elbow pathology, and pathologic fractures. These patients were then contacted and invited to return for a clinical, radiographic, and functional evaluation. Twelve patients returned for repeat clinical assessment. Twelve patients were deceased at the time of this retrospective review. The other 4 patients were unable to be reached via telephone or mail requests (Figure 1). The follow-up period was determined based on patient availability to return and standard treatment protocol for those who were unable to return.

All patients were treated by an upper extremity fellowship-trained orthopedic surgeon. Patients were treated with a short course of immobilization followed by early self-directed range of motion. Treatment modalities were at the discretion of the treating surgeon. A sling alone was utilized in 3 cases, an extension cast in 9, or a plaster or thermoplastic splint in 16.

Clinical outcomes included range of motion at forearm (pronation and supination) and elbow (flexion and extension) measured with a goniometer, as well as grip strength measured with a handheld dynamometer. In most cases, owing to patient frailty, grip strength was unable to be assessed. Active overhead elbow extension was also assessed at the time of chart review and repeat clinical assessment. Of those patients who did not return for repeat clinical assessment, only 2 did not have any documentation of the presence or absence of overhead extension in their clinical notes. Radiographic parameters reported included measurements of fracture displacement, fracture comminution, and joint depression; and radiographic outcomes included union rate. Functional outcomes included the Patient-Rated Elbow Evaluation, QuickDASH, single alpha-numeric evaluation (SANE), and the Mayo Elbow Performance Score (MEPS). Questionnaires were available in only 7 (25%) patients as cognitive impairment limited the ability of many patients to complete these evaluations. In addition, pain, tenderness, and treatment complications were assessed on clinical evaluation for those patients that returned as well as reviewing their medical records. Pain was graded by patient report as none, mild, moderate, or severe pain. In those patients who used a gait aid, inquiry was made as to whether or not they were able to continue using a cane or walker.

Statistical methods

Continuous data are reported as means, ranges, and standard deviation.

Results

We identified 28 patients with a mean follow-up of 11 ± 19 months. The mean age at the time of injury was 79 ± 10 years with 18 (64%) female. The dominant extremity was involved in 14 (50%) cases. At the time of injury, 19 patients utilized some form of a gait aid (cane in 2, walker in 15, and a wheelchair in 2). The mean Charlson Comorbidity Index (CCI) was 6.4 ± 2.6 (Figure 2).

The mean period of immobilization was 5 ± 1 weeks.

Clinical outcomes

At final follow-up, the mean elbow range of motion for the cohort was from 28° ± 21° extension to 127° ± 15° flexion based on documentation in all 28 cases. Forearm rotation was documented or obtained in 12 elbows with a mean pronation of 69° ± 22° and a mean supination of 70° ± 24°. Grip strength, which was only available for 4 elbows, averaged 24 ± 14 kg which corresponded to 115% ± 10% of the contralateral unaffected limb.

Pain and tenderness were documented in all 28 cases. No pain was noted in 18 (64%) of elbows, whereas severe pain was only documented in 1 (4%) elbow. The remainder were classified as mild pain. On examination, 8 (29%) elbows demonstrated some tenderness about the fracture site. Active overhead elbow extension against gravity was noted or documented in 24 (86%) elbows (Figure 3). In 14 of these patients, active overhead elbow extension was documented or observed between 5 and 12 weeks from the date of injury. Two patients were unable to extend their elbows against gravity. The remaining 2 patients had no documentation of the presence or absence of overhead extension (Table 1).

Radiographic outcomes

All olecranon fractures in this cohort were displaced on the initial presenting lateral radiograph. The mean displacement was 11 ± 7 mm. A joint depression fragment was present in 17 (61%) elbows. Based on the Mayo classification, 11 were type IIA, 16 were type IIB, and 1 was type IIIA. Nonunion at final radiographic outcome was observed in 23 (82%) elbows.

Functional outcomes

In the 7 elbows with complete functional outcomes, the mean PREE score was 27 ± 28, the mean QuickDASH score was 26 ± 28, the mean SANE score was 57 ± 52, and the mean MEPS was 76 ± 20. Of note, 2 of these patients rated their elbows as 0% on the SANE scale. One patient had ipsilateral flaccid hemiparesis, whereas the other had a spastic upper extremity both related to prior cerebrovascular accidents. Of the patients without associated ipsilateral upper extremity neuromuscular problems, the mean SANE score was 76 ± 27.

Of the 12 elbows that returned for clinical assessment, 11 were able to utilize a walker for mobility without any difficulty. The other patient was wheelchair-dependent due to the aforementioned prior cerebrovascular accident.

Complications and reoperations

Two patients developed skin complications. One patient (4%) had a superficial abrasion from a posteriorly placed splint which was successfully treated with dressing changes over the course of 1 week. The other patient, who had extensive radiation therapy to the upper extremity, developed significant skin breakdown over the elbow due to the posteriorly placed plaster splint. An above-elbow amputation was discussed with the patient and family members; however, the patient passed away shortly thereafter without any further intervention. No patients required any additional treatment.

Discussion

Most surgeons consider open reduction and internal fixation the gold standard for the treatment of displaced olecranon

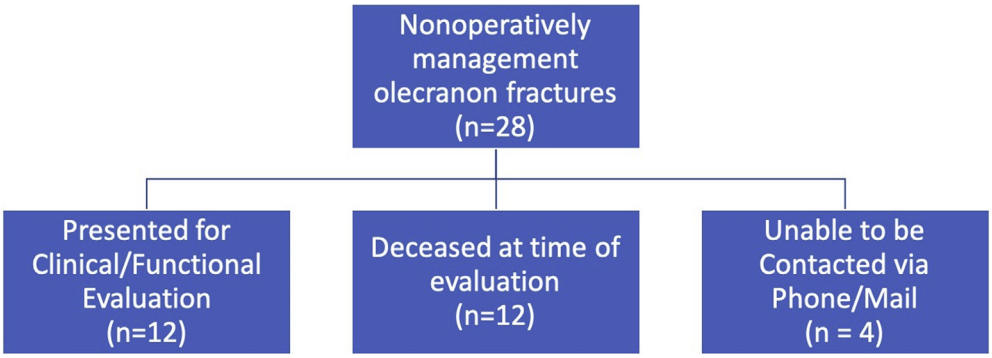

Figure 1 Flow diagram of patient follow-up.

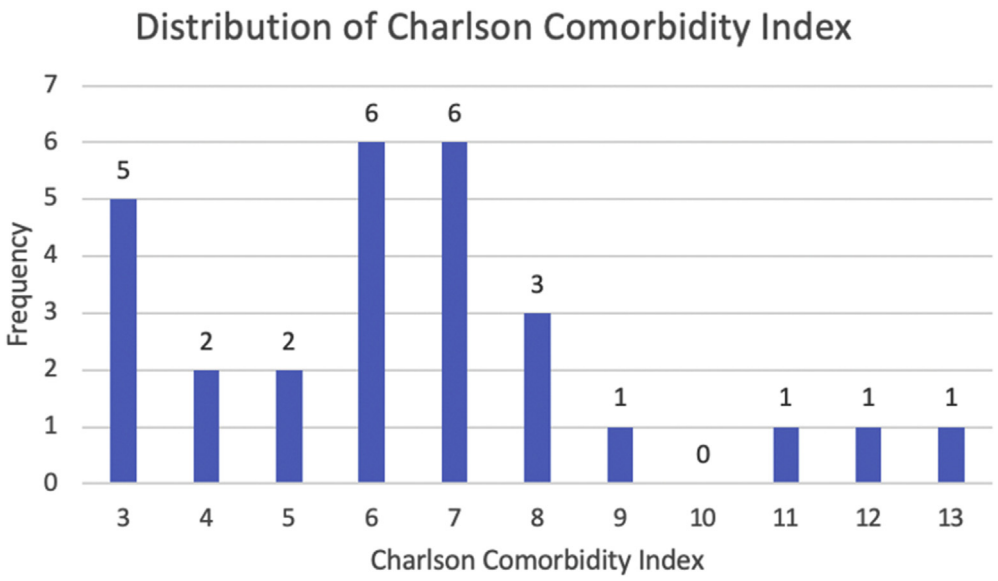

Figure 2 Distribution by frequency of Charlson Comorbidity Index in the cohort of patients.

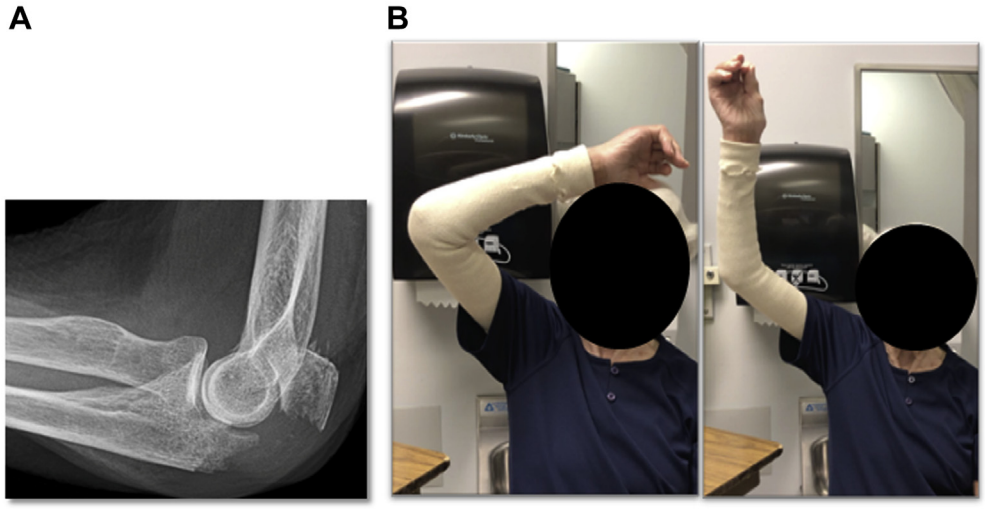

Figure 3 (**A**) This is an 86-year-old right-hand-dominant woman with atrial fibrillation and ovarian carcinoma (CCI = 6) and a displaced olecranon fracture with 16 mm of displacement treated with splinting for 4 weeks followed by active elbow range of motion. (**B**) At 2 month follow-up, the patient is able to perform overhead extension and bear weight on a front wheeled walker.

fractures.[1,7,9-11,17-19] Surgery in the elderly and medically unwell is fraught with complications, specifically related to wound healing.[1,6,7,16,19] Therefore, in low demand and elderly patients, nonoperative treatment of displaced olecranon fractures can be considered a viable option. Several authors have demonstrated that satisfactory outcomes can be attained without surgery.[4,6,8,13,15,21]

Duckworth et al reported on 43 displaced olecranon fractures managed nonoperatively with satisfactory outcomes at a mean of 4 months clinical follow-up.[4] No patients required an operation for a symptomatic nonunion and the mean DASH score at 6 years after the injury was 2.9. The authors did not comment on whether any patients experienced skin complications. In their study, 88% of patients had one or more comorbidities. The patient age range in our study (47 to 90 years) was similar to that reported by Duckworth et al; however, our clinical follow-up was longer at an average of 11 months. In our cohort, we sought to quantify the severity of medical comorbidities by utilizing the CCI, rather than the ASA classification used by Duckworth et al.[3] The mean CCI in our study was 6.4 which corresponds to a 2% estimated 10-year survival.

The same authors later performed a prospective randomized trial in an elderly population with displaced olecranon fractures comparing operative and nonoperative management.[7] The authors ceased the study early due to a high rate of complications in the surgical cohort. This supports an argument against surgical management in the medically unwell and elderly population. However, as the sample size remained small and the follow-up was relatively short, there still remains no study in the literature confirming that nonoperative management of olecranon fractures in the elderly population provides similar clinical outcomes to operative management.

A recent systematic review of nonoperative management of olecranon fractures demonstrated that reasonable clinical outcomes can be achieved with nonoperative treatment modalities in patients older than 70 years.[12] The authors concluded that nonoperative management should be considered in this cohort of patients. One of the 4 studies included demonstrated a mean MEPS of 95.3 in 22 fractures followed up for at least 6 months in patients older than 75 years.[13] However, they included only stable and minimally displaced Mayo type I and II fractures which may explain their excellent functional outcomes. Nonetheless, the available literature seems to support the findings of our study. Our cohort, however, varies in that several patients were chronologically younger and our fractures were more displaced with most being Mayo type II fractures.

Other authors have reviewed a series of younger patients including Putnam et al who reported on 14 nonoperatively managed olecranon fractures demonstrating very good functional outcomes with a mean MEPS of 96 and a mean time to discharge under 3 months from the date of injury.[15] In that study, the mean initial displacement was 8.6 mm (range, 2 to 25 mm). During the same time point of that study, the authors reported that 81% of their operatively managed elderly olecranon fractures required hardware removal and thus, a second trip to the operating room. Unlike our study, these authors had a much younger population with a mean age of 55 years, with one patient as young as 22 years of age.

Gallucci et al reviewed 26 elbows at a mean of 16 months treated nonoperatively with immobilization for a mean of 5 days.[8] Most patients in their study had multiple comorbidities and while these authors documented excellent range of motion after treatment, they did not comment on the ability to perform overhead extension. Nonetheless, the mean MEPS was 95 corresponding to an excellent outcome. Despite a mean articular gap displacement of 16 mm in their study, the authors did have 6 patients with 0 mm of displacement, which may have ultimately skewed the results. In their study, 8 patients had persistent pain and 5 reported an audible click. Skin complications were not commented on in their publication.

Table I
Demographics and outcome summary

Variable	Outcome
Age (mean, SD)	79 ± 10 years
Gender (n, %)	Female = 18 (64%)
	Male = 10 (36%)
CCI (mean, SD)	6.4° ± 2.6°
Extension (mean, SD)	28° ± 21°
Flexion (mean, SD)	127° ± 15°
Overhead extension (%)	Yes = 24 (86%)
	No = 2 (7%)
	Unknown = 2 (7%)
Pain	None = 18 (64%)
	Mild = 9 (32%)
	Moderate = 0
	Severe = 1 (4%)

CCI, Charlson Comorbidity Index.

Although previous report on patients with varying age ranges, medical comorbidities, and fracture displacement, our study helps affirm the validity of considering nonoperative treatment of displaced olecranon fractures in the elderly and medically unwell population. As demonstrated in our results, despite development of a nonunion and continued displacement, patients in this cohort are able to often regain active overhead extension and are not limited in their ability to use any preinjury gait aids which they require. We postulate that this is related to preservation of an intact lateral cubital retinaculum, providing continuity of their extension mechanism with the ulna and the development of a stable fibrous union. The ability to perform active elbow extension against gravity allows patients an increased level of independence and fulfillment of activities of daily living.

Nonoperative treatment of displaced olecranon fractures in the medically unwell population does have some potential limitations. There is the potential for superficial skin complications as noted in our study in 2 patients. Veras del Monte et al also reported on 1 of their 11 patients developing a skin sore during nonoperative treatment of olecranon fractures.[21] In addition, attentive early follow-up is necessary to ensure swelling and pain is improving, and patients are tolerating early elbow mobilization.

The study does have limitations. First, there was no consistent treatment algorithm in regard to the type and duration of immobilization. This is due to the fact patients were treated by multiple providers over the course of a decade at our institution. This does, however, provide a pragmatic and generalizable approach in the treatment of displaced olecranon fractures in elderly and medically unwell low demand patients. Second, owing to the retrospective nature of this study and the relatively high mortality rate, there was no standardized data collection. Nonetheless, a strength of our study is the high rate of documentation of the presence or absence of active overhead elbow extension in those patients who were unable to return for repeat clinical evaluation. Third, owing to the lack of a comparative group, we are unable to support whether the clinical and functional outcomes of nonoperatively managed displaced olecranon fractures are equivalent, better, or worse than those with surgical management. Finally, many patients were initially splinted in an emergency department and then referred to our tertiary care specialty center where the splint was removed. Given the retrospective nature of this study, there was inconsistent documentation of whether splints were placed anteriorly or posteriorly, except in the cases of skin complications as documented.

This study adds to the growing literature that supports nonoperative management of displaced olecranon fractures in elderly and medically unwell patients with low upper extremity demand. Our study supports a brief period of immobilization using anteriorly based splints to avoid skin pressure over the olecranon followed by early active range of motion in this population. Patients can be counseled that they have a good chance of obtaining overhead extension and the ability to continue using their prior gait aids.

Conclusion

Displaced olecranon fractures in elderly and medically unwell patients treated nonoperatively can result in reasonable range of motion, minimal pain, maintenance of extension against gravity. Posteriorly based splints should not be used to prevent skin complications.

Disclaimer

William Aibinder is a paid consultant for Exactech. George Athwal is a paid consultant for Wright Medical Technology, ConMed, and Exactech. Graham King is a paid consultant for Wright Medical Technology. Kenneth Faber is a paid consultant for Exactech. Laura Sims has no disclosures.

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