A case series on managing distal femoral bone defects with the Masquelet technique in Nicaragua

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Abstract: The management of challenging bone defects in orthopedic surgery presents a formidable task, necessitating intricate interventions and substantial resources with unpredictable outcomes. Causes of bone defects, ranging from trauma to infections, require restoration of both form and function. The Induced Membrane Technique, pioneered by Alain-Charles Masquelet, offers an effective solution, triggering the development of a vascularized membrane conducive to tissue regeneration. While sporadically introduced in one hospital in Nicaragua, the technique's national adoption faces challenges due to limited trained personnel and a lack of standardized protocols. This study addresses this gap, aiming to establish guidelines and recognize the technique's value in this context. Hospital Escuela Antonio Lenin Fonseca's orthopedic department's continuous use of the Masquelet technique since 2020 serves as a basis for evaluating its impact on significant bone loss management within the region, emphasizing the importance of adapting surgical innovations to address unique regional healthcare needs.

Methods: This study, conducted at the Hospital Escuela Antonio Lenin Fonseca from June 2020 to June 2023, aimed to assess the effectiveness of the Masquelet technique in patients with distal femoral bone defects. It employed a quantitative case review approach with a retrospective and longitudinal scope. The study area was the Department of Orthopedics and Traumatology within the hospital. The study included a universe of patients meeting clinical and radiographic criteria for the Masquelet technique, with a sample size of 13 patients who provided informed consent. Inclusion criteria encompassed full two-stage Masquelet technique management, outpatient follow-up, and case resolution at the hospital. Exclusion criteria included partial technique use, procedures initiated elsewhere, patient refusal, and non-consent. Data collection involved clinical record analysis (Instrument A) and patient interviews (Instrument B). Data were analyzed using SPSS, Microsoft Excel, and Word, yielding graphical representations, and facilitating conclusions and recommendations.

Results: The study explored the effectiveness of the Masquelet technique for managing distal femur fractures. With a sample of 13 patients treated at the Hospital Escuela Antonio Lenin Fonseca between June 2020 and June 2023, the technique demonstrated success across various parameters. The mean age of the patients was 30 years, and the gender distribution comprised 10 males and 3 females. Indications for the technique included complex fractures with soft tissue loss, infection, or nonunion, with trauma-related cases accounting for 75%. The two-stage procedure was successfully executed in all cases, involving the implantation of cement spacers to stimulate encapsulating membrane formation, followed by spongy bone graft placement. Complications were documented in 35% of cases, with soft tissue infection as the prevailing complication. Functional outcomes, evaluated via the Lower Limb Functional Scale, showcased good results, with patients attaining an average score of 68 out of 80. Radiographic evaluations indicated successful bone union in all cases. High patient satisfaction levels were observed, with 90% reporting improved quality of life and expressing willingness to recommend the technique. These findings underscore the positive impact of the Masquelet technique in enhancing outcomes for distal femur fractures.

Discussion: The orthopedic department at Hospital Escuela Antonio Lenin Fonseca has been at the forefront of adopting and implementing the Masquelet technique since 2020. This study offers a valuable opportunity to evaluate the technique's effectiveness in addressing significant bone loss management within the region. Furthermore, it highlights the pioneering efforts of the Hospital Escuela Antonio Lenin Fonseca's orthopedic department in providing comprehensive patient care. This not only objectively enhances the quality of life for patients but also contributes to the sustainability of the healthcare system. The results of this study demonstrate that the Masquelet technique, with its successful execution, favorable functional outcomes, and high patient satisfaction, holds immense promise as a viable option for the management of distal femur fractures associated with soft tissue loss, infection, or nonunion. The technique's relative simplicity and effectiveness make it particularly well-suited for a wide range of clinical contexts, including those with limited resources. As the first study of its kind in the region, its findings contribute to the ongoing efforts to integrate the Masquelet technique into national protocols, potentially benefiting a broader population facing similar orthopedic challenges.

Clinical relevance: Addressing bone defects in the distal femur is a persistent orthopedic challenge. Historically, management options lacked comprehensiveness, leading to complications. The Masquelet technique, a two-stage procedure based on immune response principles, has emerged as a promising solution. At Hospital Escuela Antonio Lenin Fonseca, a national reference unit, this technique has demonstrated effectiveness, particularly for complex cases involving significant bone and soft tissue loss. This study, the first in Nicaragua, evaluates 13 cases treated with the Masquelet technique from June 2020 to June 2023, aiming to establish its value and advocate for its inclusion in national protocols. This research underscores our commitment to improving patient outcomes, even in challenging scenarios with neurovascular involvement, by providing a simple, efficient, and resource-effective therapeutic option.

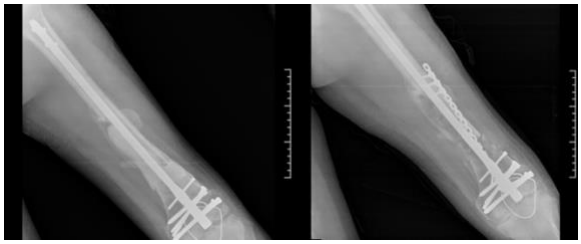

Fig 1-2., AP radiograph of patient M15 1-week post-op of each Masquelet procedure

Patient (initials)	*Size of defect*	*Etiology*	*Pre-op culture*	*Weeks between 1st and 2nd Masquelet procedure*	*Cement Spacer*	*Graft*	*Complications*	*Length of follow up (months)*
M28	6cm	Osteomyelitis	Methicillin sensitive staph aureus	18 weeks	PMMA + Gentamycin	Autologous	Soft tissue infection	18m
M45	8cm	Non-union	No growth	13 weeks	PMMA + Gentamycin	Autologous	None	16m
F42	8cm	Trauma	Methicillin sensitive staph aureus	13 weeks	PMMA + Gentamycin	Autologous	Soft tissue infection	22m
M15	10cm	Trauma	Methicillin sensitive staph aureus	10 weeks	PMMA + Gentamycin	Autologous	Soft tissue infection	18m
M21	5cm	Trauma	No growth	8 weeks	PMMA + Gentamycin	Autologous	None	12m
M25	8cm	Trauma	No growth	8 weeks	PMMA + Gentamycin	Autologous	None	16m
M31	4cm	Osteomyelitis	Methicillin sensitive staph aureus	12 weeks	PMMA + Gentamycin	Autologous	Pain	13m
M18	6cm	Trauma	Methicillin sensitive staph aureus	12 weeks	PMMA + Gentamycin	Autologous	Soft tissue infection	20m
M19	7cm	Osteomyelitis	Aeromonas hydrophilia/punctata (caviae)	15 weeks	PMMA + Gentamycin	Autologous	None	11m
M41	4cm	Non-union	No growth	8 weeks	PMMA + Gentamycin	Autologous	Pain	12m
F23	5cm	Osteomyelitis	Aeromonas hydrophilia/punctata (caviae)	13 weeks	PMMA + Gentamycin	Autologous	None	18m
M40	8cm	Trauma	Methicillin sensitive staph aureus	17 weeks	PMMA + Gentamycin	Autologous	Soft tissue infection	16m
M26	5cm	Non-union	No growth	9 weeks	PMMA + Gentamycin	Autologous	None	20m

Table 1. Data series of 13 patients