ORIGINAL ARTICLE

Comparison of Cord Osteosynthesis Versus Standard Osteosynthesis for Treating Hand Bone Fractures in the Kyrgyz Republic: A Retrospective Study

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Abstract

Introduction: Whole-body computed tomography (WBCT) can be challenging in identifying extremity injuries due to variations in pain tolerance, other injuries, and examination quality. It is advised to conduct a clinical examination and image review after the patient has stabilized or regained consciousness. Although prompt treatment of limb fractures is crucial, WBCT poses challenges, including incorrect positioning, artifacts, and accurate thin-section computed tomography interpretation. Hand and wrist reconstruction can be complicated, especially when multiple injuries are present. This study aimed to analyze the composition of hand bone fractures in the Kyrgyz Republic and evaluate the effectiveness of cord osteosynthesis compared with alternative procedures for fixing hand bones. **Materials and Methods:** This retrospective study analyzed data from patients at the National Hospital of the Ministry of Health's Hand Microsurgery Department in the Kyrgyz Republic from 2018 to 2023. The inclusion criteria were patients aged 18–65 with a confirmed wrist fracture diagnosis, informed consent, and no significant health issues. The 90 patients who underwent cord osteosynthesis comprised Group 1, while Group 2, consisting of 34 patients, underwent standard osteosynthesis. **Results:** The study found that the mean age of patients in Group 1 was 23.3 ± 1.8 years, while Group 2 had a mean age of 34.3 ± 3.0 years. The mean hospital stay for patients in Group 1 was 6.11 days, while patients in Group 2 had a mean hospital stay of 10.35 days. The mean systolic blood pressure in Group 1 was 108.2 ± 1.4 mmHg, while in Group 2, the mean systolic BP was 115.5 ± 2.4 mmHg. The difference between the two groups was statistically significant ($P = 0.009$). **Conclusion:** The findings suggest that cord osteosynthesis may be more effective in treating hand bone fractures than the standard approach.

Key words: Hand bone fractures, hospital stay, limb fractures, osteosynthesis, whole-body computed tomography

INTRODUCTION

Whole-body computed tomography (WBCT) scans can sometimes fail to detect extremity injuries due to various factors, such as differences in an individual's ability to communicate pain or the presence of other injuries that mask the severity of the injury.[1,2] This is particularly common in older patients, those with severe injuries, or those in an unconscious state. In addition, the ability to identify injuries depends on factors such as the quality of clinical examination and imaging and the expertise of physicians.[3]

As a recommended approach, re-examination involves conducting a comprehensive clinical examination and reviewing existing diagnostic images during a specific

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period after the traumatic event, once the patient's condition has stabilized or regained consciousness.[4] Although some injuries may not be immediately visible, limb fractures can usually be promptly treated.[5]

Challenges in interpreting WBCT results can arise from artifacts exacerbated by improper patient positioning during the scan.[6,7] Specialized thin-section CT can better identify wrist fractures.[8] Furthermore, reconstructing the hand and wrist in the coronal and sagittal planes following WBCT is a complex process, especially in cases of multiple injuries. This study aimed to analyze the composition of hand bone fractures in the Kyrgyz Republic and assess the effectiveness of cord osteosynthesis compared with alternative procedures for repairing hand bones.

MATERIALS AND METHODS

This retrospective study analyzed patient data from the Hand Microsurgery Department of the National Hospital of the Ministry of Health of the Kyrgyz Republic, covering the period 2018–2023. This study was approved by the Bioethical Committee of the International Higher School of Medicine (Protocol No. 32, dated December 04, 2022).

The inclusion criteria were as follows:

1. Patients aged between 18 and 65 years, excluding children and older adults with hand fractures that may exhibit distinct characteristics
2. Confirmed diagnosis of wrist fractures through clinical and/or radiological examination
3. Informed consent to participate in the study and adherence to all protocols and procedures were obtained
4. Absence of significant health issues in patients with severe concurrent illnesses.

The selected patients were then divided into two groups: Group 1 (n = 90) comprised patients with a hand fracture who underwent the cord osteosynthesis procedure and Group 2 (n = 34) included patients who underwent a standard osteosynthesis approach. This study compared the general characteristics and administrative indicators of medical treatment quality between the two groups of patients.

Statistical analysis, version 11.5 of the Statistical Package for the Social Sciences, was employed. The results are presented as mean ± standard deviation and n (%), and a paired t-test was used to evaluate the variations in treatment and outcomes across the participating sites. The test assumed equal variances for both samples, and the findings indicated statistically significant differences in platelet count, length of therapy, hospitalization duration, and demographic characteristics ($P < 0.05$).

RESULTS

In Group 1, the mean age was 23.3 ± 1.8 years, while Group 2 had that a mean age was 34.3 ± 3.0 years. The differences between groups were statistically significant ($P = 0.003$). The mean hospital stay for patients in Group 1 had a mean duration of 6.11 days, while patients in Group 2 had a mean hospital stay of 10.35 days, with both differences being statistically significant ($P = 0.001$). However, the mean respiratory rate per minute did not differ significantly between groups ($P = 0.47$). The mean heart rate per minute was similar in both groups; however, it tended to be slightly different ($P = 0.054$). The mean systolic blood pressure (BP) in Group 1 was 108.2 ± 1.4 mmHg, whereas in Group 2, the mean systolic BP was 115.5 ± 2.4 mmHg. The difference between the two groups was statistically significant ($P = 0.009$). The mean diastolic BP in the group 1 was 71.4 ± 0.9 mmHg, which was lower than the group 2 mean diastolic BP of 75.5 ± 1.7 mmHg, with a statistically significant difference ($P = 0.028$). The mean arterial pressure did not differ significantly between the groups ($P = 0.08$). The mean hemoglobin levels were similar between the groups, and there were no statistically significant differences ($P = 0.535$). The mean lymphocyte count in Group 1 was 27.3 ± 1.1, while Group 2 had a significantly higher mean lymphocyte count of 20.2 ± 1.1 ($P = 0.001$) [Table 1].

Demographic data of patients seeking assistance from hospitals in different areas of the Kyrgyz Republic were presented in Figure 1. Among them, 32% were from the Chui region, which includes the city of Bishkek, and 18% came from various locations within the country and sought help from the hand microsurgery department of the National Hospital. These data suggest that the local department effectively provides specialist medical care to regions within a 100 km radius. However, the health-care system is fragmented, leading to an increase in post-operative complications and inadequate care for patients with minor bone fractures, which can result in a partial or total loss of function. The findings highlight the need to re-evaluate and modify the health-care system's structure to ensure equitable access to expert medical care throughout all regions of the Kyrgyz Republic, particularly for hand injuries that require specialized treatment. This intervention can effectively reduce the incidence of post-operative complications and promote functional recovery.

Hand injuries, particularly fractures of the hand bones, have shown a decreasing trend over time. In 2018, 169 patients underwent reconstructive surgeries, which were reduced to 117, 111, 101, 100, and 96 patients in 2019, 2020, 2021, 2022, and 2023, respectively. Osteosynthesis was performed concurrently in these cases. The incidence of hand injuries was higher in males, resulting in a 4:1 ratio between males and females [Figure 2].

The decline in the number of patients with hand injuries requiring reconstructive surgery suggests that preventive measures and safety enhancements in daily life are effective. However, it is essential to continuously monitor the situation and scrutinize the factors contributing to fluctuations in

Table 1: Comparison of parameters between the two groups of patients

S. No.	Parameters	Group 1	Group 2	*P*-value
1.	Mean age (in years)	23.3±1.8	34.3±3.0	0.003
2.	Hospital stay(bed days)	6.1±0.2	10.3±0.2	0.001
3.	Respiratory rate (bpm)	18.7±0.2	18.4±0.3	0.47
4.	Heart rate (bpm)	79.6±0.9	76.4±0.6	0.054
5.	Systolic blood pressure	108.2±1.4	115.5±2.4	0.009
6.	Diastolic blood pressure	71.4±0.9	75.5±1.7	0.028
7.	Mean arterial pressure	79.8±1.0	76.5±0.6	0.08
8.	Hemoglobin	138.8±2.2	141.5±3.8	0.535
9.	Lymphocytes	27.3±1.1	20.2±1.0	0.001

Values are presented as the mean±standard deviation. *P<0.05

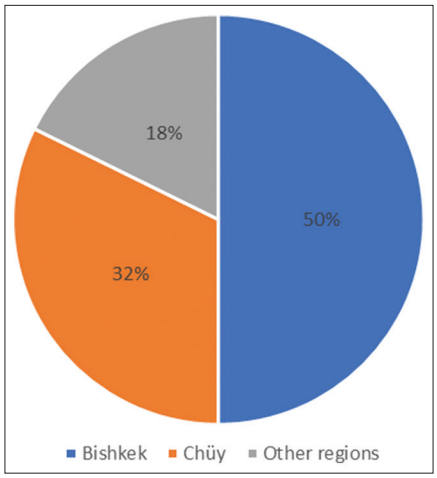

Figure 1: Demographic data of patients seeking assistance from hospitals in different areas of the Kyrgyz Republic

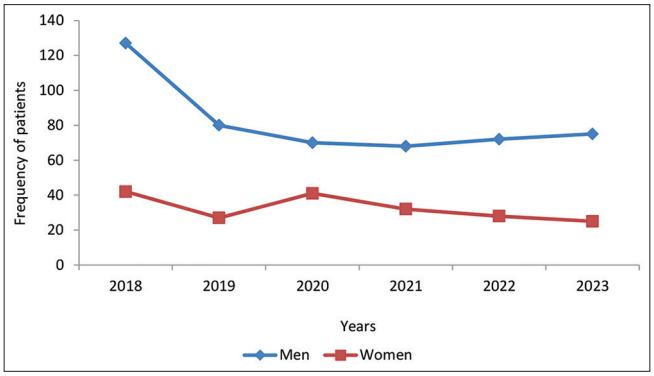

Figure 2: Sex distribution of patients who were treated between 2018 and 2022

case counts to customize medical treatments according to the patients' current needs. The hospitalization duration is a crucial determinant of surgical success. With the lace technique, the majority of patients were discharged from the hospital within 10 days, with approximately 33% discharged within 5 days and less than one-third staying for more than 10 days. In contrast, most traditional osteosynthesis patients had hospital stays exceeding 10 days, with less than one-third discharged early. These factors indicated a more favorable rehabilitation trajectory when using lace osteosynthesis [Figure 3].

This study found that cord osteosynthesis leads to shorter hospital stays and faster rehabilitation than traditional procedures, which highlights the importance of selecting the most effective therapies to improve patient outcomes and reduce health-care costs. Three primary ICD-10 codes were identified to categorize hospitalized patients: wrist injury, ankle and foot injury, and the effects of external sources, such as trauma, poisoning, and other related consequences. Only ICD-10 codes were used to streamline the narrative, resulting in the primary cohort of patients requiring osteosynthesis surgery being classified using the S61 and S62 codes, which accounted for approximately 25% and 10% of all evaluated cases, respectively. Other diseases related to S6 accounted for an additional 12% of the overall number of patients examined [Figure 4].

Data on clinical diagnoses and ICD-10 codes suggest that further research is necessary to examine how severe injuries and their consequences are distributed among patients admitted to the hospital. This is necessary to gain a comprehensive understanding of the characteristics of injuries and to identify strategies to improve the efficiency and effectiveness of medical care and treatment procedures. The study showed that 66% of the patients sustained injuries either in residential settings or during routine tasks without following safety measures. This may be due to a lack of awareness of the potential hazards and improper use of tools and equipment, including falls, wounds, bruises, and other traumatic events that occur in either the home or work setting.

Hand injuries account for 15% of workplace incidents, emphasizing the risks and potential inadequacies of workplace safety measures. These injuries often result from direct contact with power, hand tools, equipment, or materials, incorrect movement, or lifting. Transport accidents, including vehicular collisions, account for 11% of hand injuries, whereas the remaining 8% are attributed to sports injuries, falls, and severe condition-related activities [Figure 5].

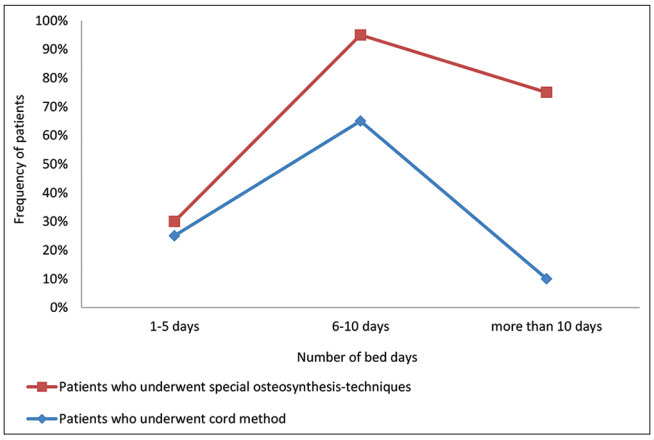

Figure 3: Number of bed days of patients included in the study

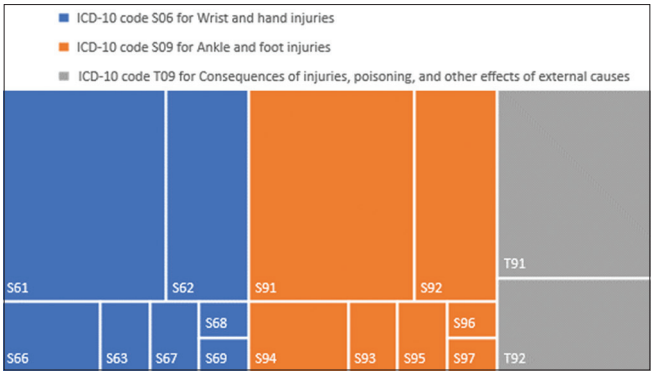

Figure 4: The clinical diagnosis of the patients included in the study

To prevent traumatic incidents, strategies should be implemented in the home, workplace, and streets, including safety training, enhanced infrastructure, and safety rules in manufacturing. These measures can significantly reduce the occurrence and severity of hand injuries and improve overall health and well-being.

DISCUSSION

This study revealed significant differences in age, length of hospital stay, BP, white blood cell (WBC), and lymphocyte counts between the two patient groups. These disparities are important in evaluating the treatment efficacy and safety of hand fractures.

Previous studies have suggested that a significant percentage of bone fractures in the arms and legs initially go undetected.[3,4,9] A 2008 meta-analysis revealed that 4–33% of limb fractures resulting from multiple injuries occur in the hand or wrist.[10] At present, the understanding of the frequency of hand and wrist fractures in polytrauma patients primarily relies on patient records or trauma databases.[11,12] However, contemporary CT scanners have the potential to detect subtle abnormalities and establish a standardized assessment method involving

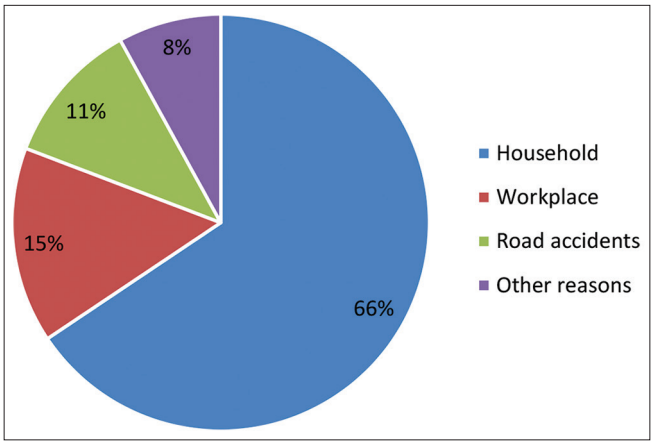

Figure 5: Structure of causes of injury in patients included in the study

the evaluation of skilled musculoskeletal radiologists. In a retrospective examination of ventilated trauma patients using WBCT, Münn *et al*. found a fracture incidence of 15.5%, particularly in the arms and forearms.[13]

A German study, investigated the factors that affect the detectability of these injuries on WBCT scans in this population.[14] Nonetheless, wrist and hand fractures are crucial for all patients with multiple traumatic injuries, especially when long-term harm and regaining functionality can be prevented.[15,16] In 2011, a collaboration of 20 medical societies released the German S3 guidelines, which outlined the indications for WBCT in the treatment of polytrauma and severe trauma.[17]

This study demonstrated the advantages of using a microsurgical approach to treat hand injuries, including enhanced precision in restoring tissue, reduced risk of complications, and shorter recovery times for patients. However, disparities in access to high-quality medical care across various healthcare settings can result in increased complications and decreased functionality in patients with hand injuries due to inadequate treatment.

CONCLUSION

Our analysis of a comparison table highlighting the differences between the two treatment methods for hand fractures revealed significant disparities among the patient groups based on age, hospitalization duration, BP, WBC count, and lymphocyte levels. Our findings provide valuable insights into the challenges and opportunities of healthcare organizations to achieve successful rehabilitation of patients with hand injuries.

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AUTHORS' CONTRIBUTIONS

Conception, design of the work, manuscript preparation, and data acquisition: Sultan Tukeshov, Urmat Alybaev, Burulai Emilbekova, Shravani Divity, Tugolbai Tagaev. Clinical management: Sultan Tukeshov, Urmat Alybaev, Burulai Emilbekova.

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