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Comparison of functional outcomes between simple and complex clavicle fractures at 6 months after open reduction internal fixation: A prospective cohort study from Indonesia

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Abstract
Background: Clavicle fractures are common upper limb injuries that can result in chronic pain, deformity, and impaired function. The Disabilities of the Arm, Shoulder, and Hand (DASH) and Oxford Shoulder Score (OSS) are validated tools for evaluating post-operative recovery. Comparative data on simple and complex fracture outcomes after open reduction internal fixation (ORIF) remain scarce in Southeast Asia.
Objective: This study aimed to compare functional outcomes between simple and complex clavicle fractures 6 months after ORIF, using DASH and OSS scores.
Methods: A prospective cohort study was conducted at Dr. M. Djamil Hospital, Padang, from December 2024 to May 2025. Patients undergoing ORIF for simple or complex clavicle fractures were evaluated at 6 months using DASH and OSS. Statistical analysis included chi-square and independent t-tests.
Results: Thirty-two patients (68.8% male; mean age <25 years most frequent) were included. All simple fracture patients achieved minimal disability (DASH 0–20) compared with 70.6% in complex fractures (p<0.001). OSS scores showed no significant difference between groups (p=0.458), with >93% in both groups reporting satisfactory outcomes.
Conclusion: Simple fractures demonstrated significantly better DASH scores at 6 months, indicating less disability, while OSS outcomes were similar. These findings suggest that fracture complexity influences overall upper limb disability but not perceived shoulder-specific function after ORIF.

Keywords: Clavicle fracture, ORIF, DASH, oxford shoulder score

Introduction
Clavicle fractures account for 2–10% of all fractures and up to 35% of shoulder girdle injuries in adults, with a high incidence among physically active individuals and athletes (Postacchini *et al*., 2002; Robinson, 1998) [11, 9]. The majority involve the middle third of the clavicle, which is biomechanically vulnerable due to its S-shape and role in transmitting forces from the upper limb to the thorax (Andersen *et al*., 2014) [8]. The consequences of malunion or nonunion can be severe, leading to persistent pain, reduced range of motion, and impaired functional capacity (Canadian Orthopaedic Trauma Society, 2007) [3].
Surgical fixation, particularly ORIF with plating, has become increasingly favored for displaced or complex clavicle fractures, with evidence suggesting faster recovery and reduced nonunion risk compared to conservative management (van der Meijden *et al*., 2012; Ban *et al*., 2021) [4, 5]. However, functional outcomes are not solely determined by fracture union; patient-reported measures such as DASH and OSS are essential for evaluating long-term recovery and quality of life (Hudak *et al*., 1996; Dawson *et al*., 1996) [1, 2]. These scores assess different aspects: DASH reflects overall upper extremity disability, while OSS focuses on shoulder-specific function.
While previous studies have explored post-ORIF outcomes for clavicle fractures, few have directly compared simple and complex fracture patterns using standardized functional scores, especially in Southeast Asian populations (Mannan *et al*., 2024; Charles *et al*., 2022) [6]. Understanding these differences could inform surgical decision-making, rehabilitation protocols, and patient counseling. This study aims to fill that gap by comparing functional recovery at 6 months post-ORIF between simple and complex clavicle fractures using both DASH and OSS scores.

2. Methods

This study was designed as a prospective cohort analysis conducted at Dr. M. Djamil Hospital, Padang, Indonesia, from December 2024 to May 2025. The hospital is a tertiary referral center for orthopedic trauma in West Sumatra, serving a diverse patient population. Ethical approval was obtained from the institutional review board, and informed consent was acquired from all participants prior to inclusion. The research adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cohort studies (von Elm *et al*., 2007) [11].

Eligible participants were adult patients (≥18 years) diagnosed with either simple (AO/OTA 15.2A) or complex (AO/OTA 15.2B, 15.2C) midshaft clavicle fractures who underwent primary ORIF within the study period. Exclusion criteria included prior ipsilateral shoulder injuries, pathological fractures, concomitant upper limb fractures affecting function, and incomplete follow-up data. A total sampling technique was employed to maximize sample representativeness, resulting in 32 patients meeting the eligibility criteria.

Baseline demographic and clinical data were collected from medical records, including age, sex, fracture type, and side of injury. Functional outcomes were assessed at 6 months post-operatively using two validated patient-reported outcome measures:

1. Disabilities of the Arm, Shoulder, and Hand (DASH) 30-item questionnaire scored from 0 (no disability) to 100 (maximum disability) (Hudak *et al*., 1996) [1].
2. Oxford Shoulder Score (OSS) 12-item questionnaire scored from 0 (worst function) to 48 (best function) (Dawson *et al*., 1996) [2].

Both tools have been validated in multiple languages and cultural settings, including Indonesian. Data were analyzed using SPSS version 26. Continuous variables were expressed as mean±standard deviation or median (interquartile range) depending on distribution. Normality was assessed via the Shapiro–Wilk test. Independent t-tests or Mann–Whitney U tests were used for between-group comparisons, while categorical variables were analyzed using the Chi-square test. A p-value <0.05 was considered statistically significant

3. Results

The study included 32 patients, 22 (68.8%) male and 10 (31.3%) female, with the most frequent age group being <25 years (31.3%). Seventeen patients (53.1%) had complex fractures, and 15 (46.9%) had simple fractures. Left-sided injuries were slightly more common (56.2%) than right-sided. The baseline demographic characteristics were comparable between the two groups, with no statistically significant differences in age or sex distribution.

At 6 months, all patients in the simple fracture group achieved minimal disability (DASH 0–20), whereas in the complex fracture group, 12 patients (70.6%) achieved minimal disability and 5 patients (29.4%) had moderate disability (DASH 21–40). The mean DASH score was significantly lower in the simple fracture group (9.00±0.55) compared to the complex fracture group (20.47±0.89) (p<0.001), indicating better functional recovery in simple fractures.

Both groups demonstrated high OSS scores, with 93.3% of simple fracture patients and 94.1% of complex fracture patients achieving a "satisfactory" category (OSS 40–48). Only one patient in each group reported mild-to-moderate symptoms (OSS 30–39). There was no statistically significant difference in OSS between groups (p=0.458), suggesting comparable shoulder-specific functional recovery despite differences in overall limb disability.

Table 1: Functional Outcomes at 6 Months Post-ORIF

Outcome Measure	Simple Fracture (n=15)	Complex Fracture (n=17)	p-value
DASH (mean ±SD)	9.00±0.55	20.47±0.89	<0.001
OSS (mean ±SD)	44.6±2.1	44.1±2.4	0.458
Minimal Disability (DASH 0–20)	100%	70.6%	0.031
Satisfactory Shoulder Function (OSS ≥40)	93.3%	94.1%	0.726

4. Discussion: This prospective cohort study demonstrates that simple clavicle fractures treated with ORIF yield significantly better DASH scores at 6 months compared to complex fractures, indicating lower overall upper limb disability. However, OSS scores were similar between groups, suggesting that shoulder-specific functional recovery may not be as affected by fracture complexity when surgically managed.

Our findings are consistent with previous studies showing that fracture complexity impacts broader upper extremity function but not necessarily isolated shoulder outcomes (Mannan *et al*., 2024; Gade *et al*., 2020) [6, 7]. The discrepancy between DASH and OSS results may be explained by the broader scope of the DASH score, which incorporates elbow, wrist, and hand functions, potentially affected by surgical trauma or immobilization duration (Hudak *et al*., 1996) [1].

From a clinical standpoint, these results suggest that even complex fractures can achieve satisfactory shoulder-specific outcomes after ORIF when modern fixation techniques and structured rehabilitation are applied. However, the higher DASH scores in complex fractures underscore the importance of early physiotherapy to address deficits in overall limb function. Surgeons should counsel patients with complex fractures regarding the potential for prolonged disability beyond the shoulder joint.

Strengths of this study include its prospective design, use of validated outcome measures, and complete follow-up. Limitations include the single-center setting, modest sample size, and 6-month follow-up period, which may not capture long-term differences in function. Future research should explore larger multicenter cohorts with longer follow-up and incorporate radiological healing parameters alongside functional scores.

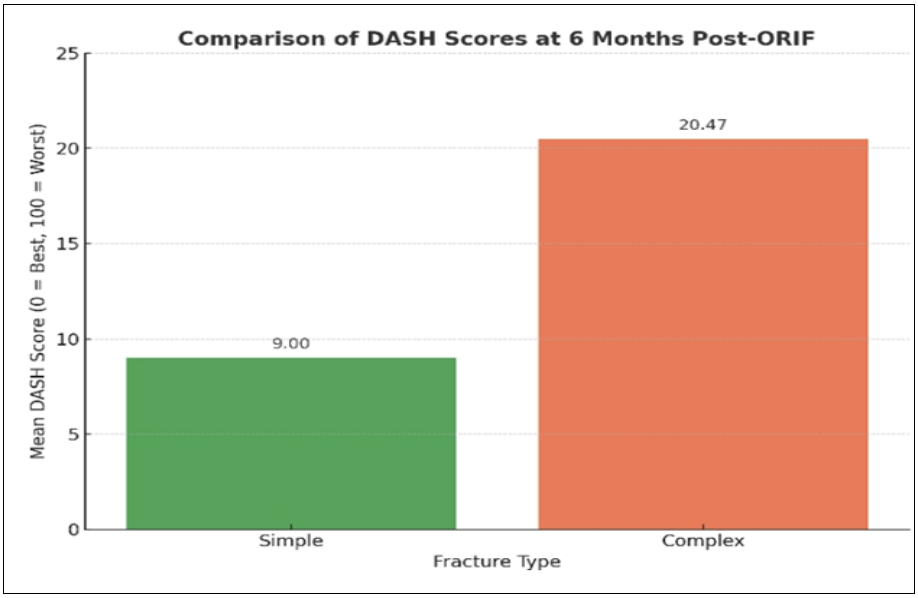

Fig 1: Comparison of dash scores at 6 months Post-ORIF

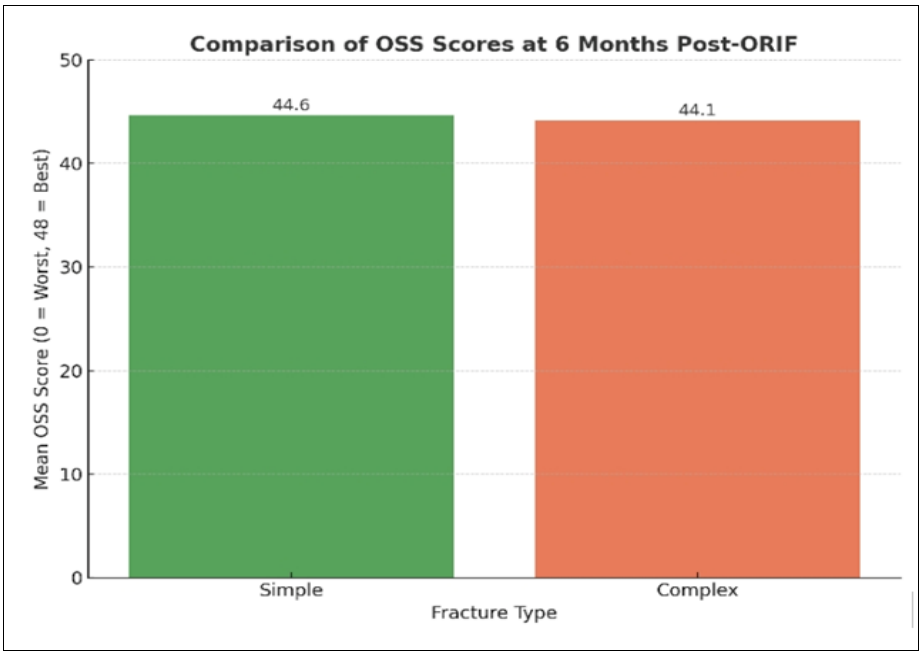

Fig 2: Comparison of OSS scores at 6 months Post-ORIF

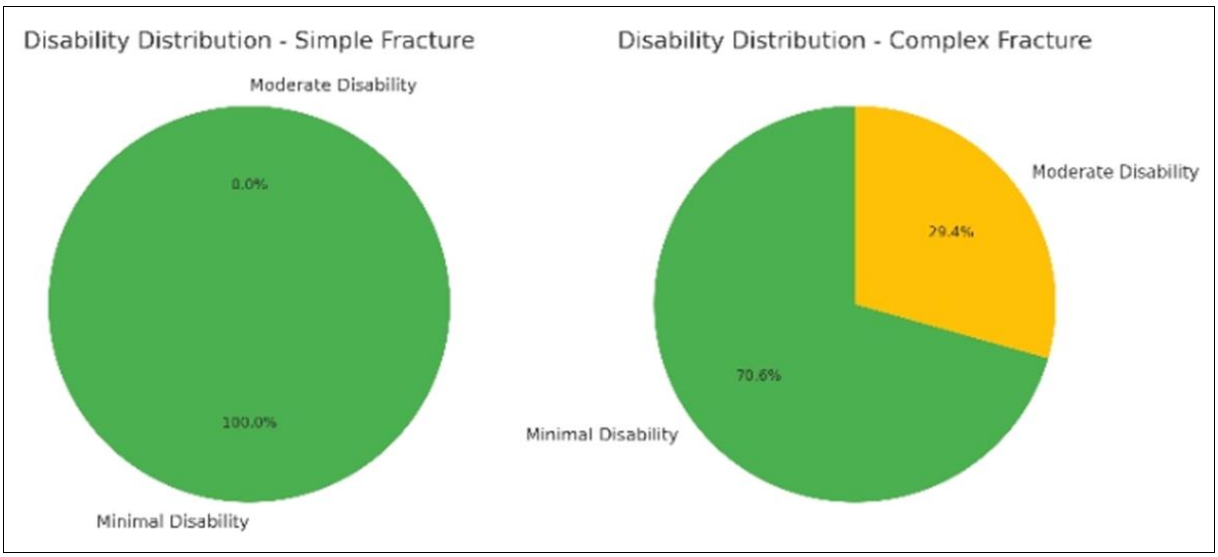

Fig 3: Simple fractures cause minimal disability.

5. Conclusion

Six months after ORIF, simple clavicle fractures demonstrated significantly better DASH scores compared to complex fractures, indicating less disability in overall upper extremity function. However, OSS scores were similar, suggesting that surgical fixation effectively restores shoulder-specific function regardless of fracture complexity. These findings support the importance of individualized rehabilitation strategies, particularly for patients with complex fractures, to optimize recovery.

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