The Accompaniment Skeletal Findings in Traumatic Pelvic Injuries in Public Tertiary Hospitals in Southwestern Nigeria

A. O. Adebola Yusuf\textsuperscript{1,2,3}, F. O. Jinadu\textsuperscript{4,3}, K. M. Onuoha\textsuperscript{5,6}, A. P. Adefalujo\textsuperscript{1,3}, M. U. Thompson\textsuperscript{1,7}, Z. A. Awoyemi\textsuperscript{4,2}, O. F. Ajiboye\textsuperscript{1} and R. A. Akinola\textsuperscript{4}

\textsuperscript{1}Radiodiagnosis Department, Benjamin Carson School of Medicine, College of Health Medical Sciences, Babcock University / Babcock University Teaching Hospital, Ilisan-Remo, Ogun State, Nigeria.

\textsuperscript{2}Radiology Department, General Hospital, 1-3, Broad Street, Marina, Lagos, Lagos State, Nigeria.

\textsuperscript{3}Radiodiagnosis Department, Lagos University Teaching Hospital, Iyi Araba, Suru-Lere, Lagos, Lagos State, Nigeria.

\textsuperscript{4}Radiology Department, Lagos State University Teaching Hospital [LASUCOM / LASUTH], Ikeja, Lagos, Nigeria.

\textsuperscript{5}Department of Surgery, Orthopedics Unit, Benjamin Carson (Snr) School of Medicine, College of Health and Medical Sciences, Babcock University/Babcock University Teaching Hospital, Ilisan-Remo, Ogun State, Nigeria.

\textsuperscript{6}Department of Surgery, Obafemi Awolowo University Teaching Hospital Complex, Ile Ife, Osun State, Nigeria.

\textsuperscript{7}Radiology Department, National Orthopedic Hospital, Igbobi, Lagos, Nigeria.

Authors’ contributions

There was a good collaborative effort by all authors. Author AOAY wrote the initial draft of the manuscript, the literature review, with substantial contribution from authors APA, FOJ, KMO, MUT, OFA reviewed the results while AOAY and RAA wrote the discussion. All authors read and approved the final draft of the manuscript and certified it for publication.

Article Information

DOI: 10.9734/CJAST/2021/v40i1531416

Editor(s): (1) Dr. Ashish Anand, GV Montgomery Veteran Affairs Medical Center, USA.

Reviewer(s): (1) Rebar M.Noori fatah, sulaimani university, Iraq.

(2) Igna Cornel, University of Agricultural Science and Veterinary Medicine of Banat, Romania.

Complete Peer review History: http://www.sdiarticle4.com/review-history/70414

Received 01 May 2021
Accepted 04 July 2021
Published 05 July 2021

Original research Article

*Corresponding author: E-mail: adebolaolukayodeyusuf@gmail.com;
ABSTRACT

Aim: This study evaluated the attendant skeletal fracture accompaniments in traumatic pelvic fractures using plain radiography.

Study Design: A prospective cross sectional study.

Place and Duration of Study: The Accident and Emergency Departments of three hospitals namely: Lagos University Teaching Hospital, National Orthopedic Hospital, Igbobi, and Lagos State Health Service Commission’s Accident and Emergency Services Hospitals (LASEMS) between January 1st and December 31st 2009.

Methodology: One hundred (100) patients of all ages diagnosed by plain radiography with pelvic traumatic injury were recruited from the hospitals stated above. There were 51 males and 49 females. The sociodemographic and clinical data of the patients as well as the radiographic skeletal findings and types of trauma were entered into a Microsoft excel database for cleanup and statistical analysis. Statistical analysis was done using Epi Info Version 6 Statistical Software on an IBM-compatible computer.

Results: Forty two (42) patients in sex distribution of sixteen (16) males and twenty six (26) females presented with sixty seven (67) different categories of accompaniment skeletal fractures. Injuries to the femur, limb shortening and head injuries were found in decreasing order.

Keywords: Pelvis; femur; tibia; skull; compression fracture.

1. INTRODUCTION

There has been exhaustive work on pelvic fractures by many workers ranging from classification [1,2,3,4] and varieties of clinical findings including surgical, neurological, urogenital accompaniments and soft tissue sequelae [5,6,7].

Pelvic fracture itself involves essentially the pelvic ring and components of the acetabulae thus excluding fractures that primarily affect the femur which was regarded as a hip rather than a pelvic fracture [8].

Pelvic fracture has largely been reported to occur in any of or combination of Anteroposterior compressed fracture (APCF), Lateral compression fracture (LCCF), Combined / Complex fracture (CCF), Vertical Shear fracture (VSF), Acetabular fracture (AF), Avulsion fracture (AVF) [3,4,9].

The associated skeletal bone injuries found in this study were highlighted for this discuss. Literature search however revealed paucity of information in this category in relation to pelvic fractures.

2. MATERIALS AND METHODS

This was a prospective hospital based study on the radiographic patterns of the various skeletal bone fractures associated with pelvic trauma in hundred (100) patients. The patients were recruited from the Accident and Emergency Departments of three tertiary hospitals in the Lagos metropolis including National Orthopedic Hospital, Igbobi, Accident and Emergency Services (LASEMS) of Lagos State Health Service Commission and Lagos University Teaching Hospital between January 1st 2009 and December 31st 2009. Lagos State is the commercial nerve center of Nigeria with an estimated population of 20 million. These tertiary centers act as referral hospitals to primary, secondary and private hospitals in the state as well as to the neighboring states of Ogun and Oyo.

Patients of all ages that met the inclusion criteria were recruited consecutively.

2.1 Methodology

The patients’ corresponding sociodemographic data, obtained from the request cards and case notes, the clinical data, radiographic skeletal findings, and the types of trauma were documented in an excel spreadsheet.

The pelvis was radiographed in the anteroposterior (AP) position, centering beam being at midline midway between the anterior superior iliac spine and the upper border of the symphysis pubis. Its lateral-oblique view was at the femoral pulse at the head of femur with the femur in the posterior oblique position, while
Judet’s view was obtained with the beam angulated 12° caudal to the raised affected part at the femoral pulse.

The femur was radiographed in both AP / Lateral views centering midway in its long axis with the patient in the supine position.

Tibia / Fibula in AP / Lateral views centering in the midline, midway between the knee joint and ankle joint distally.

The skull was imaged with the central rays passing through the nasion in fronto-occipital (FO) position. Skull lateral view was done centering midway between the glabella and external occipital protuberance, about 5cm above the external auditory meatus. Towne’s view imaged with 30° angulation caudally, centering about 5cm above the glabella.

The submentovertical view (SMV) was radiographed centering midline between the two external auditory meata, while the reverse occipitomental view (OM) was acquired with the central rays passing through the lower orbital margin in the midline.

All images were acquired with the patient lying supine considering their traumatic, non-ambulant condition.

Statistical analysis was done using Epi Info Version 6 Statistical Software on an IBM-compatible computer. Test of significance for difference between the groups were performed utilising the Statcalc AS Subprogramme of the Software by Dean A G et al. [10].

2.2 Limitation

The patients studied were specifically limited to traumatic pelvic injuries diagnosed by plain radiography.

3. RESULTS

3.1 Socio-demography of Study Participants

The age range of the participants was from 6 to 69 years with a mean age of 31.5 ± 2 SD years. The 21-30 age group was the most populous accounting for forty-one percent (41%) of this study. There were 49 (49%) males and 51 (51%) females. This is shown in Table 1.

The mechanism of injury is shown in Table 2 below where Road Traffic Accident accounted for 90% of the cases as earlier cited in references of this incident paper.

3.2 Category of Fractured Bone Involved

A total of sixty-seven (67) different categories of accompaniment skeletal fracture / dislocation findings were found in forty-two (42) patients with a sex distribution of sixteen (16) males and twenty six (26) females. The Acetabular fractures (AF) group accounted for 60% followed in decreasing order by Complex / combined (CCF) and Anteroposterior fracture (APCF) categories as detailed in Table 3.

No skeletal accompaniment fracture was observed in the other categories of Lateral compression fracture (LCF), Vertical Share (VSF), Sacral Fracture (SF) and Avulsion Fracture (AF).

Femoral injuries were the most common and accounted for 44.77% followed by limb shortening 13.43% and head injuries 10.5% in that order (Table 3).

| Age Group | Sex | Total |
|-----------|-----|-------|
|           | Male| Female|   |
| 1-10      | 0   | 2     | 2 |
| 11-20     | 6   | 10    | 16|
| 21-30     | 22  | 19    | 41|
| 31-40     | 9   | 7     | 16|
| 41-50     | 8   | 6     | 14|
| 51-60     | 3   | 4     | 7 |
| 61-70     | 1   | 3     | 4 |
| Total (%) | 49  | 51    | 100|

$X^2 = 4.86, p > 0.05$
Table 2. Mechanism of Injuries and Sex distribution (n= 100)

| Mechanism of injuries                  | Sex          | Total | %  |
|----------------------------------------|--------------|-------|----|
|                                        | Male         | Female|     |
| Road Traffic Accidents                 |              |       |    |
| Knocked down (K)                       | 15           | 23    | 38 | 38 |
| Crushed (C)                            | 8            | 6     | 14 | 14 |
| Somersault (S)                         | 4            | 2     | 6  | 6  |
| Head-on collision (Hc)                 | 4            | 4     | 8  | 8  |
| Passenger in vehicle (P)               | 10           | 10    | 20 | 20 |
| Fall off vehicle in motion (Fv)        | 2            | 2     | 4  | 4  |
| Subtotal percentage                    | 43           | 47    | 90 | 0  |
| Others                                 |              |       |    |
| Domestic Accident / Fall               | 6            | 3     | 9  | 9  |
| Child Birth Trauma                     | 0            | 1     | 1  | 1  |
| Total                                  | 49           | 51    | 100| 100|

$X^2 = 2.46, p > 0.05$

Table 3. Associated skeletal injuries components in accompaniment Skeletal fracture / dislocation findings in traumatic pelvic fractures (n = 67).

| Types: Fracture / Dislocation | APCF | LCF | CCF | AF | TOTAL |
|-------------------------------|------|-----|-----|----|-------|
| Humerus                       | 1    | 1   | 1   | 2  | 5     |
| Vertebrae / Spine             | -    | 1   | 1   | 2  | 4     |
| Femur                         | 5    | 3   | 4   | 18 | 30    |
| Fibula                        | 1    | 1   | 2   | 1  | 4     |
| Limb shortening               | -    | -   | 2   | 7  | 9     |
| Foot                          | 1    | -   | -   | 1  | 1     |
| Osteoarthrosis                | 1    | -   | -   | 1  | 2     |
| Heamoarthrosis                | 1    | -   | 2   | 2  | 5     |
| Head Injuries                 | -    | -   | 7   | 1  | 7     |
| Total                         | 9    | 6   | 12  | 40 | 67    |

Table 4. Acetabular components in accompaniment skeletal fracture / dislocation findings in traumatic pelvic fractures (n= 40)

| Findings                      | Anterior | Posterior | Central | Transverse | Total |
|-------------------------------|----------|-----------|---------|------------|-------|
| Head injuries                 | 2        | 2         | 3       | 7          | 7     |
| Femur head fracture           | 1        | 2         | 6       | 2          | 11    |
| Femur head subluxation        | 1        | 3         | 2       | 1          | 7     |
| Limb shortening               | 1        | 2         | 2       | 2          | 7     |
| Humerus fracture              | -        | 1         | 1       | -          | 2     |
| Fibular fracture              | -        | -         | 1       | -          | 1     |
| Heamoarthrosis                | -        | 2         | -       | -          | 2     |
| Vertebra fracture             | 1        | -         | 1       | 1          | 2     |
| Osteoarthrosis                | -        | -         | 1       | -          | 1     |
| Total                         | 6        | 12        | 17      | 5          | 40    |
| %                             | 15       | 30        | 42.5    | 12.5       | 100   |

3.3 Acetabular Components

In the acetabulum category, the Central acetabular column fracture accounted for forty-two and half percent (42.5%) of the findings followed by posterior column at thirty percent (30%) and Anterior column at fifteen percent (15%). Femoral injuries was the commonest being 18 (62.7%) closely followed jointly by 7 (17.5%) each of head injuries and limb shortening as shown in Table 4.

4. DISCUSSION

As earlier stated, not much work has been done on skeletal injury accompanying traumatic pelvic
injuries in this study. Head injuries as when compared to associated clinical findings reported severally [5,6,7].

Head injury findings in this study of 10.45% favourably I do not agree correlated with Giannoudis\textsuperscript{11}'s 16.9% in their studied 144,635 patients from Trauma Audit and Research Network from 106 trauma receiving hospitals in England and Wales, a major reason being the huge difference in the size of the subjects studied and Zong [6]'s 7.44% in 188 pelvic fractures patients in China. When acetabular components alone were considered, a 17.5% head injury in this study correlated well with Giannoudis et al. [11]'s 16.9% finding.

The cumulative lower limb injuries of 52.09% in this study was higher than the 19.15% of Zong et al. [6], Loder's [12] 22.9% and Varghese's [13] 33.33% while injuries of the upper extremities, of 7.46% in this study was lower than those of Zong's [6] 23.94%, Loder\textsuperscript{12}'s 50.7% and Varghese [13]'s 33.33% but correlated well with Giannoudis et al. [11] reported 7.8%.

The higher values obtained from the upper extremities could be attributed to the absence of any form of protective devices for these extremities in the studied equestrian situations. Similarly, the higher figures found in this study in the lower limb extremities was reasoned as a result of the less comfortable often overcrowded sitting arrangement with attendant poor leg space position in our public transport system. Road traffic accident accounted for 90% of the study patient population [4].

Chest injuries were found in 19.68% Zong et al. [6], 21.2% Giannoudis et al. [11] and 21% Loder [12]. Surprisingly, no Chest injuries were noted in this study.

The vertebrae / spine injury value of 5.97% in this study was lower than the 11.11% finding of Varghese VD et al. [13] in spite of consequential compulsory use of crash helmets / wearing of body protectors in their clime. Loder [12] asserted that pelvic and spine fractures were more likely in riders thrown or bucked off the horse while Varghese\textsuperscript{13} opined that the body protectors were at the expense of the extremities only but protective of the chest and abdomen while the pelvis sustained a wide spectrum of injuries in crush, rolled over or horse sitting on rider's injury categories.

The low value found in this study was attributable to patients' recruitment inclusion factors.

Another study among bi / tricycle / equestrian riders in this clime would find alarming higher values for head, spine and pelvic injuries because of the flagrant non enforcement of the wearing of protective devices by the law / security agents.

Some workers also opined that about 2/3\textsuperscript{rd} of patients with pelvic and acetabular fractures also sustained significant injuries to their skeleton or other body system [14].

Limb shortening finding of 13.43% in this study correlated well with the 11/11% by Varghese VD et al. [13] but relatively lower than the 17.5% acetabular category of this study.

This study findings of osteoarthrosis 2.98% and Heamoarthrosis 7.46% were not reported in the literature hence could not be compared. However, It was worthy of note that limb shortening and osteoaarthrosis were remarkably late complication findings while Heamoarthrosis findings was an early occurrence.

However, the effect on the individual bone involvement in this study necessitated a more detailed role of the various skeletal components in the study. This study did not find any radius, ulna, wrist and hand involvement apart from the humerus, in the upper extremities while all the corresponding bones in the lower extremities were noted in the findings.

The intrinsic relation of the femur to the pelvic girdle predisposes it to injury in traumatic pelvic injuries. This was buttressed in this study as a total of thirty (30) femoral shaft fractures out of sixty-seven (67) occurrences representing 44.77% was seen. This could also explain the remarkable 60% femoral fractures resulting from acetabular injuries.. It was noteworthy therefore that of the 44.77% femoral fracture, femoral head fracture accounted for 27.5% while femoral head subluxation occurred in 11.5%.

There were expectedly slight higher values in the acetabular fracture components being derived from those in that category only which represented 40 out of 67.

It was opined that early mortality from traumatic pelvic fracture resulted from significant injuries of
the skeletal system particularly in pelvic cum acetabular fractures [14].

5. CONCLUSION

The need for a high index of suspicion for evaluation of all the skeletal systems in totality in traumatic pelvic injuries could not be over emphasized.

6. RECOMMENDATIONS

The advocacy of enforcement of the use of protective devices is expedient to reduce to the barest minimum, the morbidity and fatality following pelvic fractures.

There is utmost need in the provision and enforcement of comfortable public transport with uncompromised sitting policy in tandem with global best practice.

Early orthodox medical intervention as opposed to traditional bone setters is advised to reduce the incidence of limb shortening to the barest minimum.

This also entails concerted information drive to disabuse the mind of our people from seeking such help.

Also, cost of orthopedic care should be highly subsidized to affordable cost to encourage patronage.

Early multidisciplinary treatment approach as a trajectory is also advocated.

CONSENT

The authors certify that they have obtained all appropriate patient consent forms. In the form the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

ETHICAL APPROVAL

All authors hereby declare that the methodology have been examined and approved by the Research and Ethics committee of the Lagos State Health Service commission. Approval was given on 2nd November 2000 Ref, P/MED/6016/224.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Dalal SA, Burgess AR, Siegel JH, et al. Pelvic fracture in multiple trauma: Classification by mechanism is the key to pattern of organ injury, resuscitation requirements and outcome. J Trauma. 1989;29:981-1002.
2. Burgess AR, Eastridge BJ, Young JW, et al. Pelvic ring disruptions: Effective classification. J. Trauma 1990;30:848-56.
3. Guthrie HC, Owens R, Bircher MD. Focus on pelvic fractures. The Journal of Bone and Joint Surgery @ 2010British Editorial: Society of and Joint Surgery.
4. Adebola Yusuf AO, Adefalujo AP, Akanji AO, Awoyemi ZA, Akinola RA. Plain radiographic patterns of pelvic fractures in public hospitals in South West Nigeria. International Journal of tropical disease and Health. 2017;27(1):1-13. Article no. IJTDH.36366. ISSN; 2278-1005, NLM ID: 101632866.
5. Figler BD, Hoffler CE, Risman W et al. Multi–disciplinary update on pelvic fracture associated bladder and urethral injuries. Injury. 2912;43:1242.
6. Zhao Wen Zong, Quan-Wei Bao., Hua-Yu Liu, Yue Shen, Yu-Feng Zhao, Xiang Hua, et al. Diagnosis and treatment of rare complications of Pelvic fractures. Chinese Journal of Traumatology. 2016;19:199-205.
7. Adebola Yusuf AO, Adefalujo AP, Emmanuel EE, Ajiboye OF, Tijani KH, Akinola RA. Clinical urogenital findings in post traumatic pelvic injuries diagnosed with plain radiography in Southwestern Nigeria. Asian Journal of Orthopedic Research. 2018;1(1):1-8. Article no. AJORR.41193.
8. Harding J, Chesser TJS and Brandley M. The bristol view: Its role in the diagnosis and surgical planning and occult fracture diagnosis for proximal femoral fractures. Scientific World Journal. 2013;2913:703783. DOI: 10.1155/2013/703783 PMCID: PMC3556889 PMID: 23365546.
9. Dunn J. Pelvic fracture: The American association for the surgery of trauma.
Available: http:/www.aast./Print.aspx April 30:2012. (Accessed on 20\textsuperscript{th} May 2017).

10. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, et al. Epi Info, Version 6: A word-processing, database, and statistics program for public health on IBM-compatible microcomputers. Centers for Disease Control and Prevention, Atlanta, GA, U.S.A. 1996;1-603.

11. Peter Giannoudis, Martin Grotz, Christopher Tzioupis, Harlambos Dinopoulos, Gareth Wells, Otmar Buamra, Fiona Lecky. Prevalence of pelvic fractures, associated injuries, and mortality: The United Kingdom perspective. The Journal of Trauma, Infection, and Critical Care. 2007;63(4):875-883.

12. Loder RT. The demographics of equestrian related injuries in the Unites States: Injury patterns, orthopedic specific injuries, and avenues for injury prevention. J, Trauma. 2008;65:447-460.

13. Varghese VD, Mika Rollman, Lars Gerhard Grobler, Mark Richman. Pelvic fractures secondary to horse accidents- an often under appreciated mechanism of injury. SM Emerg Med Crit Care. 2017;1(2):1016.

14. Harvie P, Chesser TJ, Ward AJ. The bristol regional pelvic and acetabular fracture service: Workload implications of managing the polytraumatised patient. Injury. 2008;39:839-43.

© 2021 Yusuf et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/70414