SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

OPEN ACCESS

Orthopedics-Traumatology

Bimalleolar Fractures in Adults: Epidemiological and Therapeutic Aspects at Kati University Hospital Center

Mohamed Berthé[1,2*], Cheick O Sanogo[1], Aboubacar Diallo[1], Kalifa Coulibaly[1], Abdoulaye Traoré[1], Ousmane B Traoré[3], Ibrahim Abdou[1], Soumana Traoré[1], Fadjougou Keita[2], Abdoul K Moussa[4], Layes Touré[1]

[1]Orthopedics-Traumatology Department of Kati University Hospital Center - Mali
[2]Sport Medicine Center (CMS-LT) Bamako - Mali
[3]Orthopedics-Traumatology Department of Kayes Hospital – Mali
[4]Orthopedics-Traumatology Department of Gabriel Touré University Hospital Center - Mali

DOI: https://doi.org/10.36347/sasjs.2024.v10i10.011 | **Received:** 02.09.2024 | **Accepted:** 09.10.2024 | **Published:** 14.10.2024

***Corresponding author:** Mohamed Berthé
Orthopedics-Traumatology Department of Kati University Hospital Center - Mali

Abstract **Original Research Article**

The aim of this work was to study the epidemiological and therapeutic aspects of bimalleolar fractures in the Orthopedics-Traumatology Department of the Kati University Hospital Center. This was a descriptive retrospective study of a series of 63 recent bimalleolar fractures collected between June 1, 2016 and May 31, 2019. The mean age of the patients was 40.68±14.32 years with extremes of 18 and 75 years. The age group of 21 to 40 years was the most affected with 50.8% of cases. Male sex was predominant (sex ratio: 2). Road accidents and domestic accidents (falls) were the main etiologies of these fractures. Weber's C-Type was predominant with 49.2%. Fractures were open in 25.3% of cases. Treatment was surgical (66.7%) or orthopedic (33.3%). K-wire was the most used implant for both the lateral malleolus (28 cases) and the medial malleolus (19 cases). The evolution was favourable in 64 cases (62.74%). Infection was the most common secondary complication (9.5%). Overall algofunctional outcomes were good in 84.3%. Bimalleolar fractures are frequent and severe traumatic injuries. Their treatment should restore the anatomy and function of the ankle and prevent the harmful occurrence of complications.

Keywords: Bimalleolar Fractures, Adult, CHU-Kati.

INTRODUCTION

Bimalleolar fractures are common traumatic injuries. They must be considered not as simple fractures but as extensive osteoarticular lesions that do not admit of any anatomical imperfection. These are serious injuries that can seriously impair the function of the ankle and lead to major disability. Their care is now well codified. Although it is much more surgical, orthopedic treatment has some indications, especially in countries with limited resources.

The aim of this work was to study the epidemiological and therapeutic aspects of bimalleolar fractures in the Orthopedics-Traumatology Department of the Kati University Hospital Center.

METHODOLOGY

This study was retrospective descriptive on a series of 63 recent bimalleolar fractures in 63 patients treated in the Orthopedics-Traumatology Department of the Kati University Hospital Center. It extends over 03 years from June 1, 2016 to May 31, 2019. All patients treated during the study period for recent bimalleolar fractures (less than 3 weeks) with a follow-up period greater than or equal to one year were included. Patients with ankle fractures with predominant distal tibial involvement, patients with unimalleolar fracture (medial or lateral), and patients lost to follow-up were not included in this study. (Figure 1)

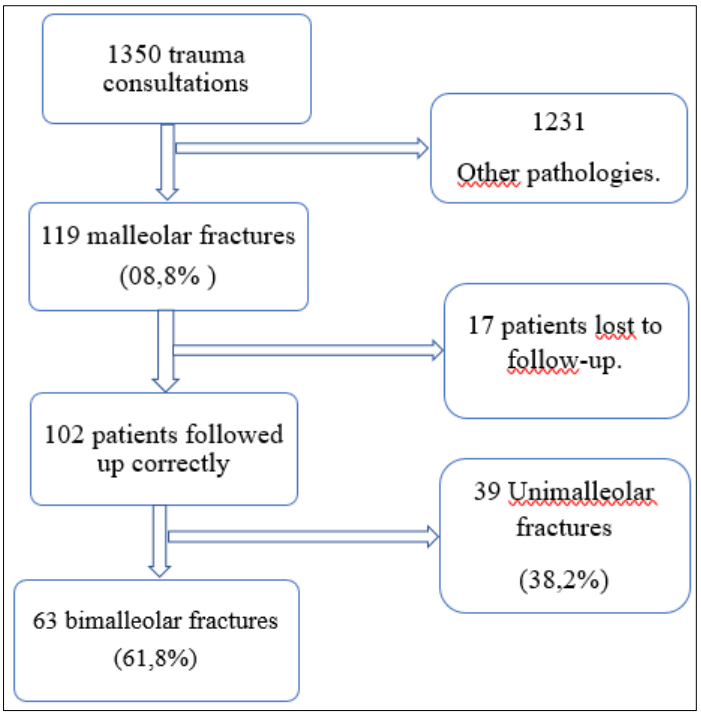

Figure 1: Flow chart of bimalleolar fractures of study

The clinical examination coupled with the standard X-ray of the ankle in two incidences (face and profile) made it possible to make the diagnosis and determine the associated lesions. Fractures were classified according to Weber and skin opening according to Gustillo and Andersonn. The therapeutic indications were defined according to the type of fracture, the extent of the displacement and the associated lesions. The treatment was orthopedic or surgical supplemented by rehabilitation. Orthopedic treatment used two modes of stabilization after reduction, represented by the cruropedic plaster cast and the plaster boot. In addition to clinical monitoring, an X-ray check was carried out on D7, D14 and D21 to detect any secondary displacement. For surgical treatment, locoregional anesthesia was used in all patients. The installation was dorsal decubitus with a pneumatic tourniquet on the ipsilateral thigh. Open fractures were treated urgently and closed fractures were delayed. Treatment of open fractures included careful debridement, reduction of foci, and fixation most often with brooches. Patients were evaluated according to the anatomical criteria of Lecestre and Ramadier [1], and the algofunctional criteria of Kitaoka [2]. A minimum of one year of follow-up was necessary to evaluate the results. Data on age, sex, etiologies, anatomopathological aspects, therapeutic and evolutionary aspects were collected. These data were analyzed using SPSS v20-32bit2 software in the following steps: coding of variables, computer input, statistical analysis of the data, and tabling to summarize the results. The significance threshold was set for p-value below 0.05. Statistical analyses were performed with a 95% confidence interval.

Ethical considerations: This study was conducted in accordance with the protocol of good clinical practice and the principles of the Declaration of Helsinki. The investigators observed total anonymity of the information obtained during the study.

RESULTS

The mean age of the patients was 40.68±14.32 years with extremes of 18 and 75 years. The age group of 21 to 40 years was the most affected with 50.8% of cases. Male sex was predominant (sex ratio = 2). Bimalleolar fractures concerned the right ankle in 50.8% and the left ankle in 49.2%. The circumstances of occurrence are summarized in Table I.

Table 1: Etiologies of bimalleolar fractures.

Etiologies	Number	Percentage
Road accident	42	66,6
Domestic accident (fall)	15	23,8
Work accident	02	03,2
Sports accident	02	03,2
Brawl	02	03,2
Total	63	100,0

According to Weber's classification, the fractures were C-type (49.2%), B-type (34.9%) and A-type (15.9%). Open fractures accounted for 25.3% of cases. According to Gustillo and Andersonn, they were divided into 11.1% type II; 07.9% type I and 06.3% type IIIA. Other associated lesions included fracture of the posterior malleolar (07 cases), distal tibiofibular diastasis (21 cases), talocrural dislocation (07 cases), and osteochondral lesions (03 cases). The mean time before consultation was 107.87 hours with extremes of 0.5 to 504 hours. Nineteen percent of patients have used traditional treatment before being admitted to our department. The mean time before treatment was 66.22±86.92 hours. Treatment was surgical (66.7%) or orthopaedic (33.3%). The orthopedic method of stabilization were cruropedious plaster (20.6%) and plastered boot (12.7%). Surgical fixation of the lateral malleolus was provided by screw-in plate (27.0%) or brooch (38.1%). The surgical fixation method of the medial malleolus are summarized in Table II.

Table II: fixation method of the medial malleolus

Fixation method	Number	Percentage
Screwing	08	12,7
K-wire fixation	16	25,4
Screwing and pinning	02	03,2
Haubannage	15	23,8
Other	01	01,6
Total	42	66,7

Other: Tibiopedious exofixation

Additional surgical procedures included temporary syndesmodesis (05 cases) and screwing of the posterior malleolar (01 cases). The mean time to immobilization was 5.61±2.75 weeks, Extremes of 2 and 16 weeks. The mean time to support was 14.59 ± 5.86 weeks with extremes of 7 and 35 weeks. Rehabilitation was prescribed in all patients. She was assisted by a physiotherapist in 28.6%. Secondary complications were represented by infection (9.5%), skin necrosis (4.8%) and secondary displacement (1.6%). In the late stage, there was limitation of ankle amplitudes (15.9%), algodystrophy (7.9%), migration of osteosynthesis material (3.2%), nonunion of the medial malleolus (1.6%) and vicious callus of the lateral malleolus (1.6%). The results according to the Lecestre and Ramadier criteria were good (82.5%), fair (14.3%) or poor (3.2%). Kitaoka's average score was 81.25±16.67. Algofunctional outcomes were good (77.8%), fair (15.9%), or poor (6.3%).

Figure 2: Bimalleolar fracture of the left ankle
A: X-rays of the knee and ankle objectifying the fracture;
B: X-ray at postoperative day 1;
C: X-ray showing consolidation;
D: X-ray after removal of osteosynthesis material;
E: Clinical appearance of the ankle.

DISCUSSION

Bimalleolar fractures are very common. They represent 9% of fractures and affect 187/100000 people per year [1, 2]. Our study reports 8.8% malleolar fractures, of which 61.8% were bimalleolar and regularly monitored. A predominance of the male sex was found (sex ratio = 2). This male predominance is reported by several studies [5-8]. However, other studies report a predominance of women, particularly in elderly patients [9, 10]. The mean age of the patients was 40.68±14.32 years. Young workers between the ages of 21 and 40 were particularly affected, accounting for more than half of the cases (50.8%). This could be explained by the physical and professional activities of this age group which expose him to etiological circumstances. Bimalleolar fractures affected both the left and right ankles with 49.2% and 50.8% respectively. Y. Asloum *et al*., [7], and Zhongbing L. *et al*., [8], found a predominant involvement of the right side in 54.93% and 62.35%, respectively. Road traffic accidents, falls, and sports accidents represent the main etiologies of malleolar fractures [9, 10]. Our study, like that of Ahmad Hafiz Z [5], found a predominance of road traffic accidents. However, in France, Y. Asloum *et al*., [7], found a

predominance of domestic accidents and sports accidents. A predominance of Weber's C- type fractures was found with 49.2%, followed by type B fractures in 34.9% of cases. This predominance of Weber's C-type was also found by Ahmad Hafiz *et al*., [5], in 64% and F Raherinantenaina *et al*., [11], in 60%. On the other hand, P. Maisongrosse *et al*., [13], in a study of 45 cases in the elderly reported 36 Weber's B-type, i.e. 80% of cases. Syndesmosis involvement was found in 20.58% of cases. F. Raherinantenaina *et al*., [11], in a study of 100 cases in Madagascar found 13% tibiofibular syndesmosis lesions. Osteochondral lesion was found in 3 cases. This lesion could have been underestimated because of its often not easy diagnosis on standard X-rays and the almost total absence of CT scanning. Several lesions were associated with bimalleolar fractures. This could be due to the violence of the trauma. There were 7 fractures of the posterior malleolar (6.86%). The incidence of this lesion varies between 7 and 44% depending on the study [14]. Fractures were open in 25.3% with a predominance of Gustillo and Andersonn type II (11.1%). O J Ogundele *et al*., [15], observed 30% open fractures. The predominance of type II is also reported by P. Maisongrosse *et al*., [13].

The treatment of choice for bimalleolar fractures remains surgical. Nevertheless, orthopedic treatment retains some indications [16, 17]. In addition, orthopedic treatment is compatible with good long-term clinical and anatomical results despite malleolar reduction defects, thanks to mechanisms for correcting the various intrafocal imperfections. In our context, the lack of financial means, the apprehension for surgery and the clinical condition of some patients were the factors motivating orthopedic treatment. Open, reduction and internal fixation (ORIF) is the treatment of choice for displaced or unstable bimalleolar fractures [7-15]. It aims to obtain an anatomical reduction and maintain it with a stable assembly in order to consider rehabilitation as early as possible [15-18]. The lateral malleolus is important for ankle stability [19]. If its osteosynthesis by nail has the advantages of a minimally invasive percutaneous technique (reducing the risk of cutaneous complications) and stable fixation [7], open osteosynthesis by plate remains the reference treatment [7-16]. Surgical treatment was predominant (66.7%) in our study. K-wire was the most used implant for both the lateral malleolus (28 cases) and the medial malleolus (19 cases). This could be explained by the fact that it is less expensive, easily accessible and easy to bone fixation [17]. There is no consensus on the method of treatment of syndesmosis injuries. For some authors, it is recommended to reduce and fix the lateral malleolus and the medial malleolus first and to look for a diastasis on the X-ray. Fixation of the syndesmosis is necessary if the diastasis is greater than 3 or 4 mm and the screw is removed between 3 and 6 weeks [6-16]. For others, ligament injuries of the syndesmosis occurring in the context of malleolar pinch injuries do not require any special treatment. Indeed, due to the integrity of the interosseous membrane upstream of the bony focus, the exact osteosynthesis of the latter places the fibula in a good position in the fibular notch and the tibiofibular ligaments in the best conditions for healing. The observation during surgery of a radiographic widening of the syndesmosis justifies not the implantation of a syndesmotic screw which only accentuates the conflict but a resumption of the reduction of the fibular focus [20]. In our study, a temporary syndesmotic procedure of 3 weeks was performed in 5 cases. Treatment of posterior malleolus fracture is controversial [20, 21]. Fixation of fragments involving less than 5% to 10% of the articular surface is technically demanding, with the possibility of crushing them by screws or plate [22]. Open fractures accounted for 25.3% of cases. They are an absolute emergency, and cannot tolerate any delay. Debridement was performed urgently in all our patients with an open fracture. This debridement was followed by reduction and stabilization of the site. Functional rehabilitation was prescribed for all patients. This is an essential step in treatment that allows for a mobile ankle and prevents trophic disorders. The mean duration of immobilization was 5.61 ± 2.75 weeks with extremes of 2 and 16 weeks. This prolonged duration could be explained by the frequency of orthopedic treatment in our study. The mean time to full support was 14.59 ± 5.86 weeks with extremes of 7 and 35 weeks. For Felts E., the early resumption of support using a walking boot seems to have a beneficial effect without risk of displacement or delayed consolidation [23].

The evolution was favorable in 64 cases (62.74%). This result is similar to those of A. Macera *et al*., [24], and Y. Asloum *et al*., [7], who found an outcome without complications in 64% (n=) and 66.67% (n=40) respectively. Infection was the most frequent early complication. It resolved spontaneously under probabilistic antibiotic therapy (4 cases) or targeted antibiotic therapy (3 cases). It is a serious complication that has been reported by several authors in different proportions depending on the series [5-24]. S. Krissian reports that infection varies from 1 to 48% depending on the studies and has a poor prognosis after surgical treatment [25]. This requires rigor in its prevention. Skin necrosis reported by Y. Asloum *et al*., [7], in 9 cases (15%) was present in 3 of our patients. It was treated with local care until healing. A secondary displacement under plaster was noted on D15 and required a revision under scopic control. Yao LB *et al*., [17], did not find any displacement under plaster. No cases of thrombophlebitis were found in our study. This complication has been reported by some studies. [6, 26]. Residual pain was found in 11 cases (10.78%). This result is lower than that of A. Macera *et al*., [24], who found residual pain in 17.2% of patients. The management of this pain involved not only analgesics but also physiotherapy. This physiotherapy improved ankle mobility in patients with stiffness. Algodystrophy was present in 5 patients (4.90%). This complex syndrome was also reported by Y. Asloum *et al*., [7], in 7 (11.67%)

and S. Steinmetz *et al*., [6], in 12 cases (9.52%). Two cases of hardware recoil that did not prevent consolidation, a pseudarthrosis of the medial malleolus and a vicious malunion were also found. These complications, although rare, are found in the literature [7-24]. The management of this pain involved not only analgesics but also physiotherapy. This physiotherapy has improved ankle mobility in patients with stiffness. Algodystrophy was present in 5 patients (4.90%). This complex syndrome has also been reported by Y. Asloum *et al*., [7], in 7 cases (11.67%) and S. Steinmetz *et al*., [6], in 12 cases (9.52%). Two cases of recoil of the material did not prevent consolidation, a nonunion of the medial malleolus and a vicious callus were also found. These complications, although rare, are found in the literature [7-24].

The mean Kitaoka score was 81.25±16.6 points. This result is comparable to that of Y. Asloum *et al.*, [7], who had a mean score of 88.62 +/-17.06. It is lower than that of E. Dahan *et al.*, [27], who found a mean Kitaoka score of 90/100 at 3 months. Our overall algofunctional results were good in 84.32%. This rate can be superimposable to those in the literature [5-17], even if other criteria were used. Indeed, almost all the criteria use the same items but with different ratings.

CONCLUSION

This study shows that bimalleolar fractures are frequent traumatic injuries, particularly in young adult males. They are serious because they can compromise ankle function. Their treatment, whether orthopaedic or surgical, must lead to a perfect anatomical reconstruction of the talocrural joint in order to prevent the harmful occurrence of complications. Rehabilitation remains a crucial therapeutic complement and is the best guarantee of a good functional result.

Conflict of Interest : None

REFERENCES

1. Lecestre, P., & Ramadier, J. O. (1976). Les fractures bimalléolaires et leurs équivalents. *Rev Chir Orthop*, *62*, 71-89.
2. Kitaoka, H. B. (1991). Salvage of nonunion following ankle arthrodesis for failed total ankle arthroplasty. *Clinical Orthopaedics and Related Research (1976-2007)*, *268*, 37-43.
3. Peuchot, H., Falguières, J., Cermolacce, M., Le Baron, M., & Flecher, X. (2022). Reprise d'appui total après ostéosynthèse des fractures bi-malléolaires par plaques anatomiques verrouillées. *Revue de Chirurgie Orthopédique et Traumatologique*, *108*(7), 898-903.
4. Seewoonarain, S., Prempeh, M., Shakokani, M., & Magan, A. (2016). Ankle fractures: Review article. *J Arthritis*, *5*, 188. Doi: 10.4172/2167-7921.1000188
5. Ahmad Hafiz, Z., Nazri, M. Y., Azril, M. A., Kassim, N. A., Nordin, N., & Daraup, S. N. (2011). Premchandran. Ankle fractures. *Malaysian Orthopaedic Journal*, *5*(1), 43.
6. Steinmetz, S., Puliero, B., Brinkert, D., Meyer, N., Adam, P., Bonnomet, F., & Ehlinger, M. (2016). Tibiofibular syndesmosis injuries treated with temporary screw fixation and ligament suture. *Orthopaedic and Traumatological Surgery Review* , *102* (8), 756-761.
7. Asloum, Y., Bedin, B., Roger, T., Charissoux, JL, Arnaud, JP, & Mabit, C. (2014). Fibula osteosynthesis in ankle fractures. Prospective, randomized, comparative study: plate versus nail. *Orthopedic and Trauma Surgery Review* , *100* (4), S51-S55.
8. Liu, Z., Tang, G., Guo, S., Cai, B., & Li, Q. (2020). Therapeutic effects of internal fixation with support plates and cannulated screws via the posterolateral approach on supination external rotation stage IV ankle fracture. *Pakistan journal of medical sciences*, *36*(3), 438.
9. Juto, H., Nilsson, H., & Morberg, P. (2018). Epidemiology of adult ankle fractures: 1756 cases identified in Norrbotten County during 2009–2013 and classified according to AO/OTA. *BMC musculoskeletal disorders*, *19*, 1-9.
10. Gauthé, R., Desseaux, A., Rony, L., Tarissi, N., & Dujardin, F. (2016). Bimalleolar fractures in the elderly: treatment and results in a series of 477 cases. *Revue de Chirurgie Orthopédique et Traumatologique* , *102* (4), S38-S41.
11. Raherinantenaina, F., Ralahy, MF, Rabemazava, A., Rambel, AH, RAJAONANAHARY, TA, & Solofomalala, GD (2012). Bimalleolar fractures seen at the Joseph Ravoahangy Andrianavalona University Hospital. *Black African Medicine* , *59* (6), 327-335.
12. Robertson, G. A., Wood, A. M., Aitken, S. A., & Court Brown, C. (2014). Epidemiology, management, and outcome of sport-related ankle fractures in a standard UK population. *Foot & ankle international*, *35*(11), 1143-1152.
13. Paul Maisongrosse, Régis Pailhé, Lionel Wasser, Sébastien Chapuis, Nicolas Bonnevialle, Pierre Mansat. fractures bi-malléolaires au delà de 80 ans traitées par ostéosynthèse conventionnelle ou fixation trans-articulaire. *88ème Réunion annuelle de la société française de chirurgie orthopédique et traumatologique* ; http://dx.doi.org/j.rcot.2013.09.214
14. Zhong, S., Shen, L., Zhao, J. G., Chen, J., Xie, J. F., Shi, Q., ... & Zeng, X. T. (2017). Comparison of posteromedial versus posterolateral approach for posterior malleolus fixation in trimalleolar ankle fractures. *Orthopaedic Surgery*, *9*(1), 69-76.
15. Ogundele, O. J., Ifesanya, A. O., Oyewole, O. A., & Adegbehingbe, O. O. (2013). Results of operative fixation of fractures of the ankle at a tertiary hospital

in a developing country. *East and Central African Journal of Surgery*, *18*(3), 76-80.
16. Zadegan, F., & Raould, A. (2014). D. Hannouche. Fractures malléolaires de l'adulte et luxtaions du cou-de-pied. *EMC–Appareil Locomoteur*, 1-12.
17. Yao, L. B., Séry, B. J. L., Kouassi, K. J., M'bra, K. I., Awotwi, J. F., & Kodo, M. (2017). Résultats du traitement des fractures malléolaires au CHU de Bouaké ï¶. *Journal Africain de Chirurgie Orthopédique et Traumatologique*.
18. Stannard, D. (2014). Surgical Versus Conservative Interventions for Treating Ankle Fractures in Adults. *Journal of PeriAnesthesia Nursing*, *29*(2), 138-139.
19. Warner, S. J. (2019). In Medial Malleolar Fractures, Single-Screw and Double-Screw Surgical Fixation Did Not Differ for Functional Outcome at 3 Months. *JBJS*, *101*(10), 942.
20. Stefan, R. E. (2018). Manka: Blessures de la syndesmose à la cheville; *Unfallchirurg*, *121*(9), 693-703 doi : 10. 1007/s00113-018-0508-5
21. Mason, L. W., Kaye, A., Widnall, J., Redfern, J., & Molloy, A. (2019). Posterior malleolar ankle fractures: an effort at improving outcomes. *JBJS Open Access*, *4*(2), e0058.
22. Jochem, M. (2016). Hoogendoorn. Posterior Malleolar Open Reduction and Internal Fixation Through a Posterolateral Approach for Trimalleolar Fractures. *Bone Joint J*, *98-B*(6), 812-7.
23. Felts, E., Flecher, X., Lami, D., Parratte, S., & Argenson, J. N. (2012). La reprise de l'appui immédiat peut-elle être envisagée sans risque à la suite de l'ostéosynthèse des fractures bimalléolaires simples?. *Revue de chirurgie orthopédique et traumatologique*, *98*(7), S359.
24. Macera, A., Carulli, C., Sirleo, L., & Innocenti, M. (2018). Postoperative complications and reoperation rates following open reduction and internal fixation of ankle fracture. *Joints*, *6*(02), 110-115.
25. Krissian, S., Samargandi, R., Druon, J., Rosset, P., & Le Nail, LR (2019). Poor prognosis of infectious complications after surgical treatment of fractures and dislocations of the ankle and hindfoot. A series of 34 cases. *Revue de Chirurgie Orthopédique et Traumatologique* , *105* (6), 705-710.
26. Shih, C. A., Jou, I. M., Lee, P. Y., Lu, C. L., Su, W. R., Yeh, M. L., & Wu, P. T. (2020). Treating AO/OTA 44B lateral malleolar fracture in patients over 50 years of age: periarticular locking plate versus non-locking plate. *Journal of Orthopaedic Surgery and Research*, *15*, 1-9.
27. Dahan, E., Maman, P., Flecher, X., & Rousseau, MA (2015). Immediate weight-bearing after locked plate surgery for bimalleolar fractures in adults. *Orthopaedic and Trauma Surgery Review*, *101* (7), S166-S167.
28. Saldanha, V., Tiedeken, N., Gaughan, J., & Sweitzer, B. A. (2015). Complications of open reduction and internal fixation of ankle fractures in patients with positive urine drug screen. *Am J Orthop*, *44*(3), 118-121.