COMPARISON OF DISTAL RADIUS FRACTURE MANAGEMENT BETWEEN TRAUMA CENTERS IN HOSPITAL OF LITHUANIAN UNIVERSITY OF HEALTH SCIENCES, KAUNAS CLINICS AND DUHOK EMERGENCY TEACHING HOSPITAL

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Kaunas 2017-2019
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SUMMARY

Author name: Awaz Hashim Bashir
Research title: Comparison of distal radius fracture management between trauma centers in Hospital of Lithuanian University of Health Sciences, Kaunas Clinics and Duhok Emergency teaching Hospital.

Aim: The aim of the study is to compare the results and outcomes of different management approaches for distal radius fractures amongst trauma centres in Hospital of Lithuanian University of Health Sciences, Kaunas Clinics and Duhok Emergency teaching Hospital.

Objectives: 1. To determine how the persistence of tradition and cultural attitudes impacts health care seeking behaviour and its consequences on treatment prognosis. 2. To determine the type of fracture and to find correlations between patient status, age, and gender and the incidence of these fractures in both trauma centers. 3. To compare the effectiveness of treatment methods and their results amongst trauma centers in Hospital of Lithuanian University of Health Sciences, Kaunas Clinics and Duhok Emergency teaching Hospital.

Methodology: The study was carried out at two separate locations, namely Duhok, Kurdistan and Kaunas, Lithuania and the two selected cities have similar population sizes. In total 78 patients were included in this study, 39 patients from each hospital. Bonesetter-intervened patients were included. Anamnestic data, physical examination findings and radiological screening measurements were used to evaluate outcomes.

Results: 39 patients were from Duhok Emergency teaching Hospital out of which 8 patients were bonesetter-intervened patients and 39 patients were from LSMU, Kaunas Clinics. In both hospitals the majority of the fractures were extraarticular fracture (Colles fracture). There were higher incidences of patients from Duhok Emergency teaching Hospital with ranges of radial height and radial inclination which suggest when radius is mostly compressed compared to the results of the same radiological parameters of patients from LSMU, Kaunas Clinics. Both RH and RI results were statistically significant, $p < 0.05$. More patients from Duhok Emergency teaching Hospital with ranges of volar tilt which suggest that there is a severe loss of hand mobility compared to patients from LSMU, Kaunas Clinics. The results were not statistically significant, $p > 0.05$.

Conclusions: Recieving bonesetter-intervened patients creates many difficulties in achieving optimal patient result for physicians at Duhok Emergency teaching Hospital, in comparison to LSMU, Kaunas Clinics where all patients go straight to the emergency department. Among bonesetter-intervened patients there were cases with type B and C in AO classification and presented at the hospital only after mismanagament and complications such as malunion due to TBS interventions. At that point, reduction of long-term sequel is not possible and often the complications cannot be reversed. Coming straight to emergency after distal radius fracture should improve the functional result.
ACKNOWLEDGMENTS

Firstly, I would like to express my deepest gratitude to Pro. Dr. Alfredas Smailys my supervisor, for accepting to supervise this work and believing in me, secondly for his tolerance, constructive criticism, patience and his guidance throughout this research project.

Special thanks to Dr. Riturau Rakauskas, at LSMU, Kaunas Clinics for his constant support and patience.

My sincere thanks to Dr. Abdullah Ibrahim the director of Duhok Emergency teaching Hospital for his willing collaboration and help.

I would like express a special appreciation to Dr. Sadeq Shawkat Sadeq, at Duhok Emergency teaching Hospital for his help and support to create this thesis.

To André Johansson, I want to thank him for his unconditional friendship and support.

Last, but not least, I wish to express my love and my gratitude to my family for their enormous support and always believing in me. This work would never be possible without the support of my family, friends and professors.
CONFLICTS OF INTEREST

The author reports no conflicts of interest.
PERMISSION ISSUED BY THE ETHICS COMMITTEE

Approval of Research Ethics Committee. Lithuanian University of Health Sciences Bioethic center. Reference number: BEC-MF-132. Date of issue: November 29th 2018. Verbal consent was obtained from all participants from Duhok Emergency teaching Hospital, Kurdistan/Northern Iraq.
ABBREVIATIONS

WHO - World Health Organization

TBS- Traditional Bonesetter

UHC - Universal Health Coverage

T&CM- Traditional and Complementary Medicine

TM- Traditional Medicine

RH-Radial Height

RI- Radial Inclination

VT - Volar Tilt

DRF- Distal Radius Fracture

LSMU- Hospital of Lithuanian University of Health Sciences
**TERMS**

Malunion: when a fractured bone heals with an anatomic deformity.

Noneunion: When a fracture fails to heal after an extended recovery period.

Reduction: The manipulation of a displaced fracture to a more anatomical position.

AO: Arbeitsgemeinschaft für Osteosynthesefragen. A medically guided nonprofit organization led by an international group of surgeons specialized in the treatment of trauma and disorders of the musculoskeletal system.
INTRODUCTION

Enhanced health is central to human happiness and well-being. It also makes an important contribution to economic progress, since healthy populations live longer and are more productive and live their lives to their full potential (WHO, 2010) [1]. There are numerous factors that influence the health seeking behaviour of people; such as social and demographic factors, treatment cost and social networks as well as biological signs and symptoms [2]. Despite availability of modern health care facilities, traditional art of bone practice refuses to disappear and consultation of traditional bonesetters still remains popular especially in Africa, Asia, South America as well as in some areas of Europe, especially Balkans [3-5]. Wrist fracture, also known as distal radius fracture, is one of the injuries that is managed by traditional bonesetting practices.

The eponym "Colles fracture" named after the Irish Surgeon Abraham Colles is still commonly used [6]. Distal radius fractures are the most common orthopaedic injury worldwide, accounting for 17% of all fractures in adults [7]. Wrist fractures are seen predominantly in the paediatric population and in the elderly age group. In adolescents and young adults, the fractures are sport-related and in the elderly it is due to osteoporosis of postmenopausal woman and bone mineral density [8].

To make an accurate diagnosis, the injuries need to be thoroughly evaluated both by the history and physical examination. Another essential element, not only for the diagnosis but also important in classification, treatment and orthopaedic follow-up assessment of these fractures is Radiographic Imaging. This imaging modality is important for describing the pattern of the fracture, the fracture location, the degree of angulation, displacement, comminution and impaction. Since most traditional bonesetters do not follow the basic principles of fracture management and evaluation; by using the radiographic imaging modality their treatment can result in serious complications. An incorrect initial assessment of the fracture and complications after bonesetter interventions may lead to long-term squeal and in some cases the complications cannot be reversed by modern healthcare [9].

This study is intended towards the study of patients with distal radius fracture from two different hospitals, namely the Duhok Emergency teaching Hospita, in Kurdistan/Northern Iraq and the Hospital of Lithuanian University of Health Sciences (LSMU), Kaunas Clinics, in Lithuania. The usage of the health services by patients that are admitted to these two hospitals are different and the patients have different behaviour in relation to their health. The aim of the study is to compare the results and outcomes of different management approaches for distal radius fractures amongst trauma centers in the Hospital of Lithuanian University of Health Sciences, Kaunas Clinics and Duhok Emergency teaching Hospital. This study seeks to explore how the persistence of tradition and cultural attitudes impacts health care seeking behaviour and its consequences on treatment prognosis.
AIM AND OBJECTIVES

Aim: The aim of the study is to compare the results and outcomes of different management approaches for distal radius fractures amongst trauma centers in the Hospital of Lithuanian University of Health Sciences, Kaunas Clinics and Duhok Emergency teaching Hospital.

Objectives:

1. To determine how the persistence of tradition and cultural attitudes impacts health care seeking behaviour and its consequences on treatment prognosis.
2. To determine the type of fracture and to find correlations between patient status, age, and gender and the incidence of these fractures in both trauma centers.
3. To compare the effectiveness of treatment methods and their results amongst trauma centers in Hospital of Lithuanian University of Health Sciences, Kaunas Clinics and Duhok Emergency teaching Hospital.
LITERATURE REVIEW

The definition of traditional medicine by groups of experts convened by the WHO Regional Office for Africa is:

"...the sum total of all the knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing."

The authors contribute some information about the background and definition of a traditional healer as follows: "a person who is recognized by the community in which he lives as competent to provide health care by using vegetable, animal and mineral substances and certain other methods based on the social, cultural and religious background as well as on the knowledge, attitudes and beliefs that are prevalent in the community regarding physical, mental and social well-being and causation of disease and disability."

The question that then naturally arises is why do people choose the utilization of traditional bonesetter practices when today’s accessibility of the modern health services has never been better compared to any other time?

The reasons for patronizing TBS differ from country to country but certain characteristics are common to all. In Albania, there are still some patients who do not go directly to the hospital and instead choose to go to a TBS. As reported by the author Neritan Myderrizi, in Albania up to 98.9% of the patients who choose TBS do so because they were forced to follow the opinion of family and friends. It was found that 83.6% had low educational levels and lacked information about modern health services especially people coming from rural areas. The patients who were initially intervened on by TBS had a poor functional result compared to the patients coming directly to the hospital after the injury. Neritan Myderrizi has observed that TBS may be adequate for treatment of simple closed fractures but not in severe cases of distal radius fractures. It was also reported that patients from Albania did not relate the bonesetter’s skills to some metaphysical or religious power as in some countries in Africa and Asia [3].

The patronization of TBS by the population in Sub-Saharan Africa is very popular, and it accounts for up to 80% of cases reported initially in 1983 by WHO textbook [11].
There have been numerous studies to investigate and update knowledge of the prevalence of traditional medicine utilization. An observation in this study revealed that the utilization of traditional medicine was lower than it has been reported and found that India is the country which has highest usage rate of traditional medicine. For a total period of three years, 11.7% of people used traditional medicine for healthcare. About 19.0% of people have patronized TM in the previous 12 months. In comparison to countries as Ghana, South Africa, China, Mexico and Russia where less than 3% of people used TM for healthcare and less than 2% of people used TM in the previous year in countries as China, Mexico, Russia and South Africa[12].

This study and several other studies from Ghana and India have reported that a particular group of people are more likely to use traditional healers. Those who were unemployed, from rural areas and with lower socio-economic status [13-15].

Moreover, a study from Turkey has illuminated that many people who utilize TBS have an affordable lifestyle. In the study from Turkey 98.2% of the patients had social insurance and affordable lifestyles, but often chose alternative treatment and 75.5% of them had some level of education. There are different factors that influence the patient’s decisions to choose the alternative treatment. Many of them prefer alternative methods because they believe that bonesetters possess some metaphysical or religious power. Other reasons were also indicated in the study such as fear and unwillingness of having materials such as metal inside their body, fear of physical disability and discomfort in cast, fear of operations, and long treatment periods in clinics. The study showed that 80.9% of patient’s decisions of seeking treatment at TBS was influenced by neighbours and relatives advice [9].

A recent study done in Nigeria concluded that educational status, occupation, and age did not influence the patronization of TBS. The reason visiting TBS was influenced by the opinion of relatives and friends and this is comparable to reports done in Albania and Turkey. Other reasons that people chose alternative treatment methods were the low cost, social and cultural beliefs and misconceptions such as believing that orthopaedics only perform operations and amputations in the hospital [3, 9, 16-17].

Several methods are reported in the literature to address this issue. The method used in Ganda divided the patients into two groups. After admission to the emergency department some patients chose the treatment provided by hospital and this group were referred to as "stayers". Another group, the "leavers" were the patients who chose to go to a TBS after the diagnosis in the hospital. The patients who utilized the bone setting practice as the initial treatment and later decided to present to the hospital were referred to as
"returners". The reason that the stayers did not go to the bonesetter were because of treatment facilities that the hospital provides. The availability of imaging techniques such as X-ray were the main reasons that the two other groups presented at the hospital before going to the bonesetter or after utilization of the bonesetter. The factors for patronizing alternative treatment methods were the same as the reasons that are mentioned above including none self- decision, fear of amputations at the hospitals and cheaper treatment costs. For example, this research clearly documents the costs. A bonesetter treatment costs on average 13 € (range 0–60 €) and hospital treatment 300 € (range 25–800 €) [17].

The literature review is full of reports showing complications caused by traditional treatment methods. WHO’s experts in their report suggested that these techniques may give rise to a very high risk of irreversible complications. Since the mode of treatment by TBS is not scientific, THEY don’t follow the basic principles of wound management, use of anti-tetanus toxoid immunoglobulin and antibiotics [18].

The most common complications in the study conducted in Turkey were malunion, Volkmann’s ischemia osteomyelitis, gangrene, joint stiffness, chronic articular dislocations, sepsis, and tetanus. The results of the study from India support previous findings in which malunion occurred in 54 cases (46%), followed by impending ischemia (28%), non-union (20%), chronic osteomyelitis (6%) and others (tetanus, Sepsis) 0.8%. Furthermore, the surgeons from Nigeria reported that the bonesetter is an obstacle to achieving the best results obtainable for a distal radius fracture especially after the poor result of the bonesetter interventions [9, 18, 19-20].

Although results appear consistent with prior research, they appear inconsistent with surgeons that had personally observed fracture care at traditional bone setting practices.

Furthermore, it is arguably important to address the question of if the orthodox orthopaedic practitioners are willing to co-operate with TBS. In order to achieve total health care coverage and prevent complications caused by TBS it is important to have mutual respect, recognition and collaboration between TBS and the modern health care system. The study from India suggested that TBS could be useful in the health care system at the primary care level if training in the basics of orthopaedic care were provided to them. The TBS need education in order to recognize compound fractures, intra articular or open fractures which would require the introduction of radiographs in the training algorithm to urban TBS and to understand when they should refer the patients with severe fractures to the hospital [21].
Promotion and development of traditional medicine have been supported by the WHO since 1978. The main goals mentioned in the WHO textbook published in 2013, are support to “Member States in harnessing the potential contribution of traditional and complementary medicine to health, wellness and people-centred health care and UHC: promoting safe and effective use of T&CM through the regulation, research and integration of T&CM products, practices and practitioners into the health system, as appropriate” [22].
METHODS

This is a prospective, parallel-group, randomized trial and was performed at the Department of Orthopaedics and Traumatology in two different hospitals. At the Hospital of Lithuanian University of Health Sciences, Kaunas Clinics, Kaunas, Lithuania which serve a region of approximately 374,643 inhabitants and at Duhok Emergency teaching Hospital, Duhok, Kurdistan/ Northern Iraq, which serve a region of approximately 284,000 inhabitants [23, 24].

In total 78 patients were included in this study. During the period of 3/8/17 to 30/8/17, 39 patients with distal radius fracture in three age groups (children, adults and elderly people) seeking treatment at Duhok Emergency teaching Hospital, Northern Kurdistan were interviewed for collecting anamnestic data with regards to age, sex, occupation and date of the injury and admission date to the hospital and reasons for not coming straight to the hospital. Verbal consent was obtained from all the patients. Physical examination findings and the anterior-posterior and lateral plain radiographs of all cases were used to evaluate fractures and the outcomes of the interventions of TBS.

At the Hospital of Lithuanian University of Health Sciences Kaunas Clinics an equal numbers of patients, 39 as in Duhok Emergency teaching Hospital, with distal radius fractures in the three age groups (children, adults and elderly people) were collected during the study period from 05/11/2017 to 13/12/17, 24/1/18 to 25/5/18, and 20/9/18 to 30/10/18. Patients’ age, sex, and admission date to the hospital were recorded. Radiological images were used to evaluate distal radius fractures.

51. 3%(20) belonged to the age group 0-17 years, and 38.5% (15) to the age group 18-64, and 10.2 % (4)to the age group 60+ years from each hospital.

Patients with distal radius fractures were included in this study, out of which most of them were treated conservatively and some of them required surgery. From the trauma center in Duhok Emergency teaching Hospital, 8 out of 39 patients did not come directly to the hospital and were initially intervened on by a TBS.

Fracture classification was done based on AO classification, A2.2 type was occurred in 51 cases (28 cases from LSMU, Kaunas Clinics and 23 from Duhok Emergency teaching Hospital), A2.3 in 1 case from LSMU, Kaunas Clinics, B1.1 in 2 cases from Duhok Emergency teaching Hospital, B3.1 in 2 cases from Duhok Emergency teaching Hospital, C3.2 in 3 cases from Duhok Emergency teaching Hospital. 10 cases with Greenstick fracture from LSMU, Kaunas Clinics and 9 cases with Greenstick fracture from Duhok
Emergency teaching Hospital were also included in the study.

Inclusion Criteria

1. No age restrictions.
2. Unilateral fracture of distal radius with or without misalignment.
3. Independent for activities of daily living.
4. Pre-existent abnormalities or functional deficits of the fractured wrist due to TBS intervention.

Exclusion Criteria

1. Fracture of contralateral arm.
2. Ipsilateral fractures proximal of the distal radius fracture.
3. Open fractures.

Anatomical results were described and evaluated by radiological imaging and specific radiographic criteria for unstable fracture and malunion. Description of the x-rays and radiographic measurements: radiographs in two views (anterior - posterior and lateral views of the arm) which were taken at the initial presentation of 78 patients with distal radius fractures were analysed. The radiographic parameters were based on radial inclination, radial height (radial shortening) and volar tilt to assess the distal radius.

The volar tilt was measured on the lateral view. A line perpendicular to the long axis of the radius is drawn; this line connects the most distal point of the volar and dorsal tip of radius. Radial inclination is assessed on the anterior - posterior view and is a measurement of the radial angle. This parameter is the line drawn between the long axis of the radial shaft and the second line from the tip of the radial styloid to the ulnar corner of the distal radius. Radial height is the distance between two lines drawn perpendicular to the long axis of the radius: one is drawn along the ulnar corner of the articular surface of the radius and the second is drawn along the styloid tip of the radius. [25].

Based on a review of the results of multiple scientific studies, a study defined unstable distal radius fractures and malunion of the distal radius fracture [25, 26].

Unstable distal radius fractures are confirmed with radiographic images and specific radiographic criteria are used to define an unstable distal radius fracture:

1. Radial inclination <15°
2. Volar tilt >15°, dorsal tilt >10°
3. Radial height <9 mm
4. Intra-articular step or gap >2 mm
Radiographic criteria is used to define a malunion of the distal radius:

1. Radial inclination <10°
2. Volar tilt >20°, dorsal tilt >20°
3. Radial height <10 mm
4. Ulnar variance >2+
5. Intra-articular step or gap >2 mm

Statistical analyses were done by using Matlab software. P<0.05 was considered statistically significant.
RESULTS

There were 78 patients who presented with distal radius fracture within the study period, out of which 39 (50%) were from Hospital of Lithuanian University of Health Sciences Kaunas Clinics, Lithuania and 39 (50%) from Duhok Emergency teaching Hospital, Kurdistan/Northern Iraq.

There were 13 (33%) females from Duhok Emergency teaching Hospital and 21 (54%) females from LSMU, Kaunas Clinics, making a total of 34 (44%) females. Forty-four (56%) patients were male out of which 26 (66.67%) were from Duhok Emergency teaching Hospital and 18 (46.15%) from LSMU, Kaunas Clinics.

51.3% (20) belong to the age group of 0-17 years and 38.5% (15) to the age group of 18-64 and 10.2% (4) to the age group of 60+ years from each hospital, as shown in figure 2.

Figure 1: Gender distribution of cases in this study
Out of the patients from Duhok Emergency teaching Hospital there were 19 (48.7%) pupils/students, 10 (25.6%) housewives and 4 (10.3%) civil servants. The others were 2 (5.1%) drivers and 4 (10.3%) with no schooling.

The Muller AO classification of fractures has been used for classifying the fractures [27]. In both hospitals the A2.1 (Colles fracture) were the most common type of fracture. The second most frequently seen fracture was the Greenstick fracture. During this study period patients with type B and type C fractures in the AO classification were also seen in Duhok Emergency teaching Hospital, but not in the Hospital of Lithuanian University of Health Sciences Kaunas Clinics. Two B1.1 Fractures of radial styloid (Chauffeur’s fracture), two B3.1 Volar rim fracture (Barton’s fracture) and three cases of type C (Articular simple, multiple fragmented). Injury types are detailed in table 1.
### Table 1: Type of fracture in this study

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Age Group (yr)</th>
<th>Incidence of Fracture LSMU</th>
<th>Incidence of Fracture Duhok Emergency teaching Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Extraarticular fracture</td>
<td>0-17</td>
<td>23.1% (9)</td>
<td>28.2% (11)</td>
</tr>
<tr>
<td>A2.1 Pouteau-Colles fracture</td>
<td>18-60</td>
<td>38.5% (15)</td>
<td>20.5% (8)</td>
</tr>
<tr>
<td>A. Extraarticular fracture</td>
<td>&gt;60</td>
<td>10.3% (4)</td>
<td>10.3% (4)</td>
</tr>
<tr>
<td>B. Intraarticular rim fracture B1.1 Fracture of radial styloid (Chauffeur)</td>
<td>0-17</td>
<td>2.6% (1)</td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>18-60</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>B. Intraarticular rim fracture B3.1 Volar rim fracture (Barton)</td>
<td>0-17</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>18-60</td>
<td>0% (0)</td>
<td>5.1% (2)</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>C. Complete intraarticular fracture C3.2 Articular simple, multiple fragmented</td>
<td>0-17</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>18-60</td>
<td>0% (0)</td>
<td>7.7% (3)</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Greenstick fracture</td>
<td>0-17</td>
<td>25.6% (10)</td>
<td>23.1% (9)</td>
</tr>
<tr>
<td></td>
<td>18-60</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td></td>
<td>&gt;60</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
</tbody>
</table>

In total 8 (20%) out of the 39 patients from Duhok Emergency teaching Hospital, had visited the TBS before attending Duhok Emergency teaching Hospital. Four patients with Colles fracture (14-year-old male, 60-year-old female, 47-year-old female, 7-year-old female) and two patients with greenstick fracture (8-year-old male, 11-year-old male) were also bonesetter-intervened patients. Two patients with fractures of distal radius AO type B and C were bonesetter-intervened patients, a 50-year-old female with B3.1 (Barton) type and a 30-years-old female with C3.2 (articular simple, multiple fragmented) type.

3 cases of bonesetter-intervened patients underwent surgery the 50-year-old female with B type and 30-year-old female with C type, as well as the 14-year-old male with A type. The rest of the patients who had been initially intervened on by a traditional bonesetter, had their fractures reduced and re-
immobilized.

The complication seen was malunion due to bonesetter intervention which lead to pain, functional disability, discomfort, swelling and bruising. The duration of treatment with TBS is shown in table 2.

<table>
<thead>
<tr>
<th>Duration (Months)</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>5</td>
<td>37.5%</td>
</tr>
<tr>
<td>2-3</td>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td>&gt;3</td>
<td>1</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

*Table 2: The duration of treatment with TBS*

Totally 5 out of 39 patients from Duhok Emergency teaching Hospital needed to undergo surgery and the rest were managed conservatively. Compared to patients from the Hospital of Lithuanian University of Health Sciences, Kaunas Clinics, totally 4 cases needed to undergo surgery and the rest were conservatively treated.

The results of radiological measurements of radiographs taken at the time of initial presentation were compared between the Hospital of Lithuanian University of Health Sciences Kaunas Clinics and Duhok Emergency teaching Hospital. The radiographic studies were based on anterior - posterior and lateral X-rays of the wrist used for various measurements. Each fracture was assessed by radial height (RH), volar tilt (VT) and radial inclination (RI).

In a study by Medoff RJ [28] normal values of roentgenographic measurements of distal radius were evaluated. His measurement of radial inclination (°) has an average of 23.6 ± 2.5°. The radial height (mm) has an average of 11.6 ± 1.6 and Volar tilt (°) with an average of 11.2 ± 4.6, these parameters are shown in table 3.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radial inclination</td>
<td>23.6° ± 2.5°</td>
</tr>
<tr>
<td>Radial height</td>
<td>11.6mm ± 1.6mm</td>
</tr>
<tr>
<td>Volar tilt</td>
<td>11.2°±4.6°</td>
</tr>
</tbody>
</table>

*Table 3: Distal radius radiographic parameters, normal values*
5 (12.8%) patients from Duhok Emergency teaching Hospital and 2 (5.1%) from LSMU, Kaunas Clinics had a radial inclination less or equal to $10^\circ$. 14 (35.9%) patients from Duhok Emergency teaching Hospital and 9 (23.1%) from LSMU, Kaunas Clinics had RI in the range of $11^\circ$-$15^\circ$. 15 (38.5%) patients from Duhok Emergency teaching Hospital and 16 (41.0%) patients from LSMU, Kaunas Clinics had RI in the range of $16^\circ$-$21^\circ$. 12 (30.8%) patients from LSMU, Kaunas Clinics and 5 (12.8%) from Duhok Emergency teaching Hospital had RI of $23^\circ$+. Radiographic findings are recorded in figure 2. The p-value was less than 0.05, meaning that the results of RI from Duhok Emergency teaching Hospital differs significantly from the results of RI from LSMU, Kaunas Clinics.

![Radial Inclination Chart]

**Figure 3.** Comparison of radiological results of radial inclination of wrist radiographs taken at the time of initial presentation at LSMU, Kaunas Clinics and at Duhok Emergency teaching Hospital.

28 (72%) patients from LSMU, Kaunas Clinics and 20 (51%) from Duhok Emergency teaching Hospital had radial shortening of less or equal to 5 mm. 19 (49%) from Duhok Emergency teaching Hospital and 11 (28%) patients from LSMU, Kaunas Clinics had radial shortening in the range of 6-9 mm, as shown in table 4. The p-value was less than 0.05, meaning the results of RH from Duhok Emergency teaching Hospital differs significantly from results of RH from LSMU, Kaunas Clinics.
9(23.1%) patients from LSMU, Kaunas Clinics and 3(7.7%) from Duhok Emergency teaching Hospital had volar tilt angulation $\leq 9^\circ$. 10(25.5%) patients from LSMU, Kaunas Clinics and 7(17.9%) from Duhok Emergency teaching Hospital had VT in the range of 10$^\circ$-15$^\circ$. 8(20.5%) patients from LSMU, Kaunas Clinics and 12(30.8%) from Duhok Emergency teaching Hospital had VT in the range of 16$^\circ$-19$^\circ$. 12(30.8%) patients from LSMU, Kaunas Clinics and 17(43.6) from Duhok Emergency teaching Hospital had VT greater than or equal to 20$^\circ$, as shown in figure 5. The p-value was more than 0.05, meaning that the results of volar tilt from Duhok Emergency teaching Hospital do not differ significantly from results of VT from LSMU, Kaunas Clinics.

Figure 4. Comparison of radiological result of radial shortening of wrist radiographs taken at the time of initial presentation at LSMU, Kaunas Clinics and in Duhok Emergency teaching Hospital.

Figure 5. Comparison of radiological result of volar tilt angulation of wrist radiographs taken at the time of initial presentation at LSMU, Kaunas Clinics and Duhok Emergency teaching Hospital.
DISCUSSION OF THE RESULTS

There were 13(33%) females from Duhok Emergency teaching Hospital and 21(54%) females from LSMU, Kaunas Clinics making a total of 34 (44 %) females. Forty-four (56%) patients were male out of which 26(66.67%) were from Duhok Emergency teaching Hospital and 18(46.15%) from LSMU, Kaunas Clinics. Distribution of the sex in this study showed a male preponderance of the patients from Duhok Emergency teaching Hospital (66.67%) as most studies emphasize the fact that males are predominately injured because they are more adventurous and engage in more behaviour that exposes them to the risk of injury [18]. The sex distribution of the patients from LSMU, Kaunas Clinics was approximately balanced, 46% male and 54% female.

51.3%(20) belong to the age group of 0-17 years and 38.5%(15) to the age group of 18-64 years, and 10.2(4)% to the age group of 60+ years from each hospital. In this study, DRFs are seen predominately in the paediatric population in both hospitals. Previous studies have also reported that DRFs are predominantly in the paediatric population and the injury in adolescents and young adults are sport-related [8]. This fracture is common in the paediatric population which is also related to decreased level of skeletal mineralization and density that exist during pubertal growth spurts. During these years the rate of bone lengthening exceeds the rate of mineralization, and therefore makes members of this demographic more prone to injuries.

Although for the most part, the Duhok Emergency teaching Hospital attains a number of qualified orthopaedic surgeons and several other standards comparable to LSMU, Kaunas Clinics, the treatment by TBS remains popular for significant proportion of the Kurdish population.

However, some significant differences between these two healthcare systems also exist. The Kurdish healthcare system is much more fragile and faces the challenges of overcrowding and inadequate resources. The healthcare infrastructure in Kurdistan has been overburdened and was affected by the Syrian Civil War, which began in 2011 and is the largest refugees crisis since World War II [29-30]. The Kurdistan Region hosts the largest concentration of Syrian refugees. It is estimated that, 97% of Syrian refugees in Iraq are located in Kurdistan and approximately 104,000 only in Duhok Governorate [31-32]. In a period of one month 39 patients with distal radius fracture were collected from Duhok Emergency teaching Hospital, out of which 6 were refugees, compare to LSMU, Kaunas Clinic, where several months were needed to collect the same amount of DRFs.

In Lithuania there were no bonesetter-intervened patients; all 39 patients went straight to the emergency
department after the injury. This can be compared to the Duhok Emergency teaching Hospital 8 patients out of 39 patients (20%) consulted a traditional bonesetter and later chose to see a physician at the hospital. The reasons that these 8 patients chose to see a physician after being intervened on initially by a TBS were unhealed fractures or suffering with complications such as malunion of distal radius fractures. This is not surprising, since traditional bonesetters do not use radiological imaging. 3 patients out of 8 patients spent 2-3 months or more with TBS which is enough time for the most of the fractures to have united.

In Duhok Emergency teaching Hospital, there were 19 (48.7%) pupils/students, 10 (25.6%) housewives and 4(10.3%) civil servants. The others were 2(5.1%) drivers and 4 (10.3 %) with no schooling. This finding is similar to the previous study where students and pupils were the largest occupational group. The next largest group in this study was housewives. Another study shows that there might be a correlation between patronization of TBS and low-income earners [33-34].

The most frequently seen fracture in LSMU, Kaunas Clinics and in Duhok Emergency teaching Hospital was of type A2.2 in the AO classification. In Duhok Emergency teaching Hospital, four patients out of 8 patients who consulted a TBS had type A2.2, and 2 patients had greenstick fractures. The fractures intervened on by bonesetters were rechecked with radiological imaging and all unstable fractures were reduced and reimmobilized. Two females- a 50- year -old with type B fracture and a 30- year-old with C3.2 type fracture, had been initially intervened on by TBS. These two patients belonged to the category of the severe cases which needed an orthopaedic surgery. Another patient which also needed to undergo surgery was a 14-year-old male with Colles fracture after being intervened on by a TBS. The complication seen was malunion due to bonesetter intervention which lead to pain, functional disability, and discomfort, swelling and bruising. In total 5 out of 39 patients from Duhok Emergency teaching Hospital needed to undergo surgery and the rest were managed conservatively. In LSMU, Kaunas Clinics 4 cases of Colles fracture out of 39 patients also underwent surgery because of the severity of the fracture but not because of malunion of distal radius fracture due to patronization of TBS, as in Kurdistan, and the rest were conservatively treated.

The limit of agreement for radial inclination is 23.6° ± 2.5°. 15 (38.5%) patients from Duhok Emergency teaching Hospital and 16 (42.0%) patients from LSMU, Kaunas Clinics had a RI in the range 16°-21°. 12(30.8%) patients from LSMU, Kaunas Clinics and 5(12.8%) from Duhok Emergency teaching Hospital had RI 23°+. One of the radiographic criteria to define unstable distal radius fracture is RI <15°, and one
of the criteria used to define a malunion of the distal radius is RI<10° [25-26]. In this study, 14 (35.9%) patients from Duhok Emergency teaching Hospital and 9 (23.1%) from LSMU, Kaunas Clinics had radial inclination in the range 11°-15°. 5 (12.8 %) patients from Duhok Emergency teaching Hospital and 2 (5.1 %) from LSMU, Kaunas Clinics, had a radial inclination ≤ 10°. There were higher incidences of patients from LSMU, Kaunas Clinics, with ranges that are closer to the limits of agreement for radial inclination compared to patients from Duhok Emergency teaching Hospital. There were higher incidences of patients from Duhok Emergency teaching Hospital with ranges of radial inclination which not close to the limits of agreement for radial inclination compared to the same radiographic parameters of patients from LSMU, Kaunas Clinics. The p-value were less than 0.05, meaning the result from Duhok Emergency teaching Hospital differs significantly from the results of LSMU, Kaunas Clinics.

Radial shortening means that radius is compressed, and the ulna is at that time high, leading to a radial shift of the wrist and hand. Measurements more than 2 mm radial shortening suggest comminute or impacted fractures. 28 (72%) patients from LSMU, Kaunas Clinics and 20(51%) from Duhok Emergency teaching Hospital had radial shortening of less than or equal to 5 mm. 19 (49%) from Duhok Emergency teaching Hospital and 11 (28%) from LSMU, Kaunas Clinics, had radial shortening in the range 6-9 mm. There were higher incidences of patients from Duhok Emergency teaching Hospital with ranges of radial height which suggest when radius is mostly compressed compared to patients from LSMU, Kaunas Clinics. The results were statistically significant, p<0.05.

One of the radiographic criteria to define unstable distal radius fracture is volar tilt >15°, and one of the criteria used to define a malunion of the distal radius is VT>20° [25-26]. 12(30.8%) from Duhok Emergency teaching Hospital and 8(20.5%) patients from LSMU, Kaunas Clinics had VT in the range 16°-19°. 12(30.8%) patients from LSMU, Kaunas Clinics and 17(43.6%) from Duhok Emergency teaching Hospital had VT greater or equal to 20°. Considering both anatomic variation and 8(20%) patients out of 39 from Duhok Emergency teaching Hospital were initially intervened on by TBS and came to the hospital with complications as malunion. More patients from Duhok Emergency teaching Hospital with ranges of volar tilt which suggest that there is a severe loss of hand mobility, compared to patients from LSMU, Kaunas Clinics. The results were not statistically significant, p>0.05.

The essential element for the best outcome of DRFs is an early evaluation of the fracture by admittance to the hospital as soon as possible for the fracture to be evaluated thoroughly and treated adequately. Due to certain cultural habits, beliefs and ignorance among Kurdish people, as well as overcrowding of hospitals with trauma cases, people choose traditional bonesetter practice. This study found that there were more
patients from Duhok Emergency teaching Hospital with radiographic parameters that suggests unstable DRFs and/or malunion according to criteria at the time of initial admission to the hospital, compared to patients from LSMU, Kaunas Clinics. The cause of this result may be multifactorial and one of the main factors that could influence the results of the patients from Duhok Emergency teaching Hospital are late admission to the hospital and complications related to TBS intervention. Due patronization of TBS, in Kurdistan the Kurdish physicians faces more challenges compare to Lithuanian physicians and therefore find more difficulties in achieving optimal patient results. Coming straight to emergency after distal radius fracture improves the functional results.
CONCLUSIONS

Some patients had a delay in treatment of musculoskeletal injuries, because they get trapped in social situations and ideas and values that they have picked up from somewhere. Their religion, society and culture has trained them to believe that traditional bonesetters are better at treating fractures. Only after mismanagement and complications due to TBS interventions do they present at the hospital. At that point, reduction of long-term sequel is not possible and some of these complications cannot be reversed.

The most frequently seen fracture in both trauma centers were extra-articular fracture, AO type A2.2. The sex distribution of the patients from Kaunas Clinics was approximately balanced, but a male preponderance was found in Duhok Emergency teaching Hospital. Distal radius fractures are seen predominantly in the paediatric population in both hospitals.

Receiving bonesetter-intervened patients creates many difficulties in achieving optimal patient results in Duhok Emergency teaching Hospital, in comparison to LSMU, Kaunas Clinics, where all patients go straight to the emergency department, making it easier to achieve the best functional results for the patients. Among bonesetter-intervened patients, there were cases with type B and C in the AO classification, and they presented at the hospital only after mismanagement and complications such as malunion due to TBS interventions.
PRACTICAL RECOMMENDATIONS

In order to overcome and change bad health-care-seeking behaviour among people who have a strong bond with cultural habits and beliefs, a deeper understanding of how to reach out to these patients by the health-care providers is needed, in order to increase the educational and social awareness of the community about the outcome of traditional bonesetter practices. Certain cultural values and beliefs must be adopted in order to avoid complications following traditional bonesetter’s interventions and to reduce the healthcare burden on modern health centers.

A proper health education program for traditional bonesetters should be provided, that can teach the basics of orthopaedic care, and provide information on when to refer complicated cases to the hospitals.
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DĖL PRITARIMO TYRIMUI

LSMU Bioetikos centras, įvertinęs Awaz Hashim Bashir pateiktus dokumentus, studento tiriamajam darbui tema „Comparison of distal radius fracture management between trauma centers in Lithuania and Iraqi Kurdistan“ pritaria*

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*Pastaba: šis pritarimas neatsidžia tiriamajį mokslinį darbą vykdantį asmenį nuo prievoles laikytis Bendrojo duomenų apsaugos reglamento nuostatų ir nuo atsakomybės gauti nacionalinio arba regioninio bioetikos komiteto leidimą, jei toks leidimas būtinas pagal LR Biomedicinių tyrimų etikos įstatymo numatytus reikalavimus.