ORIGINAL RESEARCH PAPER

Surgery

KEY WORDS: implant damage, humeral shaft, Fracture

PLATING OSTEOSYNTHESIS OF HUMERAL SHAFT FRACTURES: ABOUT 03 CASES OF IMPLANTS DAMAGES IN CAMEROON

Handy Eone Daniel*	Traumatic orthopedics unit Central Hospital of Yaoundé. *Corresponding Author
NGONO Prudence Christelle Danielle	Traumatic orthopedics unit Central Hospital of Yaoundé.
ESSI Marie Josée	Department of Public Health University of Yaounde
Manfo Agoumwa Alex Giraud	Traumatic orthopedics unit Central Hospital of Yaoundé
Ngo Nonga Bernadette	Surgery Department University Hospital Yaoundé.
Sosso Maurice Aurélien	Department of Surgery and Specialty University of Yaounde

ABSTRACT

Several varieties of medical implants are available and used by orthopedic surgeons to restore bone anatomy and facilitate the consolidation process of fractured bone. Implant damages are more and more frequent, the etiologies are variable and research work devoted to these damages in the osteosynthesis of the humerus are few. We decided to use three medical observations to highlight the insufficiency factors causing damage of implants in our environment. Over a period of 6 years 4 months in the city of Yaoundé, a retrospective study was carried out and 3 cases of implant damage were recorded. Two men and one woman with an average age of 41.7 years, all right-handed with closed bone lesions without vascular or nerves lesions. Radiologically, these were diaphyseal fractures of AO type A3 type in two cases and B2 type in one case. The first case of damage was secondary to a compression defect during the reduction in a patient operated for a pseudarthrosis of the right humerus with a type A3 medio-diaphyseal line. The second case occurred following early loading in a patient with a closed fracture of the right humerus. In the third case, this was an inappropriate mounting in a patient with a closed fracture of the right humerus.

Introduction

Fractures of the humeral shaft represent approximately 1-5% of the fractures of the humerus with an incidence of 13 per 100000 per year [1]. They have a bimodal distribution with a first peak incidence for young men aged between 20-30 years and a second peak for women aged between 60-70 years [2]. Despite the place of conservative treatment as Gold Standard, 30% of these fractures require surgical treatment [3]. The surgical therapeutic option includes several modalities and osteosynthesis by plates fixation remains the practical method at 50% [4]. Several forms of medical implants are used by orthopedic surgeons to ensure the stability of the fracture site and the maintainance the bone reduction. These implants are made using different materials such as cobalt-chromium alloys, stainless steels, titanium; the choice being made according to the biocompatibility, resistance to corrosion, mechanical resistance and the profitability. In our context, stainless steel is the most widely used material because of its accessibility and biomechanical resistance. The high incidence of road traffic accidents has precipitated the growing need for high-performance implants but these must respect specific properties including biocompatibility and resistance to stresses (torsion and compression). Therefore, they must satisfy the requirements specified in the standards, namely chemical composition, microstructure and macrographic aspect [5]. Implant damage causes additional costs in the management of these fractures thus increasing morbidity and distorting the healing process. The most incriminated factors in these damages are the design of the implant and the surgical procedure [6]. Also, maintaining the integrity of the implant depends on multiple factors and it is necessary to determine whether the damage is related to the implant or external factors [7]. There are not many studies on the damage of implants after osteosynthesis in adults. We wanted to make use of three medical observations to highlight the incriminated factors that cause the damage of implants in our environment.

Case No. 1

She is a 45-year-old right-handed trader with no contributory history. She was a passenger of a medium-sized vehicle whose driver lost control while driving at high speed. There was a direct shock on the right arm, without any notion of initial loss of consciousness. The radio-clinical assessment revealed a closed fracture of the humerus classified 12A3 according to the AO classification. The initial treatment consisted in the placement of a long arm cast. The 4-week control showed a reduced fracture with a prominent developing a mal-union. Osteosynthesis by screwed plates was indicated and this was done by an LC-DCP plate. Postoperatively, the reduction was sub-anatomic with persistence of the visibility of the radiographic fracture line and the screws not firmly attached to the plate **(Figure 1).** At day 51 postoperatively, the patient experienced spontaneous pain of the middle third of the right limb. The radiography carried out revealed a break in the osteosynthesis plate. A surgical resumption was programmed and the bone fixation done using a longer screwed plate **(Figure 2).** The final evolution was favorable with an excellent functional recovery of the shoulder and elbow (Constant and Murley score at 99 and Mayo elbow performance score at 100).

Case No. 2

This was a 41-year-old right-handed man, an administrative officer with no contributory history. He was driving a fast-moving motorcycle when he lost control and fell with reception on the right half of the body and had a direct impact on the right arm. The aftermath was marked by functional impotence of the limb and initial loss of consciousness. Clinical and radiological findings revealed fracture of the humeral diaphysis classified 12 A3 without vascular or nervous lesions. The patient had, a month later, an osteosynthesis by screwed plate. Three months after the

operation, while the patient was lifting a heavy load, perceived a sharp pain of the right arm with functional impotence. The radiographic assessment carried out revealed a plate fracture requiring a surgical re-intervention using a longer screw plate **(Figure 3).** The evolution was favourable with an excellent functional recovery of the shoulder and elbow and a normal scar eight months after the resumption of the bone fixation **(Figure 4).**

Case No. 3

This was a 39 years old male trader, right-handed with no contributory antecedents, received 6 hours after a closed trauma of the right arm following a road traffic accident. In fact, the patient was a rear passenger of a medium-weight vehicle that collided with another heavy-weight vehicle. He presented a closed fracture of the right humerus with no associated vascular or nervous lesions classified AO 12 B2. He benefited from an osteosynthesis using a reconstruction screwed plate and a tangent screw. The anterior approach was used. Following a heavy exercise, the patient experienced severe pain in the limb with functional impotence and the radiographic assessment showed a break in the implant **(Figure 5).** The patient was operated again by lateral approach with insertion of an LC-DCP screw plate. Consolidation resulted in a vicious callus with an excellent functional recovery of the shoulder and elbow **(Figure6).**

Discussion

Implant damage can be related to manufacturing defects, repeated mechanical constraints, a defect in bone reduction or a mounting with insufficient stability [6]. In the first observation, the implant damage was secondary to a reduction defect. The patient presented an A3-type fracture according to the AO for which the reduction was to ensure inter-fragmentary compression and required fixation by three bi-cortical screws on both sides of the fracture site as recommended in the osteosynthesis manuals [7]. The lack of compression observed was at the origin of the persistence of the micro movements at the level of the fracture site thus causing the fatigue of the plate and its breakage in its zone of fragility represented by the screw hole spaces. This deficiency was corrected in the patient during the new surgical intervention made one month after the loosening of the fixation. Mounting by screwed plates allows a perfect and anatomical reduction followed by a solid contention which distributes the stress forces in a balanced way on both sides of the fracture site [8]. In the second case history, the patient had not respected the immobilization time before imposing constraints on the operated limb. Ogbemudia et al reported in their study that early resumption of the limb's use before the required time would cause implant damage [9]. Thus, in its compressed mounting, the early charges aggravated by an insufficient reduction of the fracture site contributed to the damage of the implant in its zone of weakness. The patient presented in the third observation had benefited from an inappropriate mounting by a plate of small calibers less resistant to the torsion and compression stresses transmitted by the humerus. In spite of the initial anatomical reduction, the load placed on the bone will have been enough to break the plate at a postoperative delay of 6 months, thus making it possible to conclude that the implant damage could occur despite an anatomical reduction if the fixation plate does not respect the appropriate dimensions.

Conclusion

These three observations made it possible to show that the causes of implant damage in the osteosynthesis of humeral shaft fractures are multiple. We recommend a good planning in the management of these fractures, namely a rigorous selection of the plates of good caliber in thickness and length, a perfect reduction of the bone fragments in order to restore their anatomical configuration, a rigorous clinical and paraclinic follow-up of the patients and finally rehabilitation periods appropriate to each patient. All of these precautions are necessary to reduce morbidity and cost related to this implant damage.

FIGURES

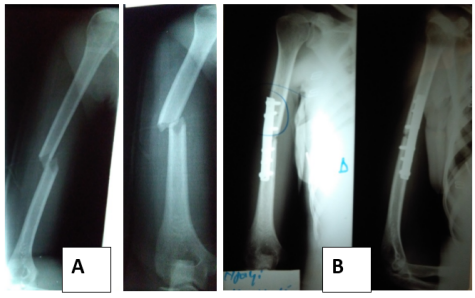

Figure 1: A Fracture 12 A3 and B Post-operatory control

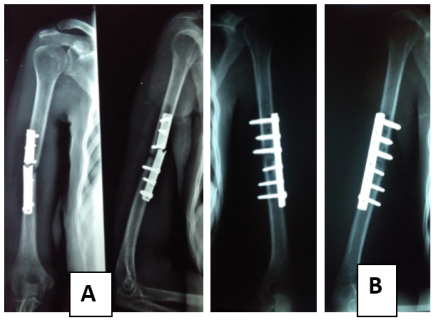

Figure 2: A, Plate breaking and B control after the re-intervention.

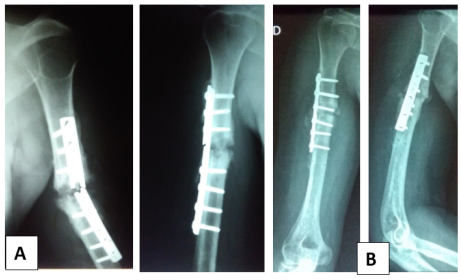

Figure 3: A Plate breaking and B X-ray control after re-intervention.

Figure 4: Clincal evolution 8 months after the surgical re-intervention.

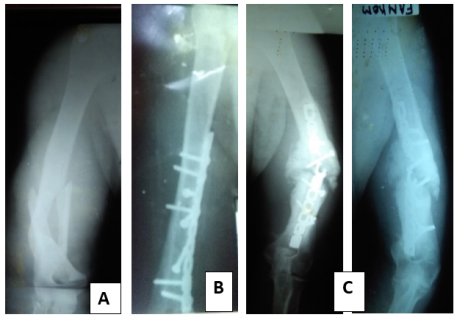

Figure 5 : A Fracture 12B2, B osteosynthesis, C Plate breaking.

Figure 6: Clinical evaluation after new osteosynthesis

REFERENCES

1. Spiguel AR, Steffner RJ. Humeral shaft fractures. Curr Rev Musculoskelet Med. 2012 Sep 8;5(3):177–83.
2. Tytherleigh-Strong G, Walls N, McQueen MM. The epidemiology of humeral shaft fractures. Bone Joint J. 1998;80-2.
3. Toivanen JAK, Nieminen J, Laine H-J, Honkonen SE, Järvinen MJ. Functional treatment of closed humeral shaft fractures.Int orthop. 2005 Fév; 29: 13-3.
4. Livani B, Belangero W, Medina G, Pimenta C, Zogaib R, Mongon M. Anterior plating as a surgical alternative in the treatment of humeral shaft non-union. Int Orthop. 2010 Oct 3;34(7):1025–31.
5. Barbosa C, do Nascimento JL, Caminha V. Premature Failure in Orthopedic Implants : Analysis of Three Different Cases. J Fail. Anal. and Preven. 2009;67–73.
6. Kumar S, Kumar D, Gill SPS, Singh P, Raj M, Gupta A. Evaluation of Implant Failure in Long Bones Fractures – A Retrospective Study. Indian J of Orthop Surg. 2014:64–8.
7. Sharma AK, Retd AK, Joshi GR, John JT. Retrospective Study of Implant Failure in Orthopaedic Surgery. Med J Armed Forces India . 2006;62(1):70–2.
8. Singh AK, Narsaria N, Seth RR, Garg S. Plate osteosynthesis of fractures of the shaft of the humerus : comparison of limited contact dynamic compression plates and locking compression plates. J Ortho Traumatol. 2014;117–22.
9. Ogbemudia AO, Umebese PFA. Implant failure in osteosynthesis of fractures of long bones. Journal of Medicine and Biomedical Research.2006;5(2):5–8.