

Original Research Article

Acetabular fractures: epidemiological, lesional, therapeutic and evolutionary aspects

Daffe Mohamed*, Toure Mamadouba, Sarr Lamine, Diouf Alioune Badara, Dembele Badara, Thiao Marina C., Dieme Charles B., Sane Andre D.

Department of Orthopaedics, Traumatology, Dakar, Senegal

Received: 08 October 2020

Accepted: 12 November 2020

***Correspondence:**

Dr. Daffe Mohamed,

E-mail: mohameddaffe78@yahoo.fr

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Fractures of the acetabulum are serious because they affect a deep, load-bearing joint that is difficult to repair surgically at first. They occur in a context of polytrauma. The aim of our work is to study the epidemiological, lesional, therapeutic and evolutionary aspects of acetabulum fractures.

Methods: This is a 5-year retrospective study from January 2012 to December 2016 including 45 patients treated for acetabulum fracture.

Results: 45 patients including 38 men and 7 women with a mean age of 36 years (extremes 18 and 74). The circumstances of occurrence were dominated by road traffic accidents with 42 cases (93.3%).

According to the Judet-Letournel classification, we observed 28 elementary fractures (16 posterior wall fractures, 11 posterior column fractures, 1 anterior column fracture) and 17 complex fractures (7 posterior column and posterior wall fractures, 6 transverse and posterior wall fractures, 3 posterior and anterior column fractures, 1 anterior column and posterior hemi-transverse fracture). The association of a dislocation with an acetabulum fracture was found in 32 cases. Associated lesions (fractures) were observed in 23 patients. One case of associated TCE was noted. Treatment was orthopedic in 18 patients, surgical in 18 patients and functional in 9 patients. According to the Matta criteria we obtained after treatment 46.7% good reduction, 51.1% satisfactory and 2.2% unsatisfactory reduction. According to the Postel-Merle D'Aubigné rating, 16 patients obtained excellent results with overall 93.3% satisfactory results. The complications found were coxarthrosis (15 cases), para-articular ossification (2 cases) and vicious callus (1 case).

Conclusions: The treatment of acetabulum fractures depends on the type of fracture, the age and activities of the patients. Orthopedic, surgical as well as functional treatment can give good acetabular reconstructions and functional results.

Keywords: Acetabulum, Fracture, Treatment

INTRODUCTION

Fractures of the acetabulum are serious because they affect a deep, load-bearing joint that is difficult to repair surgically. They occur in a context of polytrauma. Young, active adults are most at risk.¹ The prognosis of acetabulum fractures depends on good radiological analysis to determine the anatomic-pathological type and

early, adequate and correct therapeutic management. Acetabulum fractures are a therapeutic emergency. The treatment is still controversial: functional, orthopedic or surgical; its indications depend on many factors. The aim of our work is to study their epidemiological, lesional and therapeutic aspects; and to give the evolutionary results of 45 cases of acetabulum fracture.

METHODS

We conducted a 5-year retrospective study (from January 2012 to December 2016) at the Orthopedics-Traumatology Department of the Aristide Le Dantec Hospital in Dakar. Included were all patients aged 18 years and older with a recent acetabulum fracture whose medical records were complete and treated regardless of the method.

The parameters studied were epidemiologically, age, sex, profession, and etiology.

The radiological study included standard radiographs (frontal pelvis, oblique wing, oblique obturator) and computed tomography (CT) scan. Based on these examinations, we studied 3 items: the main anatomical lesions according to the Judet and Letournel classification and the associated lesions.²

The therapeutic study concerned functional, orthopedic and surgical treatments;

On the evolutionary level, we evaluated: the anatomical results by the study of: the quality of the reduction of displacements on the 3 fundamental radiographic images according to the criteria of Matta et al [3]; the quality of the reduction of displacements on the 3 fundamental radiographic images according to the criteria of Matta et al.³

Anatomical reduction: 1 mm maximum displacement at the fracture site on all three incidences;

Satisfactory reduction: 3 mm maximum displacement on one of the three incidences; Unsatisfactory reduction: more than 3 mm of displacement on at least one of the three incidences; o Unsatisfactory reduction: more than 3 mm of displacement on at least one of the three incidences.

The congruence between the femoral head and the roof (TT) and the head and acetabulum (TA) was studied according to Duquesnoy's criteria.⁴

Functional results according to Postel Merle D'Aubigné's criteria.⁵

Complications were evaluated according to the type of treatment.

Data analysis was performed using Sphinx plus, version 5, and graphs were generated using Excel 2016.

RESULTS

We have documented 45 cases of recent acetabulum fractures. They were 38 men and 7 women with an average age of 36 years (extremes 18 and 74 years). The most affected profession was represented by workers with 11 patients followed by traders with 9 patients.

The circumstances of occurrence were dominated by road traffic accidents with 42 cases (93.3%).

According to the Judet-Letournel classification, we observed 28 elementary fractures and 17 complex fractures distributed according to table 1.

Table 1: Distribution of fractures according to the Judet-Letournel classification.

Injuries		Number
Elementary fractures	Posterior wall fracture	16
	Posterior column fracture	11
	Anterior wall fracture	0
	Anterior column fracture	1
	Pure transverse fracture	0
Complex fractures	Fracture in "T"	0
	Posterior column + posterior wall fracture	7
	Transverse fracture + posterior wall	6
	Anterior column + transverse hemi fracture	1
	Fracture of the two columns	3

Table 2: Distribution of complications by type of treatment.

Complications/ Treatment	Coxar throsis	Cal vicious	Ossifications
Surgical	04	00	02
Orthopaedic	08	01	00
Functional	03	00	00

Table 3: Comparison of therapeutic indications with those in the literature.

	Mahdane ¹⁷	Letournel ²	Mayaki ¹⁸	Fathi ¹⁹	Our series
Functional	6.8%	3.1%	-	3%	20%
Orthopaedic	58.6%	6.5%	80.52%	71.2%	40%
Surgical	34.6%	90%	19.48%	28.78%	40%

The posterior wall fracture (Figure 1) was the most frequent (16 cases). Fracture of the acetabulum was associated with dislocation in 32 cases. There were 20 posterior dislocations and 12 central dislocations.

Lesions associated with acetabulum fractures were observed in 23 patients including one case of traumatic brain injury (Figure 2).

Treatment was orthopedic (trans-osseous traction) in 18 cases, surgical in 18 cases and functional in 9 cases.

Surgical treatment (Figure 3) was dominated by osteosynthesis by reconstruction plate (9 cases) (Figure 4).

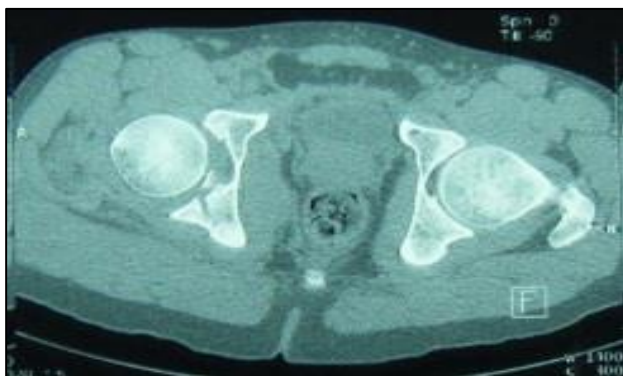


Figure 1: Posterior wall fracture with an intra-articular fragment.

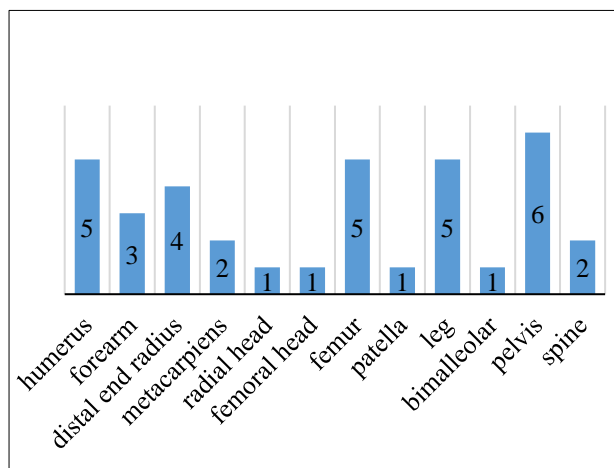


Figure 2: Distribution of associated fractures.

The average delay was 15 months with extremes of 7 months and 23 months.

According to Matta's criteria, the reduction was good in 21 cases (46.7%), satisfactory in 23 cases (51.1%) and unsatisfactory in 1 case (2.2%).

Vertical head/roof joint congruence (TT) according to Duquesnoy's criteria was perfect in 23 patients, good in 21 patients and fair in 1 patient.

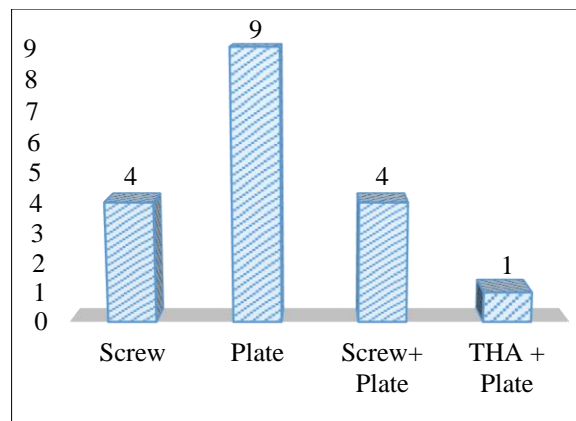


Figure 3: Different types of surgical treatment.



Figure 4: Osteosynthesis of a transverse fracture with a reconstruction plate.

Horizontal head/acetabulum joint congruence (TA) was perfect in 19 cases, good in 23 cases and fair in 3 cases.

According to Postel-Merle D'Aubigné's rating, the functional result was excellent in 16 cases, very good in 13 cases, good in 13 cases and fair in 3 cases.

No early complications were noted in our study.

The late complications found were coxarthrosis (15 cases), para-articular ossification (2 cases) and vicious callus (1 case).

Complications according to the type of treatment were noted in table 2.

DISCUSSION

It will be approached according to: epidemiological, lesional, therapeutic and evolutionary aspects.

The male predominance in the acetabulum fractures of the series is similar to that found in our own with a sex ratio of 5.42.⁶⁻⁸ The male predominance in the acetabulum fractures of the series is similar to that found in our own with a sex ratio of 5.42.⁶⁻⁸ This can be explained by the fact that men have easier access to means of transport, which exposes them to traffic accidents.

Acetabulum fractures can be observed at any age. They remain primarily the prerogative of the young active adult, with an average age of 36 years in our series and extremes of 18 and 74 years. The high frequency of these fractures in this age group can be explained by the more intense socio-professional activity. In the various publications consulted, the average age of patients is between 34 and 41 years.^{6,7,9}

We note in our series a predominance of acetabular lesion on the left side with 71% (32 patients) against 28% on the right side. These figures are close to those of the Hocine and Tarraq series.^{7,8} This can be explained by the fact that the driver's left foot is in contact with the floor of the car, whereas at the time of the accident the right foot is most frequently used to switch from the gas pedal to the brake pedal; and that the left hip in flexion and abduction will suffer the consequences of the trauma.

The cause of acetabulum fractures is most often violent trauma. In fact, road traffic accidents come first with 42 cases or 93.3%. This may be related to the increase in the number of cars, especially two-wheeled vehicles, to the narrowness and lack of materialization of our roadways, their concomitant use by pedestrians and the many drivers of two-wheeled vehicles and cars.^{3,8}

Acetabulum fractures are the result of high-energy trauma. In nearly 50% of cases these fractures are associated with other injuries. They may be general or regional complications that must be managed by a multidisciplinary team.¹⁰

In our series, 23 patients had other fracture sites. Mauricio et al, in their study of twenty-two patients (30%) had associated fractures, including eight cases (36.3%) of pelvic ring injuries, five cases (22.5%) of femur fracture, four (17.2%) of tibia, two (9%) of distal radius, one (5%) of patella, one (5%) of clavicle, and one (5%) of pelvic ring, femur and tibia.¹¹

In our series, elementary lesions are found in 62.2% of cases. These fractures represent 75% for Trouillaud and 66.6% for Hegg, in contrast to Glas, which reports 42%.¹²⁻¹⁴

Of all the elemental fractures in the above series, posterior wall fractures are the most frequent, as shown in our series with 16/28 cases, i.e. 57.2% of the elemental fractures.

As for complex fractures, they represent 37.8%, of which the most frequent group is posterior wall fractures associated with a posterior column fracture. Transverse fractures associated with a posterior wall fracture come in second place.

Transverse fractures associated with posterior wall fractures were the most frequent in the Trouillaud et al and Hegg et al studies, and the least frequent posterior column and posterior wall fractures, unlike our series.^{12,13}

We note the rarity hemi-transverse fractures associated with anterior column fracture in our series (1 case) which are also rare in all authors.

In 32 of our patients, acetabulum fracture is associated with dislocation. It is posterior in 20 cases (44%) and central in 12 cases (27%). Posterior dislocation is associated in 13 cases with posterior wall fracture, in 6 cases with posterior column and posterior wall fracture, in 1 case with transverse and posterior wall fracture. Central dislocation is associated in 5 cases with transverse and posterior wall fracture, in 3 cases with posterior column fracture, in 2 cases with posterior column and posterior wall fracture, in 2 cases with both columns. Ndiaye found that posterior dislocation was associated with posterior wall fracture in 8 cases.¹⁵ This explains the violence of the trauma and the mechanism of its occurrence.

Posterior dislocations occur mainly during trauma on a bent knee (dashboard accident). Hip fracture-dislocations have increased in frequency with the increase in traffic accidents; they account for 36% of all acetabulum fractures according to Duquennoy et al, 38% according to Rafai et al.^{4,16}

Functional treatment was performed in 20% of cases.

We note that orthopedic and surgical treatments are applied in equal measure with our series. In the other series, the orthopedic treatment dominates: Mahdane et al with a percentage close to 59%, Fathi et al 71.2% and Mayaki et al 80.52%.¹⁷⁻¹⁹ This compares with 6.5% for orthopaedic treatment in the Letournel et al series.²

It should be noted that the therapeutic modalities are a matter of schools. The therapeutic choice is not only imposed by the classification, but is also dependent on existing conditions in a hospital structure.

For example, all patients have benefited of an orthopedic treatment because of a lack of technical facilities in the Kante series.¹

Two therapeutic trends are individualized. The first, whose leaders are represented by Judet and Letournel, which opts for surgical rather than orthopedic treatment. The other trend, which was particularly represented at the last SOFCOT congress, seeks above all to develop orthopedic methods.

In our series, the therapeutic choice was justified by the type of fracture, the age and the activities of our patients.

Para-articular ossification was found in 2 patients. The onset of postoperative ossification is difficult to predict and varies considerably from one case to another.²⁰⁻²¹

In the literature, the incidence of aseptic osteonecrosis of the femoral head ranges from 2% to 10%.²² However, Mayaki found 23.38% of cases of osteonecrosis of the

femoral head, possibly explained by the fact that only 40.91% of dislocation fractures were reduced within the first six hours. In our series, no patient developed any.¹⁸

The protrusion of the femoral head and the lack of joint congruence at the acetabulum roof are responsible for the most progressive arthroses. The existence of a periacetabular osteophytic collar is frequently found. These lesions cannot be considered osteoarthritic, since nearly half of these patients have no clinical signs at age 20.²³

Coxarthrosis can occur even after apparently perfect surgical reduction due to cartilage damage caused by the joint fracture. In our series, 15 cases of coxarthrosis have been reported, i.e. 33%, of which 4 after surgical treatment, 8 after orthopedic treatment and 3 after functional treatment. This proportion is close to that found by Mayaki, which is 33.33%.¹⁸

According to Postel-Merle D'Aubigné, the excellent result was noted in 16 patients. Analyzing the functional results obtained in our series, we had overall 93.1% satisfactory functional results (excellent, very good and good) against 6.6% unsatisfactory results (average and poor).⁵

Duquenois and the authors of the SOFCOT round table in 1981 showed that both orthopedic and surgical treatment can give good acetabular reconstructions and good functional results, which are maintained over time with very few complications and, above all, despite sometimes incomplete anatomical efficacy.^{4,24}

Several elements are involved in assessing the immediate effectiveness of treatment, in particular- the quality of the reduction in displacement; according to Matta's criteria only one patient had a poor reduction, 23 patients had satisfactory results, 21 had a good reduction. The anatomical results obtained by Glas in 2001 (61.6%), Dequenois in 1981 (60% anatomical reduction, all classes combined) for the SOFCOT symposium, and PETSATODIS (78% anatomical reduction with less than 2 mm displacement) are better than ours.^{14,9} Congruence- is the assessment of the congruence between the head and the roof on the one hand and the head and the rest of the acetabulum on the other a good prognostic element?

This apparently rough estimate is perfectly valid, since there is a parallelism between the frequency of satisfactory results and the quality of congruence.

Overall we find that whatever the therapeutic modality, when congruence is perfect, the functional results are satisfactory.⁷

CONCLUSION

The treatment of acetabulum fractures depends on the type of fracture, the age and activities of the patients. Orthopedic, surgical as well as functional treatment can

give good acetabular reconstructions and functional results.

ACKNOWLEDGEMENTS

The authors thank all those who participated in the development of this work.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Kanté A. Etude épidémioclinique et thérapeutique des fractures du cotyle dans le service de chirurgie orthopédique et traumatologique du CHU Gabriel Touré. Thèse de Médecine, Bamako (Mali), 2012.
2. Letournel E. Acetabular fractures: classification and management. *Clin Orthop Relat Res.* 1980;(151):81-106.
3. Matta JM, Anderson LM, Epstein HC, Hendricks P. Fractures of the acetabulum. A retrospective analysis. *Clin Orthop Relat Res.* 1986;(205):230-240.
4. Duquenois A, Sénégal J, Augereau B, Copin G, Delcour JP, Durandau A, et al. Fractures du cotyle. Résultats à plus de 5 ans. *Rev Chir Orthop.* 1982;68(2):45-82.
5. Merle d'Aubigné R. Cotation chiffrée de la fonction de la hanche. *Rev Chir Orthop.* 1990;76:371-4.
6. Déo SD, Tavares SP, Pandey RK, El-Saied G, Willett KM, Worlock PH. Operative management of acetabular fractures in Oxford. *Injury.* 2001;32(7):581-6.
7. Hocine H. Fractures de l'acétabulum: étude rétrospective sur 18 cas. Mémoire de fin de cycle. Bejaia : Université Abderahmane Mira. 2018.
8. Tarraq A. Fracture cotyle : aspects épidémiologique, thérapeutique et pronostique. Thèse de Médecine Université Cadi Ayyad Marackech (Maroc), n°4. 2014.
9. Petsatodis G, Antonarakos P, Chalidis B, Papadopoulos P, Christoforidis J, Pournaras J. Surgically treated acetabular fractures via a single posterior approach with a follow-up of 2-10 years. *Injury.* 2007;38(3):334-43.
10. Laude F, Puget J, Martimbeau C. Fractures du cotyle. EMC-Appareil locomoteur 1999. Article 14-073-A-10.
11. Maia MS, Santos DCM, Queiroga DMD, Castro CDO, Silva RMF, Reis ACB, et al. Epidemiological analysis on acetabular fractures. *Rev Bras Ortop.* 2011;46(1):23-26.
12. Trouilloud P, Nosses J, Regnard P, Piganiol G. Les fractures du cotyle : étude anatomique et traitement chirurgical. *Lyon Chir.* 1982;78(4):260-264.

13. Heeg M, Klasen HJ, Visser JD. Operative treatment for acetabular fractures. *J Bone Joint Surg Br.* 1990;72(3):383-6.
14. Glas PY, Fessy MH, Carret JP, Bejui-Hugues J. Traitement chirurgical des fractures de l'acétabulum. Résultats d'une série contenue de 60 cas. *Rev Chir Orthop Traumatol.* 2001;87(6):529-538.
15. Ndiaye A, Sow CM, Dansokho A, Bassène N, Diop EI. Ostéosynthèse des fractures déplacées du cotyle par plaque de Letournel. A propos de 14 cas. *Dakar Med.* 1993;38(2):147-151.
16. Rafai M, Cohen D, Ouarab M, Rahmi M, Arssi M, Fadili M, et al. Les luxations-fractures de la hanche corrélation entre le type lésionnel; Le procédé thérapeutique et l'évolution anatomo-fonctionnelle. *Rev Maroc Méd Santé.* 1995;17(1):25-32.
17. Mahdane H, Elghazi A, Shimi M, Elibrahimi A, Elmrini A. Le traitement chirurgical des fractures du cotyle : à propos de 22 cas. *Pan Afr Med J.* 2014; 17:123.
18. Mayaki AH. Fractures du cotyle. Aspect thérapeutiques et évolutifs : à propos de 77 cas. *Mémoire DES Orthopédie-Traumatologie.* Dakar : Université Cheikh Anta Diop. 2019.
19. Fathi I. Les fractures du cotyle à propos de 42 cas. *Thèse de Médecine Université Mohammed V, Rabat (Maroc), n° 165.* 2014.
20. Brooker AF, Bowerman JW, Robinson RA, Riley Jr LH. Ectopic ossification following total hip replacement: incidence and a method of classification. *J Bone Joint Surg Am.* 1973;55(8):1629-1632.
21. Johnson EE, Kay RM, Dorey FJ. Heterotopic ossification prophylaxis following operative treatment of acetabular fracture. *Clin Orthop Relat Res.* 1994;(305):88-95.
22. Goulet JA, Bray TJ. Complex acetabular fractures. *Clin Orthop Relat Res.* 1989;(240):9-20.
23. Letenneur J, Fleuriet M, Sanguy D, Rogez JM, Lignon J, Perol H, et al. Intra-articular bony incarceration after reduction of dislocated hip. Diagnostic and therapeutic problems. *J Chir.* 1978;115(2):97-100.
24. El Kihal S. Les complications des fractures du cotyle. *Thèse Médecine.* Casablanca : Université Hassan II. 1992.

Cite this article as: Mohamed D, Mamadouba T, Lamine S, Badara DA, Badara D, C TM. Acetabular fractures: epidemiological, lesional, therapeutic and evolutionary aspects. *Int J Res Orthop* 2021;7:6-11.