Acta Biomed 2022; Vol. 93, N. 2: e2022050 DOI 10.23750/abm.v93i2.11563

Original article

Reoperation of Maisonneuve fracture with quatricortical syndesmotic screw, zip tight and fibula elongation by autograph: a case report in covid-19 patient

Valerio Arceri[1], *Arianna Di Marcantonio*[2], *Attilio Basile*[1], *Riccardo Maria Lanzetti*[1], *Marco Spoliti*[1]

[1]Department of Orthopaedics and Traumatology, San Camillo Hospital, Rome, Italy; [2]Department of Orthopaedics and Traumatology, University of Rome "Tor Vergata", Italy.

Abstract. *Introduction:* Maisonneuve fracture includes a pattern of injuries characterized by fibula proximal fracture and unstable syndesmosis, which is frequently misdiagnosed. We describes the surgical technique and rehabilitation program in a Maisonneuve case, characterized by the rupture of trans-syndesmotic screw, in a Covid- 19 positive patient. *Presentation of cases*: We report a case of 49- year old patient with a Maisonneuve fracture. The first surgery has failed with three-cortical screw rupture. The second surgery was based on the implantation of quatricortical screw, zip tight and fibula elongation with autograph. The results were excellent despite the patient having contracted Covid-19 virus during rehabilitation. *Background and aim:* Maisonneuve fracture is a misdiagnosed injury. RX or TC of lower limb may make the diagnosis. The literature describes different surgical tecnique to stabilized and reduced the ankle. We believe that the gold standard is the correct realignment of syndesmosis and a strong synthesis. *Conclusion*: The Maisonneuve fracture accounts for 7% of all ankle fractures but it is frequently misdiagnosed. There is no doubt that interposition of quarantine after surgery mean a delay of rehabilitation. Despite this, the clinical and radiological controls were optimal with a good functional recovery at 6th months after surgery. The patient was satisfied and he returned to his daily life and physical activity. (www.actabiomedica.it)

Key words: Maisonneuve fracture, Covid-19 infection, ankle fracture, sports activity

Introduction

Maisonneuve fracture is defined as a broad spectrum of injuries characterized by proximal fibular fracture, a tibial sided bony or ligamentous injury, and an unstable syndesmosis (distal tibiofibular syndesmosis and interosseous membrane) with ligamentous or bony avulsion of the syndesmotic ligaments, with a mechanism of trauma in pronation-external rotation of ankle (1-2). This fracture accounts for 7% of all ankle fractures but the diagnosis is often delayed or missed (3).

French surgeon Jacques Gilles Maisonneuve was the first to describe the ankle injury characterized by a high fibular fracture with associated disruption of the tibiofibular syndesmotic ligaments, and it is disruption of the ankle mortise with proximal fibular fracture (4). Maisonneuve variants are describes in literature (1-4-5-6). Nowadays, there is not a univocal definition of Maisonneuve fracture (2).

The treatment, conservative or surgical, provide for the stabilization and reduction of the ankle, because the instability of this articulation leads on post-traumatic arthrosis. There are a lot treatment for repairing the ruptured ligaments, the fractures of the fibula, avulsed tubercles and medial malleolus. Stabilization techniques of syndesmosis include the use

of bio absorbable screws, syndesmotic staples, circular wire external fixators, K-wires, flexible implants, syndesmotic hooks (7). The most popular treatment option of the unstable distal tibiofibular joint is a static 3.5-mm screw fixation with one or multiple screws through three or four cortices. Disadvantages of the syndesmosis screws are partial weight-bearing for at least 6 weeks, neglect of the dynamic property of the syndesmosis, and an increased risk of chronic instability as well as the potential of late diastasis due to loosening, screw breakage, or screw removal (8). Another surgical treatment is the use of dynamic suture button device without need for implant removal. Several studies reported equivalent or better functional results in comparison to the syndesmotic screw (8-9-10-11).

Our case describe the management of two rare complication after recovery of the patient. The first surgery has failed and required a further intervention; the second complication was an infection of Saars Covid 19 virus after post-operative period, which caused a delay rehabilitation. Despite that, the outcome after second surgery at 1-2-3-6th months was excellent thanks to a good physical rehabilitation program and many periodic monitoring at the hospital. To our knowledge this surgical technique in a rare Maisonneuve fracture with two important complications, has not been described before with good surgical result and optimal outcome.

Presentation of case

49-year-old healthy man without any comorbidities (BMI 26.12), went to out hospital emergency room on 16/06/2020 after falling from a ladder with pronation and external rotation of ankle.

He could not walk and his inferior left limb was edematous whit an ecchymosis and swollen in perimalleolar area. The skin over the ankle was intact. The ankle was unstable and severely painful during active and passive movement with a bony tenderness over the proximal fibula. There was no distal neurovascular deficit. No other skeletal injuries. The X-ray shown proximal spiral fibular fracture and diastasis of the syndesmosis with a no displaced parcel fracture of the posterior malleolus. CT scan examination confirming diagnosis without deltoid ligament lesion. The injured limb was stabilized by a trans-calcaneal skeletal traction with partial syndesmosis reduction. The medial joint space was intact without talar shift. (Fig.1).

Operative planning had to stabilize the syndesmosis with three-cortical screw, lateral distal fibular plate and knee high brace. The patient was taken to the operating room the next day. He was placed in supine position with tourniquet control under general anesthesia and a single shot antibiotic was administered Cefazolin 2g i.v. We performed a lateral approach to fibula. Under image intensification, the ankle was reduced and stabilized by third tubular plate with three bi-cortical screw and a three-cortical syndesmotic screw. Ankle stability was satisfactory. On the AP and mortise views and ankle appeared to be well aligned (Fig.2-3). The patient was discharged with good clinical condition after two days. We opted for no loading on the operated limb for two months fracture and partial load for the following three months.

Figure 1. X-ray show proximal spiral fibular fracture with partial reduction using trans-skeletal.

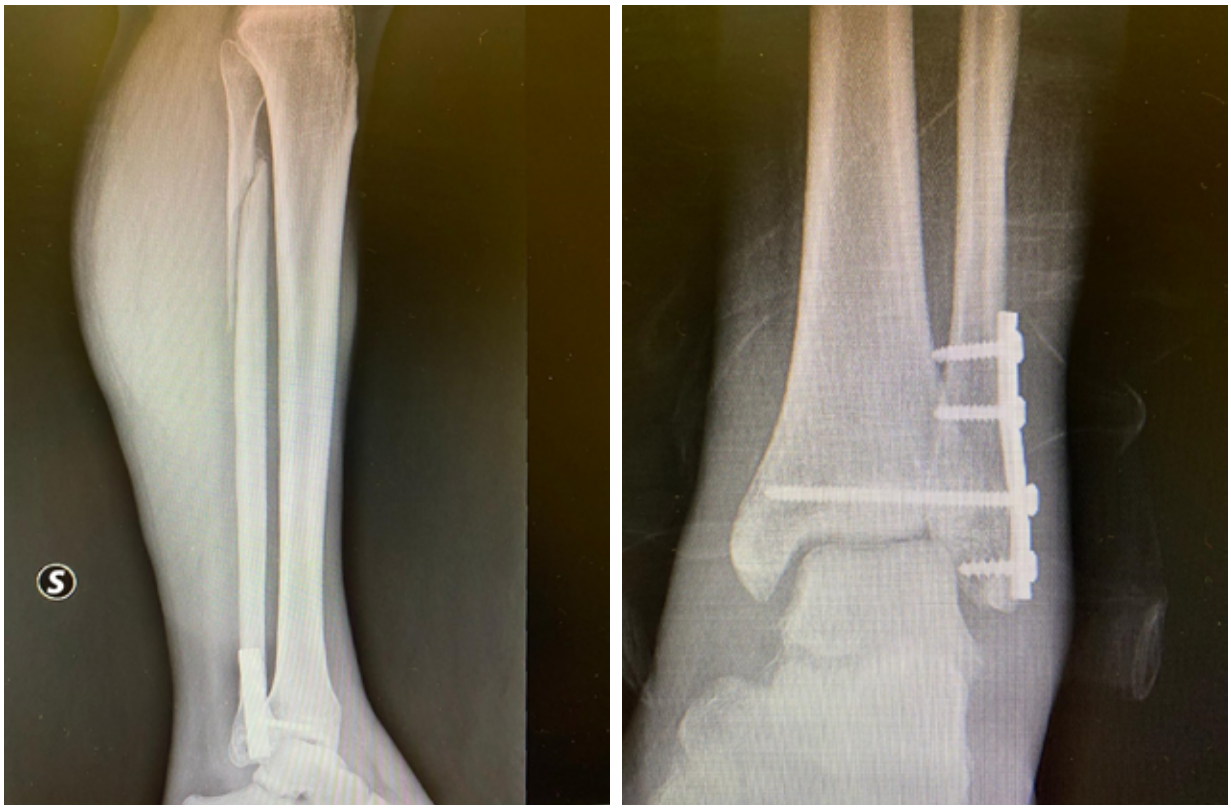

Figure 2-3. Post operative X-ray shows LL and AP views, syndesmosis is reduced with plate and three-cortical screw.

After these five months, the patient could have a total loading in the operating limb starting a physiotherapy program with strengthening muscles exercises and retraining walking. Unfortunately, the patient complained of ankle pain and he felt a sensation of rupture of the means of synthesis without any trauma or injury.

X-rays and CT scan shown the rupture of three-cortical screw, ankle luxation and fibular shortening with reopening of syndesmosis (Fig.4).

We opted for surgical treatment to stabilize the syndesmosis with quatricortical screw and zip thight, and we decided to elongate the fibula with a fragment of iliac crest of the patient.

Under general anesthesia and an antibiotic prophylaxis, the patient was taken in supine position with tourniquet performing two sterile fields, one at the ankle and one to the left iliac crest. First time: we performed the approach on the previous surgical scar and we removed the means of synthesis. We performed the distal third fibular osteotomy and removed the fibrous tissue in syndesmosis. Second time: we took three cortical iliac crest bone and we performed the medial ankle approach, viewing intact deltoid ligament. Through lateral approach, we realigned the fibula-tibia joint plane and positioned the iliac crest fragment; than we fixed it with a long plate, four bicortical screws, and one quatricortical screw. We positioned the zip thight to the third plate hole to ensure the stability of syndesmosis (Fig.5-6). Under image intensification, we were sure of the stability of ankle by dynamic test. Finally, we positioned a knee-high cast for 1 month without loading on the operating limb, and we want to plan the physiotherapist program for strghteling muscle and passive exercises.

Unfortunately, the nose pharyngeal Sars Covid 19 swab routine control was positive after two days to the surgery. The patient was isolated at home for 40 days with fever and pain throat but good saturation and

Figure 4. X-ray shows the rupture of three-cortical screw, ankle dislocation and opening of the syndesmosis.

no other symptoms. He took heparin 4000UI, cortisone therapy and ceftriaxone for ten days. He could not begin physiotherapy exercises. The wounds were treat by home nurse with necessary health aids. After 40 days, he was negative and asymptomatic. He was able to start the rehabilitation exercises at 50 days: for one month, he has partial load with a cast walker and become active and passive exercises with physiotherapist; at the 3rd month after surgery the physiotherapy program was dedicated to muscle strengthening and walking reeducation with total loading. The last physical examination at the end of 6rd month was optimal, he return to work and his ordinary activity life including a light exercise. The ankle was not swelling and the scars were good. The patient was satisfied, and joint excursion was complete with optimal muscle strengthening. The last X-rays shows no signs of means synthesis rupture and increased bone callus formation. We used a Foot and Ankle Disability Index (FADI) Score to assess the clinical appearance. The FADI score was 17 and 34 respectively after one month and six months after the second surgery.

Figures 5-6. post-operative X-ray shows AP an LL views. We have positioned ten holes plate, quatricortical screw, zip tight. The AP view shows optimal syndesmosis reduction and fibula elongation.

Discussion

Certainly, Covid -19 pandemic has changed world health. In literature there are not many studies currently describing the change in pre and post-operative management of the trauma patient. Our study want to highlight the importance to evaluating the best post-operative management and to not delay the rehabilitation.

The other complication was the rupture of three-cortical screw without any injury. We assume that three-cortical screw was insufficient to support the load in so we opted to a stronger construct. Michel P. J. van den Bekerom et al. (12) describes many technique for stabilizing the distal tibiofibular syndesmosis such as traditional screw, with good result but necessity for removal, biabsorbable screw, equal result without the need for removal, staple making early movement, the flexible suture fixation not compared to fixation with screw, finally ilizarov, ligamentoplasty and kirschner wires are poor in studies (7). Our surgical experience is based on metallic screw and/or zip thight with good results. The reopening syndesmosis is due to recession of fibula and loss of housing of peroneal malleolus, moreover it suggest the lack of trans syndesmosis fibrotic tissue. For this reason, we opted for an extension of fibula with suitable malleolar housing.

There are not a lot of study about managing of Maisonneuve fracture. Many of these are misdiagnosed due to inaccurate physical examination or inadequate X-ray projection of the total lower limb. For this reason, it is important to ask the patient about the mechanism of injury, and to carefully physically examine the ankle, particularly concerning the structural integrity of the malleoli and the ligaments (12).

The recent studies describes many variation of Maisonneuve united to presence of proximal fibular fracture and unstable ankle injury (2-13-1-14). They describe association with a posterior malleolar fracture and disruption of the anterior-inferior tibiofibular ligament, without disruption of the deltoid ligament or fracture of the medial malleolus(4); tibiofibular syndesmosis injury, and proximal tibiofibular luxation (14); fracture of the distal-lateral tibia plafond in the presence of intact deltoid and syndesmotic ligaments (1); equivalent Maisonneuve like right tibia plateau fracture and an ipsilateral syndesmotic injury in the setting of a completely intact fibula (14); and failed reduction of the distal tibiofibular syndesmosis following a Maisonneuve fracture due to interposition of an osteochondral fragment in the syndesmosis from the tibia plafond (15).

It could be interesting to study prognostic classification. Maisonneuve ankle fracture is categorized as type C3 in AO. The Lauge-Hansen system categorizes the trauma mechanism in pronation external rotation (PER), Pankovich describes five stages in the development of the Maisonneuve injury, but this classification is in contrast with the widely used Lauge-Hansen (12). Sjoerd A. Stufkens et al believe that the most appropriate nomenclature for categorization of the Maisonneuve fracture to be PER-3, wherein the proximal fibular fracture is accompanied by fracture of the medial malleolus, rupture of the deltoid ligament with an intact posterior malleolus, and PER-4, wherein the posterior malleolus is fractured. We suggest that all classification are incomplete because there are other fracture patterns associated with different ligament injuries that result with different prognostic factors.

In our case, the rehabilitation program without any complications would start 2 months after surgery and the patient might have walked after other 3 months, returning at daily life and work. Due to complications, this program have a 5 month of delay.

Conclusion

The Maisonneuve fracture accounts for 7% of all ankle fractures but misdiagnosed. There are different pattern of injury as many types of treatments. In this particular case report we have treated it two times to guaranteed the right stability of the ankle and to eliminate long-term complications. The best choice is a stronger fixation of syndesmosis; in the second surgery, we used zip thight and quatricortical screw to restore the peroneal malleolus anatomical position with elongation of fibula with iliac crest. The Covid-19 infection delayed the rehabilitation, but we have a good functional and aesthetic result thanks to a strong physiotherapy program and good patient compliance. We emphasize the importance of making good diagnosis

of Maisonneuve fracture with appropriate anamnesis, physical examination and prescription of radiographic exams of the completely lower limb. We suggest carrying out further studies related on the effects of delay rehabilitation due to quarantine in orthopedic patients.

Declaration of Competing Interest: The authors report no declarations of interest.

Funding: No funds were received in support of this study.

Ethical approval: The study was notified to the ethical committee of our hospital (S.Camillo hospital Rome, Italy); it does not need a specific ethical approval because only one cases is included in the study.

Consent: Written informed consent was obtained from the patients for publication of this case report and accompanying images.

References

1. Madhusudhan TR., Medapati Dhana SR., and Smith IC. Report of the Case of a Rare Pattern of Maisonneuve Fracture. J. Foot Ankle Surg 2008; 47:160–162.
2. He JQ, Ma XL, Xin JY et al. Pathoanatomy and Injury Mechanism of Typical Maisonneuve Fracture. Orthop. Surg 2020; 12:1644–1651.
3. Van Den Bekerom MPJ, Haverkamp D, Kerkhoffs GMMJ, and Van Dijk CN. Syndesmotic stabilization in pronation external rotation ankle fractures. Clin Orthop Relat Res 2010; 468: 991–995.
4. Charopoulos I, Kokoroghiannis C, Karagiannis S, Lyritis GP, and Papaioannou N. Maisonneuve Fracture without Deltoid Ligament Disruption: A Rare Pattern of Injury. J. Foot Ankle Surg 2010; 49: 86. e 11-7
5. Jehlicka D, Bartonícek J, and Rysavý M. The Bosworth ankle fracture (case report). Acta Chir. Orthop. Traumatol Cech 2001; 68: 256–260.
6. Healy WA, Starkweather KD, Meyer J, and Teplitz GA. Triplane fracture associated with a proximal third fibula fracture. Am J Orthop 1996; 25: 449–451.
7. Van Den Bekerom MPJ and Raven EEJ. Current concepts review: Operative techniques for stabilizing the distal tibiofibular syndesmosis. Foot Ankle Int 2007; 28: 1302–1308.
8. Doll J, Waizenegger S, Bruckner T, Schmidmaier G, Wolf SI, and Fischer C. Differences in gait analysis and clinical outcome after TightRope® or screw fixation in acute syndesmosis rupture: Study protocol for a prospective randomized pilot study. Trials 2020; 21:1–10.
9. Laflamme M, Belzile EL, Bédard L, Van Den Bekerom MPJ, Glazebrook M, and Pelet S. A prospective randomized multicenter trial comparing clinical outcomes of patients treated surgically with a static or dynamic implant for acute ankle syndesmosis rupture. J. Orthop Trauma 2015; 29: 216–223.
10. Soin SP, Knight TA, Dinah AF, Mears SC, Swierstra BA, and Belkoff SM. Suture-button versus screw fixation in a syndesmosis rupture model: A biomechanical comparison. Foot Ankle Int 2009; 30: 346–352.
11. McKenzie AC, Hesselholt KE, Larsen MS, and Schmal H. A Systematic Review and Meta-Analysis on Treatment of Ankle Fractures With Syndesmotic Rupture: Suture-Button Fixation Versus Cortical Screw Fixation. J. Foot Ankle Surg 2019; 58: 946–953.
12. Stufkens SA, Van Den Bekerom MPJ, Doornberg JN, Van Dijk CN, and Kloen P. Evidence-based treatment of maisonneuve fractures. J. Foot Ankle Surg 2011; 50: 62–67.
13. Alencar Neto JB, Cavalcante MLC, Pinto Neto LH, De Lucena IF, Garrido RJ, and Da Rocha PHM. Maisonneuve Variant Lesion with Proximal Tibiofibular Dislocation TT - Lesão variante de Maisonneuve com luxação tibiofibular proximal. Rev bras ortop 2019; 54: 339–342.
14. Wilson JM, Kukoski NR, Lunati MP, Moore Jr T. Tibial Plateau Fracture with Ipsilateral Syndesmotic injury: A Previously Undescribed Maisonneuve-Equivalent Injury Pattern: A Case Report. JBJS Case Connect 2020; 10: e0208.
15. Smith MG, Ferguson E, and Kurdy NM. Persistent diastasis in a maisonneuve fracture - Interposition of a tibial osteochondral fragment: A case report. J. Foot Ankle Surg 2005; 44: 225–227.

Correspondence:
Received: 3 April 2021
Accepted: 18 May 2021
Riccardo Maria Lanzetti MD
Department of Orthopaedics and Traumatology, San Camillo Hospital, Rome, Italy
E-mail: riccardolanzetti@gmail.com