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Functional and clinical outcomes of open versus closed radius and ulna shaft fractures in adults: A prospective cohort study

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Abstract

Objective: To compare functional and clinical outcomes of open versus closed radius ulna shaft fractures in adults treated by internal fixation.

Methods: A prospective cohort study was conducted on patients presenting with traumatic radius and ulna shaft fractures to Aga Khan University and undergoing internal fixation between July 2015 to June 2019. Data was extracted from an ongoing orthopaedic trauma registry. Functional and clinical outcomes were assessed by Price et al. criteria at 6 weeks, 3, 6 and 12 months follow-up. Outcome scores of open versus closed fractures were compared.

Results: Twenty-nine adult patients with isolated radius and ulna shaft fracture were identified. Cause of injury was road traffic accident in 18 (62%) and fall in 11 (38%) patients. Seventeen (59%) were closed and 12 (41%) were open fractures. At 6week follow-up, better outcomes were observed in closed fracture group ($p=0.01$) with near-full range of motion and activity in 10(83%) patients as compared to 3(27%) in the open fracture group. No significant difference in outcomes was observed at 3 months and thereafter.

Conclusion: Earlier recovery of function at 6 weeks was observed in majority of patients in the closed fracture group. Our data shows that good-excellent functional and clinical results are achievable by internal fixation in both open as well as closed fractures of the shaft of radius and ulna in adults.

Keywords: Trauma; standard of care; registry, radius and ulna shaft fractures, outcomes. (JPMA 70: S-24 (Suppl. 1); 2020)

Introduction

Radius and/or ulna fractures constitute the largest proportion of upper limb fractures (44%).¹ Restoration of forearm rotation with full range of supination and pronation is of utmost importance in daily upper limb activities, and it depends on adequacy of fracture reduction and alignment of fracture bones, and early mobilization. Furthermore, available evidence in the literature shows that conservative treatment of adults with both radius and ulna shaft fractures leads to complications that result in poor functional and clinical outcomes.²⁻⁴ It has been reported that open reduction and internal fixation (ORIF) with locking compression plate or dynamic compression plate (ORIF with LCP/DCP) leads to good clinical and functional outcomes, has a low complication rate and a high success rate.⁵⁻⁸ Based on available evidence, open reduction internal fixation has become widely accepted as the most common procedure to treat radius and ulna shaft fractures in adults.^{9,10} The objective of the current study was to compare the functional and clinical outcomes of open versus closed radius and ulna shaft fractures treated by internal fixation in adults.

Methods

After agreement within the orthopaedic faculty group on the requirement and usefulness of an orthopaedic trauma registry, a single-center, prospective, longitudinal cohort study on trauma registry database was designed. Institutional and Ethical Review Committee approvals were obtained prior to study start-up. The study started in July 2015 and patient enrollment is ongoing. Patients, irrespective of age and gender, presenting to Aga Khan University Hospital with trauma related upper and/or lower limb fracture/dislocation injury were included in the registry while pathological fractures were excluded. After obtaining written informed consent, data was collected from the patients' medical record.

The current study was derived from the trauma registry data between July 2015 to June 2019. Adult patients with radius and ulna shaft fractures were identified. Information about management of the fracture including details of surgery were extracted. In order to minimize confounding factors in outcome results, patients in paediatric age group or with comminuted fractures treated with external fixator were excluded from the current study. In the registry, functional and clinical outcomes were serially assessed at 2 weeks \pm 5 days, 6 \pm 2 weeks, 3 months \pm 2 weeks, 6 \pm 1 months and 12 \pm 2 months follow-up post treatment. For radius and ulna fracture cases, loss of forearm supination/pronation in degrees, pain and activity related symptoms of the injured upper limb were assessed

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as per Price et al. criteria¹¹ for determining clinical and functional outcomes. According to the criteria, scores were then classified as excellent, good, fair and poor outcome.

The Statistical Package for Social Sciences (SPSS) version 19.0 was used for data analysis. Continuous variables were expressed as mean ± standard deviation (SD) and categorical variables as percentages. The p-value of less than 0.05 was considered as statistically significant with a confidence interval of 95%. The post-procedure clinical and functional outcomes were compared between open and closed fractures and group difference was assessed by Fisher Exact test.

Results

Total 39 patients presented at Aga Khan University with trauma associated radius and ulna shaft fractures without concomitant upper limb fracture. In this study, 29(74%) adult patients (≥18 years) were selected. Mean age was 40±11 years (range 21 to 59). Seventeen (59%) were closed fractures in which 8 (47%) were males and 9 (53%) females while 12(41%) were open fractures in which 8 (67%) were males and 4 (33%) females. Mechanism of injury was road traffic accident in 18 (62%) and fall in 11(38%) patients. Post-procedure follow-up status of patients and outcomes are shown in Table.

At 6 weeks follow-up, 10(83%) patients attained excellent-good and 2 (17%) fair-poor outcomes in closed fracture group (N=12). In open fracture group, 3 (27%) excellent-good and 8 (73%) fair-poor results (N=11). There was significant difference with better outcome in closed fracture group as compared to open fracture group (p=0.01).

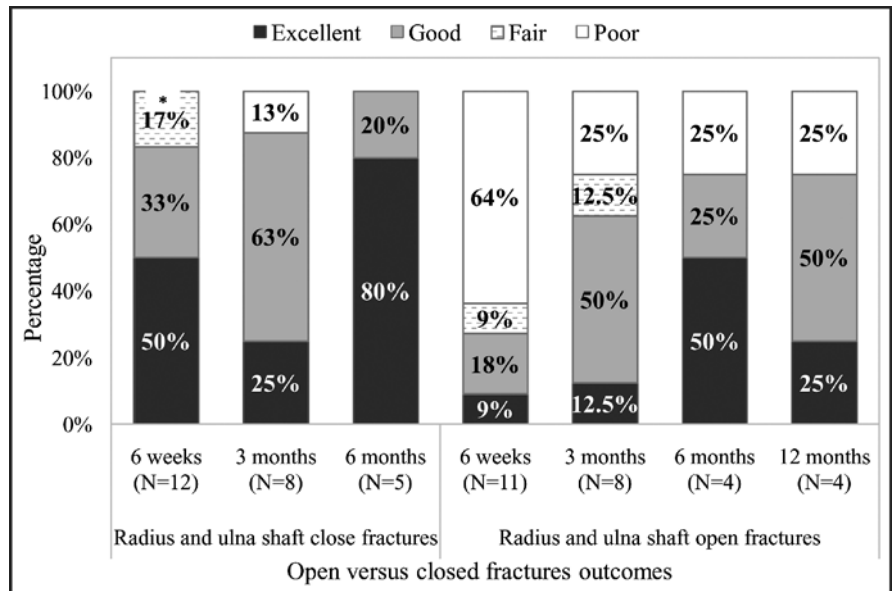
At 3 months, 7 (88%) excellent-good

and 1 (12%) fair-poor outcome was observed in closed fracture group (N=8). In open fracture group, 5 (63%) had excellent-good and 3 (37%) had fair-poor outcomes observed (N=8).

At 6 months, all of 5 (100%) patients achieved excellent-good outcomes in closed fracture group. In open fracture group, 3 (75%) excellent-good and 1 (25%) fair-poor outcome assessed (N=4). There was no significant difference in outcomes between both groups at 3 and 6 months follow-up.

At 12 months, in open fracture group, 3 (75%) excellent-good and 1 (25%) with fair-poor outcomes were recorded (N=4). Poor outcome in 1 patient was due to radial nerve injury with wrist drop. In closed fracture group, outcome was not recorded at 12 months follow-up thus, could not be compared with open fracture group (Figure).

All patients were operated within 24 hours of hospital



* = Significant difference (p = 0.01).

Figure: Outcomes of Radius and ulna shaft fractures - Open versus closed fractures.

Table: Patients follow-up status and outcomes assessment.

Follow-up	Arrived N (%)	Outcomes assessed N (%)	LTF N (%)	Recovered N (%)	Visit anticipated N (%)
2 weeks(N=29)	27 (93%)	24 (89% of 27)	2 (7%)	-	-
6 weeks(N=29)	26 (90%)	23 (88% of 25)	3 (10%)	-	-
3 months(N=29)	19 (65%)	16 (84% of 19)	5 (17%)	1(3%)	4 (14%)
6 months(N=28)	8 (28%)	8 (100% of 8)	11 (39%)	2 (7%)	7 (25%)
12 months (N=26)	4 (15%)	4 (100% of 4)	11 (42%)	-	11 (42%)

N = Number of patients
LTF = Lost to follow-up.

admission except 1 (3%) who had diabetes mellitus with hypertension for whom risk stratification was done for treatment optimization. Only 1 (3%) patient in closed fracture group developed urinary tract infection as in-hospital complication and was managed accordingly. No surgical site wound infection or in-hospital complication was observed after surgery except for 1 (3%) in closed fracture group who developed post-surgical urinary tract infection.

Discussion

The current study on patients who encountered radius and ulna fractures, secondary to a road traffic accident or a fall showed that open fracture was more common in males and closed in females. All included patients were treated with ORIF as standard of care. There was significant difference in functional and clinical outcomes of closed fractures at 6 weeks follow-up with resuming almost complete ROM and upper limb activity suggesting early recovery in closed fractures compared to open fractures. Open fracture seems to be a prognostic factor affecting early outcomes (up to 6 weeks) of radius and ulna shaft fractures. There was no significant difference in outcomes at 3 and 6 months follow-up. Radial nerve injury at the time of trauma with wrist drop resulted in poor outcomes up to 12 months follow-up in a patient who had an open fracture and underwent ORIF with bone grafting. Present research findings are in accordance with the previously published research studies that ORIF is appropriate surgical procedure to treat radius and ulna shaft fractures in adults.⁵⁻⁸

Additional clinical factors were also considered like age, time of surgery and surgical site wound infection that might influence outcome results. The mean age was almost similar in both observed groups. All patients were treated within 24 hours of arrival except the one with comorbid condition and required risk stratification for optimizing treatment and none of the patients acquired surgical site wound infection suggesting ORIF as a safe technique. Furthermore, in both groups, no expiry recorded up to 14 months post-procedure. Thus, trauma registry enables evidence-based assessment of the performance of our trauma care system.

Among the patients lost to follow-up, i.e. who did not complete 12 month follow-up, one patient had a good outcome at 6 weeks follow-up, 5 patients were with excellent to good outcomes at 3 months follow-up and 1 patient had excellent outcome at 6 months follow-up. Thus, of the total 15 lost to follow-up patients, 7 (47%) patients almost completely recovered before 12 months were completed and for them further follow-up was not required. After surgery, 5 (33%) patients did not return to the hospital

for assessment.

Conclusion

Radius and ulna shaft fractures, primarily treated with ORIF as treatment of choice were associated with 75% excellent-good results in open fractures and 100% in closed fracture at 6 months follow-up. Current evidence supports the existing research that ORIF is an appropriate technique to treat radius and ulna shaft fractures in adults. In closed fracture group, patients acquired significantly better excellent-good outcomes 6 weeks post-surgery, suggesting early better functional and clinical recovery as compared to open fractures. It is important to highlight that open fractures in radius and ulna shaft fractures seems to be one prognostic factor determining the ultimate outcome. Moreover, even in open fractures, ORIF has low chance of wound infection in selected patients undergoing debridement and fixation.

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Conflict of Interest: None.

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