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REVIEW

Olecranon fractures in the elderly during the COVID-19 pandemic: Is non-operative treatment reasonable? Review of the current evidence

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Abstract
The current COVID-19 global pandemic presents a major challenge and unprecedented pressures on health systems. The national guidelines in the UK advise non-operative treatment of fractures whenever possible to reduce the risk of surgical intervention to both patient and healthcare staff. The elderly population over 70 years are highlighted as a high-risk group in this pandemic as well as being often high risk for surgery in general due to co-morbidities. This article reviews the current literature regarding treatment of displaced olecranon fractures in the elderly. Literature search of the available databases. One randomised controlled trial has been published, comparing operative versus non-operative treatments of olecranon fractures in this age group. The study was terminated prematurely due to the high complication rate in the operative group. No difference in functional scores was recorded. Other published retrospective case series report good functional outcome scores and high satisfaction rates in the majority of patients in whom olecranon fractures were treated non-operatively. Non-operative treatment of olecranon fractures in elderly patients seems to be safe and an acceptable management option in these unprecedented times.

Keywords Olecranon fractures · Elderly patients · COVID-19 · Non-operative treatment · Literature review

Background

During the COVID-19 pandemic, orthopaedic surgeons share the responsibility with other specialities to maximise the use of health services' resources to provide the best possible care for all patients. Changes to standard management plans including a shift towards non-operative treatment whenever possible have been considered to minimise patient exposure to risk of contracting the viral disease and overall impact on resources.

There are nearly 12 million (11,989,322) people aged 65 and above in the UK [1], and such elderly patients often have multiple co-morbidities increasing the risk of mortality with COVID-19 infection [2–5]. Thin or poor-quality skin and soft tissues are risk factors for surgical wound breakdown and infection.

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Olecranon fractures account for approximately 20% of all proximal forearm fractures (approximately 12 per 100,000 population) [6, 7]. As an intra-articular injury, the traditional default treatment is to reconstruct the joint surface with anatomic reduction, stable internal fixation and early mobilisation as per AO (Arbeitsgemeinschaft für Osteosynthesefragen) principles [8]. Commonly used surgical techniques include tension band wiring (TBW), plate and screw fixation or excision of fragment and triceps tendon advancement repair [9, 10]. The mean age of patients at the time of fracture is higher in females (57 years) compared to males (50 years) [6, 7]. Complications of surgical treatment have been reported to be as high as 30% [11, 12], and these include wound breakdown, infection and the risk of re-operation [10, 13, 14] for either failure of fixation with poor-quality bone or removal of prominent symptomatic metalwork. The high re-operation rate poses a further surgical and peri-operative risk to older and sometimes frail patients.

The alternative to surgical fixation is conservative treatment. This comprises an initial period of rest and immobilisation followed by active mobilisation [12, 15–17]. Prior to the COVID-19 pandemic, there was an increasing trend

amongst orthopaedic trauma surgeons to recommend such non-operative management particularly in patients with multiple co-morbidities [10, 17, 18].

Despite these unprecedented times, clinical decisions should be backed by scientific evidence whenever possible. In this review article, we present the most recent available evidence.

Methods

Literature search included comparative and observational studies that looked at operative (open reduction and internal fixation (ORIF) using plate and screws or TBW) versus non-operative treatments, including all methods of immobilisation (i.e. cast, sling) of displaced (more than 5 mm) olecranon fractures in patients above 65 years old. We were interested in looking at complications secondary to operative treatment and functional outcome with the Disabilities of the Arm, Shoulder and Hand (DASH) score.

Literature search

The Cochrane database yielded no records, MEDLINE OvidSP revealed eight records, NIHR PROSPERO (international prospective register of systematic reviews) one record (an ongoing review), ClinicalTrials.gov no records and the WHO ICTRP (International Clinical Trials Registry platform) two records, one terminated prematurely and the other still recruiting. We also searched Open Grey for any grey literature but returned no results.

As only one randomised controlled trial (RCT) was identified, the search was expanded to include studies that looked at either treatment in this age group. Six other case series studies were identified, two reporting surgical treatment and four reporting non-operative treatment.

Keywords used in search: exp *Olecranon Process/ or olecranon fracture.mp, operat* adj4 versus adj4 non$, surg$ adj4 versus adj4 conservative, displac$ adj10 olecranon adj10 fracture$, elderly, low demand.

Results

Comparative studies

The comparative evidence between the two treatments included one RCT from Edinburgh discussed here and another from Australia which is still recruiting.

Duckworth et al. [18] included both ORIF and TBW in their operative treatment group depending on fracture configuration. The non-operative group were treated with two weeks in a collar-and-cuff sling followed by mobilisation supervised by physiotherapists. This trial was terminated prematurely due to the high rate of complications observed in the surgical treatment arm of the trial. Of 19 participants, 8 received non-operative treatment and 11 underwent surgery. The termination was due to loss of equipoise amongst investigators following the high rate of complications (83%). These included infection (10.5% $n=2$), loss of reduction (54.5% $n=6$) and prominent metalwork (27.3% $n=3$).

Early termination of the study due to unacceptable complications emphasises the risk of surgery in patients of this age. The only complication reported in the non-operative group was in a patient who crossed over and underwent ORIF of the fracture due to subluxation of the elbow joint that became apparent two weeks after injury. The fixation subsequently became infected which led to fixation failure requiring irrigation, removal of metalwork and prolonged course of suppressive antibiotics.

Retrospective cohort studies

Operative treatment

Previous case series studies [10, 13] have reported up to 30% risk of complication such as painful metalwork, loss of reduction and infection with TBW and ORIF using plate techniques [11, 12], including high risk of re-operation due to prominent or painful metalwork [9, 10, 12, 13]. As a result of these concerns, techniques have been developed and published using suture techniques [19–21] to fix olecranon fractures without the need for metal implants. Despite the theoretical benefits of such treatment, surgeons reported complications due to wound infection that required intravenous antibiotics [20]. Bateman et al. rated the clinical outcome of the suture technique as 'acceptable' [19]. Although some surgeons have adopted such suture techniques for treatment of olecranon fractures in the elderly to avoid symptomatic metalware, the risks of anaesthesia and poor soft tissue quality remain.

No interventional trials were identified comparing a suture technique to other surgical management strategies.

One systematic review in the Cochrane Library compared different surgical techniques [9]. They included studies that reported plate fixation, TBW, intramedullary fixation and olecranon excision and triceps advancement. Due to the low quality of evidence, their conclusion was that there is not enough evidence to determine the best treatment for these fractures with confidence. They also noted that metalwork prominence remains the most commonly encountered problem that often requires further surgery to remove the metalwork. The review protocol mentions their intention to conduct a subgroup analysis based on participants' age and compare young versus elderly patients which would have been informative; however, this was not achievable.

Non-operative treatment

Three case series have published the results of non-operative treatment.

Veras del Monte et al. [15], in their small series of 12 patients, reported good outcome in eight patients (66%). However, their outcome measure was based on their own classification without any validated functional scoring. Non-operative treatment involved elbow immobilisation for up to 5 weeks followed by mobilisation.

Gallucci et al. [16] published a bigger case series (26 patients) of treatment using above elbow cast for 5–7 days followed by mobilisation. They used validated functional scores. Mean follow-up was 16 months (range 12–26), and they reported high satisfaction on visual analogue score (VAS) with the majority of patients (85%) developing an asymptomatic non-union. Elbow extension power in all patients was recorded 4–5/5. The median pain score VAS was 1.1 (0 no pain–10 severe pain), and 25 of 28 patients obtained good results with the remaining 3 obtaining a fair result. The mean Mayo Elbow Performance Index (MEPI) score was 95 (range 85–100), with 22 excellent (79%) and 6 good (21%) results. The limitations of case series studies apply to this paper.

Marot et al. [22] included 22 patients in their series. The majority of patients (82%) developed asymptomatic non-union and reported high functional scores with the Mayo Elbow Performance Score (MEPS) and the Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH) score. Their non-operative treatment involved a sling for 2 weeks with analgesia and then mobilisation under the guidance of a physiotherapist.

Duckworth et al. [17] published a retrospective case series of 43 patients prior to their RCT. They reported good outcome of non-operative treatment in this age group. They used the 100-point rating system of Broberg and Morrey which is based on motion (40 points), strength (20 points), stability (5 points) and pain (35 points). Broberg and Morrey score was 83 points (range 48–100 points), with a 72% rate of excellent ($n=7$) and good ($n=24$) outcomes. The majority of patients had asymptomatic non-union (78%), which is similar to previously published papers.

All the case series that reported non-operative treatment shared limitations including small numbers of patients and the inherited limitations of observational studies such as risk of bias and confounding. Given the widely held basic principle of fracture treatment is early mobilisation to prevent stiffness and allow early return to function [8], the treatment described by Monte et al. [15] can be considered a major limitation as it is unlikely to be recommended by a majority of orthopaedic trauma surgeons.

It is worth noting that all of the above-mentioned studies have excluded fractures with subluxation or instability of the elbow joint, which remains a major challenge for orthopaedic trauma surgeons. Ongoing research continues to investigate this difficult problem.

The protocol for the SOFIE trial (Surgery for Olecranon Fracture in the Elderly) has been published, and the results are awaited as recruitment continues in Australia [23]. In addition, a systematic review has been registered on PROSPERO [24] although no results have been published thus far. Table 1 summarises studies that reported non-operative treatment.

Discussion

NHS (National Health Service) England in collaboration with the British Orthopaedic Association (BOA) and Royal Colleges of Surgeons have produced clinical guidance for the management of trauma patients [25] in these unprecedented times of the COVID-19 pandemic. They state that 'In patients with injuries that can reasonably be managed either operatively or non-operatively … we must explore non-operative care first, especially if this avoids admission to hospital'.

The BOA also produces Standards for Trauma (BOAST) guidelines [26]. These emphasise non-operative treatment whenever possible to maximise the use of resources and reduce the risk to patients and staff. In vulnerable groups such as elderly patients, the risks may outweigh the potential benefit of operative treatment.

In addition to the high mortality of COVID-19 associated with elderly patients, they are a high-risk group with respect to anaesthesia. Surgical fixation of olecranon fractures in these patients can be associated with poor fixation in osteoporotic bone, wound breakdown and prominent metalwork causing soft tissue irritation which might require a second procedure [13, 27–30]. Umer et al. [13] described complications up to 30% in their case series including persistent pain in 16% and reduced range of movement in 75%.

Based on the currently available published literature, there is not enough evidence to draw any conclusions regarding superiority of any treatment for olecranon fractures in this age group. However, the results from these case series are important and should not be ignored. The only published randomised controlled trial observed a high complication rate and was terminated early highlighting the risk of operative intervention in this age group. Future randomised controlled trials to answer this research question are indeed needed. Nonetheless, this might not be ethically possible due to exposure of patients in the operative group to potentially significant risks.

These low-demand patients' main priority is to be able to execute their daily activities and function satisfactorily. Despite the limitations of the above-mentioned studies, the

Table1 Summary of studies reporting non-operative treatment of displaced olecranon fracture in the elderly

Study	Number of patients	Mean age (years)	Immobilisation method (patients)	Immobilisation duration (mean days)	Mean follow-up (months)	Pain	Elbow ROM	Functional assessment/patient satisfaction	Treatment complications (number of patients)
Duckworth et al. [18] RCT	19 11 ORIF **8 non-op**	83 (75–92)	In non-op group Collar and cuff (4) Above elbow plaster (4)	15	12	–	**ORIF:** mean arc flexion: 129° **Non-op:** mean arc flexion: 106°	**ORIF:** Mean DASH: 22, mean MEPI: 95 Mean Broberg & Morrey: 94 (80–100) **Non-op:** Mean DASH: 23, mean MEPI: 95 Mean Broberg & Morrey: 88 (66–100)	**ORIF:** 81.8% complications rate (11); infection (1), loss of reduction (6), further surgery (3), removal of metalwork (3) **Non-op:** 14.3% complications rate (1) patient crossed over to ORIF group with subsequent infection and further surgery
Marot et al. [22]	21	88.8 (77–95)	Elbow-to-body sling-and-swathe	14	6	VAS 1 (0–3)	Mean ROM: Extension −15° Flexion 135°	Mean MEPS: 95.26/100 (85–100) Mean quick DASH: 4.3(0–29.55)	None
Duckworth et al. [17]	43	76 (40–98)	Above elbow plaster (28) Collar-and-cuff sling (15)	Plaster: 28 (7–42)	72 (24–180)	Mild pain 2pts (9%) Mod-severe pain 1 pt (4%)	Mean elbow flexion 126° Mean extension 18° Mean pronation 79° Mean supination 80°	Mean DASH 2.9 (0–33.9) Mean OES 47 (42–48) Satisfaction rate 91%	Weakness/inability to push up from a chair 17% (4) Elbow stiffness 4% (1)
Gallucci et al. [16]	28	82 (71–91)	Above elbow plaster (28)	5(4–7)	16 (12–26)	Median VAS (1.1) 2 pt during ROM 8 pts episodes of pain	Mean ROM: Flexion 140° Extension 15° 92% compared to contralateral	Excellent: 22 pts Good: 6 pts Mean MEPI: 95 (85–100) Mean DASH: 15.4 (0–43) Mean satisfaction:9 (8–10)	-

Table 1 (continued)

Study	Number of patients	Mean age (years)	Immobilisation method (patients)	Immobilisation duration (mean days)	Mean follow-up (months)	Pain	Elbow ROM	Functional assessment/patient satisfaction	Treatment complications (number of patients)
Veras del Monte et al. [15]	12	81.8 (73–90)	Above elbow plaster (4) Splint (8)	29 (7–84)	15.2 (6–33)	67% pain free	Median ROM: Flexion 136.5° Extension-7.5° Pronation 83.5° Supination 83.5°	Good (8 pts) Fair (3 pts) Poor (1 pt) Excellent satisfaction in 92% (11) of patients	Skin sore (1) Degenerative arthropathy (1)

ROM range of motion, *ORIF* open reduction and internal fixation, *Pt* patient, *VAS* visual analogue scale, *MEPI* Mean Mayo Elbow Performance Index; *DASH* Disability of Arm Shoulder and Hand, *OES* Oxford Elbow Score, *MEPS* Mayo Elbow Performance Score

majority of patients that have been treated non-operatively developed asymptomatic non-union. Patients were tolerant of such fracture non-union and able to maintain functional pain-free elbow movement. Functional scores and patient satisfaction were also reported to be good to excellent. These results make risks of surgery hard to justify in this age group.

Suture fixation techniques [19–21] can provide a good solution for the elderly patients, in terms of reducing the surgical risks related to metalwork. But the other risks related to anaesthesia, poor soft tissue envelope, wound healing and post-operative medical risks remain significant.

The primary goals of non-operative treatment are analgesia and early mobilisation. Prolonged period of immobilisation does not seem to offer any extra benefits and will expose patients to joint stiffness and further significant morbidity. There is not enough evidence to suggest any superiority of either plaster of Paris or sling immobilisation. Again, there is not enough evidence to suggest benefit from formal physiotherapy. In our institution, initial immobilisation using a sling in the first week to reduce pain is followed by mobilisation as pain allows and seems to be well tolerated by patients allowing early movement and functional independence.

Conclusions

In view of the currently available evidence, non-operative treatment of displaced olecranon fractures in the elderly seems to be safe and certainly an appropriate option for patients during the COVID-19 pandemic and should be considered in all circumstances going forward.

Author contributions Amir Abdelmalek contributed to conceptualisation, literature search and writing—original draft preparation. Mark Crowther helped in supervision and writing—reviewing and editing.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. (ONS) OfNS. Living longer - Office for National Statistics [Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/ageing/articles/livinglongerhowourpopulationischangingandwhyitmatters/2018-08-13#how-is-the-uk-population-changing.
2. Team C-NIRS. COVID-19, Australia: Epidemiology Report 14 (Reporting week to 23:59 AEST 3 May 2020) (2020) Communicable diseases intelligence (2018) 44

3. Liu K, Chen Y, Lin R, Han K (2020) Clinical features of COVID-19 in elderly patients: a comparison with young and middle-aged patients. J Infect 80(6):e14–e18
4. Muller O, Neuhann F, Razum O (2020) Epidemiology and control of COVID-19. Epidemiologie und Kontrollmasnahmen bei COVID-19 145(10):670–674
5. Wang L, He W, Yu X, Hu D, Bao M, Liu H et al (2020) Coronavirus disease 2019 in elderly patients: characteristics and prognostic factors based on 4-week follow-up. J Infect 80(6):639–645
6. Duckworth AD, Clement ND, Aitken SA, Court-Brown CM, McQueen MM (2012) The epidemiology of fractures of the proximal ulna. Injury 43(3):343–346
7. XXXX
8. Richard E Buckley CGM, Theerachai Apivatthakakul (2018) AO principles of fracture management, 3rd ed: Thieme (Stuttgart)
9. MatarHE A, Buckley S, Garlick NI, Atkinson HD (2014) Surgical interventions for treating fractures of the olecranon in adults. Cochrane Database System Rev
10. Powell AJ, Farhan-Alanie OM, Bryceland JK, Nunn T (2017) The treatment of olecranon fractures in adults. Musculoskeletal Surg 101(1):1–9
11. Gathen MJM, Peez C, Weinhold L, Schmid M, Welle K, Burger C, Kabir K (2019) Plate fixation and tension band wiring after isolated olecranon fracture comparison of outcome and complications. J Orthop 69–75
12. Bugarinovic GMK, Benavent KA, Janssen SJ, Blazar PE, Earp BE (2020) Risk factors for hardware-related complications after olecranon fracture fixation. Orthopedics 1–6
13. Umer SVM, Baker J, Fleming P (2011) Olecranon fractures in the elderly: is tension band wiring the right treatment? Injury Extra 42:122
14. Chalidis BESN, Samoladas EP, Dimitriou CG, Pournaras JD (2008) Is tension band wiring technique the "gold standard" for the treatment of olecranon fractures? A long term functional outcome study. J Orthop Surg Res 3:9
15. Veras Del Monte L, Sirera Vercher M, Busquets Net R, Castellanos Robles J, Carrera Calderer L, Mir BX (1999) Conservative treatment of displaced fractures of the olecranon in the elderly. Injury 30(2):105–110
16. Gallucci GL, Piuzzi NS, Slullitel PAI, Boretto JG, Alfie VA, Donndorff A, et al. Non-surgical functional treatment for displaced olecranon fractures in the elderly. The bone & joint journal. 2014;96-B(4):530–4.
17. Duckworth AD, Bugler KE, Clement ND, Court-Brown CM, McQueen MM (2014) Nonoperative management of displaced olecranon fractures in low-demand elderly patients. J Bone Joint Surg Am Vol 96(1):67–72
18. Duckworth AD, Clement ND, McEachan JE, White TO, Court-Brown CM, McQueen MM (2017) Prospective randomised trial of non-operative versus operative management of olecranon fractures in the elderly. Bone Joint J 99-B(7):964–972
19. Bateman DK, Barlow JD, VanBeek C, Abboud JA (2015) Suture anchor fixation of displaced olecranon fractures in the elderly: a case series and surgical technique. J Shoulder Elbow Surg 24(7):1090–1097
20. Cha SM, Shin HD, Lee JW (2016) Application of the suture bridge method to olecranon fractures with a poor soft-tissue envelope around the elbow: modification of the Cha-Bateman methods for elderly populations. J Shoulder Elbow Surg 25(8):1243–1250
21. Phadnis JWA (2017) Tension band suture fixation for olecranon fractures. Shoulder Elbow 9(4):299–303
22. Marot V, Bayle-Iniguez X, Cavaignac E, Bonnevialle N, Mansat P, Murgier J (2018) Results of non-operative treatment of olecranon fracture in over 75-year-olds. Orthopaedics Traumatol Surg Res: OTSR 104(1):79–82
23. Symes M, Harris IA, Limbers J, Joshi M (2015) SOFIE: Surgery for Olecranon Fractures in the Elderly: a randomised controlled trial of operative versus non-operative treatment. BMC Musculoskeletal Disorders 16:324
24. Tara Hoffmann Padtoft SB. Surgical versus non-surgical management of displaced olecranon fractures in the elderly: a systematic review
25. England N. Clinical guide for the management of trauma and orthopaedic patients during the coronavirus pandemic. Available from: https://www.england.nhs.uk/coronavirus/wp-content/uploads/sites/52/2020/03/C0274-Specialty-guide-Orthopaedic-trauma-v2-14-April.pdf
26. Association BO. Management of patients with urgent orthopaedic conditions and trauma during the coronavirus pandemic. Available from: https://www.boa.ac.uk/uploads/assets/ee39d8a8-9457-4533-9774e973c835246d/4e3170c2-d85f-4162-a32500f54b1e3b1f/COVID-19-BOASTs-Combined-FINAL.pdf
27. Helm RH, Hornby R, Miller SW (1987) The complications of surgical treatment of displaced fractures of the olecranon. Injury 18(1):48–50
28. Holdsworth BJ, Mossad MM (1984) Elbow function following tension band fixation of displaced fractures of the olecranon. Injury 16(3):182–187
29. Kiviluoto O, Santavirta S (1978) Fractures of the olecranon Analysis of 37 consecutive cases. Acta Orthop Scand 49(1):28-31.
30. Macko D, Szabo RM (1985) Complications of tension-band wiring of olecranon fractures. J Bone Joint Surg Am 67(9):1396–1401