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Mechanical Complications of Osteosynthesis: Frequency and Management at the Orthopedics-Traumatology Department of CHU Ignace DEEN

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Abstract

Introduction: Mechanical complications after osteosynthesis are spontaneous and harmful modifications of the joint compromising the consolidation process. The aim of this study is to report on the frequency of these complications and their management in the Orthopaedic-Traumatology Department of CHU Ignace Deen. **Patients and Methods:** we conducted a retrospective descriptive and analytical cross-sectional study from January 2017 to December 2022. It focused on the records of patients hospitalized and treated in the department for a mechanical complication after osteosynthesis. **Results:** The frequency of mechanical complications was 1.2%, with an average age of 44.2 years and a sex ratio of 3.2 in favor of men. Non-compliance with postoperative instructions, non-compliance with surgical technique, postoperative infection and early loading were the main contributing factors. Disassembly of the screw-plate was the most common cause in 6 cases (35.5%), with a mean delay of 4.1 months. Revision osteosynthesis was carried out using screw plates in 8 cases (47.1%). **Conclusion:** Mechanical complications of osteosynthesis are less frequent traumatic conditions in our department. Several factors contribute to their occurrence.

Keywords

Mechanical Complications, Frequency, Therapeutics, Osteosynthesis

1. Introduction

Mechanical complications after osteosynthesis are defined as any spontaneous

and harmful modification of the joint occurring during the evolution of an osteosynthesis and most likely compromising the consolidation process. Osteosynthesis has established itself as a highly effective means of fracture treatment, with the advantage of good reduction and solid stabilization of the fracture site, enabling mobilization or even weight-bearing and early consolidation [1] [2]. Despite these technical advances, mechanical complications such as dismantling of screw plates and external fixators, plate, nail and pin breakage, migration of nails and pins, displacement or breakage of surgical hardware can occur. These can lead to residual pain and permanent functional disability. They often require re-intervention [1] [3].

Mechanical complications after surgery persist in 20% of cases over a 4-year period, and may justify delayed resumption of full weight-bearing of the osteosynthesis during consolidation [4]. Diagnosis is suspected when limb deformity, protrusion of osteosynthesis hardware or functional discomfort are observed. This is confirmed by standard radiography [1].

Treatment of these complications consists of removal of the hardware, followed on a case-by-case basis by conservative treatment with a cast, correction by osteoclasty or osteotomy in the event of vicious consolidation, and then revision of the synthesis [1]. The aim of this study is to report on the frequency of these complications and their management in the Orthopedics-Traumatology Department of CHU Ignace Deen.

2. Patients and Methods

This was a cross-sectional, retrospectively collected, descriptive study lasting 6 (six) years, covering the period from January 2017 to December 2022.

We targeted the records of patients who had undergone osteosynthesis in the department. The study population consisted of records of patients presenting with a mechanical complication of osteosynthesis. We included in this study the records of patients hospitalized, treated and followed-up in the department for a mechanical complication of osteosynthesis.

Data were collected on quantitative variables (frequency, age and time to onset of complication) and qualitative variables (gender, initial lesion, bone involved, favouring factors, types of mechanical complications encountered and surgical procedures performed).

All patients underwent a complete clinical examination to identify the initial lesion, the time of onset and any factors favoring its development.

X-rays of the involved limb (face/profile) (**Table 1** and **Figure 1**) were systematically performed on all patients. This revealed the type of implant, the condition of the bone, and the type of mechanical complications (implant rupture, disassembly of the material and torsion of the osteosynthesis material, etc.).

All patients underwent spinal anaesthesia for the lower limbs and general anaesthesia for the upper limbs.

Surgical treatment was performed on a case-by-case basis. In cases of mechanical complication without infection or consolidation of the fracture site, we proceeded with removal of the hardware, decortication, fibrolysis and repermeabilization of the medullary canal. We then performed a new osteosynthesis using cancellous grafts harvested from the iliac crest. In cases of mechanical complication with infection and non-union of the focus, we removed the synthetic material, followed by collection of the pus for cytobacteriological examination and antibiotic susceptibility testing. This was followed by debridement and placement of external fixators. The osteosynthesis materials used during revision were: nails, external fixators, screw plates, plate blades and Dynamic Hip Screw (DHS) plate screws (Table 2).

After surgery, a control radiograph (Table 3 and Figure 1) was taken. Patients received antibiotics, analgesics, anticoagulants (except in cases of lesions localized to the thoracic limbs and in children) and biphosphonate for the treatment of osteoporosis.

Rehabilitation began on the third day of surgery with passive mobilization of the joints above and below the affected bone segment, followed by active mobilization as soon as pain was sedated.

Data were collected from the patients' medical records, and from operative and hospitalization logs.

With the approval of the ethics committee of CHU Ignace Deen de Conakry, Data were treated anonymously and confidentiality was respected.

All authors contributed to this work and there are no conflicts of interest.

3. Results

We compiled 1413 records of patients who had undergone osteosynthesis, including 17 cases of mechanical complications, representing a hospital frequency of 1.2%. Males were most represented in 13 cases (76.5%), with a sex ratio of 3.2. The average age of patients was 44.2 ± 15.8 years, with extremes of 11 and 71 years.

Closed fracture was the main initial lesion in 16 cases, compared with 1 case of open fracture. The initial line was comminuted in 13 cases (76.5%) versus 4 cases (23.5%) of simple line. Lesions were located on the femur in 13 cases (76.5%), followed by the tibia and humerus in 3 cases (17.6%) and 1 case (5.9%) respectively.

Table 1. Breakdown of mechanical complications by implant type.

Type of mechanical complication	Numbers	Proportion (%)
Disassembly (n = 9 cases):		
Screwed plate	6	35.2
DHS	1	5.9
DCS	1	5.9

Continued

Blade plate	1	5.9
Breakage (n = 7):		
Screwed plate	5	29.4
Blade plate	1	5.9
Pin	1	5.9
Torsion of screwed plate	1	5.9
Total	17	100

The mean time to onset of mechanical complications was 4.1 months, with extremes of 2 and 7 months. Disassembly of the screw-plate was the most common mechanical complication in 6 cases (35.2%), followed by rupture of the screw-plate in 5 cases (29.4%).

Non-compliance with postoperative instructions and non-compliance with surgical technique were the most common factors, accounting for 88.2% and 70.6% of cases respectively.

All cases of mechanical complications were reported. The most common surgical procedure was removal of the osteosynthesis material, followed by resynthesis using a screw-plate with grafts in 8 cases (47.1%).

Table 2. Breakdown of patient files according to surgical procedures performed.

Surgical procedures performed	Number	Proportion (%)
Material removal + screw-plate osteosynthesis and grafting	8	47.1
Material removal + pus removal + debridement + placement of external fixators	4	23.5
Material removal + centromedullary nail osteosynthesis	4	23.5
Material removal + DHS osteosynthesis	1	5.9
Total	17	100

Table 3. Breakdown of mechanical complications according to contributing factors.

Favoring factors	Number	Proportion (%)
Failure to follow postoperative instructions	15	88.2
Failure to follow surgical technique	12	70.6
Postoperative infection	7	41.2
Early loading	6	35.3
Inappropriate material	5	29.4
Reused implant	1	5.9
Osteoporosis	1	5.9

In the analysis of factors favoring the occurrence of mechanical complications of osteosynthesis, we found no statistically significant link.

Figure 1. (A): Fracture line persistence and Chiron plate disassembly; (B): Fracture line persistence and screw-plate rupture. (C): Control radiograph after revision osteosynthesis using external fixators; (D): Control radiograph after revision osteosynthesis using a centromedullary nail.

4. Discussion

Difficulties and limitations of this study were encountered in the retention of records, the lack of information on risk factors, but also the retrospective nature, which impacted on the result.

In relation to the frequency of mechanical complications of osteosynthesis, Morvan A *et al.* [5] in France, in 2018, recorded a frequency of 5.7% of cases. This frequency in our study could be explained by postoperative infections, early weight-bearing of the limb concerned, failure to observe the operative technique and postoperative instructions.

The average age of patients is higher than that of Gogoua DR *et al.* [2] in Ivory Cost, in 2006, who found an average age of 36 years, with extremes of 12 and 69 years. Our results show that young adults suffer trauma of all kinds.

On the subject of gender, Tépka BJD *et al.* [1] in the Central African Republic, in 2020, also observed a male predominance in their study. Our result would be justified by the fact that family responsibility forces men into early autonomy without medical advice.

According to topography, Tépka BJD *et al.* [1] in the Central African Republic in 2020 also noted a predominance of lesions in the femur, with 59.1% of cases.

This result can be explained by the fact that the lower limb is the weight-bearing limb, so any damage to it is a handicap to the patient's mobility.

Regarding the type of mechanical complication, Gogoua DR *et al.* [2] in Ivory Cost, in 2006, found disassembly and fracture of screw plates in 14 and 5 cases respectively. These results can be explained by the fact that, in children, the cortical bone is thin and, in the elderly, the bone is generally porotic, with a tendency to disassemble, whereas fracture is most often found in young adults, whose cortical bone is thick and solid. The use of unsuitable high-speed motors, blunt drills that burn the bone, and failure to use the right implant may all contribute to these complications.

In relation to their management, Essadki B *et al.* [6] in Morocco in 2000 reported that 22% of patients had a screw-retained plate. This result may be explained by the fact that the screw-retained plate is a rapid and less demanding means of synthesis than other materials.

5. Conclusion

Mechanical complications of osteosynthesis are less frequent traumatic conditions in our department. Several factors contribute to their occurrence; however, rigorous planning with respect to indications, judicious choice of synthesis material and compliance with postoperative instructions will help to avoid them.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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