Indonesian Journal of Global Health Research
Volume 6 Number 6, December 2024
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

RETROGRADE INSERTION OF AN ANTEGRADE INTRAMEDULLARY FEMORAL NAIL FOR TREATMENT OF A PATHOLOGICAL FEMORAL SHAFT FRACTURE IN A PATIENT WITH METASTATIC BONE DISEASE

Kevin Kusuman[1]*, I Gede Eka Wiratnaya[2]
[1]Resident of Department of Orthopaedic and Traumatology, Faculty of Medicine, Udayana University, Prof. Dr. IGNG Ngoerah General Hospital, Jl. Diponegoro, Dauh Puri Klod, Denpasar Barat, Denpasar, Bali 80113, Indonesia
[2]Consultant of Department of Orthopaedic and Traumatology, Faculty of Medicine, Udayana University, Prof.Dr. IGNG Ngoerah General Hospital, Jl. Diponegoro, Dauh Puri Klod, Denpasar Bar., Denpasar, Bali 80113, Indonesia
*kevin.kusuman@student.unud.ac.id

ABSTRACT
Pathological fractures of the femur due to metastatic bone disease are challenging to treat, requiring stabilization to improve patient quality of life. Intramedullary nailing is a common treatment method, typically performed in an antegrade manner. However, in cases where antegrade insertion is difficult, retrograde techniques may be considered. We report a case of a 68-year-old female with metastatic breast cancer, presenting with a pathological fracture of the femoral shaft. Due to a large proximal femoral lesion and limited access for traditional antegrade femoral nail insertion, a retrograde approach was chosen. A standard antegrade intramedullary femoral nail was inserted retrograde through the distal femur. The procedure was successful, providing immediate stability and pain relief. Postoperatively, the patient was able to ambulate with assistance and was discharged for further oncological management. The retrograde insertion of an antegrade femoral nail offers an alternative in cases where antegrade insertion is not feasible due to proximal femoral involvement. While antegrade nailing is traditionally preferred, retrograde techniques offer comparable stability and functional outcomes, especially in metastatic bone disease where palliative treatment is a priority. This approach allows for reduced surgical trauma and faster recovery. Retrograde insertion of an antegrade femoral nail can be a viable option for stabilizing pathological femoral shaft fractures in patients with metastatic bone disease. It provides a feasible alternative when conventional approaches are not suitable, improving patient outcomes and quality of life.

Keywords: antegrade nail; metastatic bone disease; pathologic fracture; retrograde insertion

How to cite (in APA style)
Kusuman, K., & Wiratnaya, I. G. (2024). Retrograde Insertion of An Antegrade Intramedullary Femoral Nail for Treatment of A Pathological Femoral Shaft Fracture in A Patient with Metastatic Bone Disease. Indonesian Journal of Global Health Research, 6(6), 4159-4166. https://doi.org/10.37287/ijghr.v6i6.4420.

INTRODUCTION

Pathological fractures are common in patients with metastatic bone disease, often affecting weight-bearing bones such as the femur. These fractures occur when bone integrity is compromised due to the presence of metastatic lesions, weakening the bone structure and predisposing it to breakage under normal or minimal stress. Metastatic bone disease, most commonly seen in patients with cancers such as breast, prostate, lung, and renal cell carcinoma, can significantly impact the patient's quality of life due to pain, immobility, and functional impairment. Among the various bones affected by metastatic spread, the femur is a frequent site due to its significant load-bearing role and rich blood supply, making it particularly vulnerable to metastatic deposits.(Nugraha *et al.*, 2020; Putro *et al.*, 2024)

In cases of pathological femoral shaft fractures, surgical stabilization is often necessary to manage pain, restore function, and improve the patient's overall quality of life. One of the primary goals in managing these fractures in metastatic disease is not just anatomical

alignment but also early mobilization and palliation of symptoms. Several surgical techniques have been employed to address this issue, with intramedullary nailing (IMN) being one of the most commonly used methods. IMN offers stable fixation, allowing patients to bear weight early, which is crucial in individuals with limited life expectancy and reduced bone healing potential.(Sah, Gyawali and Kandel, 2023).

Traditionally, intramedullary femoral nails are inserted in an antegrade fashion, with the nail introduced through the proximal femur at the level of the greater trochanter. This approach is widely accepted because it provides excellent control of the fracture and maintains the natural biomechanics of the femur. However, in certain clinical scenarios, such as extensive metastatic involvement of the proximal femur or severe deformities, the antegrade approach may not be feasible or advisable. Large metastatic lesions in the proximal femur can make it difficult to achieve stable fixation through the standard antegrade entry point, and surgical manipulation in this area could exacerbate the patient's pain or worsen their condition.(Sharma, Jain and Luthra, 2022; ERGİŞİ *et al.*, 2023)

In such cases, alternative approaches are necessary to achieve the goals of surgical stabilization. Retrograde femoral nailing, where the nail is inserted through the distal femur and advanced proximally, has been utilized as a solution in situations where antegrade nailing is not practical. Although typically reserved for distal femur fractures, retrograde nailing can be adapted for midshaft or even proximal shaft fractures when antegrade access is compromised. This technique allows for stabilization without violating the diseased proximal femur, thus avoiding further trauma to the affected area.(DeCoster and Patti, 2018).

The retrograde approach is not without challenges, as it may require modification of standard surgical techniques and careful preoperative planning. However, it offers an effective alternative for stabilizing femoral fractures in patients with proximal femoral lesions, as in the case of metastatic bone disease. It also minimizes the risks of intraoperative complications associated with manipulating the diseased proximal femur, such as uncontrollable bleeding, fracture propagation, or excessive damage to the surrounding soft tissues, fat embolism and ARDS risk.(Cole *et al.*, 2000) This case report highlights a unique instance in which a standard antegrade intramedullary femoral nail was inserted retrograde through the distal femur to treat a pathological femoral shaft fracture in a patient with metastatic thyroid cancer.

METHOD

We report a case of a 68-year-old female with metastatic breast cancer, presenting with a pathological fracture of the femoral shaft. Due to a large proximal femoral lesion and limited access for traditional antegrade femoral nail insertion, a retrograde approach was chosen. A standard antegrade intramedullary femoral nail was inserted retrograde through the distal femur. The procedure was successful, providing immediate stability and pain relief. Postoperatively, the patient was able to ambulate with assistance and was discharged for further oncological management.

RESULT

A 50-year-old female was referred from West Nusa Tenggara Regional Hospital with and presented with a chief complaint of pain in the right thigh region after stumbling off 9 months before being admitted to the hospital, the patient was also unable to weight bear on the right lower limb since 3 weeks before admitted to hospital. The plain X-ray showed a pathological fracture at the right distal of the femur alongside lytic bone destruction at the proximal region of the same side of the femur. The lesion on the proximal side of the fracture meant that we

are unable to consider the use of a conventional cephalo-medullary nail. It was observed that an antegrade intramedullary nail introduced retrograde would allow locking perpendicular to the shaft into the distal femur given the more distal position of what would then be its distal locking holes. We therefore planned to perform retrograde intramedullary femoral nailing with a femoral nail designed for antegrade insertion.

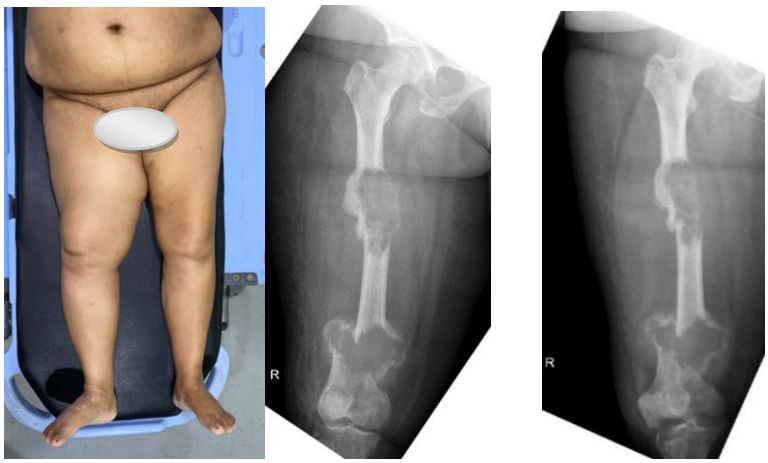

Figure 1. AP and lateral view of right femur displaying a pathological fracture at distal femur and lytic bone destruction at the mid shaft of femur

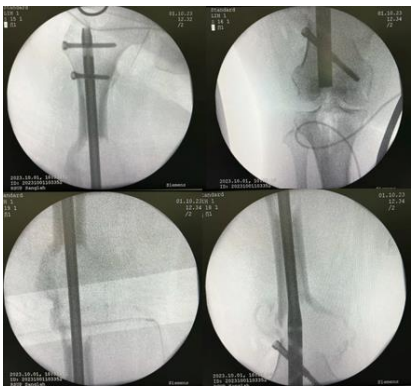

Figure 2. Durante op C-arm

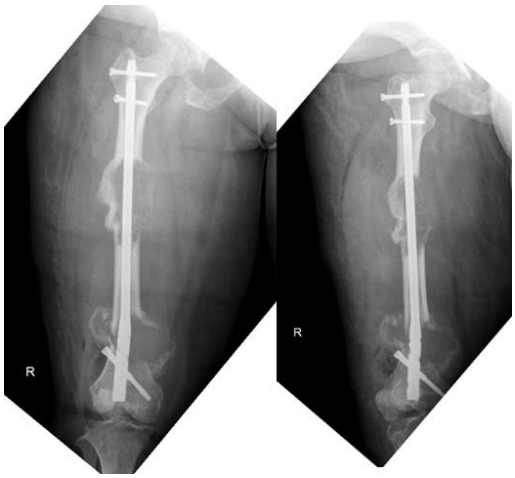

Figure 3. X-ray of right thigh AP and lateral view post-surgery

Surgical Procedure

In a sterile operating room, the patient is placed in the supine position in preparation for a retrograde A2FN nail installation, a common orthopedic procedure used to stabilize fractures of the femur. After ensuring proper alignment, the surgeon begins by making an incision according to the anterior approach, providing optimal access to the femur. The first critical step involves determining the entry point for the guide wire insertion. This point is identified on the distal femur under the guidance of a C-arm, a fluoroscopic imaging device. With the pathway prepared, the surgeon introduces the A2FN nail, measuring 9x340R mm, into the medullary canal. Once inserted, the position of the nail is carefully evaluated using the C-arm to ensure that it is correctly aligned. The imaging confirms that the nail is in an optimal position within the bone.

The next phase involves securing the nail with locking screws. Two proximal locking screws, one measuring 48 mm and the other 36 mm, are inserted. These screws provide stability near the top of the implant. A third standard locking screw, measuring 70 mm, is then installed in the distal part of the femur. Once all components are in place, the surgeon checks the overall stability of the construct. The bone and nail are found to be stable, and a final confirmation of the implant position is made using the C-arm. With all elements secure and in the proper position, the procedure is deemed successful. Subsequently, the histopathological result revealed a metastatic papillary thyroid carcinoma follicular variant.

Patient Outcome

One month following surgery, the SF-36 questionnaire was used to evaluate the patient condition. It was revealed that patient still exhibits complete limitations in physical functioning (0%) and role participation due to both physical health and emotional problems (0% for both). Moderate levels of energy (45%) and emotional well-being (44%) suggest persistent fatigue and emotional distress, while their social functioning (50%) is only somewhat maintained. Pain and general health are rated at 55%, indicating ongoing discomfort and a perceived moderate decline in overall health. The health change score of 50% suggests that the patient perceives their health as neither improving nor worsening dramatically over recent times.(Lins and Carvalho, 2016)

Figure 4. Patient condition 1 month after surgery showing a limited daily activity

DISCUSSION

Managing a distal femur fracture is quite a challenge and another pathological fracture due to metastatic bone disease adds several considerations for surgeons to choose the best approach for the patients. In this case, we presented a neglected multiple pathological fracture at the distal and midshaft femur due to metastatic bone disease. Normally, in extra-articular or simple partial articular distal femur fractures, we can choose minimally invasive techniques, through lateral approaches or nailing techniques.(Prabhakaran *et al.*, 2023) As to osteosynthesis, intramedullary nailing is biomechanically superior to the plate with greater axial stability, rotational control and better distribution of the loads along the bone. The long nails also prevent future potential diaphyseal fractures.(Arvinius *et al.*, 2014) Retrograde intramedullary nailing has emerged as a reliable and promising treatment in this case. The techniques offer several advantages, including a minimally invasive approach, closed reduction techniques, and preservation of the soft tissue envelope. Clinical studies have shown high union rates, shorter operating times, and reduced blood loss with retrograde nailing. Complication rates, including infection, implant failure, and knee-related issues, have generally been low.(Shah, Desai and Mounasamy, 2015).

The retrograde approach was initially developed for distal femoral fractures but has demonstrated effectiveness in specific pathological fractures of the femur. This approach allows the surgeon to avoid areas of bone weakness and minimize trauma to the proximal femur, which is often the site of significant metastatic involvement. In this case, retrograde insertion of an antegrade intramedullary nail was particularly advantageous because the metastatic involvement in the proximal femur posed a risk of further bone compromise if a standard antegrade approach had been used.(Durigan *et al.*, 2019). Despite its advantages, the retrograde approach presents certain challenges, especially when inserting an antegrade nail.

The design of antegrade nails is optimized for insertion from the greater trochanter or piriformis fossa, and their geometry may not be ideal for retrograde placement. Additionally, navigating the distal femoral entry point and directing the nail proximally through the medullary canal can be technically demanding, particularly in the presence of bone metastases that may alter the normal anatomy. In this case, careful preoperative planning was essential to ensure the nail passage through the femoral shaft without causing further damage to the bone. Another concern is the risk of joint damage associated with the retrograde approach. Since the distal femoral entry point is through the intercondylar notch, this raises concerns about compromising the knee joint's integrity, particularly in patients with pre-existing knee pathology.(Alzahrani *et al.*, 2023) Several studies have compared the risk between antegrade and retrograde insertion techniques. The antegrade insertion presents several disadvantages, such as challenges in the insertion of the stem in patients with obesity, as well as potential complications including necrosis or fracture of the femoral head, pain related to the implant, insufficiency of the gluteus medius, and the occurrence of heterotopic ossification in the vicinity of the hip.

Conversely, the retrograde insertion is characterized by the necessity to open the joint for the insertion of the nail, which may lead to knee pain, restricted mobility, iatrogenic damage to the anterior cruciate ligament, and an increased risk of septic arthritis. Regarding consolidation rates and associated complications, existing literature suggests that both methods yield comparable clinical outcomes.(Durigan *et al.*, 2019) However, in our patient, the benefits of using the retrograde approach outweighed this risk, as preserving the proximal femur from additional surgical trauma was a higher priority in the context of widespread metastatic disease.

Our patient, who presented metastatic bone disease and a pathological distal femoral fracture, achieved successful stabilization and early mobilization following retrograde insertion of the antegrade intramedullary femoral nail. Postoperative pain was significantly reduced, allowing the patient to regain a degree of function that improved quality of life during the palliative stage of their cancer treatment. The primary goal of surgical intervention in metastatic bone disease is not necessarily to cure but to provide pain relief, maintain mobility, and prevent further pathological fractures or complications. In this regard, the surgical strategy was successful.(Rizzo SE, 2023) One crucial aspect of managing pathological fractures in metastatic bone disease is to consider the patient's overall prognosis and life expectancy. The treatment goals are generally palliative, focusing on maximizing function and minimizing pain for the remaining time. In this case, the patient had a limited prognosis due to the extent of metastatic disease, and the surgical approach was chosen to achieve these palliative goals efficiently while minimizing surgical morbidity.

CONCLUSION

The retrograde insertion of an antegrade intramedullary femoral nail for the treatment of a pathological femoral shaft fracture in a patient with metastatic bone disease offers a viable alternative to traditional approaches, particularly when proximal femoral involvement or anatomical constraints make conventional antegrade techniques impractical. While technically challenging, this method provides effective fracture stabilization, pain relief, and functional improvement, contributing significantly to the palliative care of patients with limited prognosis. The success of this approach in our case underscores the importance of individualized treatment planning in orthopedic oncology, where the primary goals are to preserve function, alleviate pain, and enhance the patient's quality of life. Further studies with more samples and longer follow up duration is needed to elucidate the effectiveness of this approach in managing pathological fracture due to metastatic bone disease.

REFERENCES

Alzahrani, M.M. *et al.* (2023) 'Optimal entry point for antegrade and retrograde femoral intramedullary nails', *Chinese Journal of Traumatology - English Edition*, 26(5), pp. 249–255. Available at: https://doi.org/10.1016/j.cjtee.2023.03.006.

Arvinius, C. *et al.* (2014) 'Benefits of early intramedullary nailing in femoral metastases', *International Orthopaedics*, 38(1), pp. 129–132. Available at: https://doi.org/10.1007/s00264-013-2108-x.

Cole, A.S. *et al.* (2000) 'Femoral nailing for metastatic disease of the femur : a comparison of reamed and unreamed femoral nailing', 31, pp. 25–31.

DeCoster, T. and Patti, B. (2018) 'Retrograde Nailing for Treating Femoral Shaft Fractures: A Review', *UNM Orthopaedic Research Journal*, 7(1), p. 18.

Durigan, J.R. *et al.* (2019) 'Antegrade x retrograde nailing in femoral fractures: a study on consolidation and infection TT - Haste anterógrada x retrógrada em fraturas femorais: um estudo sobre consolidação e infecção', *Acta ortop. bras*, 27(6), pp. 313–316. Available at: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-78522019000600313.

ERGİŞİ, Y. *et al.* (2023) 'Treatment of distal femur fractures with retrograde intramedullary nailing utilizing a tibial nail', *Journal of Health Sciences and Medicine*, 6(1), pp. 73–76. Available at: https://doi.org/10.32322/jhsm.1197527.

Lins, L. and Carvalho, F.M. (2016) 'SF-36 total score as a single measure of health-related quality of life: Scoping review', *SAGE Open Medicine*, 4. Available at: https://doi.org/10.1177/2050312116671725.

Nugraha, G.K.A.S. *et al.* (2020) 'Characteristic of risk factor of thyroid cancer related metastatic bone disease at Sanglah General Hospital Denpasar between January 2013 to March 2019', *International Journal of Research in Medical Sciences*, 8(4), p. 1430. Available at: https://doi.org/10.18203/2320-6012.ijrms20201337.

Prabhakaran, D.A. *et al.* (2023) 'Functional and radiological outcome of retrograde ILIM nailing for distal femur fracture', *International Journal of Orthopaedics Sciences*, 9(3), pp. 278–284. Available at: https://doi.org/10.22271/ortho.2023.v9.i3d.3437.

Putro, Y.A.P. *et al.* (2024) 'Analysis of the effectiveness and efficiency of the Indonesian metastatic bone disease of unknown origin algorithm (INA-MBD): time to diagnosis and cost to diagnosis : Quasi-experimental study', *F1000Research*, 13, p. 333. Available at: https://doi.org/10.12688/f1000research.146118.2.

Rizzo SE, K.S. (2023) 'Pathologic Fractures - StatPearls - NCBI Bookshelf', *Pathological Fractures*, pp. 1–10.

Sah, S.K., Gyawali, M. and Kandel, P.R. (2023) 'Functional outcome of intramedullary nailing of the femoral shaft fracture', *Janaki Medical College Journal of Medical Science*, 11(2), pp. 40–52. Available at: https://doi.org/10.3126/jmcjms.v11i2.58027.

Shah, S., Desai, P. and Mounasamy, V. (2015) 'Retrograde nailing of femoral fractures: a retrospective study', *European Journal of Orthopaedic Surgery and Traumatology*, 25(6), pp. 1093–1097. Available at: https://doi.org/10.1007/s00590-015-1658-6.

Sharma, A., Jain, A. and Luthra, G. (2022) 'Clinical outcomes of the intramedullary femoral nailing system in the treatment of femoral fractures', *International Journal of Research in Orthopaedics*, 9(1), p. 11. Available at: https://doi.org/10.18203/issn.2455-4510.intjresorthop20223253.