

# Managing Periprosthetic Fracture of the Proximal Femur Using Total Hip Arthroplasty in a Patient with Sequelae of Poliomyelitis: Case Report and Literature Review

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## Learning Point of the Article:

Although technically demanding, arthroplasty can achieve meaningful pain relief and improved quality of life in carefully selected post-poliomyelitis patients.

## Abstract

**Introduction:** Patient with poliomyelitis can have long-term sequelae such as paralysis and muscle weakness in their lower limb caused by motor atrophy and degradation of motor and autonomic neurons. Patients can also develop osteoporosis, causing instability. This leads to a greater risk of falls and fractures, such as hip fractures. There are difficulties and risks in doing management, especially doing total hip arthroplasty (THA) in poliomyelitis patients due to differences in anatomy and function of the lower limb.

**Case Report:** A 70-year-old woman came to the hospital with pain in her left hip after she slipped and landed on her left hip first 5 h before. She underwent a femoral surgery 30 years ago and has a history of polio. She was diagnosed with a periprosthetic fracture at the left femoral neck post-open reduction and internal fixation plate and screws with equinus deformity at the left ankle due to poliomyelitis and osteopenia. She then undergoes implant removal and total hip replacement with cerclage wire. The surgery showed excellent results, with no sign of infection or dislocation, and significant pain improvement. Further physiotherapy will lead to an improvement in motoric function.

**Conclusion:** THA in patients with poliomyelitis presents with several complications and difficulties. However, if the indication outweighs the risk, it should be done with good surgical planning and close post-operative follow-up and rehabilitation

**Keywords:** Total hip arthroplasty, poliomyelitis, femoral neck fracture, equinus deformity.

## Introduction

Poliomyelitis is a disease infecting the anterior horn cell of the spinal cord, affecting motor function [1]. Polio is so close to being eradicated after the invention of the polio vaccine. To this day, there are still patients living with the long-term sequelae of polio even years after the last epidemic of poliomyelitis [2]. These patients mostly live in developing nations or have economic disadvantages. Recovery may be worse in patients

with loss of motor function beyond 12 months [3]. Polio can cause degradation of motor and autonomic neurons, leading to paralysis and muscle weakness [2, 4]. Abnormal gait patterns and motor impairment caused by muscular atrophy and leg weakness are some of the reasons for a greater risk of falls in poliomyelitis patients [5]. These complaints are most commonly experienced in the lower limb because the virus often targets the anterior horn cells of L2 and

## Author's Photo Gallery



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**Figure 1:** Pre-operative patient presentation.

L3 that innervate the quadriceps [6]. Adults with polio are also more likely to have low bone mass, causing osteoporosis [5]. Recent investigations showed that there are risks for patients with polio to develop degenerative hip arthritis, which leads to instability [2]. These risks can lead to fractures. These conditions are called post-polio syndrome, in which symptoms of paresis and paralysis of polio can return many decades after the original infection [6]. These complaints will worsen as the patients age due to degenerative changes [7].

The great risk of falls and fractures in poliomyelitis patients may lead to the patients needing total arthroplasty, such as total hip arthroplasty (THA), especially after a fracture. Proximal fractures are among the most common osteoporotic fractures and can cause further motoric and gait issues [8]. However, there is still a small number of published literature discussions about the management of femoral fracture and the effect of

THA in poliomyelitis patients because although replacement surgery is the most common treatment for the “normal” patients, poliomyelitis patients have anatomical and physiological difference causing difficulty and risk of complication.

This report presents a case of a poliomyelitis patient with a periprosthetic fracture at the left femoral neck post-open reduction and internal fixation (ORIF) plate and screws, and osteopenia who then underwent successful THA with cerclage wire, continued with a boot cast for immobilization and lengthening of the tendon Achilles. Despite the risk and difficulty, we hope this case report can highlight the possibility and outcome of THA in poliomyelitis patients.

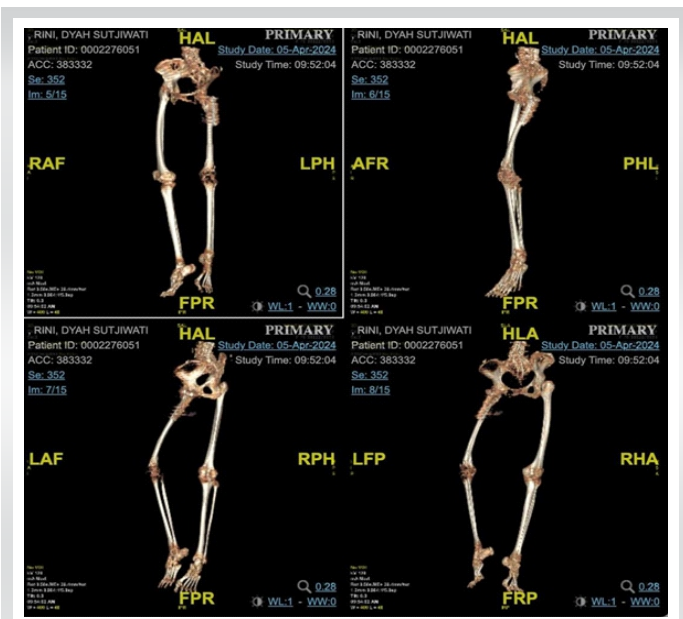
### Case Report

A 70-year-old woman came to the hospital with pain in her left

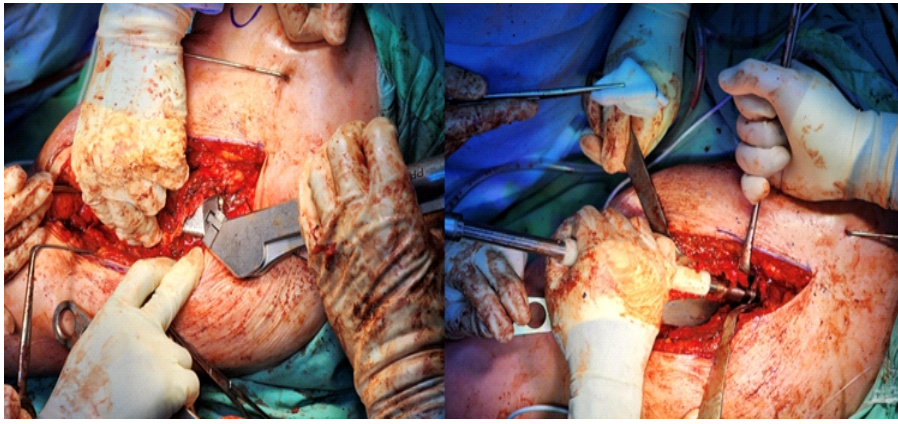


**Figure 2:** Bone mineral density result in L1-L4 vertebrae, right hip, and right forearm showing osteopenia.

hip after she slipped and landed on her left hip 5 h before. After the incident, the patient complained of pain in the left hip but could still bear her body weight, with no complaints about other body parts. She underwent a femoral surgery 30 years ago and has a history of polio. Before the fall, the patient used a walker in her day-to-day life. She denied taking any medicine or doing any intervention before coming to the hospital. When examined, shortening and muscle wasting in her left thigh and leg with tenderness limited her range of movement (Fig. 1). The apparent length of her right leg is 88 cm, while her left leg is 86 cm, and the true length was 79 cm and 77 cm for her right and left leg, respectively. There was also equinus deformity in her left knee. The X-ray showed bone discontinuity at the left neck femur without implant failure. Bone mineral density results showed osteopenia in vertebrae with T score  $-0.9$  standard deviation (SD) and Z score  $1.3$  SD, right femur with T score  $-1.8$  SD and Z score  $-0.3$  SD, and right forearm with T score  $-1.8$  SD and Z score  $-0.3$  SD (Fig. 2). The ultrasound Doppler of the lower extremity showed no plaque and there was good



**Figure 3:** 3D bone reconstruction from magnetic resonance imaging.

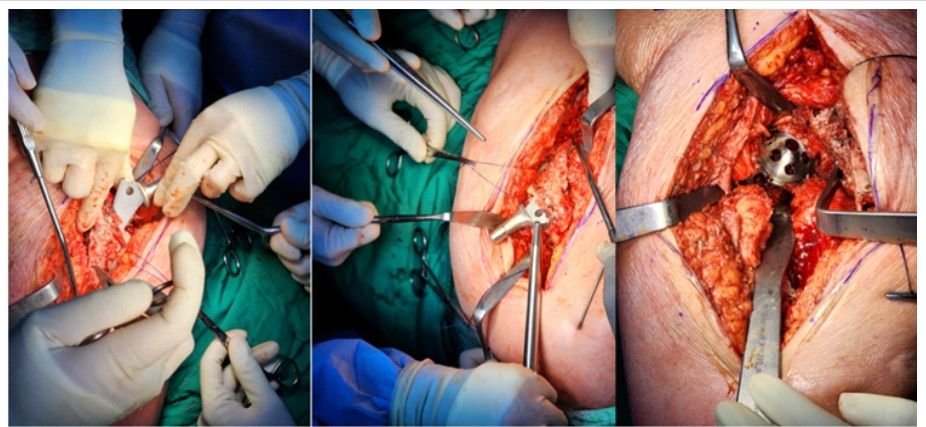


**Figure 4:** Intraoperative reaming of femur and acetabular.

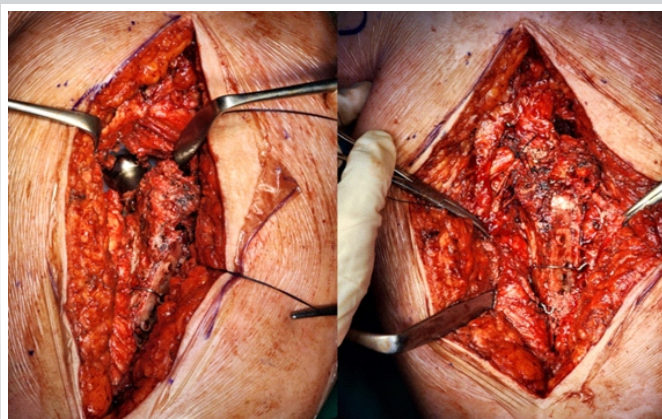
flow in both arteries and 3D reconstruction was made (Fig. 3). There was no thrombus in the vein or chronic venous insufficiency.

She was diagnosed with a periprosthetic fracture at the left femoral neck post-ORIF plate and screws with equinus deformity at the left ankle due to poliomyelitis and osteopenia (Fig. 4, 5, 6). A surgical intervention was required, so implant removal and total hip replacement with cerclage wire were performed. The patient was in the lateral position with a direct lateral approach for implant removal and total hip replacement. After that, she wears a boot cast for immobilization after Achilles tendon lengthening (Fig. 7).

Five days post-surgery, the patient showed excellent results, with less tenderness in the left hip and no sign of infection, such as swelling, pus, fever, or leukocytosis. Her range of movement is still limited due to pain. The lab results from 4 days post-surgery were 9.5 g/dL in



**Figure 5:** Intraoperative insertion of femoral stem and acetabular cup.



**Figure 6:** Intraoperative post-implant and cerclage wire insertion.

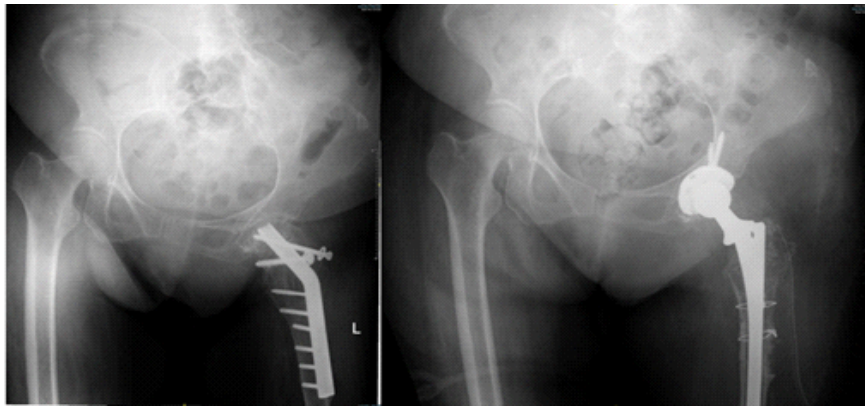
hemoglobin, 28.4% in hematocrit, 7010 in leukocyte, and 204.000 in thrombocyte. The patient was then discharged with a future rehabilitation plan to increase range of movement with physiotherapy and instructed not to bear weight on the fractured limb (Fig. 8). At 2-years follow-up, the patient was pain-free and able to walk with crutches (Fig. 9).

### Discussion

There are a significant number of complications that can happen to poliomyelitis patients after THA surgery, such as dislocation, non-unions, peri-implant fractures, malunion, cutout, and prominent hardware, which can lead to re-operation, causing many surgeons to feel

reluctant to do it [8,9,10]. Some difficulties can affect the surgery due to the pathological difference in anatomy and function in patients with poliomyelitis, such as weakening bone due to osteoporosis, deformity in bone size and structure, sequelae from previous fractures or surgery, weakening of the abductor muscle, and a narrow intramedullary canal [9,11]. These factors cause most poliomyelitis patients with fractures to undergo conservative treatment, unlike other cases where the main treatments are surgical and aggressive rehabilitation. Rehabilitation in poliomyelitis patients can also be troubled by low bone mass, low muscle strength, and impaired gait [8].

This case highlights the significant impact of poliomyelitis on bone health, particularly in the context of trauma and surgical intervention. Polio survivors are at an increased risk for osteoporosis, with studies showing that up to 96% of polio patients exhibit osteopenia or osteoporosis, making them highly susceptible to fractures [12]. In this patient, her history



**Figure 7:** Post-operative imaging showing neglected femoral neck fracture post-open reduction and internal fixation with plate and screw, and post-operative imaging showing post-total hip replacement and cerclage wire.

challenges faced by clinicians managing similar cases. Bone healing in polio-affected patients is often compromised due to reduced vascularity, disuse atrophy, and poor bone stock. The asymmetrical bone loss commonly observed in these patients further complicates recovery after surgeries like arthroplasty or fracture fixation [14]. In this case, the patient’s pre-existing equinus deformity at the left ankle – likely a sequela of poliomyelitis – indicates long-standing musculoskeletal abnormalities that may have contributed to altered biomechanics and stress distribution across the hip joint. In pre-operative

of polio combined with advanced age likely contributed to her osteopenic condition, which predisposed her to a periprosthetic fracture after a fall. In addition, recurrent falls are common in post-polio patients, with 39.2% experiencing falls and a subsequent higher incidence of fractures [13]. This combination of poor bone density and fall risk underscores the

narrow canal and osteoporosis, is commonly found with acetabular dysplasia in poliomyelitis patients. These conditions, combined with weakened hip abductors, can lead to difficulty achieving stability of the acetabular component and lead to periprosthetic intraoperative fracture [9]. Our patient had osteopenia in her vertebrae, femur, and forearm, combined



**Figure 8:** Five days post-surgery, showing the patient was able to sit down without support and still wearing boot cast for immobilization after lengthening of achilles tendon.



**Figure 9:** At 2 years follow-up, showing that the patient was pain-free and able to walk with crutches.

**Table 1: A comprehensive review of the existing literature and available manuscripts**

Authors	Year	Study type	Patient	Surgical approach	Outcome	Follow-up duration
Castillo, <i>et al.</i> [11]	2024	Case report	1 patient	Open reduction, locking cable-type anatomical compression plate + three cerclage cables	>20° of abduction and 10° of adduction in the hip	5 months
Sakellariou, <i>et al.</i> [15]	2023	Case report	1 patient	Open reduction, 4.5 mm with 10-hole diaphyseal plate was implanted anteromedially + medial strut graft	Successful healing (1 year) of the peri-implant fracture, no complications or signs of infection, and regained independence in daily activities using a prosthesis and walking stick.	12 months
Wang, <i>et al.</i> [6]	2013	Retrospective cohort	19 patients	Open reduction, locking compression cable-type anatomical plates	All fractures healed successfully (mean union time: 4 months), with one case of delayed union. No non-union, implant cutout, or complications occurred. At final follow-up, the mean knee flexion range was 105°, and the mean Hospital for Special Surgery (HSS) score was 76 points.	24 months
Kumar, <i>et al.</i> [16]	2017	Case series	7 patients	Philos plate, anterolateral proximal tibia locking compression plate, Austin Moore prosthesis	Functional outcome assessments included range of motion and early return to activities of daily living. All fractures healed except for one non-union due to conservative management	3-6 months

with past fracture and surgery, and weakened muscle, proven by abnormal gait and the need to use a walker to walk. These conditions showed that our patient has the risk of complications and difficulty.

Data from recent publications show that fall rates in poliomyelitis patients are 66–74%, and up to 35% of these patients have a history of previous fractures from a fall [9]. A cohort study showed that adults with poliomyelitis have a higher risk of femoral neck or hip fractures than other adults [5, 8]. This can be caused by muscle paralysis in polio due to quadriceps weakness, imbalanced gait due to deformities, contractures, or limb length discrepancies [11]. This also happened to our patient, who had a neck femoral fracture resulting from a fall, and this was not her first femoral fracture. The most common treatment for those patients was conservative, considering it is safer; meanwhile, the risk and difficulty of surgical intervention may outweigh the benefit.

Conservative management was not pursued in this acute setting due to the severity of the periprosthetic fracture; it remains a viable option for less severe injuries or as part of post-operative care. Non-operative approaches, such as pharmacotherapy with bisphosphonates, can improve femoral neck bone mineral density in post-polio patients, potentially reducing future fracture risks [15]. Physical therapy focused on strengthening unaffected muscles and improving balance could help mitigate fall risks, with tailored rehabilitation emphasizing gait training and mobility enhancement being particularly essential given the patient's equinus deformity and prior surgery. In addition, assistive devices like braces or walking aids may help offload

stress from fragile bones and joints, preventing further damage [12]. However, in this specific case, conservative measures alone would have been insufficient to address the periprosthetic fracture, making surgical intervention necessary.

Several publications have shown that many THAs done to poliomyelitis patients did not show dislocation episodes or significant complications [6]. The average Harris score also showed improvement and decreased VAS score postoperatively [10]. They also showed improvement in functional and radiographic parameters [2]. Surgical treatment of fractures of the lower limbs in patients with poliomyelitis is possible. It can be done when the benefits outweigh the risks as long as there is good surgical planning and anticipation for possible intraoperative problems followed by post-operative rehabilitation [6,9]. For patients with advanced and painful degenerative change and fractures, THA is the best option because if left untreated or using conservative treatments, it could lead to damaging the previously normal contralateral hip because of increasing load or further severe deformities of the affected hip, such as discrepancy in leg length, causing greater instability and fall risk [10]. Patients with femoral neck or hip fracture have a risk of dying within 1 year, and even then, more than half of those patients have difficulty walking, compromising their quality of life [5]. Meanwhile, conservative treatment has its risks, such as malunion, contractures, and pressure sores. In the long run, conservative treatment, if it is not adequate to the injury and degenerative changes, could predispose to further mobility problems, leading to loss of muscle mass and strength and osteoporosis [11]. In doing THA, long, slim stems and a restrictive or dual mobility

acetabular system are recommended [9]. While post-operative complications still exist, they occur 2 years after surgery and can be fixed with surgical fixation of periprosthetic fractures. Modern implants have lessened the number of reoperations and revisions needed in the patients [2].

In evaluating the optimal treatment strategy for peri-implant fractures in patients with polio sequelae, a literature review (Table 1) underscores the importance of a multifaceted surgical approach. Advanced fixation techniques, such as those involving locking plates and cables, have demonstrated significant improvements in joint function and mobility, as evidenced by successful case reports and cohort studies [16, 17]. These methods not only promote robust bone healing but also enhance functional recovery, enabling patients to regain independence in daily activities. However, conservative management approaches have been associated with higher rates of non-union and complications, highlighting the critical need for early surgical intervention. Given the high mortality rates observed post-fracture, a proactive and integrated treatment strategy becomes imperative [18,19]. This approach should combine open reduction with stable internal fixation using advanced locking plates and cables, complemented by diligent post-operative rehabilitation. Such a strategy not only mitigates the risk of complications but also fosters expedient functional recovery, ultimately enhancing the overall quality of life for this vulnerable patient population [16,17,18,19].

Initially, the patient underwent ORIF with plates and screws following her femoral surgery 30 years ago. However, plate fixation in polio patients carries inherent risks, including hardware failure due to poor bone stock, which increases the likelihood of screw pullout or plate breakage, as well as delayed union or non-union caused by impaired vascularity and osteoporosis that hinder proper bone healing [20]. In addition, polio-related soft-tissue atrophy and scar formation elevate the risk of post-surgical infections. In contrast, the decision to perform implant removal and proceed with THR (total hip replacement) using cerclage wires proved advantageous in this scenario. THR offers superior long-term outcomes for periprosthetic fractures in elderly patients with osteopenia, providing better stability and pain relief compared to revision ORIF [21]. The absence of post-operative complications, such as infection or dislocation, further highlights the efficacy of this approach when tailored to the patient's unique anatomical and physiological challenges.

Several factors contributed to the successful outcome of this patient's treatment. Pre-operative imaging likely revealed significant osteopenia, guiding the decision to pursue THR over alternative methods like plate fixation. Given the patient's age, functional limitations, and history of polio, restoring

mobility and alleviating pain were prioritized, with THR aligning well with these goals. Collaboration between orthopedic surgeons, physical therapists, and rehabilitation specialists ensured comprehensive care tailored to the patient's unique condition. While the surgery yielded excellent results, ongoing physiotherapy will be critical in maximizing motor function and preventing future falls, emphasizing the importance of realistic expectations and continued multidisciplinary support for long-term success.

The patient underwent implant removal followed by THA with the use of cerclage wires, along with post-operative immobilization using a boot cast and Achilles tendon lengthening. These interventions were selected based on several indications for THA, primarily the presence of a femoral neck fracture causing significant pain and deformity. In addition, the patient exhibited degenerative changes, including osteopenia and leg length discrepancy, which further supported the decision for THA. The surgical procedure was successfully performed without any notable complications, yielding excellent outcomes. Postoperatively, the patient experienced significant pain reduction, and motor function demonstrated substantial potential for improvement, provided that rehabilitation was continued as planned. This case underscores that THA can be a viable option in poliomyelitis patients when clinically indicated and appropriately tailored to the individual's condition.

### Conclusion

The following case highlights the challenges of managing fractures in polio patients, who are at increased risk of osteoporosis, falls, and complications due to weakened bones, muscles, and altered biomechanics. While conservative treatment is often preferred in less severe cases, surgical intervention was necessary here to address the fracture and improve mobility. THR proved effective, providing stability and pain relief without post-operative complications, underscoring its viability for such complex cases when tailored to the patient's unique condition. Successful outcomes were achieved through meticulous surgical planning, multidisciplinary care, and a structured rehabilitation plan aimed at restoring function and preventing future falls.

### Clinical Message

Careful preoperative assessment of muscle strength, joint stability, limb alignment, and functional expectations is essential to optimize surgical planning and outcomes. Despite technical difficulties, arthroplasty can provide substantial pain relief and functional improvement in selected post-poliomyelitis patients.

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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