Access this Article online
Quick Response Code:

Website: jecajournal.com
Doi: doi.org/10.4314/jeca.v21i2.32

Submitted: 9th December, 2024
Revised: 14th December, 2024
Accepted: 15th December. 2024
Published: 31st December, 2024

[1]School of Anatomical Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa; [2]Anatomy Department, Ambrose Alli University, Ekpoma, Nigeria; [3]Edo State College of Health Sciences and Technology, Benin City, Nigeria; [4]Radiology Department, Irrua Specialist Teaching Hospital, Irrua, Nigeria. [5]Medical Biochemistry Department, Ambrose Alli University, Ekpoma, Nigeria; [6]Department of Anatomical Sciences, St George's University/NU Program, Newcastle upon Tyne, United Kingdom. [7]Nursing Department, Ambrose Alli University, Ekpoma, Nigeria; [8]Anatomy Department, University of Port Harcourt, Rivers State, Nigeria. [9]Gateshead Health NHS Foundation Trust, England, United Kingdom.

Address for Correspondence:
Ujaddughe, O.M.
School of Anatomical Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa.
ujaddughemoses1@students.wits.ac.za

Original Article

Assessment of epidemiological risk factors of humeral fractures using x-ray findings of patients presenting at Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria: A 2-year review

[1,2]Ujaddughe, O.M.; [3]Eseine, D.O.; [4]Aimua, H.I.; [5]Eseine-Aloja, C.E.; [6]Okodaso, H.A.; [7]Eseine, C.O.; [8]Ebhojaye, K.I.; [2]Izunya, A.M.; [9]Ujaddughe M. E.

Abstract

BACKGROUND AND AIM: Humeral fractures are among the most common fractures occurring today. In Nigeria, humeral fractures have been reported to account for nearly 3% of all fractures in adults and for about 20% of all fractures in some populations. This is expected to triple in the next three decades. This study aimed to assess the pattern of humeral fractures in Irrua Specialist Teaching Hospital (ISTH), Irrua, between January 1, 2020, and December 31, 2021, to provide baseline epidemiological data that can help practitioners prepare for effective treatment and management of humeral fractures.

MATERIALS AND METHOD: The study was a retrospective descriptive study of records of humeral fracture patients who had x-rays done to determine the pattern of humeral fractures while being managed at ISTH, Irrua over the 2 years. All 35 cases that met the inclusion criteria were selected for the study. The resulting data was analyzed using Microsoft Excel and presented in distribution tables.

RESULTS AND CONCLUSION: The result of this study shows that the incidence of humeral fracture was higher in males, while the adult age group (18 to 59 years) was the most affected by humeral fractures (n = 23, 65.70%). Road Transport Accidents were the leading cause of humeral fractures (n = 25, 71.40%) while the midshaft fractures of the humerus were more prevalent. There is a need for those in charge of healthcare planning at ISTH, Irrua to ensure that equipment and manpower needed for the treatment of humeral fractures are readily available and traffic authorities could devise means of reducing the incidence of Road Transport Accidents.

Keywords:
Fracture; Humeral; Road Transport Accident (RTA); X-ray

INTRODUCTION

The humerus is the largest bone of the upper limb and defines the human brachium (arm) (Capo *et al*., 2014), consisting of an upper extremity made up of a rounded head, a narrow neck, and two short processes called tubercles or tuberosities. The body is cylindrical in its upper portion, and more prismatic below, ending as a lower extremity that is made up of 2 epicondyles, 2 processes (trochlea and capitulum) and 3 fossae (radial fossa, coronoid fossa, and olecranon fossa) (Capo *et al*., 2014; Paryavi *et al*., 2014). It also has a true anatomical neck (also referred to as its surgical neck due to its tendency to fracture easily) which is the constriction below the greater and lesser tubercles of the humerus (Paryavi *et al*., 2014).

Humeral fractures are among the most common fractures occurring in today's world (Schmid, 2017), including Nigeria, where it is reported to account for up to 3% of all fractures in adults and 20% of all fractures in some populations (Ezeuko *et al*., 2016). It is expected that this incidence will triple in the next three decades (Plath *et al*., 2019). Commonly encountered in general orthopedic practices, they can occur alone or as part of associated injuries in a polytraumatized individual (Allemann *et al*., 2019). A study by Cameron *et al*., (2014) indicated that proximal humeral fractures constitute 5% of all fractures and 25% of humeral fractures; middle humeral fractures account for about 12% of all fractures and 60% of humerus fractures, while distal fractures make up the remainder (Cameron *et al*., 2014). The most common location of proximal fractures is at the surgical neck of the humerus (Cuccurullo, 2014) because of its high susceptibility to fractures (Paryavi *et al*., 2014; Rudran *et al*., 2022). Incidence of proximal fractures increases with age, with about

How to cite this article: Ujaddughe, O.M.; Eseine, D.O.; Aimua, H.I.; Eseine-Aloja, C.E.; Okodaso, H.A. *et al.* Assessment of epidemiological risks factors of humeral fractures using x-ray findings of patients presenting at Irrua Specialist Teaching Hospital, Irrua, Edo State, Nigeria: A 2-year review. J Exp Clin Anat 2024; 21(2): 377-384.
https://dx.doi.org/10.4314/jeca.v21i2.32

75% of cases occurring among people over the age of 60 (Twiss, 2015). In this age group, about three times as many women than men experience a proximal fracture (Twiss, 2015). Middle fractures are also common among the elderly, but they more frequently occur among physically active young adult men who experience physical trauma to the humerus (Cameron *et al.*, 2014; Twiss, 2015). Distal fractures are rare among adults, occurring primarily in children who experience physical trauma to the elbow region (Cameron *et al.*, 2014). In a retrospective study at the National Orthopedic Hospital, Igbobi, Nigeria, using plain films, the results showed that simple fractures of the humeral shaft was the most frequent type (Ezeuko *et al*., 2016).

Injuries involving the humerus cut across all ages and the mechanism of injury varies from road traffic accidents, falls and assault. Fractures involving the proximal humerus may also occur commonly in elderly osteoporotic females, meanwhile humeral shaft fractures do occur following a direct blow or fall on the outstretched arm just as it is also the site of pathological fractures (Oboirien & Ukwuani, 2015).

In a study in the United States, the incidence of humeral fractures was found to correlate with age and gender, with an overall bimodal distribution due to a peak incidence for males between 20 to 30 years old and a second peak for older females aged between 60 and 70 years (Kim *et al.*, 2012). The mortality rate associated with humeral fractures is also a cause for concern especially because its incidence is expected to triple over the coming three decades (Plath *et al*., 2019). In a study of a total of 18,452 patients who sustained a proximal humeral fracture, the mean age was found to be 68.8 years (16 to 107), while a total of 310 (1.68%) deaths were recorded within 30 days, 615 (3.33%) deaths within 90 days, and 1,445 (7.83%) deaths within one year after the injury (Bergdahl, 2020). However, epidemiological data is generally scarce and specifically unavailable in the Edo Central Senatorial District of Edo State. Hence the need for this present study using Irrua Specialist Teaching Hospital, the sole tertiary hospital in the senatorial district and the only hospital in the senatorial district with full specialist orthopaedic and radiologic practices. This study therefore aims to assess the pattern of humeral fractures using X-ray findings of patients who presented at Irrua Specialist Teaching Hospital (ISTH), Irrua between January 2020 and December 2021.

MATERIALS AND METHODS

Materials

Patient radiology reports and case notes provided data needed for this study. The collected information was entered into a data collected sheet.

Study design

This was a retrospective study conducted at the Radiology Department of Irrua Specialist Teaching Hospital (ISTH), Irrua Edo State. The researchers accessed and studied case notes and x-ray reports that were obtained from all the patients who presented with diagnosis of humeral fracture at ISTH Irrua between January 1, 2020, to December 31, 2021, using the Conventional X-ray Machine, 2000 model, produced by Bennette X-ray Corporation NY, C-80MLF, 6437 version

Study area

This study was carried out at Irrua, the administrative headquarter of Esan Central Local Government Area of Edo State, Nigeria, which lies between latitude 6°44′10″ N and longitude 6°13′11″ E with an altitude of 1305 feet above sea level. It has an annual rainfall that exceeds 200mm^2 with the highest average temperature of 38°C in February and the lowest temperature of 29°C in July. It covers an area of 253 km² and has population density of 545.1/km² (Nigeria Administrative Division, 2016). Irrua Specialist Teaching Hospital, Irrua, provides a full range of specialized medical and surgical services as well as providing facilities for training students and engaging in medical research (Eseine-Aloja *et al.*, 2024).

Inclusion and Exclusion criteria

All suitable patients' case notes and x-ray films obtained between January 1, 2020 and December 31, 2021 at Irrua Specialist Teaching Hospital were included in this study. Patients with obvious congenital or acquired deformities of the upper extremity were excluded from this study. A total of 35 patients who satisfied the inclusion were recruited for this study.

Ethical Considerations

Ethical approval for this research was obtained from the Research Ethical Committee of Irrua Specialist Teaching Hospital (ISTH), Irrua, Edo State, Nigeria with approval number ISTH/HREC/20220509/328.

Methodology

Socio-demographic characteristics (such as age, gender, occupation, tribe and causes of the fractures) of patients who met the inclusion criteria were extracted from the case notes and x-ray reports of the patients. The causes of fracture were broadly grouped into two – those due to RTA and those that occurred due to falls. The patients were assigned to age groups accordingly as infants (under 1 year), child (1-11 years), adolescents (12-17), adults (18-59) and elderly (60 and above). Also, the method of treatment was noted. The obtained data were analyzed using the Microsoft Excel and presented in distribution tables.

RESULTS

Gender of patients who were managed for humeral fractures at ISTH, Irrua

The gender of the 35 patients who were determined upon evaluation using x-ray at ISTH, Irrua to have humeral fractures between January 1, 2020, and December 31, 2021, is presented in Table 1. Findings of this study showed that humeral fractures were more predominant amongst males (n = 22, 62.90%) than females (n = 13, 37.10%).

Age of patients who were managed for humeral fractures at ISTH, Irrua

The age distribution of the 35 patients who were managed for humeral fractures during the review period is presented in Table 2. Findings of this study showed that humeral fractures were more predominant amongst adults (n = 23, 65.70%). The incidence of humeral fractures in infants, children and adolescents were recorded to be 8.60%, 11.40% and 11.40% respectively. Of all the categories in this study, the incidence of humeral fractures was least recorded in the elderly (n = 1, 2.90%).

Ethnicity of patients who were managed for humeral fractures at ISTH, Irrua

The ethnicities of the 35 patients who were managed for humeral fractures during the review period is presented in Table 3. A notable finding of this study is that most of the patients with humeral fractures hailed from the Esan ethnic group (n = 20, 57.10%).

The occupation of patients who were managed for humeral fractures at ISTH, Irrua

The occupation of the 35 patients who were presented with humeral fractures at ISTH, Irrua between January 1, 2020, and December 31, 2021, is presented in Table 4. From data analysis in this study, it was found that individuals who engage in business (n=14) and students (n=13), had the highest incidence of humeral fractures, while civil servants, drivers and nurses, had the least incidence with recorded frequencies of 1 (2.90%) each.

Types of humeral fracture in patients who were managed for humeral fractures at ISTH, Irrua

The different types of humeral fractures recorded from the patients' case notes and x-ray at ISTH, Irrua between January 1, 2020 and December 31, 2021 are presented in Table 5. From data analysis in this study, it was found that the incidence of fractures at the distal, midshaft and proximal sites of the humerus were 10 (28.60%), 14 (40.00%) and 11 (31.40%) respectively. The types of humeral fractures recorded in this study were comminuted and simple fractures with the frequency of the respective incidence being 20 (57.10%) and 15 (42.90%).

Cause of humeral fractures amongst patients who were managed at ISTH

The cause of humeral fractures amongst patients who were managed at ISTH, Irrua during the review period are presented in Table 6. Most of the fractures followed road traffic accidents, which accounted for over 71 % of the cases. Proximal fractures accounted for most of the cases of fractures caused by RTA (10 out of 25) while midshaft fractures accounted for most of the cases of fractures caused by falls (7 out of 10).

Prior use of traditional and other interventions by patients before hospital visits

The use of traditional and other interventions by patients with humeral fractures before presenting in the hospital for treatment was determined in this study. It was found that none of the patients had received any form of treatment outside the hospital setting prior to presentation at the ISTH, Irrua. These findings are presented in Table 7.

Treatment method used in the management of humeral fractures in ISTH, Irrua

The type of treatment commonly used for treatment of humeral fractures in ISTH, Irrua was determined in this study. Findings are presented in Table 8.

Table 1: Gender of patients who presented with humeral fractures at ISTH, Irrua

Gender	Frequency	Percentage (%)
Females (F)	13	37.10
Males (M)	22	62.90
Total	35	100.0

Key: F = Female, M = Male

Table 2: Age of patients who presented with humeral fractures at ISTH, Irrua

Category	Age within category	Frequency	Percentage
Infants	Under 1 year	3	8.60
Children	1 – 11 years	4	11.40
Adolescents	12 – 17 years	4	11.40
Adults	18 – 59 years	23	65.70
Elderly	60 years and above	1	2.90
TOTAL		35	100.00

Table 3: Ethnicity of patients who presented with humeral fractures at ISTH, Irrua

Ethnic group	Frequency	Percentage (%)
Esan	20	57.10
Etsako	3	8.60
Hausa	4	11.40
Igbo	5	14.30
Ijaw	1	2.90
Yoruba	2	5.70
Total	**35**	**100.00**

Table 4: Occupation of patients who presented with humeral fractures at ISTH, Irrua

Occupation	Frequency	Percentage (%)
Business	14	40.00
Civil servants	1	2.90
Drivers	1	2.90
Farmers	2	5.70
Nurses	1	2.90
Students	13	37.10
Unemployed	3	8.60
Total	**35**	**100.00**

Table 5: Types of humeral fracture recorded amongst patients at ISTH, Irrua.

Type of humeral fracture	Frequency	Percent
Distal	10	28.60
Midshaft	14	40.00
Proximal	11	31.40
Total	**35**	**100.00**
Simple	15	42.90
comminuted	20	57.10
Total	**35**	**100.00**

Table 6: Cause of humeral fractures amongst patients who were managed at ISTH, Irrua for humeral fractures.

Cause of Humeral Fracture	Frequency	Percentage (%)	Type of fracture	Frequency	Percentage (%)
Fall	10	28.60	Distal	2	05.71
			Midshaft	7	20.00
			Proximal	1	02.86
Road Transport Accident (RTA)	25	71.40	Distal	8	22.86
			Midshaft	7	20.00
			Proximal	10	28.57
Total	**35**	**100**		**35**	**100.0**

Table 7: Prior use of traditional and other interventions by patients before hospital visits

Did the patient use traditional or other interventions before hospital visit?	Frequency	Percentage (%)
Yes	0	0.00
No	35	100.00
Total	**35**	**100.0**

Table 8: Type of treatment used for humeral fractures in ISTH, Irrua

Treatment used for humeral fracture	Frequency	Percent
Cast	21	60.00
Plate and/or screw	14	40.00
Total	**35**	**100.00**

DISCUSSION

The socio-demographic characteristics of the 35 patients who were treated for humeral fractures within the period under review were assessed in this study. Statistical analysis of the data showed that there were more males than females, indicating a higher incidence of humeral fractures in men than women with a male-to-female ratio of 1.69:1. This finding is similar to those of Ezeuko *et al.*, (2015), Onyemaechi *et al.*, (2018) and Nwagbara & Nwabueze (2019) who in their different studies reported that in Nigeria, males recorded a higher incidence than females with male-to-female ratio ranging from 3:1 to 4.3:1. Babalola *et al.*, (2020) equally recorded a higher incidence of humeral fracture in males among children of school age with a male-to-female ratio of 2.8:1. The greater incidence of fracture among males may be due to the fact that the males are more active and are likely to engage in activities that predispose the individual to fractures (Bahrs *et al.*, 2013).

Analysis of the age distribution of the 35 patients recorded in this study ranged from 63 days to 60 years old. Patients were thus categorized as infants, children, adolescents, adults and the elderly. Furthermore, findings in this study show that adults aged 19 to 59 years had the highest incidence of humeral fractures (n = 23, 65.70%), a pattern similar to reports by other researchers who found that most humeral fracture patients are between 21 and 40 years of age (Ezeuko *et al.*, 2015; Onyemaechi *et al.*, 2018; Nwagbara & Nwabueze, 2019). This is probably because this group represents the most active group of the population and hence most likely to be involved in fractures.

Ethnic distribution of the subjects showed most patients with femoral fracture recorded in this study hailed from the Esan ethnic group. Indigenes of Igbo, Hausa, Etsako, Yoruba and Ijaw ethnic

groups formed the minority population in the study. This distribution of ethnicity observed in this study is most likely because the health institution from which data was sourced is situated in the part of Edo inhabited largely by Esan people (Eseine-Aloja *et al.*, 2024). The few subjects who were unemployed were all the infants and students. Among the employed, the predominant occupation of the employed was business/trading. These findings agree with socio-demographic patterns of persons who live in central district of the state (Ogbeni, 2023; Eseine-Aloja *et al.*, 2024).

Analysis of the data revealed that midshaft fractures were the most common type of humeral fracture recorded while the least common was the distal humeral fracture. As regards the nature of fracture, comminuted fracture accounted for most of the cases, this could probably be because most of the fractures resulted from RTA accidents which are likely to result in multiple injuries including humeral fractures as part of associated injuries in a polytraumatized individual (Allemann *et al.*, 2019). Meanwhile, this study reveals that the preponderance of humeral fractures was located in the midshaft region of the humerus, which does not agree with the findings of the study by Bergdahl *et al.,* (2016) who in a retrospective study of the epidemiology and patho-anatomical pattern of 2,011 humeral fractures, using data from the Swedish Fracture Register (SFR) revealed that 79 % of humeral fractures were of the proximal type. Similarly, it disagrees with the findings of Ekholm *et al*., (2006) who reported that the proximal part of the humerus was the more likely location of humeral fracture.

Assessment of the cause of humeral fractures in this study shows that road traffic accidents (RTA) was responsible for most of cases, while others resulted from falls. Ezeuko *et al*., (2015), Onyemaechi *et al*., (2018) and Nwagbara & Nwabueze, (2019) equally recorded in their respective studies that the most common cause of the humeral fracture was RTAs. Omoke & Ekumankama, (2020) also found that RTAs were responsible for majority of fractures, while fall and gunshots injuries were the least likely causes of fractures. The World Health Organization earlier ranked RTAs among the top 10 leading causes of death and several public health experts worldwide have also conceded that there is a global RTA epidemic, with RTA being the leading cause of injury-related deaths (Mohammed *et al.,* 2019). This may be attributed to the absence of airbags in vehicles, poor road conditions, and unregulated speed limits, which have been major contributors to road traffic accidents (Odero, 1998), meanwhile, these conditions are widespread across Africa (Ezeuko *et al*., 2015). In Nigeria, the incidence of RTAs is high, as road accidents have been identified as the third-leading cause of overall deaths, the leading cause of trauma-related deaths and the most common cause of disability (Nwadinigwe & Ofoma, 2016). This is perhaps the reason why midshaft fractures were the most prevalent type in this study, which though has been reported to be rare, but when they do occur, they typically occur due to a direct force or bending force that has been applied to the middle humerus (Jayaseelan *et al*., 2014) which can occur in RTA.

Incidentally, pathology and gunshots were not recorded causes of humeral fractures in this study, contrasting the recent increase in incidence of pathologic fractures, primarily due to improved diagnosis and treatment of metastatic diseases leading to prolonged patient survival (Rizzo & Kenan, 2022). This might be because cancer care and treatment for other medical conditions that could lead to pathological fractures are not well-developed or offered at the facility under study. Thus, most patients who are prone to pathological fractures do not seek treatment there.

This study also looked at the use of traditional and other interventions by patients with humeral fractures before presenting in the hospital for treatment. Findings from patients' case notes showed that all the patients came directly to the hospital and had no form of intervention prior to hospital presentation. This finding does not agree with that of Nwagbara & Nwabueze (2019) who reported the average time interval between injury and presentation in the hospital as 10 hours, a time window that is believed to allow for the use of other conventional and unconventional interventions such as self-medication possibly to alleviate pain. This study finding is also different from the study by Ossai *et al*., (2018) who reported that about a third of patients with fractures had patronized traditional bone setters. Also, Oboirien & Ukwuani, (2015) reported that over 10% of fracture patients had prior treatment by traditional bone setters (TBS). Some reasons for the patronage of TBS include ignorance, poverty and superstitious beliefs that TBS have supernatural powers (Onyemaechi *et al*., 2015; Nwokeke *et al*., 2018). The difference in the findings of this study and past studies could possibly be because of increased knowledge and education among the patients in this study, where students and businesspersons formed the majority. Furthermore, the senatorial district is home to three tertiary institutions and two schools of midwifery, a factor that might have improved the health-seeking attitude of the inhabitants. The fact that the patients in this study were all gainfully employed also indicates that poverty, a factor that positively influences TBS, is unlikely to be associated with the patients in this study. Ola-Olorun *et al*., (2001) recorded that over half of the patients who patronized traditional bone setters were either poor or uneducated. It is however worthy of note that the use of traditional interventions in bone treatment before presenting at the hospital can also lead to minor complications such as limb length discrepancies from mal-union of fractures with minimal effect on function, to major complications like limb gangrene, amputation and death. These complications constitute a significant challenge to the orthopaedic practitioners in Nigeria with associated negative socioeconomic impact on our society (Odatuwa-Omagbemi, 2018).

The type of treatment commonly used for treatment of humeral fractures in ISTH, Irrua was also assessed. It was found that the use of cast (external fixation) was the predominant method at 60%, while plates and/or screws (internal fixators) accounted for 40%. This finding implies that conservative management of humeral fracture such as casting was more in practice at ISTH, Irrua in comparison to internal fixation. This may probably be because most of the fractures were not displaced, contaminated or complicated, which are factors that influence the use of internal fixation as a method of fracture management (Cross & Swiontkowski, 2008). Unfortunately, these factors were not considered in this study. This serves as a major limitation to this study and creates room for further studies. There exists very limited information on the specific treatment modalities practiced across several hospitals in Nigeria to which the findings of this study can be compared with. However, the findings of this study are like that of Odatuwa-Omagbemi, (2018) who carried out a retrospective study of all cases of humeral fractures managed at the outpatient and emergency departments from January 2012 to December 2014, in North-Western Nigeria and reported the predominant treatment offered was with cast splintage while open reduction and internal fixation accounted for less. It is noteworthy that that the treatment modality for managing humeral fractures in a health institution depends on several factors such as the age of the patient, etiology and site of the fracture, surgeon's preference, resources available in the institution and patient's request (Adesope *et al.*, 2023; Eseine-Aloja *et al.*, 2024).

Conclusion: This study has shown that there was a higher incidence of humeral fractures in males than females, also that RTAs was the leading cause of humeral fractures, and the use of cast was the predominant treatment modality offered patients who had humeral fracture at ISTH. In consideration of the findings of this research, there is the need for those in charge of healthcare planning at ISTH, Irrua to ensure that equipment and manpower that are needed for management of humeral fractures are always available at the hospital and same for other hospitals in the environs. Furthermore, traffic authorities could consider measures such as safer mass transit systems, re-organisation of the traffic regulatory systems by strengthening the licensing procedures for drivers and provision of safer roads in a view to reducing RTAs.

Authors' declaration: The authors declare that there are no conflict(s) of interest and that this article is an original work of the authors. All authors have agreed to the final draft of the manuscript.

Acknowledgements: The authors would like to appreciate the Radiology Department of Irrua Specialist Hospital for their cooperation as well as Oghenedero, S. O.; Oruku-Lawal, A. O.; Salami, C. O. and Akinbuwa, I. O. who as students in the Department of Anatomy of Ambrose Alli University, Ekpoma, assisted in carrying out clerical duties during the research.

REFERENCES

Adesope A. S., Olusayo A. I., Owolabi J.I., Oyewusi O. O., Goodness A. I. & Uwale E. S. (2023). Locked intramedullary nailing of open fractures in resource-poor settings: a prospective observational study of challenges and functional outcomes in 101 fractures at Ogbomoso, Nigeria. *BMC Musculoskeletal Disorders*, *24*(1), p.170. https://doi.org/10.1186/s12891-023-06271-7

Allemann F., Heining S., Zelle B., Probst C. & Pape H. C. (2019). Risk factors for complications and adverse outcomes in polytrauma patients with associated upper extremity injuries. *Patient safety in surgery*, *13*, pp.1-9. https://doi.org/10.1186/s13037-019-0187-3

Babalola O. O., Ugwoegbulem O. A., Izuagba E. B., Idowu O. K. & Owoola A. M. (2020). Supracondylar humeral fractures in school children: Incidence and aetiology during school terms and holidays. *Niger J Orthop Trauma* 19: 69-72. https://link.gale.com/apps/doc/A646882222/HRCA?u=anon~5699fab5&sid=googleScholar&xid=339f85a3

Bahrs C., Bauer M., Tepass A., Weise K., Rolauffs B., Bahrs S.D., Eingartner C. & Blumenstock G. (2013). The complexity of proximal humeral fractures is age and gender specific. *Journal of Orthopaedic Science*, *18*(3), pp.465-470. https://doi.org/10.1007/s00776-013-0361-x

Bergdahl C., Ekholm C. and Wennergren D., (2016). Epidemiology and patho-anatomical pattern of 2,011 humeral fractures: data from the Swedish Fracture Register. *BMC Musculoskelet Disord* 17: 159 – 208. https://doi.org/10.1186/s12891-016-1009-8

Bergdahl C., Wennergren D., Ekelund J. & Möller M. (2020). Mortality after a proximal humeral fracture: data on 18,452 patients from the Swedish Fracture Register. *The bone & joint journal*, *102*(11), pp.1484-1490. https://doi.org/10.1302/0301-620X.102B11.BJJ-2020-0627.R1

Cameron P., Jelinek G., Kelly A. M., Brown, A. F. T and Little M., (2014). Humerus, In: Textbook of Adult Emergency Medicine. New York Elsevier Health Sciences. Pp. 167–170.

Capo J. T., Criner K. T. & Shamian B. (2014). Exposures of the humerus for fracture fixation. *Hand Clin.*; 30(4): 401-414. https://doi.org/10.1016/j.hcl.2014.07.001 PMID: 25440069

Cross III W. W. & Swiontkowski M. F. (2008). Treatment principles in the management of open fractures. *Indian journal of orthopaedics*. 42(4):377. https://doi.org/10.4103/0019-5413.43373

Cuccurullo S. J. (2014). Humeral fractures, In: Physical Medicine and Rehabilitation Board Review, Third Edition. Demos Medical Publishing. Pp 177–178.

Ekholm R., Adami J. & Tidermark J., (2006). Fractures of the shaft of the humerus: An epidemiological study of 401 fractures. *J Bone Joint Surg.* 88B: 1469–1473. https://doi.org/10.1302/0301-620X.88B11.17634

Eseine-Aloja C. E., Aimua H. I., Izunya A. M., Ugbah J. O., Sakpana U. H., Ehichoya F. E., Agbontaen A., Ebhojaye K. I., Eseine C. O., Ujaddughe M. E., Ujaddughe O. M. (2024). Assessment of the Pattern of Femoral Fractures Using X-Ray Findings of Patients Presenting at Irrua Specialist Teaching Hospital (ISTH), Irrua, Edo State, Nigeria. West J Med & Biomed Sci. 5(2):60-66. https://doi.org/10.5281/zenodo.12664116

Ezeuko V. C., Ehimigbai A. R. & Esechie E. L. (2015). Assessment of some demographic risk factors associated with diaphyseal humeral fractures among Nigerians. *Burns & trauma* 3, 33 - 36. https://doi.org/10.1186/s41038-015-0007-7

Ezeuko V., Ehijele L., Esechie V., Oigbochie E. & Ighalo C. (2016). A retrospective insight into patterns of humeral shaft fractures among Nigerians from radiological viewpoint. *Journal of Experimental and Clinical Anatomy*, 15: 43-48. https://doi.org/10.4103/1596-2393.190819

Jayaseelan D. J., Post A.A., Ruggirello L.D. & Sault J.D. (2014). Midshaft humeral fracture following a proximal humeral fracture: a case report. *International Journal of Sports Physical Therapy*, *9*(7), p.1014. PMID: 25540715; PMCID: PMC4275189.

Kim S. H., Szabo R. M. and Marder, R. A., (2012). Epidemiology of humerus fractures in the United States: nationwide emergency department sample, 2008. *Arthritis care & research*, 64(3): 407–414. https://doi.org/10.1002/acr.21563

Mohammed A.A., Ambak K., Mosa A.M. & Syamsunur, D. (2019). A review of traffic accidents and related practices worldwide. *The Open Transportation Journal*, *13*(1). https://doi.org/10.2174/1874447801913010065

Nigeria Administrative Division - States and Local Government Areas (2016). Population Statistics, Charts and Map. https://citypopulation.de.

Nwagbara I. C. & Nwabueze F. C. (2019). Epidermiology of open fractures in Nigerian teaching hospital. *Niger J Orthop Trauma* 18: 48 -53. https://doi.org/10.4103/njot.njot_9_19

Nwokeke C., Igwillo U., Abdullahi M., Ihekorom C., Nwokeke C., Chukwu U. & Ofoegbu I.K. (2018). A review of factors influencing patronage of traditional bone setters (TBS) in Nigeria. *Alternative Integrative Med*, *7*, pp.46-9. ISSN 2349-7823

Oboirien M. & Ukwuani S. (2015). Management of Humeral Fractures in a Resource Poor Region in North-Western Nigeria. *J Trauma Treat*, 4: 279 - 287.

Odatuwa-Omagbemi D.O., Adiki T.O., Elachi C.I. & Bafor A. (2018). Complications of traditional bone setters (TBS) treatment of musculoskeletal injuries: experience in a private setting in Warri, South-South Nigeria. *Pan African Medical Journal*, *30*(1). eISSN: 1937-8688

Odero, W. (1998). Alcohol-related Road traffic injuries in Eldoret, Kenya. *East African Medical Journal*, *75*(12), pp.708-711. PMID: 10065211.

Ogbeni S. O. (2023). Ancestors and Moral Sanctions among Indigenous Esan people of Edo State, Nigeria: An Exposition. ABRAKA JOURNAL OF RELIGION AND PHILOSOPHY. 3(1): 192-207.

Ola-Olorun D. A., Oladiran I. O. & Adeniran A. (2001). Complications of fracture treatment by traditional bonesetters in southwest Nigeria, *Family Practice*, 18 (6): 635 – 637. https://doi.org/10.1093/fampra/18.6.635

Omoke N. I. & Ekumankama F. O. (2020). Incidence and Pattern of Extremity Fractures seen in Accident and Emergency Department of a Nigerian Teaching Hospital. *Nigerian journal of surgery: official publication of the Nigerian Surgical Research Society*, 26(1): 28–34. eISSN: 1117-6806

Onyemaechi N.O., Lasebikan O.A., Elachi I.C., Popoola S.O. & Oluwadiya K.S. (2015). Patronage of traditional bonesetters in Makurdi, North-Central Nigeria. *Patient preference and adherence*, pp.275-279. https://doi.org/10.2147/PPA.S76877

Onyemaechi C. N. O., Nwakwo O. E. and Ezeadawi R. A. (2018). Epidermiology of injuries seen in tertiary hospital. *Niger J Clin Pract* 21: 752 – 757. eISSN: 2229-7731

Onyemaechi, N.O.C. & Ofoma, U.R. (2016). The public health threat of road traffic accidents in Nigeria: A call to action. Annals of medical and health sciences research, 6(4), pp.199-204. https://doi.org/10.4103/amhsr.amhsr_452_15

Ossai E. N., Ofojebe O. L., Ede D. O., Diala L. P. & Ogbnnaya L. U. (2018). Willingness to patronize traditional bone setters among patients attending general out-patients department of Federal Teaching Hospital, Abakaliki, Nigeria. *Austin Orthop.* 3 (2): 1011 - 1017.

Paryavi E., Pensy R. A., Higgins T. F., Chia B. & Eglseder W. A. (2014). Salvage of upper extremities with humeral fracture and associated brachial artery injury. *Injury*. 45 (12):1870-1875. https://doi.org/10.1016/j.injury.2014.08.038

Plath J. E., Kerschbaum C., Seebauer T., Holz R., Henderson D. J., Förch S. & Mayr E. (2019). Locking nail versus locking plate for

proximal humeral fracture fixation in an elderly population: a prospective randomised controlled trial. *BMC musculoskeletal disorders*, 20(1), 1-13. https://doi.org/10.1186/s12891-019-2399-1

Rizzo S. E. & Kenan S. Pathologic Fractures. [Updated 2023 May 22]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559077/

Rudran B., Little C., Duff A., Poon H. & Tang, Q. (2022). Proximal humerus fractures: anatomy, diagnosis and management. *British Journal of Hospital Medicine*, *83*(7), pp.1-10. https://doi.org/10.12968/hmed.2021.0554

Schmid G. L., Lippmann S., Unverzagt S., Hofmann C., Deutsch T., & Frese T. (2017). The Investigation of Suspected Fracture-a Comparison of Ultrasound with Conventional Imaging. *Deutsches Arzteblatt international*, 114(45):757–764. https://doi.org/10.3238/arztebl.2017.0757

Twiss, T. (2015). Nonoperative Treatment of Proximal Humerus Fractures. In: Crosby, L., Neviaser, R. (eds) Proximal Humerus Fractures. Springer, Cham. https://doi.org/10.1007/978-3-319-08951-5_2