Epidemiology of shoulder dislocation at Chris Hani Baragwanath Academic Hospital over a one-year period

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WITWATERSRAND,
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DECLARATION

I, Prince-Stoffel Elias Thabiso Mosiuoa Motlolisi, declare that this research report is my own work. It is submitted for the degree of Master of Medicine in the branch of Orthopaedic Surgery at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

Student number: 1250117

Signature of candidate: PETM. Motlolisi

08 September 2020 in Johannesburg, South Africa

DEDICATION

This research report is dedicated to my wife (Rofhiwa), and children (Kamohelo, Onthatile, and Mohau). You guys are my foundation and strength. None of this would have been possible without you by my side. Love you always.

ABSTRACT

INTRODUCTION: Anterior shoulder dislocation is the commonest clinical presentation of gleno-humeral joint instability. Shoulder dislocation incidence of 56.3 per 100 000 person-years have been reported. This is associated with morbidity and heavy burden on the country's healthcare system. This study aims to investigate the epidemiology of shoulder dislocations at Chris Hani Baragwanath Academic Hospital (CHBAH).

METHODOLOGY: Our study was a retrospective analysis of records of patients who presented at the Orthopaedic trauma unit at CHBAH with shoulder dislocations during the period of 01 June 2016 to 31 May 2017. Our study's main outcome measures were shoulder dislocations and associated injuries. Ethics approval was granted by the Human Research Ethics Committee (HREC) (Medical), University of the Witwatersrand prior to data collection. Moreover, permission to conduct the study was obtained from the Chief Executive Officer (CEO) at CHBAH prior to data collection.

RESULTS: The incidence of shoulder dislocations was found to be 34.9%. Most of our patients were males with a mean age of 43.5 years. Patients in the age-group 21 to 40 years accounted for the majority of all the dislocations (45.4%). We observed that approximately two-thirds of the shoulder dislocations occurred in the colder months (Autumn & Winter seasons) and less than one-tenth of the patients required admissions. Anterior dislocations

accounted for the majority of the cases (99.4%). Most of the dislocations were on the right shoulder (56.9%) and about a tenth of these patients with shoulder dislocations also had associated fractures; the humerus being the most affected bone.

CONCLUSION: Our study found that, although the majority of dislocations were found in young active males, in patients older than 60 years, females had a higher dislocation rate in comparison to their male counterparts. Efforts to improve safety in these elderly patients (> 60 years) require prioritisation to reduce shoulder injuries in this high-risk group.

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LIST OF ABBREVIATIONS

ALSPA: Anterior labro-ligamentous Periosteal Sleeve Avulsion

AMBRI: Atraumatic, multidirectional, bilateral, rehabilitation

CEO: Chief Executive Officer

CHBAH: Chris Hani Baragwanath Academic Hospital

CHL: Coraco-humeral ligament

FEDS: Frequency, Etiology, Direction, Severity of the dislocation

GLAD: Gleno-labral articular disruption

GP: General Practitioner

HAGL: Humeral Avulsion of the Gleno-humeral Ligaments

IGHL: Inferior gleno-humeral ligament

MGHL: Middle gleno-humeral ligament

MVA: Motor Vehicle Accident

POLPSA: Posterior labro-scapular periosteal sleeve Avulsion

PVA: Pedestrian Vehicle Accident

SGHL: Superior gleno-humeral ligament

SLAP: Superior labrum anterior posterior

TUBS: Traumatic, Unidirectional, Bankart

UK: United Kingdom

CHAPTER ONE

1. INTRODUCTION

1.1 BACKGROUND

Glenohumeral instability is a common orthopaedic condition characterised by a spectrum of pathologies consisting of disruption of the dynamic and static stabilisers. [1] Glenohumeral instability refers to both shoulder dislocations and subluxations.[1] The eventual development of functional and/or positional shoulder pain is the main reason that leads patients to seek medical treatment. The shoulder discomfort is best described as pain and/or sensation of instability of the joint within a functional position. Due to this, patients may consequently have clinical and radiological evidence of dislocation, subluxation, or apprehension. Although, most of these injuries are non-fatal, they often cause significant morbidity and burden on the healthcare system.

Dislocation occurs when there is complete loss of the glenohumeral joint articulation; whilst subluxation consists of partial loss of the glenohumeral articulation. These presentations are confirmed on plain x-rays. Shoulder joint dislocation requires immediate reduction, whilst subluxation does not. In certain circumstances, there may be no diagnostic radiological evidence to confirm the cause of glenohumeral instability, therefore, in such cases further investigation and clinical observation are prescribed.[1]

CHAPTER TWO

LITERATURE REVIEW

2.1 Incidence of shoulder dislocations

The glenohumeral joint, also referred to as the "*shoulder joint*", is described as a ball and socket joint. A large humeral head (three times larger than the glenoid fossa) articulates with the glenoid fossa of the scapular. This affords the glenohumeral joint much more mobility in relation to other joints, whilst compromising stability. The static and dynamic stabilisers, therefore, play a significant role in attaining some stability. [2]

Traumatic anterior shoulder dislocation is the commonest cause of instability, with its incidence ranging between 8.2 and 23.9 per 100 000 person-years.[3] In 2014, A study published by Leroux *et al*. of 20 719 patients over a 8 years period in patients with primary anterior shoulder instability managed non-operatively by closed reduction under sedation were predominantly males of about 74% with a median age of 35 years with a reported dislocation rate of 23.1 per 100 000 person-years.[4]

The above-mentioned researchers performed a similar study of 1937 patients in 2015. On this occasion, their study focused on younger patients aged between 10 to 16 years. The shoulder dislocation incidence was found to be highest among male patients aged 16 years (164.4 per 100 000 person-years).[5] A study by Owens and Zacchilli reported an incidence 23.9 per 100 000 person-years of shoulder dislocation in about 8940 patients which was conducted over a period of 4 years.[6]

2.2 The static stabilisers

The glenoid labrum is a fibrocartilage rim that contributes approximately 50% depth of the glenoid fossa and provides proprioception and about 10-20 % static stability. The glenohumeral ligaments aid in stabilising the shoulder joint. The ligaments consist of the superior glenohumeral ligament (SGHL), middle glenohumeral ligament (MGHL), inferior glenohumeral ligament (IGHL) and the coracohumeral ligament (CHL) (see Figure 2.1).[7] The joint capsule consists of a negative intra-articular pressure which if lost, leads to subluxation of the humeral head inferiorly.[2]

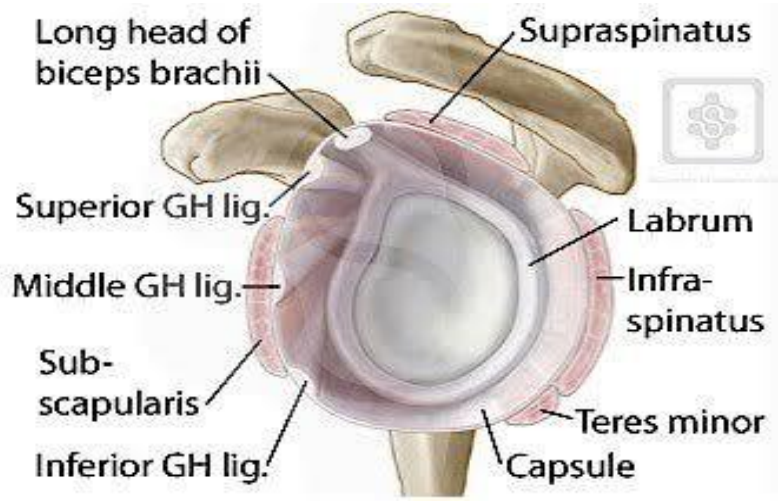

Figure 2.1: The static stabilisers of the glenohumeral joint.[7]

2.3 Dynamic Stabilisers

The rotator cuff muscles are fundamental components of the stabilisers of the glenohumeral joint (see Figure 2.2).[8] These muscles are composed of the subscapularis anteriorly, supraspinatus and infraspinatus superiorly, and lastly the teres minor posteriorly. Their primary role is to maintain the humeral head within the glenoid fossa. The long head of the biceps muscle functions as a humeral head depressor.[2]

Non-contact glenohumeral joint instability is therefore diagnosed by objective clinical signs or subjective clinical symptoms due to repetitive motion or as a result of the sequalae of generalised ligamentous laxity.[3] Traumatic instability is characterised by the presence of a traumatic event; with subjective symptoms or objective clinical findings that have led the patient to seek medical attention.[3] Traumatic dislocation of the glenohumeral joint, therefore, may leads to disruption of either the static and/or dynamic stabilisers of the joint.[3]

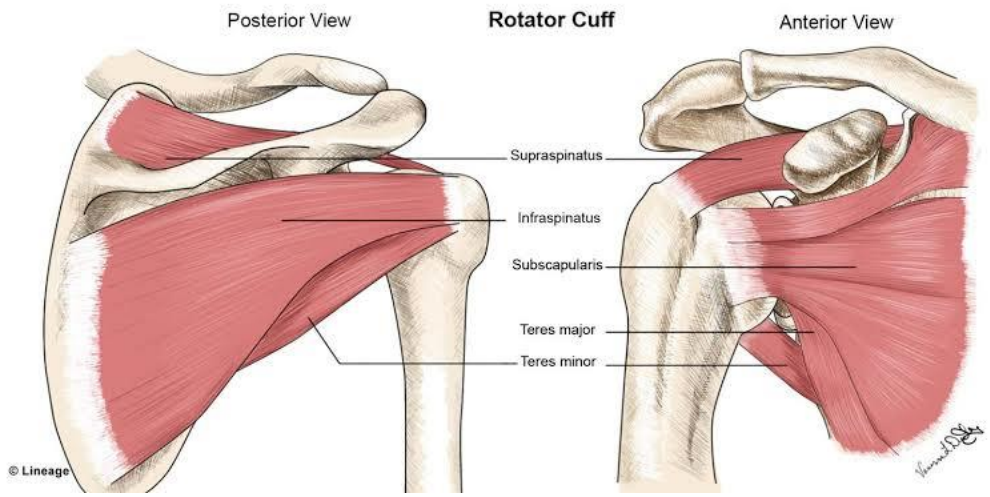

Figure 2.2: Rotator cuff muscles.[8]

The mechanism of injury in the anterior glenohumeral instability (dislocation) is usually due to a fall on an outstretched hand with the arm in a functional position (see Figure 2.3). Posterior glenohumeral instability (dislocation) is due to posterior directed force or muscular imbalance (electrocution or seizure episodes) with the arm internally rotated, adducted and flexed [2] (see Figure 2.4).

Figure 2.3: Anterior shoulder dislocation. AP and lateral x-rays, respectively (with permission from CHBAH Radiology archives).

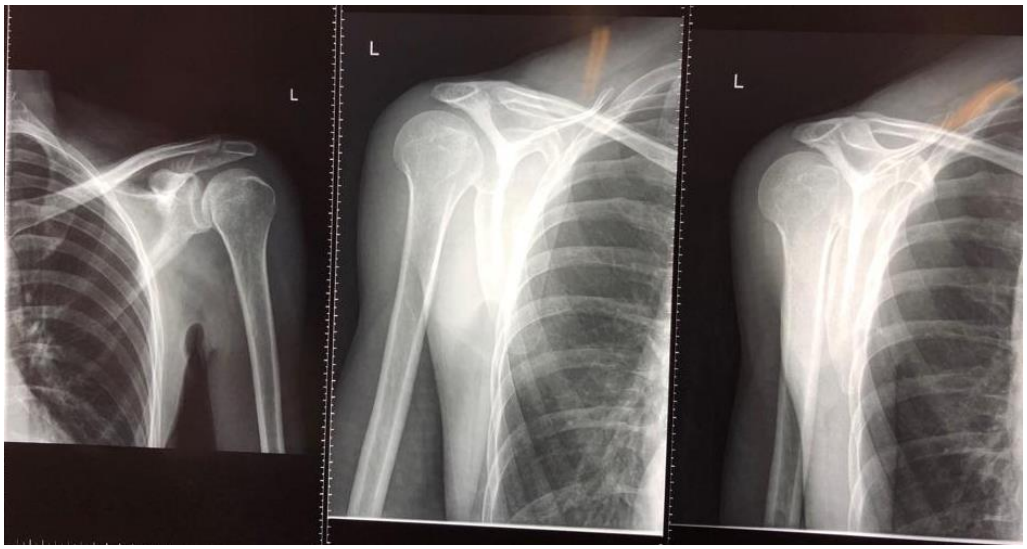

Figure 2.4: Posterior shoulder dislocation. AP, oblique and lateral x-rays, respectively (with permission from CHBAH Radiology archives).

2.4 Classification of gleno-humeral instability

Glenohumeral instability is classified based on the causative event, direction, duration or chronicity of instability. The ideal classification systems should be simple, easy to apply and guide treatment. Most historical classification systems were non-validated and were dependent

on the clinician's examination skills, whether it is in the emergency department, his/her consultation rooms or in the operating theatre.[3]

Classifications that included imaging modalities were limited in locations where imaging modalities were not readily available. The intra-operative findings as part of a classification system would be done retrospectively and therefore, would not consider conservative management. This, therefore, defeats the purpose of a classification system aiding in choosing the best treatment strategy. These historical challenges, therefore, made the findings more subjective and variable, with outcomes and findings that could not be implemented uniformly into a classification system.[3]

The evolution of glenohumeral instability clinical presentation and management has resulted in the development of numerous classification systems (see Figure 2.5).[9] The classification system used mostly is the one described by Matsen *et al*. It is based on two broad groups namely (i) Traumatic, Unidirectional, Bankart lesion requiring a repair (TUBS) and (ii) Atraumatic Multidirectional Bilateral (frequently),Rehabilitation(often responds to) ,Inferior capsular shift (often required).[9]

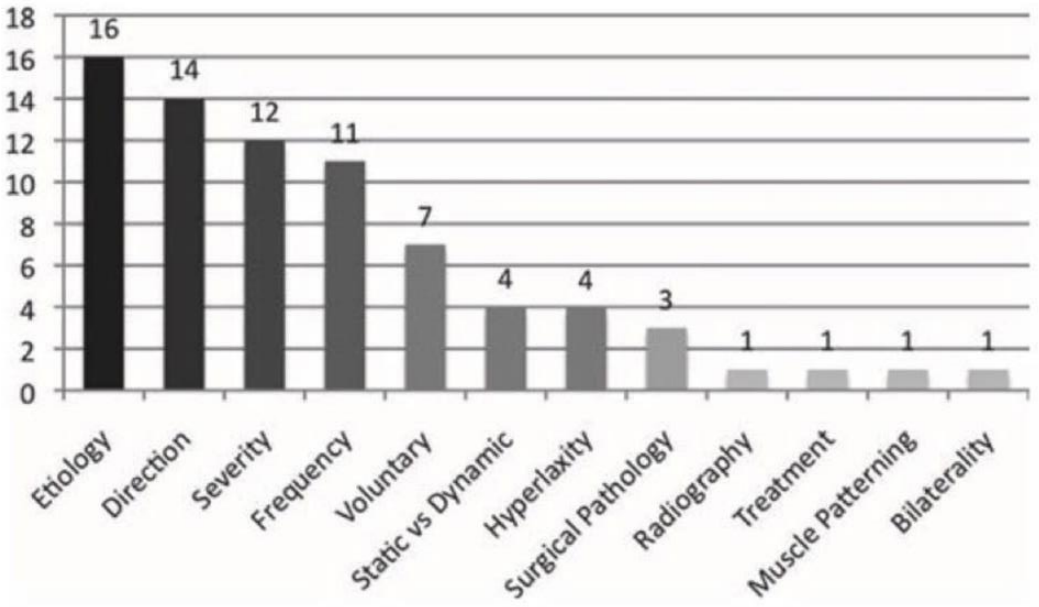

Figure 2.5: Different modalities used to classify/describe glenohumeral instability.[9]

In 2009, Kuhn *et al*. developed a more unified classification system, which was called FEDS. The FEDS system includes (F) frequency, the (E) etiology, the (D) direction and (S) severity of the dislocation. In contrast to these historical classification systems, the FEDS system is highly reliant on the comprehensive history of injury and has been reported to have both high inter- and intra-observer agreement.[3]

2.5 Associated Glenohumeral instability lesion

The classic Hill-Sachs lesion is observed on the humeral side in patients with anterior shoulder dislocation located on the postero-superior surface of the humeral head (see Figure 2.6).[10] Taylor and Arciero performed a sonographic review of 3633 patients over a decade. Their results showed that 13.5% of patients were found to have a neurological deficit following reduction; 33.4% were found to either have a rotator cuff muscle tear or a greater tuberosity fracture. These findings were observed more consistently in patients who were 60 years and older, more so in females who had sustained low energy falls.[11]

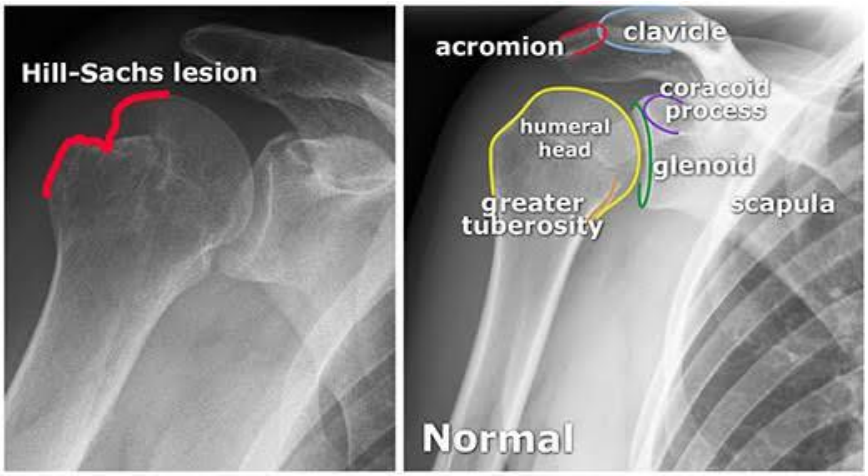

Figure 2.6: Antero-posterior x-rays reveals a Hill-Sachs lesion compared to normal anatomy.[10]

The clinical significance of the Hill-Sachs lesion is highly variable and not well understood. However, it is dependent on the location and size of the lesion, functional characteristics on whether the lesion is either engaging or non-engaging; or whether it is part of a bipolar lesion or not. The concept of functional engaging Hill-Sachs lesion was initially described in details by De Beer and Burkhart. This is when the humeral head defect engages the rim of the glenoid.[12]

The concept of the glenoid "on" and "off" track lesion was first described by Yamamoto *et al*. They developed an approach to the lesion using the size and the location of the humeral head defect, and the glenoid bone lost.[13] On the glenoid side, the defect is known as a Bankart lesion (see Figures 2.7 and 2.8),[7]located on the antero-inferior aspect of the glenoid. It affects either the labrum only (Bankart lesion) or the labrum plus the osseous component (bony Bankart lesion).[14]

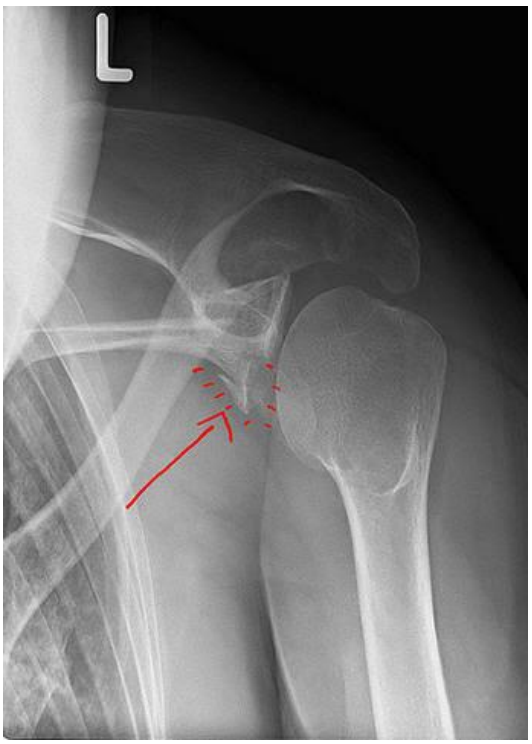

Figure 2.7: Antero-posterior x-ray demonstrating a bony Bankart lesion.[7]

Figure 2.8: Sagittarius cut, digital subtraction of June rap head. Glee kid showing bony Bankart lesion of glenoid.[7]

Other lesions that can be associated with shoulder instability are: ALSPA; HAGL; Perthes; POLPSA; GLAD; and SLAP lesion. Associated injuries post reduction of a shoulder

dislocation includes rotator cuff muscle tear, greater tuberosity bone fractures, and neurological deficit.[15-16]

2.6 Recurrence of shoulder dislocation

The most important indicator of recurrence is the age of the patient at index dislocation. Literature shows an inversely proportional relationship between age of index dislocation and recurrence. [17] This means the youngest of patients, have the highest risk of re-dislocation. A prospective study of 247 patients by Hovelius *et al*. reported that 62% of the patients younger than 30 years of age, required surgery; compared to only 9% of patients older than 30 years who required surgery.[18]

Leroux *et al*. in their 2014 and 2015 studies, respectively, found that older age, higher medical comorbidity score and associated greater tuberosity fracture were protective for re-dislocations. Repeat dislocations were highest in those aged between 14 and 16 years, and much less reduced in those aged between 10 and 13 years, respectively. The male gender in both studies had a significantly increased risk of re-dislocations.[5]

2.7 Treatment: non-operative and operative approach

Management of the glenohumeral joint instability requires a thorough understanding of the pathoanatomy and epidemiology. Goal directed clinical and radiological evaluation are of paramount importance, bearing in mind the natural history of both non-operative and operative treatment strategies. The outcomes of non-operative treatment for anterior glenohumeral joint instability are determined by the age of the patient.[17-18]

In 2016, Hovelius and Rahme published a ground-breaking article that described the long-term prognosis in 257 patients, younger than 40 years, who sustained their index anterior glenohumeral joint dislocations. They found that among patients younger than 25 years of age, half needed operative stabilisation.[16] Robinson *et al*. conducted a prospective study which followed 252 patients who were younger than 35 years. These patients had sustained anterior glenohumeral joint dislocations and were treated in a sling and followed a physiotherapy program. Recurrent dislocations were found in about half of the patients (55.7%) within the first two years and the incidence of re-dislocations increased to almost two thirds (66.8%) at five-year follow up. Younger patients were found to have a higher risk of recurrent anterior dislocations.[19]

A recent meta-analysis of fifteen level I and II research articles, evaluating the natural history of non-operatively managed traumatic anterior glenohumeral dislocations, found repeat presentations of 21% (among males younger than 20 years, the repeat presentations approached 80%).[20]

2.8 Problem Statement

Glenohumeral joint instability resulting in shoulder dislocations is a common clinical condition and is professionally researched globally. There is, however, limited data representing the South African demographic.

CHAPTER THREE

METHODOLOGY

3.1 Aim and objectives

3.1.1 Aim

To evaluate the epidemiology and mechanisms of injury in patients presenting with a shoulder dislocation at Chris Hani Baragwanath Academic Hospital (CHBAH) Orthopaedic surgery department.

3.1.2 Objectives

i. To determine the demographics and patterns of shoulder dislocations at CHBAH.
ii. To determine the mechanism of injury and/or associated injuries in patients presenting with shoulder dislocations.
iii. To describe laterality of shoulder dislocations and confirm radiological evidence of dislocations.

3.2 Study design and sample size

This is a retrospective analysis of records of all patients who presented at the Orthopaedic trauma unit at CHBAH with shoulder dislocations during the selected period from 01 June 2016 to 31 May 2017. A total of 690 patients with suspected shoulder dislocations presented during our selected period.

3.3 Selection Criteria

3.3.1 Inclusion criterion

- All patients who presented with suspected shoulder dislocations.

3.3.2 Exclusion criterion

- No exclusion criteria

3.4 Data collection

The data collection commenced in September 2019, after obtaining ethics approval from the Human Research Ethics Committee (HREC) (Medical) of University of the Witwatersrand. Furthermore, in February 2019 permission was granted to conduct the study at CHBAH. Patient records of all patients seen and treated at the Orthopaedic trauma unit at CHBAH during the selected period were reviewed. The primary researcher (Dr Motlolisi) retrieved the data of all the patients with suspected shoulder dislocations from the Orthopaedic trauma unit's Registry. The patients' x-rays were retrieved from the Radiology Department's Online X-Ray database which is accessible to clinicians employed at CHBAH. The relevant data from the Orthopaedic trauma unit registry and x-rays were extracted and transferred to the data collection sheet (see Appendix A). Furthermore, HREC Ethics Approval and CHBAH permission to conduct study are shown in Appendices B and C. The completed data collection sheets were kept safe by the primary researcher and subsequently the data collection sheets were transferred into an MS-Excel spread sheet of the primary researcher's computer which was password coded.

3.5 Data analysis

Data were entered into the windows 10 MS-Excel spread sheet and imported to the statistical software for coding and analysis. Data were analysed using STATA Version 14 statistics software package (Stata Corp, College Station, TX). Descriptive statistics were done as appropriate – **"categorical variables"** were described using frequencies and percentages. The

“continuous data” were assessed for normality and presented as means and standard deviations. The **“incidence”** was calculated by using the different types of dislocations (e.g. anterior or posterior as the *numerator*) and the total shoulder dislocations during the selected period as the *denominator*.

CHAPTER FOUR

RESULTS

This chapter presents the results of the data collected during the study period. A total of 690 patients were identified to have presented with suspected shoulder dislocations during the selected study period. Out of these patients, 494 patients' radiographs were available for review, and only 173 had a confirmed shoulder dislocation.

4.1 Patients' characteristics

4.1.1 Age

Figure 4.1 shows the age distribution of the patients where the majority (41.7%) of the patients were aged 21 to 40 years, followed by patients aged 41 to 60 years (29.9%). Together, patients in these two age-groups accounted for more than 70% of all (total) study participants. Patients younger than 20 years were less than 7.5% of the total cases. The 21 to 40 years age group represents young, very active individuals who may be involved in activities such as sports, motor vehicle or bike accidents which may predispose them to shoulder dislocations. The mean age of our participants was 43.5 years (standard deviation = 19.0), the median was 41 years, and the interquartile range was 30 years.

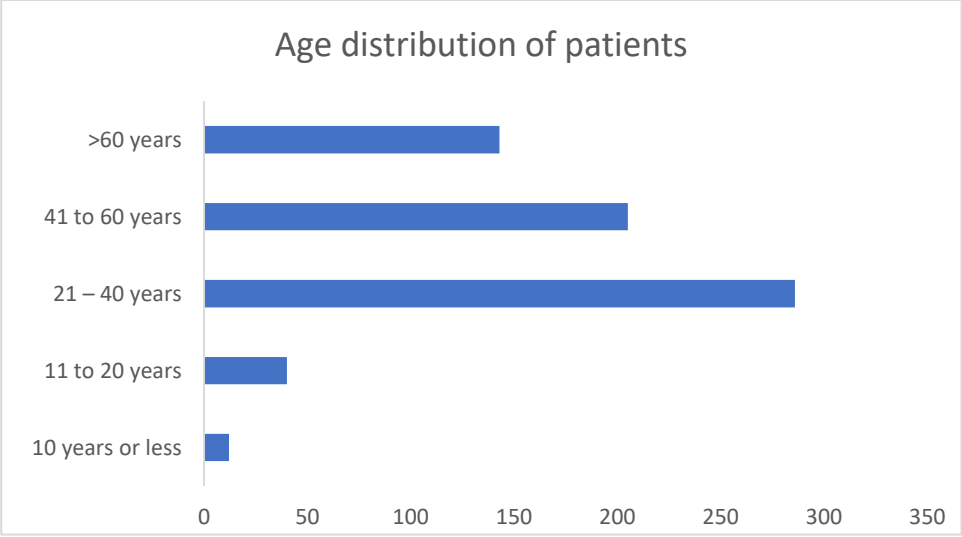

Figure 4.1: Age distribution of patients.

4.1.2 Gender

The histogram below (see Figure 4.2) depicts a gender distribution of the patients and males accounted for almost 59.6% and female 40.3% of the total patients in our study. Mean age at presentation were 41.1 years and 46.9 years for males and female, respectively.

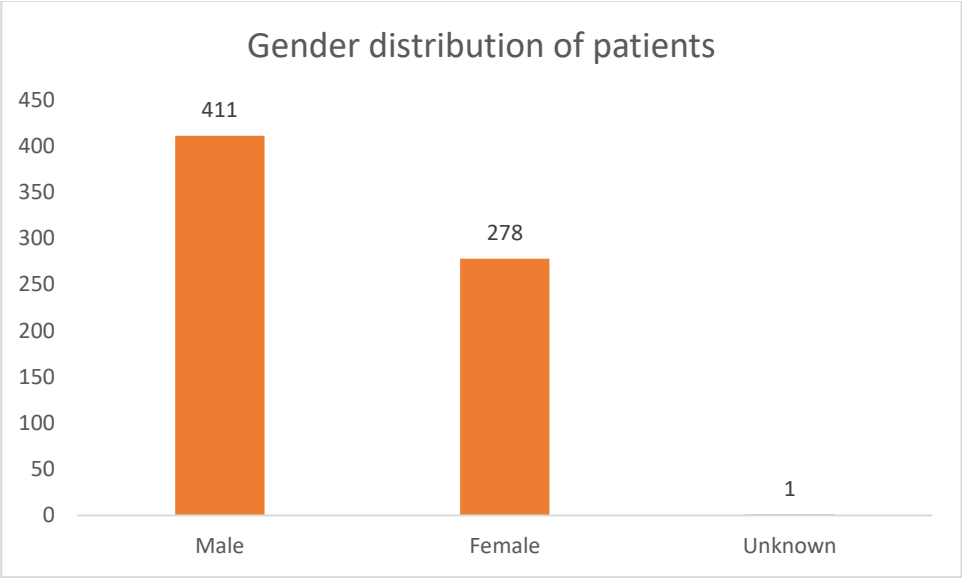

Figure 4.2: Gender distribution of patients.

4.1.3 Race

Racial distribution could not be ascertained. In the records this variable was not captured. In this diverse country (South Africa), it is impossible to deduce race based on the patient's name and surname.

4.1.4. Comorbidities

According to the records, five patients (1%) had convulsion. This could have been either epilepsy or drug reactions. The rest of the cases with confirmed dislocations had no records pertaining to their comorbidities.

4.1.5 Referrals

The various sources of referrals for our patients are shown in the Table 4.1. Most of the referrals were from the CHBAH trauma surgery and emergency department unit (74.4%) and least referrals from prison (0.3%).

Table 4.1: Sources of patients' referral.

Sources of referral	Frequency (%)
Trauma surgery and Emergency department	514 (74.4)
Clinics	96 (13.9)
Home/self-referral	42 (6.1)
Local Hospitals	27 (3.94)
Medical Wards (in-patients)	6 (0.9)
Local General Practitioner (GP)	3 (0.4)
Prison	2 (0.3)
Total	**690**

4.1.6 Season of injury

Figure 4.3 illustrates that most injuries occurred in autumn and summer had the least injuries.

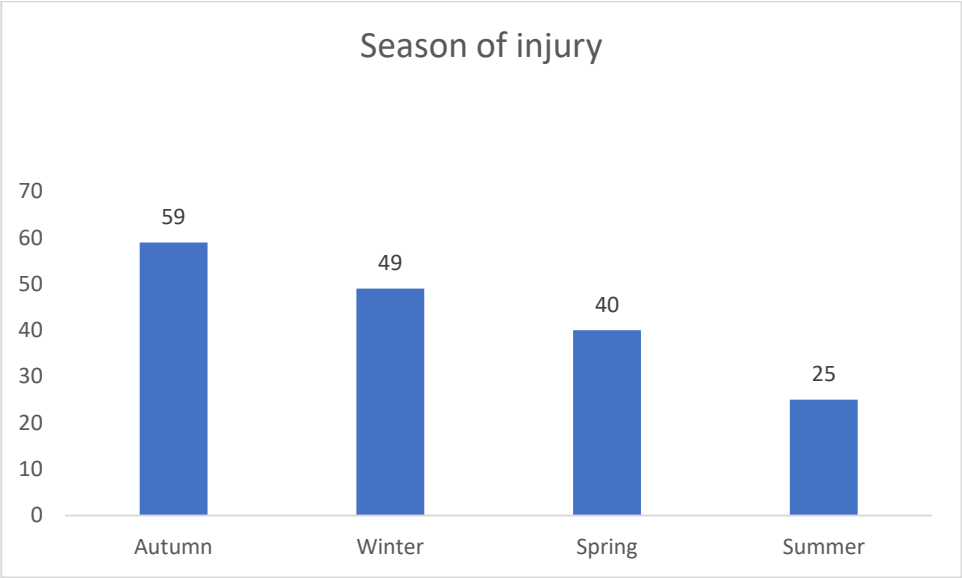

Figure 4.3: Seasons of injury.

4.1.7 Patients admitted

Table 4.2 shows that almost 90% of the shoulder injury cases were managed or treated as out-patient cases in the orthopaedic treatment room and discharged, with only 9.4% admission rate and less than 1% of the cases had no record of the treatment plan. Furthermore, only one case of repeat presentation was recorded during the study period.

Table 4.2: Proportion of patients admitted for further care.

Admission	**Frequency (%)**
Yes	65 (9.42)
No	619 (89.7)
No record	6 (0.87)
Total	**690 (100)**

4.1.8 Incidence of shoulder dislocations

On presentation, all patients with shoulder-related symptoms were suspected of shoulder dislocations. Subsequent radiological investigations were conducted to confirm the diagnosis. Tables 4.3 and 4.4 below show findings of radiological investigations. Table 4.3 provides the definitive diagnosis post x-ray for suspected shoulder dislocation patients. Of the 496 patients with x-rays, confirmed dislocations were reported in 173 patients including one case of bilateral shoulder dislocation. Therefore, the overall rate of shoulder dislocations rate was 34.9% over a one year-period.

Table 4.3: Distribution of the patients with shoulder dislocations post x-rays.

Patients	Frequency (%)
Patients without x-rays	194 (28.12)
Patients with confirmed shoulder dislocations on x-rays	173 (25.07)
Patients without shoulder dislocations on x-rays	323 (46.81)
Total	**690 (100)**

Patients' details were checked or confirmed with the radiology department to confirm a dislocation or not. Table 4.4 revealed 24.8% were anterior, 0.14% posterior, 0.14% bilateral anterior and 28.1% had no radiographs. Of the confirmed dislocations, the proportion of anterior dislocations was 99.4% and that of posterior dislocations was 0.6%.

Table 4.4: X-ray findings for all the patients.

Evidence of dislocation confirmation on radiographs	Frequency (%)
Anterior dislocation	171 (24.8)
No radiographs available	194 (28.1)
No radiographic evidence of dislocation	323 (46.8)
Bilateral anterior dislocation	1 (0.14)
Posterior dislocation	1 (0.14)
Total	**690 (100)**

4.2 Mechanism of injury

Table 4.5 shows the mechanisms of injuries where falls accounted the most (61.1%) and convulsions contributed the least (1%).

Table 4.5: Mechanisms of injury (of all records available for review).

Causes of injury	Frequency (%)
Fall	302 (61.1)
MVA	63 (12.8)
PVA	42 (8.5)
Convulsions	5 (1.0)
Unknown	82 (16.6)
Total	**494 (100)**

The age-group 21 – 40 years was observed to have the highest fall injuries while the age-group 10 years or younger had the least injuries (see Table 4.6).

Table 4.6: Mechanisms of injury by age group (of all records available for review).

Age group	Causes of injury	Frequency
10 years or less	Fall	10
	MVA	1
	PVA	0
	Convulsions	0
	Unknown	0
11 – 20 years	Fall	15
	MVA	3
	PVA	6
	Convulsions	0
	Unknown	9
21 – 40 years	Fall	133
	MVA	25
	PVA	11
	Convulsions	4
	Unknown	25
41 – 60 years	Fall	74
	MVA	23
	PVA	17
	Convulsions	1
	Unknown	33
Older than 60 years	Fall	70
	MVA	11
	PVA	8
	Convulsions	0
	Unknown	15
Total		**494**

4.3 Shoulder dislocation diagnoses

4.3.1 Diagnoses on presentation

The recorded diagnoses for suspected shoulder dislocation patients who presented at the Orthopaedic trauma unit is illustrated in Table 4.7. The presumed diagnoses before radiological diagnosis were conducted, thereby, indicating that the right shoulder dislocation had the most cases (47.7%) followed by the left shoulder. Dislocations without any indication of the side affected were also recorded. The information in Table 4.7 was vital in the selection of patients who required further scrutiny in order to confirm or refute the suspected diagnosis of a shoulder dislocation.

Table 4.7: Diagnosis in casualty book (before x-rays).

Diagnosis	Frequency (%)
Left shoulder dislocation	275 (39.9)
Right shoulder dislocation	329 (47.7)
Shoulder dislocation	84 (12.2)
Right shoulder and elbow dislocation	1 (0.14)
Painful shoulder	1(0.14)
Total	**690 (100)**

4.4 Laterality of shoulder dislocations

Table 4.8 shows the distribution of the affected shoulder by injury post x-rays. In our study, 56% of dislocations were observed to occur on the right shoulder and one case had bilateral shoulder dislocation. The left shoulder only made up 42.8% of the dislocations. The high dislocations in the right shoulder may due to the fact that our patients' daily activities, including sports or defending oneself in terms of a fall, will be done using the dominant hand. Although in our study the hand dominance was not specifically recorded, it is safe to assume that the majority were right-handed.

Table 4.8: Laterality of dislocations.

X-ray findings for patients with confirmed dislocations	Frequency (%)
Left anterior dislocation	74 (42.8)
Right anterior dislocation	97 (56)
Bilateral anterior dislocation	1 (0.58)
Right posterior dislocation	1 (0.58)
Total	**173 (100)**

4.5 Shoulder dislocation by patients' characteristics

4.5.1 Shoulder dislocations versus age

Table 4.9 shows the distribution of shoulder dislocations by age group. Patients in the age group 21 to 40 years accounted for majority of the dislocations, followed by patients aged 41 to 60 years. There was no radiological confirmation of shoulder dislocation among participants younger than 10 years old. Shoulder dislocations are also extremely rare in the paediatric population (< 13 years). This age group is more prone to physeal injuries. Although we had a total of 173 confirmed dislocation, the Table 4.9 only shows 172 cases because one patient's age was not captured on the data set.

Table 4.9: Shoulder dislocations versus age.

	No shoulder dislocation	**Shoulder dislocation**	**Total**
10 years or less	11	0	11
	3.42%	0.00	2.23 %
11 to 20 years	27	6	33
	8.39 %	3.49 %	6.68 %
21 to 40 years	120	78	198
	37.27 %	45.35 %	40.08 %
41 to 60 years	101	47	148
	31.37 %	27.33 %	29.96 %
> 60 years	63	41	104
	19.57 %	23.84 %	21.05 %
Total	**322**	**172**	**494**
	100.00	**100.00**	**100.00**

4.5.2 Shoulder dislocation versus gender

Table 4.10 shows the distribution of shoulder dislocations by gender. The majority of the confirmed dislocations were recorded in the male patients with a male to female ratio of 1.7 to 1. The higher dislocations in males may be due to them being more active, especially, the young males who may be involved activities such as sports and fights that exposes them to dislocations.

Table 4.10: Shoulder dislocations versus gender.

	No shoulder dislocation	Shoulder dislocation	Total
Female	129	65	194
	40.06 %	37.57 %	39.19 %
Male	193	108	301
	59.94 %	62.43 %	60.81 %
Total	**322**	**173**	**495**
	100.00	**100.00**	**100.00**

4.6 Associated injuries

4.6.1 Types of injury

Figure 4.4 shows that the greater tuberosity contributed to the most fractures in comparison to the other fractures.

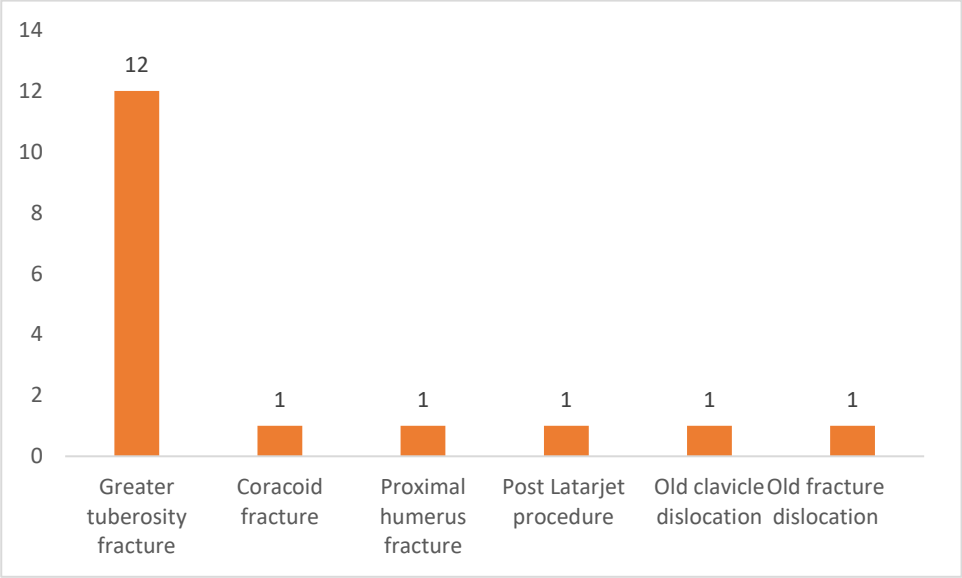

Figure 4.4: Types of injuries.

4.6.2 Associated fractures in patients with confirmed shoulder dislocation

Table 4.11 illustrates the presence of fractures in patients who had x-rays confirmed shoulder dislocations. Associated fractures were observed in 17 of all the x-rays confirmed dislocations cases. Furthermore, fractures associated with right shoulder dislocations accounted for 64.7% of these cases.

Table 4.11: Distribution of associated fractures in patients with shoulder dislocations.

Types of shoulder dislocation	**Associated fracture**	
	Yes **Frequency (%)**	**No** **Frequency (%)**
Left anterior dislocation	6 (35.3)	68 (43.6)
Right anterior dislocation	11 (64.7)	86 (55.1)
Anterior dislocation	**17 (100.0)**	**154 (98.7)**
Bilateral anterior dislocation	0	1 (0.64)
Right posterior dislocation	0	1 (0.64)
Total	**17**	**156**

4.6.3 Types of fractures in admitted patients

Table 4.12 shows the different types of fractures in admitted patients. Among the patients who were admitted, the proximal humerus fracture was the most observed fracture and was followed by the clavicle fracture.

Table 4.12: Types of fractures in admitted patients.

Fracture/Injury	Frequency (%)
Acromioclavicular dislocation	2 (3.1)
Clavicle and acromion fracture	1 (1.5)
Clavicle fracture	10 (15.4)
Distal humerus fracture	1 (1.5)
Proximal humerus fracture	16 (24.62)
Scapula fracture	1 (1.5)
No fracture	17 (26.2)
No x-rays	17 (26.2)
Total	**65**

CHAPTER 5

DISCUSSION

5.1 Incidence

The overall incidence of shoulder dislocations in our study was found to be 34.9%. Anterior dislocations accounted for all but one of the cases (173/174). Previous population-based studies reported incidences ranging from 15.3 to 56.3 per 100 000 person-years.[6,22-23] The study population in the literature was followed up for longer period and they reported in person-years which are not applicable to the current study. The current study provides shoulder dislocation incidence rate obtained over a relatively short period of time and may serve as a baseline rate for future references.

Our study found that, the majority of the dislocations were on the right shoulder (56.9%) in comparison to 43.1% on the left shoulder. Only one case of repeat presentation to the Orthopaedic trauma unit at CHBAH was recorded in our study. The recorded low recurrence rate may be due to under documentation by staff at the Orthopaedic trauma unit because this information is not routinely requested at patients' presentation at the above-mentioned sites. Zachilli *et al*. also suggested that there was under reporting of repeat presentation of shoulder dislocations which accounted for the low recorded recurrent dislocation rate in their study with a rate of 2.1% over a period of four years.[5] In contrast, a study on the epidemiology of shoulder dislocations among athletes in high schools and colleges reported shoulder dislocation recurrent rates of 14.5% and 12.9% of respectively. Majority of these dislocations were sustained from contact sports such as soccer. [24]

There is a male preponderance (62.4%) in the incidence of shoulder dislocations in comparison to females in our study. This is in keeping with findings from previous studies which reported a preponderance of shoulder dislocations in males.[1,3,6,23,25,26] The predominance of shoulder dislocations among males is attributed to activities performed by males which expose them to a greater risk of injury. The mean age of patients with shoulder dislocation in our study was 43.5 years. This mean age is higher than the mean age of a cross-sectional study which described the epidemiology of shoulder dislocations in American population,[6] which reported a mean age of 35.4 years. The mean age of patients with shoulder dislocations in other studies are lower than the mean age in the index study.[6,23,26] The age variation may be as a result of different population samples. For instance, the Iranian study[26] was conducted in the emergency department of an academic tertiary hospital while the Norwegian study[23] was population-based study, a setting comparable to the American study.[6] Although all patients who presented at the Orthopaedic trauma unit were included in the index study, a relatively high mean age was observed. This may require further research to investigate reasons for this advanced age.

The highest incidence of shoulder dislocations in both males and females was observed among those aged 21 to 40 years. This trend is comparable to findings from the Norwegian study.[23] Conversely, the bimodal distribution of incidence rate with peak in incidence of dislocations among young adults and in the elderly reported in both genders in previous studies [6,23] was not observed in the present study. Noteworthy is the fact that across all age categories, males maintained the majority in cases of dislocations except among patients aged older than 60 years when females were in the majority.

Although information on the sources of referral of patients was captured, details on the mechanisms of injury were not available for some of the patients in our study. The diagnosis of a dislocation was made in CHBAH trauma surgery and emergency department unit and

further assessment and management by the orthopaedic surgery department. The other possible explanation could be that CHBAH hospital has a level one trauma unit, therefore, high energy accidents, i.e. Motor Vehicle Accident (MVA) and/or Pedestrian Vehicle Accident (PVA) are referred to our centre. If these patients are found to have dislocations, they would be referred to our orthopaedic trauma unit. A previous study reported that among young males, shoulder dislocations were related to recreational and sporting activities; while in elderly women these injuries were due to falls at home.[6] The trend in the incidence rate of dislocations as disaggregated by gender and age category in the current study supports this theory. A population-based cohort study in the United Kingdom (UK),[25] highlighted the biological differences between ageing men and women, i.e. difference in joint proprioception, soft tissue tendon quality as a possible contributing factor to the increased risk of shoulder dislocations in elderly women. This may also apply in the South African context, hence, an area for further research.

5.2 Associated fractures in patients with confirmed shoulder dislocations

In the current study, among patients with confirmed dislocations the incidence of associated fractures was 9.5%. Fractures associated with right shoulder dislocations accounted for 64.7% of these cases. Majority of the fractures (70.6%) involved the greater tuberosity of the humerus. Anatomically, the rotator cuff, i.e. the supraspinatus, infraspinatus and teres minor, insert on the greater tuberosity. During a dislocation, if the force is severe enough, either the bone or the tendon is going to fail. In patient younger than 60 years of age, generally the bone would fail, i.e. sustain a greater tuberosity fracture whereas in patients older than 60 years, they are more likely to sustain a rotator cuff tear.

5.3 Alternate diagnoses in patients without shoulder dislocations on x-rays

Records were available for 322 patients without shoulder dislocations as verified radiologically. We noted that just above a third of the 322 patients had documented final alternative diagnoses. Fracture of the clavicle was the leading alternate diagnosis 32.1%, followed by fracture of surgical head of the humerus and fracture of the proximal humerus at 18.8% and 15.2%, respectively. The involvement of the humerus in most of the fractures in patients without shoulder dislocation may be suggestive of the mechanism of injury in the patients seen at the study site. The foregoing further highlights poor documentation of vital information at the Orthopaedic trauma unit which is a limitation in our study.

5.4 Reason/s for admission

Just under a tenth of the patients required admission. Fractures of the clavicle and humerus were the main indications among the patients requiring admission. The records of reason/s for admission were unavailable for more than a quarter of the admitted patients. Majority of shoulder dislocations can be manipulated and reduced under sedation in casualty. However, a small proportion of the closed reductions may fail in the casualty and the patient will then require admission for reduction under general anaesthesia in theatre. Some of the reasons for failed reduction in casualty include inadequate sedation, improper reduction technique and/or a locked dislocation.

5.5 Injury seasonality

Regarding season of injury, the highest number of injuries was recorded in autumn, followed by winter. This trend is in keeping with results from a study by Szyluk *et al*. who reported higher incidence of shoulder dislocations in the winter months in Poland due to increased risk of slipping or stumbling over objects during this season. Shoulder injuries including dislocations were also noted

to be more among less physically able individuals having poorer co-ordination skills.[27] The elderly, especially females in their study also demonstrated a higher incidence of dislocations, hence, the same reason may apply in our study context. In contrast, a cross-sectional study conducted in Iran which described the epidemiology of dislocations did not detect any seasonal variations in the incidence of shoulder dislocations.[23]

5.6 Study limitations

- A retrospective cross-sectional study design was used to investigate the epidemiology of shoulder dislocations. The non-collection of data on variables such as co-morbidity, hand dominance and race which could have enhance the understanding of the research subject is a potential limitation of the study.
- The relatively short study period which was informed by the unavailability of data for a longer period posed a limitation to the in-depth understanding of the trend of shoulder dislocations at the study site.

5.7 RECOMMENDATIONS

1. Review of the triaging and data collection process at the Orthopaedic trauma unit should be considered. This may reduce the proportion of incorrectly diagnosed shoulder dislocations, thereby, reducing the workload on clinicians.

2. Shoulder dislocations are the most prevalent joint dislocations. In our study, although the majority of dislocations were found in young active males, an interesting finding was a higher incidence of shoulder dislocations among females older than 60 years in comparison to their male counterparts. With increasing life expectancy and an aging population in South Africa, we need to put measures in place to protect the aged and reduce their risk of falling which predisposes them to dislocations.

CHAPTER 6

6.1 CONCLUSION

This study found that shoulder dislocations occurred mainly in young (21 – 40 years) males and female, and elderly females (> 60 years). About a quarter of the suspected shoulder injuries were confirmed as shoulder dislocations. The majority of the dislocations were on the right shoulder (56.9%) as compared to 43.1% on the left shoulder. The mean age of patients with shoulder dislocation in our study was 43.5 years and in addition, fractures associated with right shoulder dislocations accounted the most, with the majority of the fractures (70.6%) involving the greater tuberosity of the humerus. Regarding the season of injury, the highest number of injuries was recorded in autumn, followed by winter.

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APPENDICES

- **Appendix A:** Data Collection Sheet

STUDY PARTICIPANT NUMBER:	
DEMOGRAPHIC INFORMATION	
Race	White
	Indian
	African
	Other
Gender	Male
	Female
	Other
Age of Presentation of Dislocation	
SHOULDER DISLOCATION INFORMATIOM	
Mechanism of injury	Fall MVA PVA Convulsions Unknown
Comorbidities	
Reason for Admission	Failed Closed Reduction
	Associated Injuries
Radiological confirmation of the direction and laterality of the dislocation (AP, Lateral X-ray)	Anterior
	Posterior
	Inferior
	Laterality:_____
	Associated Fractures: _____
Referral Institution/Unit	Clinic
	Local GP

	Self-referral/home
	Trauma surgery/emergency unit
	Hospital
Location of Injury	Left
	Right
	Bilateral
Season of Presentation:	Summer
	Autumn
	Winter
	Spring

Appendix B: HREC Ethics approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Dr Prince-Stoffel Elias Thabiso Mosiuoa Motlolisi

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M190860 MED19-07-129

NAME: (Principal Investigator)	Dr Prince-Stoffel Elias Thabiso Mosiuoa Motlolisi
DEPARTMENT:	Orthopaedics Chris Hani Baragwanath Academic Hospital
PROJECT TITLE:	The incidence of anterior shoulder dislocation at Chris Hani Baragwanath Academic Hospital over a one year period
DATE CONSIDERED:	30/08/2019
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Nyiko Chauke
APPROVED BY:	Dr C Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	02/09/2019

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

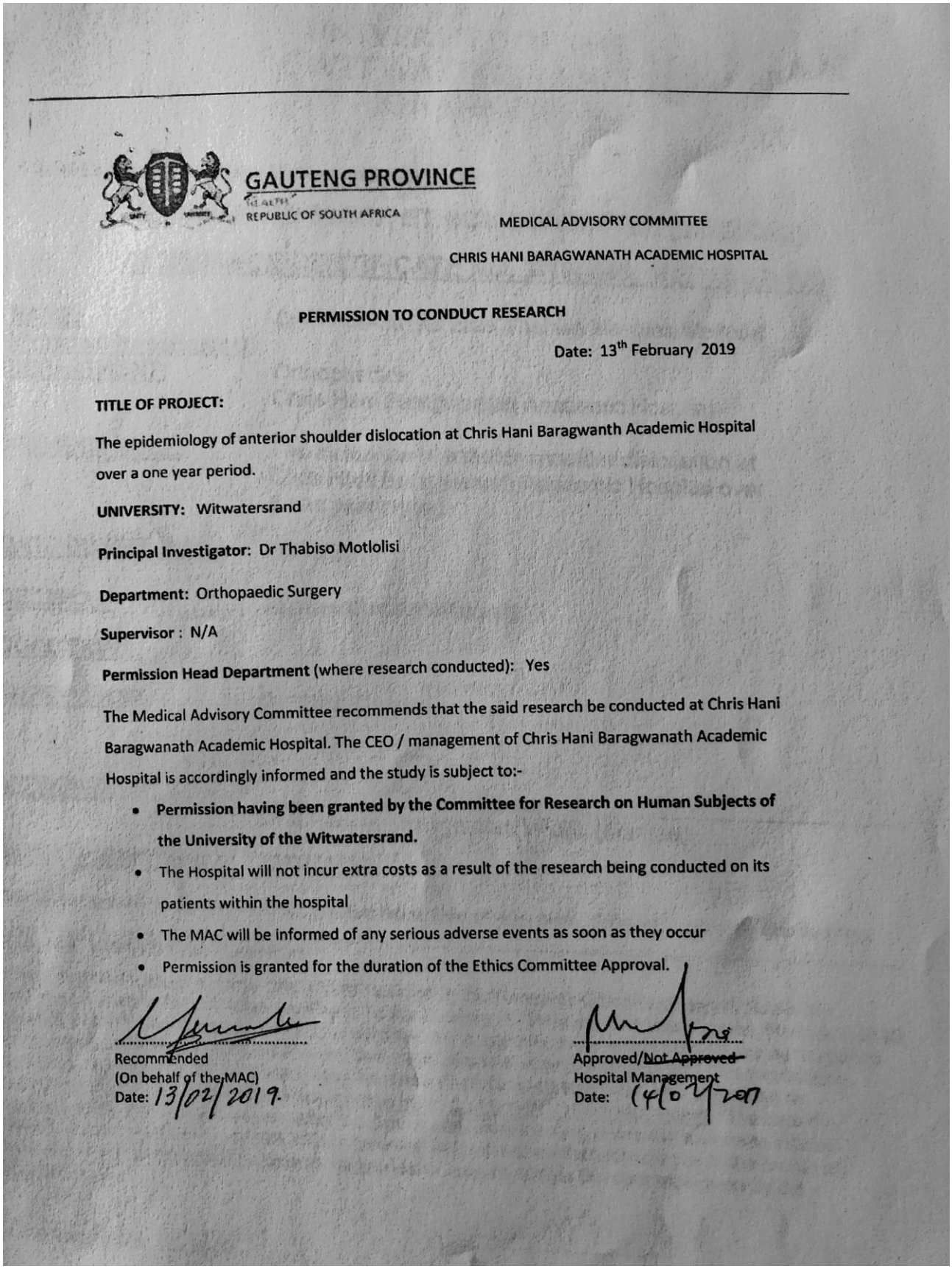
To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed August and will therefore be due in the month of August each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

12/09/2019
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix C: CHBAH Permission to conduct research



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 13th February 2019

TITLE OF PROJECT:

The epidemiology of anterior shoulder dislocation at Chris Hani Baragwanth Academic Hospital over a one year period.

UNIVERSITY: Witwatersrand

Principal Investigator: Dr Thabiso Motlolisi

Department: Orthopaedic Surgery

Supervisor : N/A

Permission Head Department (where research conducted): Yes

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Academic Hospital. The CEO / management of Chris Hani Baragwanath Academic Hospital is accordingly informed and the study is subject to:-

- **Permission having been granted by the Committee for Research on Human Subjects of the University of the Witwatersrand.**
- The Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- The MAC will be informed of any serious adverse events as soon as they occur
- Permission is granted for the duration of the Ethics Committee Approval.

Recommended
(On behalf of the MAC)
Date: 13/02/2019.

Approved/~~Not Approved~~
Hospital Management
Date: 14/02/2019

Appendix D: Orthopaedic Surgery HOD Permission to conduct research

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

ENQ: Prof.M.T. Ramokgopa
Mmampapatla.ramokgopa@wits.ac.za
DEPT: ORTHOPAEDIC DEPT
TEL: 011 933 8914
DATE: 02/01/2019

The CEO
CC: Clinical Manager, Research committee
Chris Hani Baragwanath academic hospital
P.O. Bertham
Diepkloof
Johannesburg 1862

PERMISSION TO CONDUCT A RESEARCH PROJECT

I hereby give permission to conduct a research project in the Orthopaedic surgery department at Chris Hani Baragwanath academic hospital.

Title of the project: The epidemiology of glenohumeral dislocation presenting to trauma emergency unit and or orthopaedic surgery at Chris Hani Baragwanath academic hospital (over a 1-year period)

Primary researcher : Dr P.E.T. Motlolisi

Secondary Investigators: Dr Collen Nkosi and Dr Nyiko Chauke

Please do not hesitate to contact me if you have any questions.

Regards

Prof M.T.Ramokgopa

University of Witwatersrand/ Chris Hani Baragwanath academic hospital

Academic Head Orthopaedic surgery/HOD – Orthopaedic surgery