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FUNCTIONAL OUTCOMES AND SATISFACTION IN CONSERVATIVE TREATMENT OF MIDSHAFT CLAVICLE FRACTURES: A STATISTICAL ANALYSIS OF PREDICTIVE FACTORS IN A SOUTH ASIAN COHORT

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Abstract
This prospective observational study analyzes functional outcomes and satisfaction scores among patients receiving conservative treatment for midshaft clavicle fractures (MCFs) in a Karachi, Pakistan, tertiary trauma center. Employing analysis via SPSS-based, the investigation assesses how demographic predictors and comorbidities influence patient-reported satisfaction using the Disability of the Arm, Shoulder and Hand (DASH) scoring system. Among 110 patients, 58.7% were improved, and dissatisfaction was positively related to old age and the conditions of diabetes mellitus and hypertension. The results emphasize the unfulfilled expectations of conservative management in targeted subpopulations and demand evidence-based risk stratification. The findings contribute regional data to the worldwide orthopedic literature and promote a more informed approach to the treatment of MCFs in low-resource groups

INTRODUCTION

Midshaft clavicle fractures (MCFs) are rightfully known to be amongst the most frequently encountered orthopedic trauma injuries. According to widespread epidemiological data, MCFs account for approximately 70–80% of all clavicle fractures and contribute nearly 5% of all fractures registered in the adult population (Robinson, 1998; Khan et al., 2022). These fractures are responsible for the majority of injuries to the shoulder region and typically result from direct trauma to the shoulder region, caused by high-energy mechanisms such as road traffic accidents, fall from height, or sports. The anatomic position of the clavicle, and especially its midshaft, exposes it to significant mechanical stress, thereby making it a common area for fracture.

Historically, MCFs have conventionally been treated with non-operative, or conservative, treatment approaches. This is mainly due to several important factors like cost-effectiveness, decreased likelihood of surgical complications, and greater ease of accessibility in rural and resource-poor communities (Neer, 1960; Postacchini et al., 2002). Furthermore,

the conservative routine—typically consisting of arm slings or figure-of-eight bandages—has conventionally been advocated for its simplicity and efficacy in achieving fracture union in the majority of instances. However, even with achievement of radiographic union, recent clinical experience increasingly identifies that anatomical healing does not constantly match with optimal functional healing, particularly in some patient subgroups (Woltz et al., 2017; McKee et al., 2012).

Current orthopedic literature has reported growing concern regarding the limitations of conservative management, especially for the problems of functional impairment and long-term patient dissatisfaction. This is particularly evident in the elderly, bone diseased patients metabolically, and individuals with physically demanding work (Robinson et al., 2004; Greenblatt & Shim, 2013). In these patient cohorts, fractures that have been treated conservatively may be associated with malunion, scapular dyskinesis, chronic pain, and reduced performance of the upper limb, and hence adversely impact global quality of life. Patient-reported outcome measures (PROMs) are coming to be used more to measure successful treatment. Of these, the Disabilities of the Arm, Shoulder and Hand (DASH) score has become popular as a validated and reliable measure for determining patient-perceived functional disability (Hudak et al., 1996; Gummesson et al., 2003). Several studies have confirmed that even with radiological union, most patients still have apparent functional deficits and dissatisfaction, captured in high DASH scores and extended rehabilitation periods (Zlowodzki et al., 2005).

Against these emerging complexities, the current study is focused on critically evaluating the functional results and overall levels of patient satisfaction in those treated conservatively for midshaft clavicle fractures. The primary objective is to identify the key predictors of patient dissatisfaction in the form of multivariate statistical modeling. Integrating clinical, demographic, and functional variables, this study seeks to introduce an evidence-based framework for optimizing patient selection criteria and treatment protocols. A secondary aim is risk factor stratification for adverse outcome with the aim of informing a more individualized approach to fracture treatment in orthopedic practice. Findings should contribute to the mounting evidence in favor of outcome-based treatment decision-making and, as such, potentially cause a reappraisal of the conservative-first approach in particular patient populations.

Literature Review

There was early orthopaedic thinking, strongly grounded in classical literature, supporting non-operative treatment as the first approach to managing midshaft clavicle fractures (MCFs). Pioneering work by Neer (1960) was at the heart of bringing about this conservative school of thought. Neer's study reported extremely high levels of fracture union and satisfactory functional results following immobilization with figure-of-eight bandages or arm slings and thus triggered widespread clinical application of the conservative management of MCFs for decades. It was further supported by the low cost, reduced incidence of surgical complications, and simplicity of outpatient and low-resource environments application (Postacchini et al., 2002). But the limitations of those early studies—most of which lacked standardized outcome measures and follow-up—have more and more come under attack in recent evidence-based orthopedic practice.

Subsequent prospective studies and randomized clinical trials have challenged the efficacy of conservative management in selected groups. For instance, McKee et al. (2012) conducted a multicenter trial which reported that while radiological union in most conservatively treated patients was seen, nearly 30% still had moderate to severe upper limb functional impairment, i.e., restricted range of motion, muscle fatigue, and pain on activity. These results brought to light an essential disparity between clinical recovery and radiographic healing, calling into question the appropriateness of conservative treatment—particularly in physically active young adults and complicated fracture patterns.

To gain a better understanding of patient-reported outcomes and functional status, researchers have increasingly relied on Patient-Reported Outcome Measures (PROMs). The Disabilities of the Arm, Shoulder and Hand (DASH) score, originally

developed and validated by Beaton et al. (2001), is now among the most commonly employed PROMs within upper limb studies. It gives a global measurement of subjective symptoms such as weakness, pain, paresthesia, dexterity decrease, and difficulty with activity of daily living performance—symptoms not usually measured in routine radiographic assessment (Gummesson et al., 2003). Various studies have shown that patients with apparently well-aligned and united clavicle fracture may still exhibit functional impairment, as reflected in consistently high DASH scores many years following immobilization treatment (Zlowodzki et al., 2005).

The Canadian Orthopaedic Trauma Society (2007) also reported further evidence in favor of surgical management in some MCF cases, notably in young, active patients or highly displaced fractures. Their randomized trial concluded that surgical fixation, particularly more frequently plate osteosynthesis, provided superior early functional outcome, faster return to work or sport, and lower malunion rates compared with conservative management. Importantly, operative management also significantly reduced the need for late surgery, often mandated by a breakdown in conservative treatment (Robinson et al., 2013).

Aside from mechanical issues, systemic comorbidities have been shown to affect patterns of fracture healing as well. Long-term diseases such as diabetes mellitus and hypertension compromise osteogenesis with vascular impairment, delayed collagen synthesis, and increased oxidative stress (Greenblatt & Shim, 2013; Sun et al., 2020). These biological deficits impair the formation of callus and are at risk of causing delayed or non-union, particularly in unsurgical stabilization. Thus, conservative treatment with such comorbidities is less than ideal, and patient-specific management that considers systemic health is being advocated more and more in modern orthopedic practice (Giannoudis et al., 2007).

Treatment choices in the South Asian health milieu are determined by factors such as poor operative facilities, financial considerations, and patient preference for non-surgery. Despite this, there is limited regional evidence regarding outcomes following conservative treatment of MCFs. This study therefore makes an attempt to bridge a huge knowledge gap by evaluating predictors of poor functional outcomes in patients treated non-operatively in a South Asian population. Having these risk factors—patient demographic-, fracture-, or comorbidity-related—understanding will be essential to creating evidence-based practice guidelines that are relevant in low- and middle-income country (LMIC) environments. By integrating local clinical realities with global research understanding, this study aims to contribute a meaningful message to the overall discourse on the delivery of fracture care in low-resource environments.

Methodology

3.1 Study Design and Setting

This study used a prospective observational study design to evaluate the functional outcome and level of satisfaction among patients with conservatively managed midshaft clavicle fractures (MCFs). This study was carried out for 12 months, from January 2023 to January 2024, in a tertiary care teaching hospital in Karachi, Pakistan. The hospital sees a mix of patients and has specialized orthopedic wards, making it the right venue where this study could be carried out. The fact that the study was prospective allowed it to obtain data in an orderly manner at regular intervals, minimizing recall bias and boosting the validity of the results.

The design also allowed for observation of the natural history of naturally occurring disease and treatment reactions in real time, unmanipulated by treatment protocol, so preserving the external validity of the data. Ethical approval to carry out the study was received from the Institutional Review Board (IRB) of the hospital, and all procedures were carried out in accordance with the Declaration of Helsinki and local ethical standards for human research. Informed written consent was given by each study participant prior to entry.

3.2 Sampling Method and Inclusion/Exclusion Criteria

A non-probability consecutive sampling technique was used to target eligible patients presenting to the orthopedic outpatient clinic or emergency department with a confirmed diagnosis of a midshaft clavicle fracture. Over the 12 months of recruitment, a total of 110 adult patients were enrolled in the study according to accurate clinical and radiographic

criteria. All the patients were given uniform non-operative treatment modalities, including the application of an arm sling and patient education about rest, progressive mobilization, and pain control. Subsequently, they were followed-up at regular intervals and resulted in thorough assessment with the use of the Disabilities of the Arm, Shoulder, and Hand (DASH) score at 12 weeks after injury.

Inclusion Criteria:
Adult patients between the ages of 18 to 65 years
Radiologically confirmed isolated, closed midshaft clavicle fracture
No shoulder pathology or neurovascular trauma history
Ability and willingness to attend arranged follow-up visits and assessments, including the return of the 12-week DASH questionnaire
Exclusion Criteria:
Individuals with open clavicle fracture or segmental injury
History of polytrauma, head injury, or concurrent fracture in other regions of the body
Individuals with a previous upper limb or clavicle surgical procedure
Comorbid psychiatric disorder, impaired cognition, or any condition most likely to interfere with comprehension of the questionnaire
Refusal to cooperate or inability to provide informed consent

This rigorous selection and exclusion was aimed at excluding potential confounders of fracture healing and functional recovery so that isolation of the effect of non-operative treatment of uncomplicated MCFs could be achieved

3.3 Data Collection and Statistical Analysis

On enrollment, detailed baseline demographic data were obtained for all the participants, including age, gender, occupation, handedness, and smoking status. Additional clinical parameters such as the presence of comorbidities—diabetes mellitus (DM) and hypertension (HTN)—were also recorded since their documented influence on bone healing dynamics exists (Greenblatt & Shim, 2013; Sun et al., 2020). Displacement and fracture site were verified by standard anteroposterior (AP) and 15° cephalic tilt radiographs.

All of the patients at 12-week follow-up were administered the DASH questionnaire, a validated tool for the measurement of upper limb disability and symptoms. The 0 (no disability) to 100 (severe disability) score was a quantitative measure of function and patient satisfaction.

All the data collected were entered and analyzed using IBM SPSS Statistics version 26. Descriptive statistics, e.g., means, standard deviations, and frequency distributions, were calculated in an effort to summarize patient characteristics and outcome measures. Chi-square tests were employed in evaluating the associations between categorical variables such as comorbidities, gender, and DASH outcomes. A p-value of <0.05 was considered statistically significant for all comparisons. Further bivariate and logistic regression analyses would be performed to identify predictors of poor functional outcome, including age group, fracture displacement, and disease. This methodological framework was designed to enable detailed analysis of both clinical and patient-rated outcomes in conservatively managed MCFs, and derivation of meaningful conclusions transferable to both clinical and resource-poor healthcare environments.

Results

4.1 Demographic Profile

Variable	Frequency	Percentage
Male	55	50.0%
Female	55	50.0%
Age ≤30	37	33.6%
31–45	41	37.2%
>45	32	29.1%

The cohort in the study showed a gender distribution on par with male and female patients, reflecting an even representation of gender within the sample group. Such gender equality makes it a reasonable foundation for comparative analysis, as well as ensuring findings are not skewed toward one gender. Additionally, noteworthy among demographic patterns in the data was that the patients were more than 70% below 45 years of age. This age profile is consistent with the literature, which indicates that midshaft clavicle fractures are more common in young, physically active people who are likely to have high-risk lifestyles or occupations predisposing to trauma (Court-Brown et al., 2001). The dominance of young adults in the sample could also be due to their higher rates of road traffic injuries and sporting injuries. Such a population profile is with international patterns of orthopedic trauma and supports the external validity of the study within comparable city dwelling populations in developing nations.

4.2 DASH Score–Based Satisfaction

DASH Score	Classification	Frequency	Percentage
0–25	Excellent	26	23.6%
26–50	Good	39	35.5%
51–75	Fair	30	27.3%
76–100	Poor	15	13.6%

Satisfied (Excellent + Good): 58.7%
Unsatisfied (Fair + Poor): 41.3%

While the study findings reported that barely more than 50% of the patients were generally satisfied with the result of their treatment following conservative management of midshaft clavicle fractures, it is alarming—and indeed perturbing—that more than 40% of the respondents continued to experience functional impairment at 12-week follow-up. This patient subgroup experienced impaired mobility, strength deficits, or difficulty with activities of daily living, evidenced by elevated DASH scores. Such a high rate of functionally impaired patients, nonetheless, precipitates significant questioning about the adequacy of non-operative treatment regimens, especially when compared against uniformly superior outcomes reported in surgical series. Previous research by Virtanen et al. (2012) has conclusively demonstrated that patients undergoing operative fixation of similar fractures proceed to have greater immediate functional recovery, reduced residual disability, and higher overall satisfaction.

The present findings therefore establish a significant disparity in outcome between surgery and conservative management, and underscore the potential need to revisit treatment regimes—particularly in the case of those individuals who remain young, engage in physically demanding vocations, or are otherwise active. This level of dissatisfaction and impaired function in a significant percentage of the cohort requires more customized treatment planning and is supportive of the growing evidence for selective surgical intervention where nonoperative care may not yield optimal functional recovery.

4.3 Satisfaction vs Age

Age Group	Satisfied	Unsatisfied	% Unsatisfied	p-value
≤30	30	7	18.9%	
31–45	25	16	39.0%	
>45	10	22	68.8%	0.004

A statistically significant decline in patient satisfaction was found among the patients over 45 years old, which reflects a clear trend of aging in treatment outcomes following conservative treatment of midshaft clavicle fracture. This also aligns with modern orthopedic literature, which recognizes the limitations of biology related to aging—namely the diminution of bone regenerative and remodeling capacity. According to Giannoudis et al. (2007), natural aging leads to decreased osteoblastic activity,

impaired vascular supply, and further delayed callus formation, all of which are accountable for delayed or suboptimal fracture healing in older adults. Thus, elderly patients may be predisposed to suffering from chronic pain, functional impairment, or the delayed restoration of normal function, ultimately resulting in lower levels of satisfaction at treatment conclusion. These physiologic constraints of advancing age underscore the necessity of individual planning and can be invoked to justify a lower threshold for intervention in patients aged more than 45 years, especially when optimal functional result is a major goal.

4.4 Satisfaction vs Comorbidities

Comorbidity	Satisfied	Unsatisfied	% Unsatisfied	p-value
Diabetes	17	26	60.6%	0.01
Hypertension	14	29	67.4%	0.02
Both	4	13	76.5%	0.001

The study found that diabetes mellitus (DM) and hypertension (HTN) were important predictors for patient dissatisfaction with nonoperative management of midshaft fractures of the clavicle. The result is biologically reasonable and consistent with growing evidence in the literature for the negative impact of chronic systemic disease on bone healing and restoration of function. Diabetic patients tend to exhibit compromised angiogenesis, repressed cell proliferation, and dysregulated inflammatory response, all of which hamper the formation and remodeling of bone tissue along the fracture line. Hypertension is also found to be associated with endothelial dysfunction, disturbed microvascular perfusion, and reorganized cellular signaling processes, aggravating physiological events inherent to successful osteogenesis (Sun et al., 2020). Thus, the patients suffering from either or both of them are at increased risk of longer healing time, increased rate of delayed union or non-union, and chronic musculoskeletal pain—all of which contribute to lower post-treatment satisfaction. These findings underscore the advantage of considering systemic health in selecting treatment alternatives and establishing patient expectation. Clinically, they will be improved by increased monitoring, adjunctive treatment, and potentially surgery if indicated to enhance healing and enhance quality of life.

4.5 Satisfaction vs Gender

Gender	Satisfied	Unsatisfied	p-value
Male	33	22	0.12
Female	32	23	

The analysis revealed that gender played no statistically significant role in post-treatment satisfaction or functional results among conservatively treated midshaft clavicle fracture patients. This implies that, in the population under study, male and female patients underwent similar recovery patterns, both in subjective satisfaction and DASH score performance. The lack of gender-based difference suggests that other issues—such as chronological age, fracture type, and underlying systemic health status—have a more significant impact on recovery and long-term outcomes.

Although some previous studies have suggested that hormonal variations or differences in muscle mass and bone density between males and females may have an effect on fracture healing, findings here do not support the presence of significant association in this regard. Rather, this supports the idea that patient management should focus on clinical parameters with proven predictive value, such as biological age, lifestyle behaviors, and comorbidities (e.g., hypertension, diabetes), over gender alone. These findings are part of the mounting evidence supporting a more sophisticated, health-status-based method to orthopedic treatment planning independent of the sex of the patient.

Discussion

The findings of this study provide strong evidence that while conservative management of midshaft

clavicle fractures (MCFs) continues to yield satisfactory results in young and otherwise healthy individuals, its effectiveness appears significantly limited in older adults and those with underlying medical comorbidities. This observation is in line with well-established clinical patterns, where younger patients benefit from a more robust physiological capacity for bone healing and tissue regeneration. On the contrary, with increasing age comes biological alterations such as decreased osteoblastic activity, decreased vascularization, and diminished callus formation, all of which impede fracture healing and functional restoration.

In agreement with findings described by McKee et al. (2012), our investigation noted that over 40% of patients were dissatisfied with their outcomes following treatment. This dissatisfaction was most significant among patients above 45 years of age, and it once again highlighted the interaction between age-related bone healing decline and worse clinical outcomes after non-operative treatment. The implications are important as they indicate that age needs to be a major driver while choosing an appropriate treatment strategy in MCFs.

In addition, statistically significant effects of systemic comorbidities like diabetes mellitus and hypertension on functional recovery as reported by patients affirm the results of previous studies (Greenblatt & Shim, 2013). Both diseases are well-documented to cause interference with bone metabolism by various biological pathways such as delayed angiogenesis, deranged collagen synthesis, and dysregulation of inflammation that all lead to prolonged healing times as well as poor functional results. Those with such comorbidities often have lingering pain, stiffness, and decreased utility of the upper limb—factors that together decrease satisfaction and quality of life after treatment.

While the cohort was divided equally between male and female subjects, the analysis found no statistically significant gender-based difference in terms of satisfaction levels. This indication is that gender is not a large factor in affecting recovery in conservatively treated MCFs, something that is consistent with the findings obtained by Postacchini et al. (2010). The focus in treatment planning should therefore continue to be on modifiable and biologically relevant variables instead of sex-based assumptions.

Last but not least, the application of the Disabilities of the Arm, Shoulder and Hand (DASH) score as a Patient-Reported Outcome Measure (PROM) was a highly effective and valid method to record real-world functional outcomes. In contrast to radiographic evaluation only, which tends to miss out on minor but significant limitations, the DASH score gave a richer insight into how patients self-assessed their recovery and capacity for everyday activities. Based on its performance in this study, routine use of the DASH score in clinical follow-ups is highly recommended, as it will allow clinicians to monitor functional improvement better and to identify patients who can be helped through early intervention or rehabilitation practices.

Conclusion

The current study supports the increasingly held opinion that conservative treatment for midshaft clavicle fracture (MCF) although traditionally considered the standard of care is not equally effective among all patient groups. While numerous younger and otherwise fit patients recover adequatelewith non-operative treatment, a significant percentage of patients—especially those of older age and those with metabolic comorbidities like diabetes mellitus and hypertension—reveal persistent functional impairment and elevated levels of dissatisfaction. These observations strongly argue against the classic "one-size-fits-all" management and highlight the requirement for more sophisticated, individualized treatment approaches.

The evidence clearly shows that some patient factors have important effects on healing patterns and subjective outcomes. Thus, age stratification, screening for comorbidity, and the routine use of validated patient-reported outcome measures (PROMs) like the DASH score should be the foundation of clinical decision-making in the treatment of MCFs. These instruments allow practitioners to more accurately predict which patients will profit by conservative treatment and which will need early surgical intervention to prevent delayed recovery, chronic disability, or subsequent revision surgery.

Additionally, in resource-limited health care settings, where the availability of operating facilities, implants, and rehabilitation services can be compromised, following a personalized protocol-based method can assist in maximizing clinical results while being cost-effective. Through planning treatment based on the individual patient's physiological status and functional requirements, medical professionals can utilize the limited resources optimally without compromising the quality of treatment.

Lastly, this research promotes a paradigm shift in treating MCFs—abandoning strict compliance with conservative approaches to more flexible, evidence-based treatment protocols responsive to patient-specific factors. This is critical not only to enhance patient satisfaction and functional restoration but also to advance equitable and sustainable orthopedic care in both high-income and low-to-middle-income environments.

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