

Mechanical Failure of Internal Fixation and Arthroplasty Implants in the Department of Orthopaedics and Traumatology, Bouaké University Hospital, Côte d'Ivoire

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Abstract

Objective: To describe the mechanical failures of internal fixation constructs and arthroplasty implants managed. **Materials and Methods:** We conducted a cross-sectional, descriptive observational study of all patients admitted and treated for mechanical failure of an internal fixation construct or of an arthroplasty implant between 2015 and 2025. The variables studied were the characteristics of the series and the characteristics of the mechanical failures. **Results:** Forty-three patient records were collected over the study period. The mean age was 40 ± 16 years. There were 27 men (63%). Loosening or disassembly of the fixation construct and implant breakage accounted for 53% ($n = 23$) and 30% ($n = 13$) of cases, respectively. Arthroplasty failure occurred in two cases (5%). The most frequent causes were unauthorised early weight-bearing on the lower limb ($n = 15$; 35%), comminuted fracture ($n = 7$; 16%) and unidentified causes ($n = 7$; 16%). Treatment consisted of implant removal followed by revision fixation with a screw plate ($n = 15$; 35%), a locked intramedullary nail ($n = 13$; 31%) or a sliding hip screw-plate ($n = 9$; 21%), and cemented bipolar hemiarthroplasty ($n = 2$; 5%). Five postoperative infections were recorded (11%). Among the 35 patients reviewed, the mean time to bone union was 6 ± 2 months (range 4 - 7). Both revised arthroplasties had a favourable outcome. **Conclusion:** Loosening or disassembly of the internal fixation construct was the most frequently observed mechanical failure in this series, with the femur as the predominant site. Arthroplasty failure was rare. The most frequent cause was unauthorised early weight-bearing on the lower limb.

Keywords

Arthroplasty, Mechanical Failure, Implant Loosening, Implant Breakage, Osteosynthesis

1. Introduction

1.1. Context

Mechanical failure, also termed mechanical complication, of an internal fixation construct or of an arthroplasty implant is defined as permanent deformation or breakage of the implant or of its anchorage [1]. Such complications have been recognised since internal fixation was first introduced into fracture care. Lane, cited by Pidhorz, described them as early as the beginning of the twentieth century under the heading of “screw loosening” [2]. At that time they were attributed to manufacturing defects; with the improvement of manufacturing processes and surgical techniques, such causes have become exceptional. Nevertheless, mechanical failures continue to represent, alongside postoperative infection, a major source of concern for the orthopaedic surgeon [2] [3]. The main nosological forms of mechanical failure of internal fixation devices and arthroplasty implants described in the literature [4] [5] include implant breakage or fracture, loosening or disassembly of the fixation construct, implant migration, bending, and extrusion. Mechanical failure may also result in bone fracture at the implant fixation site. In arthroplasty, mechanical complications include dislocation, fracture, or loosening of prosthetic components, as well as periprosthetic fracture. Several African studies have identified multiple contributing causes, including non-compliance with postoperative instructions, the use of unsuitable salvage implants, inappropriate surgical indications and technical errors during surgery [6], as well as early weight-bearing [7]. Others have reported migration of Küntscher nails [6] and cases of intrapelvic migration of guide wires [8].

In Côte d’Ivoire, a study conducted at Treichville University Hospital in 2017 found that plate loosening and screw extrusion were the most frequent forms of failure, and that implant failure was multifactorial, involving patient-related, fracture-related, implant-related and surgeon-related factors [5]. Mechanical complications are frequently observed in the Department of Orthopaedics and Traumatology of Bouaké University Hospital, yet no study specifically devoted to mechanical failure of internal fixation constructs and arthroplasty implants had been conducted in the department.

1.2. Objective

The objective of this study was therefore to describe the mechanical failures of internal fixation constructs and arthroplasty implants managed in the Department of Orthopaedics and Traumatology of Bouaké University Hospital.

2. Patients and Methods

2.1. Study Design, Setting and Patient Eligibility

This was a cross-sectional, descriptive observational study. It included all patients managed for mechanical failure of an internal fixation construct or of an arthroplasty implant between 2015 and 2025 in the Department of Orthopaedics and Traumatology of Bouaké University Hospital, Côte d'Ivoire.

All records of patients admitted and treated for mechanical failure of an internal fixation construct or of an arthroplasty implant were included, irrespective of the institution in which the index procedure had been performed. Recruitment was consecutive and exhaustive over the study period. Data were collected retrospectively using a standardised data collection form and were subsequently completed by face-to-face review or by telephone interview.

2.2. Study Variables

The variables studied were the characteristics of the series (age and sex) and the characteristics of the mechanical failures, namely the type of mechanical failure, the time to occurrence, the cause, the anatomical site, the treatment performed, the length of hospital stay, the complications and the time to bone union. The diagnosis was based on clinical findings (pain and functional impairment of the limb) and standard radiography, which revealed the mechanical failure.

The removal of the osteosynthesis material corresponded to a separation of the material from the bone. The hardware failure corresponded to a fracture of the implant. The fracture of the bone at the site of the osteosynthesis hardware consisted of a discontinuity in the bone occurring despite the presence of the implant. The migration of the screws and pins corresponded to a change in their location relative to the initial implantation site. Dislocation and loosening of the prosthesis involved a loss of normal contact and a disassembly of the prosthetic components. Union was defined by the absence of pain on weight-bearing and the absence of mobility at the fracture sites. Radiologically, union was defined as the formation of callus involving at least three out of four cortices [9]. The favorable clinical course corresponded to the patient's recovery without the occurrence of complications.

2.3. Statistical Analysis

Quantitative variables are expressed as means $\pm$ standard deviation with the range in parentheses. Qualitative variables are expressed as absolute frequencies and percentages. The analysis was purely descriptive; no inferential testing was performed, in keeping with the descriptive design of the study.

2.4. Ethical Considerations

The study was conducted in accordance with prevailing ethical standards. Anonymity and confidentiality of patient information were maintained throughout. Authorisation was obtained from the scientific and medical directorate of the hos-

pital. The reporting of this study was guided by the STROBE recommendations for observational research [10].

3. Results

3.1. Characteristics of the Series

Forty-three patient records were collected over the study period. The mean age was 40 ± 16 years (range 17 - 83). There were 27 men (63%) and 16 women (37%), giving a sex ratio of 1.7.

3.2. Characteristics of the Mechanical Failures

The mean time to occurrence of mechanical failure was 75 ± 37 days (range 35 - 120). The distribution of the various types of mechanical failure is summarised in **Table 1** (**Figure 1**). The distribution of patients according to the cause of failure is summarised in **Table 2**.



Figure 1. Radiograph showing mechanical failure (A, B). A: radiograph of the arm showing plate breakage following humeral osteosynthesis; B: radiograph of the thigh showing breakage of the intramedullary nail.

Table 1. Distribution of mechanical failures by type of failure and implant.

Type of mechanical failure	n	%
Loosening/disassembly of the fixation construct	23	53
Screw plate	(14)	33
Sliding hip screw-plate	(5)	12
Intramedullary nail	(3)	7
K-wire	1	2
Breakage of the fixation implant	13	30

Continued

Locked intramedullary nail	(8)	19
Screw plate	(4)	9
Sliding hip screw-plate	(1)	2
Fracture of the bone at the implant site	3	7
Screw plate	(1)	2
Locked intramedullary nail	(2)	5
Migration of the fixation implant	2	5
K-wire	(1)	2
Screw	(1)	2
Dislocation and loosening of bipolar hip hemiarthroplasty	1	2
Periprosthetic fracture of the hip	1	2
Total	43	100

Percentages are rounded to the nearest whole number and therefore may not sum exactly to the subtotal shown.

Table 2. Distribution of patients according to the cause of mechanical failure.

Etiology	n	%
Unauthorised early weight-bearing on the lower limb	15	35
Comminuted fracture	7	16
Cause not identified	7	16
Early mobilisation of the upper limb	6	14
Surgical technique (biomechanically unsound construct)	5	12
Trauma (fall on the operated limb)	3	7
Total	43	100

Unauthorized early weight-bearing on the lower limb was suspected when weight-bearing occurred prior to authorization for full weight-bearing. The radiological analysis highlighted a non-biomechanical construct that failed to adhere to the principles of osteosynthesis

The distribution of mechanical failures according to anatomical site is summarised in **Table 3**. The distribution of patients according to the treatment performed is summarised in **Table 4**.

3.3. Length of Stay, Complications and Outcome

The mean length of hospital stay was 10 ± 3 days (range 5 - 20). Five postoperative infections were recorded, corresponding to 11% of the series. The postoperative infection occurred on the mean of 15 days, and the infection was superficial. Among the 35 patients who attended follow-up review, the mean time to bone union was 6 ± 2 months (range 4 - 7). Both revised arthroplasties had a favourable clinical course.

Table 3. Distribution of mechanical failures according to anatomical site.

Anatomical site	Loosening	Breakage	Bone fracture at implant	Migration	Total
Shoulder (clavicle)	-	-	-	1	1
Arm	5	-	-	-	5
Forearm	2	-	1	-	3
Hip	1	-	1	-	2
Thigh	12	12	2	-	26
Knee (patella)	1	-	-	-	1
Leg	2	2	-	-	4
Ankle	-	-	-	1	1
Total	23	14	4	2	43

The two arthroplasty failures (one dislocation with loosening of a bipolar hip hemiarthroplasty and one periprosthetic fracture of the hip) are not tabulated here, as this table relates to internal fixation.

Table 4. Distribution of patients according to the treatment performed.

Treatment	n	%
Removal of screw plate + revision fixation with screw plate	19	35
Removal of nail + revision fixation with locked intramedullary nail	13	31
Removal of sliding hip screw-plate + revision fixation with sliding hip screw-plate	6	21
Removal of prosthesis + revision with cemented bipolar hemiarthroplasty	2	5
Removal of K-wire + drainage	1	2
Removal of K-wire and steel wire + tension-band wiring	1	2
Removal of arthrodesis screw	1	2
Total	43	100

4. Discussion

The objective of this study was to describe the mechanical failures of internal fixation constructs and arthroplasty implants managed in the Department of Orthopaedics and Traumatology of Bouaké University Hospital. The study showed that loosening or disassembly of the internal fixation construct was the most frequently observed mechanical failure, with the femur as the predominant site. Arthroplasty failure was rare. The most frequent cause was unauthorised early weight-bearing on the lower limb. Treatment consisted predominantly of implant removal followed by revision fixation with a screw plate. Both arthroplasties were revised using cemented implants, and the clinical course was favourable in most patients.

The mean time to occurrence of failure was 75 ± 37 days (range 35 - 120), indicating that most events occurred within two to four months of the index procedure. The wide dispersion of this interval reflects the possibility of failures occurring either very early or several months after surgery, as previously reported [4] [7].

Loosening or disassembly of the fixation construct was the most frequent complication in this series (53%), in agreement with the findings of Essadki *et al.* [11]. This mode of failure generally occurs when fixation is insufficiently stable or when the construct is exposed to premature mechanical loading [4] [7] [11]. Implant breakage was the second most frequent complication (30%) and is commonly attributed to material fatigue or mechanical overload [11]. The remaining complications comprised fracture of the bone at the implant site (7%) and implant migration (5%), which may result from suboptimal initial implant positioning or from inadequate bone healing. All of these modes of failure have been documented in the African literature [4] [5] [7] [10].

In the present series, 44% of failures involved screw plates. Mujinga *et al.* [7] similarly reported that postoperative complications followed screw-plate fixation in 51.8% of their patients. Arthroplasty failure was rare in our series (n = 2; 5%), which is largely explained by the small number of arthroplasties performed in the department. In the African literature, arthroplasty complications remain comparatively under-reported; when they do occur, they are dominated by aseptic loosening, dislocation and wear of the prosthetic components. In their series of total hip arthroplasty revisions in Morocco, Essadki *et al.* [12] found aseptic loosening and infection to be the most frequent indications for revision, frequently requiring prosthetic exchange or revision surgery.

Unauthorised early weight-bearing on the lower limb was the most frequent cause of failure, accounting for 35% of cases. Premature loading may compromise the stability of the bone-implant interface and jeopardise union. Comminuted fractures were the second most frequent cause (16%), which is explained by the intrinsic difficulty of achieving stable fixation of multiple bone fragments. Comparable findings have been reported by other authors [5] [6] [10] [13].

The femur was the site of the majority of complications, with a frequency of 60%. This predominance is explained by the fact that the femur is a major long bone subjected to substantial mechanical and weight-bearing loads, which renders it more vulnerable to complications after internal fixation. Our findings are consistent with those reported in the literature [5] [6] [13]-[17] and confirm that the femur, by virtue of its structure and its functional role, is particularly exposed to implant-related mechanical complications [14] [15].

In this series, revision fixation with a screw plate was performed in 35% of patients. This proportion reflects the selection of patients requiring surgical stabilisation appropriate to the severity and location of the fracture [11]. Removal of the failed implant was necessary in the great majority of cases, which underlines that postoperative management of implants, including their removal, is a frequent requirement and is often dictated by mechanical complications or by the state of bone healing. These findings highlight the importance of rigorous postoperative follow-up in order to prevent and effectively manage implant-related complications [6] [11].

The two failed arthroplasties were revised by exchange to a cemented-stem prosthesis, a technique frequently indicated in cases of prosthetic loosening or failure

[18] [19]. Similar results have been reported in the literature, notably by Schwarzkopf *et al.* [20], who emphasise that revision using a cemented stem represents a reliable option for restoring prosthetic stability in hip arthroplasty revision.

The mean length of hospital stay was 10 ± 3 days (range 5 - 20), and the mean time to bone union among the 35 patients reviewed was 6 ± 2 months (range 4 - 7). These figures reflect the complexity of the fractures treated and the need for rigorous postoperative surveillance. Tekpa *et al.* [6] reported a shorter time to union, of 30 to 90 days, probably related to less complex fracture patterns or to differences in management protocols.

Strengths and Limitations

The main strengths of this study are the ten-year study period and the consecutive, exhaustive recruitment of all patients managed for mechanical implant failure in the department. Several limitations should nevertheless be acknowledged. First, the retrospective and single-centre design limits the generalisability of the findings and exposes the study to information bias, as illustrated by the 16% of cases in which no cause could be identified. Second, because the index procedure had been performed in another institution in a proportion of patients, the total number of procedures at risk was not available; consequently the true incidence of mechanical failure could not be calculated, and only the relative distribution of failure types is reported. Third, eight of the 43 patients were lost to follow-up before union was documented, which may have led to an underestimation of late complications. Finally, the descriptive design precludes any analysis of risk factors.

5. Conclusions

Loosening or disassembly of the internal fixation construct was the most frequently observed mechanical failure in this series, with the femur as the predominant site. Arthroplasty failure was rare. The most frequent cause was unauthorised early weight-bearing on the lower limb. Treatment consisted predominantly of implant removal followed by revision fixation with a screw plate, and both failed arthroplasties were revised using cemented implants. The clinical course was favourable in most patients.

These findings suggest that a substantial proportion of mechanical failures in this setting is potentially preventable through biomechanically sound implant selection and construct design, and through rigorous patient education regarding postoperative weight-bearing restrictions. Future work should take the form of a prospective, multicentre study incorporating an analysis of risk factors, with the aim of reducing the burden of this complication.

Ethical Approval and Consent to Participate

The study was conducted in accordance with prevailing ethical standards, and authorisation was obtained from the scientific and medical directorate of Bouaké University Hospital. Patient anonymity and confidentiality were maintained

throughout.

Author Contributions

All authors contributed to the design of the study, the acquisition and interpretation of the data, and the drafting and critical revision of the manuscript. All authors read and approved the final version.

Conflicts of Interest

The authors declare that they have no competing interests.

References

- [1] Burny, F., Bourgois, R. and Lemaire, L. (1974) Failure of the Osteosynthesis Material: Implication of the Implant. *Acta Orthopaedica Belgica*, **37**, 846-860.
- [2] Hunter, S.G. (1982) The Migration of Femoral Küntscher Nails: A Clinical Study. *Injury*, **13**, 460-463. [https://doi.org/10.1016/0020-1383\(82\)90159-0](https://doi.org/10.1016/0020-1383(82)90159-0)
- [3] Müller, M.E. (1976) Pitfalls of Internal Fixation [Pièges de l'ostéosynthèse]. *Conférences d'Enseignement de la SOFCOT*, **6**, 95-113.
- [4] Moyikoua, A. and Pena-Pitra, B. (1993) Mechanical Complications of Osteosynthesis of the Lower Limb: Analysis of 22 Cases. *Medecine d'Afrique noire*, **40**, 509-515.
- [5] Traore, M., Gogoua, R., Kouame, M., Yepie, A., Anoumou, M. and Varango, G. (2017) Mechanical Complications after Limb Osteosynthesis: Analysis of Etiologic Factors in 42 Cases. *Open Journal of Orthopedics*, **7**, 43-52. <https://doi.org/10.4236/ojo.2017.72006>
- [6] Tekpa, B.J.D., Yafondo, T.A., Nguena-Yamalet, U., Issa-Mapouka, A., Fassioni, E., et al. (2020) Mechanical Complications of Osteosynthesis in a Developing Country: Frequency and Risk Factors. *International Journal of Musculoskeletal Disorders*, **4**, 1-7.
- [7] Mujinga, I.M.W., Ilunga, G.N., Baba, A.L.A., Mukakala, A.K., Kitoko, H.T., Ntanga, D.I., et al. (2024) Surgical Revision of Limb Osteosynthesis at the University Clinics of Lubumbashi: Epidemiological, Clinical, Aetiological, Therapeutic and Outcome Features. *Revue Africaine de Médecine et de Santé Publique*, **7**, 182-204.
- [8] Mudiangombe, N., Mbodji, M., Jalloh, M., Kabeya, Y., Kyungu, Y., Diagne, S., et al. (2023) Migration pelvienne d'une broche guide au cours d'une ostéosynthèse pour fracture de la hanche: À propos de 2 cas. *African Urology*, **3**, 184-185. <https://doi.org/10.36303/auj.0114>
- [9] Ware, J.E., Kosinski, M. and Keller, S.D. (1996) A 12-Item Short-Form Health Survey: Construction of Scales and Preliminary Test of Reliability and Validity. *Medical Care*, **34**, 220-233. <https://doi.org/10.1097/00005650-199603000-00003>
- [10] Sheffler, L.C., Yoo, B., Bhandari, M. and Ferguson, T. (2013) Observational Studies in Orthopaedic Surgery: The STROBE Statement as a Tool for Transparent Reporting. *Journal of Bone and Joint Surgery*, **95**, e14. <https://doi.org/10.2106/jbjs.l.00484>
- [11] Essadki, B. and Lamine, A. (2000) The Aseptic Mechanical Complications of Fractures of the Femoral Diaphysis Treated by Screwed Plates. *Acta Orthopaedica Belgica*, **66**, 61-68.
- [12] Essadki, B., Largab, A., El Ibrahim, A. and Elmrini, A. (2003) Revision of Total Hip Arthroplasty: A Series of 60 Cases. *Revue de Chirurgie Orthopédique et Réparatrice*

de l'Appareil Moteur, **89**, 553-560.

- [13] Ibrahimou, T.K., Ibrahimou, B., Makekita, W.N. and Mudimisi, M. (2016) The Mechanical Complications of Centromedullary Nailing of the Femur in a Precarious Environment: Report of Six Observations at N'Djili Hospital, Kinshasa. *Revue médicale des Grands Lacs*, **5**, 96-103.
- [14] Gogoua, D., Touré, S., Anoumou, M., Kouamé, M., Koné, B. and Varango, G. (2006) Mechanical Complications of Osteosynthesis of Limb Fractures: An Epidemiological Analysis of 26 Observations. *Mali Médical*, **21**, 5-9.
- [15] Loubignac, F. and Chabas, J.F. (2009) A Newly Designed Locked Intramedullary Nail for Trochanteric Hip Fractures Fixation: Results of the First 100 Trochanteric™ Implantations. *Orthopaedics & Traumatology: Surgery & Research*, **95**, 139-144.
<https://doi.org/10.1016/j.otsr.2009.01.002>
- [16] Batchom, A.D., Nana, C.T., Arabo, S. and Handy Eoné, D. (2021) Mechanical Failure of Osteosynthesis Using Nails, Plates and Blade Plates at Laquintinie Hospital, Douala. *La Revue de Médecine et de Pharmacie de Douala*, **11**, 1321-1325.
<https://www.ajol.info/index.php/rmp/article/view/229205>
- [17] W'Ifongo, W., Lembalemba, B., Kalokola, L. and Afelokoky, E. (2014) Nail Migration and Bending, Two Complications of Centromedullary Nailing of the Femur: A Case Observed at the University Clinics of Kisangani, Democratic Republic of the Congo. *Kisangani Médical*, **5**, 104-108.
- [18] Parvizi, J., Rapuri, V.R., Purtill, J.J., Sharkey, P.F., Hozack, W.J. and Rothman, R.H. (2004) Treatment Protocol for Infected Total Hip Arthroplasty. *The Journal of Bone and Joint Surgery—American Volume*, **86**, 134-143.
- [19] Ramaniraka, N.A., Rakotomanana, L.R. and Leyvraz, P.F. (2000) The Fixation of the Cemented Femoral Component: Effects of Stem Stiffness, Cement Thickness and Roughness of the Cement-Bone Surface. *The Journal of Bone and Joint Surgery—British Volume*, **82**, 297-303.
- [20] Schwarzkopf, R., Oni, J.K. and Marwin, S.E. (2014) Total Hip Arthroplasty Revision: Current Concepts. *Orthopedic Clinics of North America*, **45**, 257-268.