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Functional Outcome of ORIF of Clavicle Fracture with Clavicular Plate and Screw

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Abstract **Original Research Article**

Background: Chronic Kidney Disease (CKD) is a progressive condition that significantly affects the global population, with increasing prevalence in low- and middle-income countries like Bangladesh. Among CKD patients, cardiovascular disease remains a leading cause of morbidity and mortality, with arterial stiffness emerging as a critical indicator of cardiovascular risk. The brachial-ankle pulse wave velocity (baPWV) is a non-invasive measure of arterial stiffness, offering valuable insights into vascular health. This study explores the association between baPWV and clinical parameters in non-dialysis CKD patients in Bangladesh. ***Objective:*** To investigate the association between baPWV and various clinical and laboratory parameters in non-dialysis CKD patients in Bangladesh. ***Methods:*** A cross-sectional observational study was conducted at the Department of Nephrology, Dhaka Medical College, between September 2021 and March 2023. The study involved 100 non-dialysis CKD patients (50 with vitamin D deficiency and 50 without), aged 18 years or older, in stages 3-5. Demographic, clinical, and laboratory data were collected, and baPWV was measured. Data analysis was performed using SPSS version 26.0 with statistical tests including t-tests, ANOVA, and regression analysis. ***Results:*** Vitamin D deficiency was associated with higher baPWV compared to non-deficient patients, with significant differences observed across all CKD stages ($p<0.05$). The mean baPWV in the vitamin D deficient group was 22.5±1.75 m/s, while in the non-deficient group it was 16.86±1.82 m/s ($p<0.05$). The regression analysis identified vitamin D levels, age, and serum iPTH as significant independent predictors of baPWV. ***Conclusion:*** This study demonstrates that baPWV is significantly higher in non-dialysis CKD patients with vitamin D deficiency. The findings suggest that baPWV can serve as a reliable indicator for assessing cardiovascular risk in CKD patients, particularly in Bangladesh, where CKD prevalence is on the rise. Further research is warranted to explore the clinical implications of baPWV as a routine tool for cardiovascular risk management in CKD.

Keywords: Chronic Kidney Disease, Arterial Stiffness, Pulse Wave Velocity, Brachial-Ankle Pulse Wave Velocity, Vitamin D, Cardiovascular Risk, Non-Dialysis, Bangladesh.

INTRODUCTION

The human clavicle or the collarbone is the double-curved S-shaped bone that links the axilla with the appendicular skeleton [1]. It is sometimes considered more prone to injury, and statistics show that almost 2% to 10% of fractures are related to clavicle fractures [2]. As the clavicle is the most crucial structural component of the shoulder griddle, a little injury of this area can

significantly impact the shoulder function. With severe pain, clavicle fractures can associated with functional impairment, lifelong trauma, and morbidity if remain untreated [3]. Traditionally, clavicle fractures were treated with both surgical and non-surgical methods. The surgical methods included coracoclavicular ligament disruption [4], intra-operative external fixation [5], and plates and screw and pins method whereas arm-sling and rehabilitation is the non-surgical method for the clavicle fracture treatment [6]. Clavicle fracture Open reduction and internal fixation (ORIF) is a new-era surgical procedure that treats severe fractures or dislocations by realigning and stabilizing them [7]. The fracture site is visualized directly during this operative procedure and it is stabilized with a clavicular plate and screws. Optimal healing, minimizing fracture-associated complications like malunion or nonunion, and early mobilization of the fracture site are the major goal of ORIF surgery [8], thus, it has become one of the most dependable processes for managing acute and osteoporosis fractures since the last two decades [9]. This research aims to analyze the functional outcomes of ORIF of clavicle fracture with clavicular plate and screw fixation with several key parameters such as time of realignment, complication rates, and postoperative complications. Overviewing the functional outcomes of ORIF with a clavicular plate and screw in the perspective of a developing country and assessing if the method is capable of an early return of normal activities to its patient or not will help physicians to conclude clavicle fracture treatment.

METHODOLOGY

This study follows a retrospective method and it was conducted at the Department of Orthopaedic Surgery Moulvibazar 250 Bed District Sadar Hospital by maintaining all ethical standards the period of July 2022 to June 2024. Patients with clavicle fractures displaced, comminuted, or unstable managed with ORIF using clavicular plates and screws were enrolled in this bi-year study. Data collection was done by the hospital records and patient interviews including patient demography, fracture types, surgical procedures, and outcomes. The surgical procedures has been observed thoroughly to ensure uniformity among all cases. A sum of 50 patients was included in this study by following the stated inclusion and exclusion criteria.

Inclusion criteria

- Patient aged 16 or older.
- Patients with displaced or comminuted clavicle fractures were treated with ORIF.
- Patient with written informed consent.

Exclusion criteria

- Patient age below 16.
- Patients with pathological fractures or previous shoulder surgery.
- Patients with an incomplete medical history.
- The patient a lack of consent.

Figure I: Surgical procedure

Consent was taken either from the adult patients themselves or the first-degree relatives of the patients including the biological father, mother, brother, sister, or spouse. In the case of adolescent patients (16-17), with the consent of first-degree relatives, the study has been carried out. MS-Excel and the Statistical Package for Social Sciences (SPSS), version 20 were used to analyze the collected data.

RESULT

This is a male-dominant study with 28 male participants and 22 female participants. The male-female ratio for the study was 1:0.8.

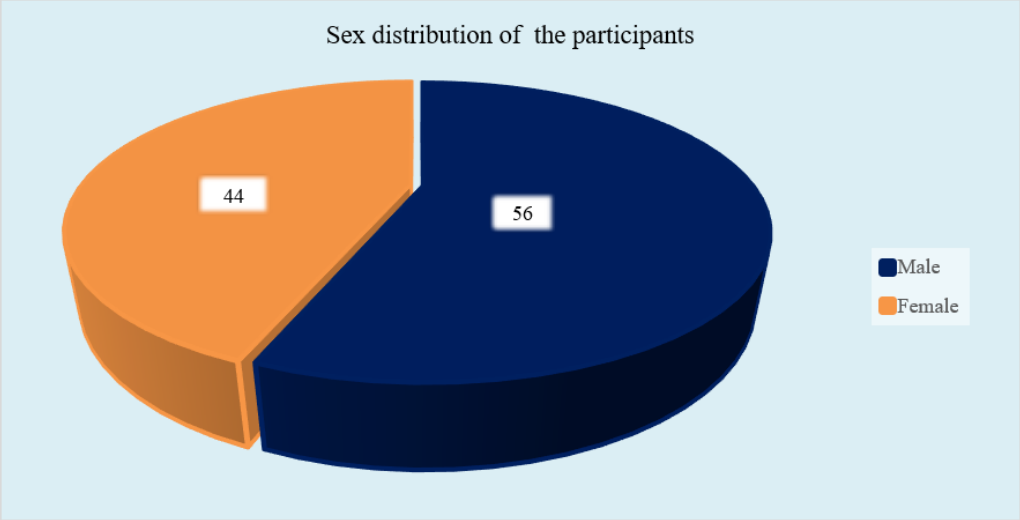

Figure II: Pie chart showed gender wise *patients* distribution *(N=50)*

The study involved patients ages ranging from 16-78 years whereas, the mean age of study subjects was 35.02 ± 2.26 years.

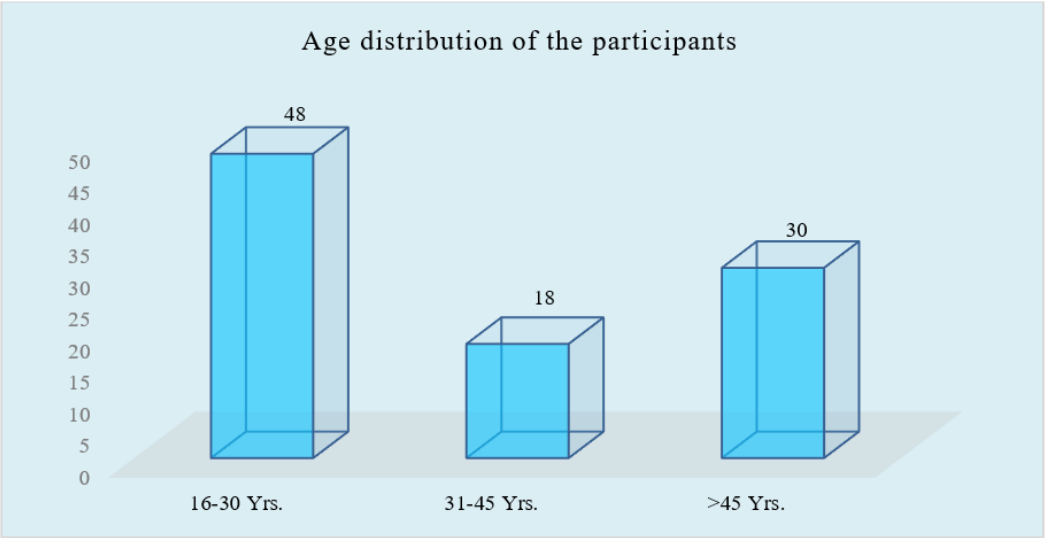

Figure II: Column chart showed age wise *patients* distribution *(N=50)*

The most common mode of clavicle injury recorded in this study was sports injury (23), followed by accidental fall (12), motorbike injury (9), and physical assault (6).

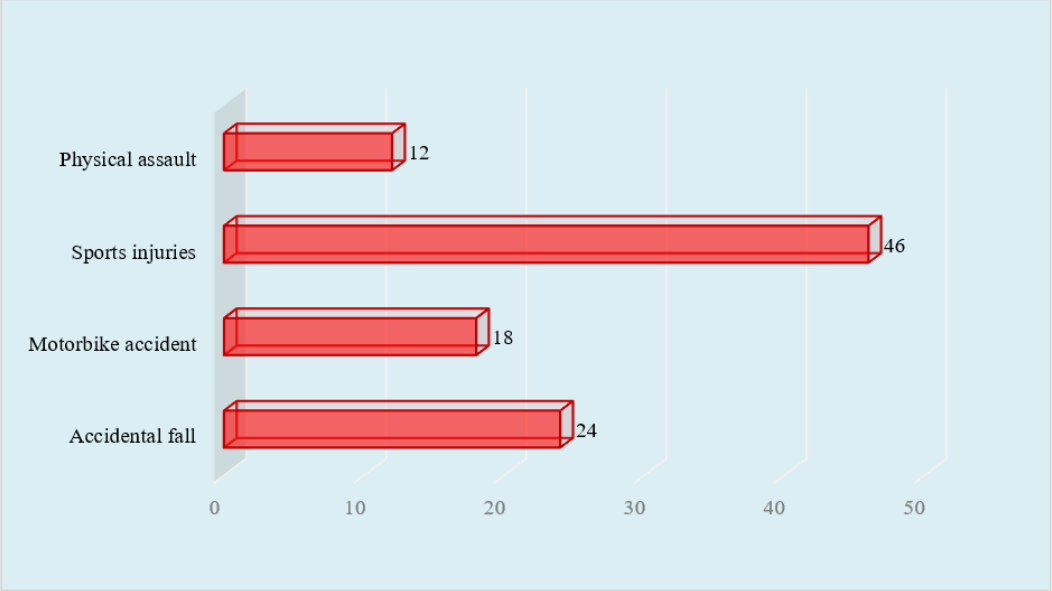

Figure III: Column chart showed mode of clavicle fracture *(N=50)*

Figure IV: After surgery radiography

After surgery radiography image shows good-fitting of clavicular plate and screw in patient's body without affecting other organs.

Table 1: Functional outcome of patients on DASH score (N=50)

DASH score	Frequency	Percentage (%)
Excellent (98-100)	36	72%
Good to excellent (93-97)	11	22%
Fair to good (82-92)	3	6%
Total	50	100%

DASH= Disabilities of the Arm, Shoulder, and Hand according to the Questionnaire. Here, excellent means (98-100), good to excellent (93-97), and fair to good (82-92) by the participants.

Table 2: Complications of study patients (N = 50)

Complication details	Frequency	Percentage (%)
Superficial infection	02	4%
Adhesive capsulitis	12	24%
Paresthesia over the surgical site and anterior chest and anterior chest	8	16%
None	28	56%
Total	50	100%

DISCUSSION

Clavicle injuries can be considered traumatic experiences for patients, which need surgical interventions for complete fixation in most cases [10]. The absorption and distribution of stress during bending and compressive load are the basic biomechanics of the clavicle [11] and a successful ORIF with clavicular plate and screw surgery ensures this functioning for a patient. Studies suggested that male patients are more susceptible to clavicle fractures, a 2017 study ended with 70% male victims of clavicle fractures from different hospitals in China which share quite similar results with this study [12,13]. In this study, we can see that male patients are more prevalent study subjects (56%) but the gender difference is not that huge like in previous studies as 46% of female patients also participated in this two-year study. A Bangladeshi study also found similar findings with 59.06% male and 40.94% female patients with fractures in 2022 [14]. That study also showed that the maximum of the incidents occurred in patients with 18-50 years and above 50 years [14]. Pecci M. *et al,* 2008 found that clavicle fracture typically occurs below the age of 25 [15]. The mean age for clavicle fracture of patients is 35.02 ± 2.26 years where we observed that 48% of victims were from 18-30 age groups. 31-45 aged people are less prone to clavicle injury in comparison with >45 and 18-30 year-old patients. With 34.75 ± 9.787 mean age, a United Kingdom study also complements our study with 20-59 year-old subjects [16]. Midshaft clavicle injury can occur at any age but younger-older are at a higher risk of this injury. The reason can be the vulnerable anatomical structure of the age groups and can be physical activities [17-19]. The mode of clavicle fracture is one of the key demographic factors to consider for understanding the scenario better. 46% of clavicle fractures resulted from sports injury in this study. Vice-versa 48% of study subjects of 18-30 years old reported clavicle injury. Int J Sports Med. reported that sports play an important factor in clavicle fracture with 45% of all incidents [20]. Accidental fall is another important mode for clavicle fracture in this study with 24% of victims and 18% of victims coming from motorbike accidents. Likewise, Mannan *et al,* 2024 declared that 73.8% of clavicle fractures caused a fall for height and 13.3% were road traffic accidents in their study [16]. In this study, 12% of physical assault victims were also traced; a 2014 report stated that 12-20% of all fractures account for physical abuse in pediatrics but no overall statistics have been published yet for discussion [21]. The functional outcome of the study patients was analyzed by DASH score in this study and we found that 72% of patients reported excellent DASH scores, representing that ORIF with clavicular plate and screw is a potent treatment option for clavicle fracture. Similarly, other studies also noted a good DASH score by ORIF surgeries [16, 22]. Previous studies reported that after removing the fixation material 4.5% of the patients experienced a recurrent fracture by screw-plate fixation, within 90 days [23]. By Open reduction and internal fixation, 56% of patients complained about no complications, and 24% of patients presented with Adhesive capsulitis in this study. Adhesive capsulitis is referred to as frozen shoulders, it can be associated with other comorbidities like diabetes, gender, and age factors, studies suggest that women are more susceptible to adhesive capsulitis [24]. The final result overall verdict that the study is in good agreement with other research projects related to clavicle fracture and suggests ORIF with clavicular plate and screw is an effective treatment method for clavicle injuries with fewer complications [16, 22].

LIMITATION

Clavicle fractures are the most common form of fractures. So far, Open reduction and internal fixation have become a reliable treatment method, still, there's a scope for a lot of studies to declare the method as the finest of all procedures. A short study subject with a limited period can be considered as the major restriction for the study. This retrospective study opens the door to future cohort studies to evaluate the functional outcome of ORIF of clavicle fracture with clavicular plate and screw in a better way.

CONCLUSION

Clavicles are the most vulnerable regions to injury. A simple form of clavicle injury can lead to a fracture due to the skinny anatomy of the collarbone. Traditionally, clavicle fractures were treated with non-operative methods where the success rate was not that impressive [25]. Open reduction and internal fixation (ORIF) is a new-age surgical treatment for clavicle fracture that grabs the attention of patients and physicians with its effectiveness. Still, there's a risk of adhesive capsulitis and stiffness after surgery, this provides early and complete recovery of patients in most cases.

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