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Case Study

Total Knee Arthroplasty in a Stiff Knee Post Infection - A Case Report

Aashish Chaudhry[1], Aakarsh Mahajan*[2], Sandeep Chauhan[3], Namita Sharma[4], Ishan Bhatia[5]

[1]MS Orthopedics, HOD, Dept. of Orthopedics, Aakash Healthcare Superspecilaity Hospital, Dwarka, New Delhi
[2]MS Orthopedics, Consultant, Dept. of Orthopedics, Aakash Healthcare Superspecilaity Hospital, Dwarka, New Delhi
[3]DNB Orthopedics, Associate Consultant, Dept. of Orthopedics, Aakash Healthcare Superspecilaity Hospital, Dwarka, New Delhi
[4]HOD, Senior Consultant, Dept. of Orthopedics, Aakash Healthcare Superspecilaity Hospital, Dwarka, New Delhi
[5]Senior Consultant, Dept of Anesthesia, Aakash Healthcare Superspecilaity Hospital, Dwarka, New Delhi

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Corresponding Author: Aakarsh Mahajan
Email: mahajanaakarsh15@gmail.com
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Abstract:

Purpose: This case report highlights the successful case of a fused knee to a functional joint through total knee arthroplasty (TKA) using a constrained hinge prosthesis in a 72-year-old male with a history of post-infectious ankylosis. **Background:** The patient developed septic arthritis following a platelet-rich plasma (PRP) injection, necessitating multiple debridements and long-term antibiotic therapy. Despite infection resolution, he experienced persistent stiffness, pain, and a minimal range of motion with knee (ROM) of 0–10°. **Methods:** Extensive preoperative planning confirmed the absence of infection and prepared for the challenges of fibrosis and bone deformity. The surgery utilized a medial parapatellar approach with extensive soft tissue release and constrained hinge prosthesis implantation. **Outcomes:** An intraoperative ROM of 0–90° was achieved, with postoperative radiographs confirming proper prosthetic alignment and fixation. Early rehabilitation helped maintain mobility, and no complications were observed in the early recovery phase. **Conclusion:** This report demonstrates the viability of constrained hinge prostheses in addressing complex cases of post-infectious knee ankylosis, emphasizing the importance of multidisciplinary care, meticulous planning, and early rehabilitation for favorable outcomes.

Keywords: Arthroplasty, Knee arthrodesis, Periprosthetic joint infection (PJI), Stiff knee, Total Knee Arthroplasty (TKA), Constrained hinge implant, Ligament release.

1. Introduction

Stiff knee arthroplasty is considered one of the most complex orthopedic procedures due to the need for simultaneous correction of deformities, release of contractures, and restoration of the functional joint space. While knee arthrodesis has traditionally been employed for end-stage joint conditions, the use of TKA to reverse fusion and re-establish joint mobility is a relatively rare procedure. It poses several surgical challenges, including addressing severe bone loss, joint ankylosis, and absent ligamentous support. Advances in constrained prosthetic designs, particularly hinge knee prostheses, have made this conversion feasible in selected cases. These implants provide rotational stability, facilitate proper joint alignment, and compensate for ligamentous deficiencies, making them particularly effective in cases of ankylosed or stiff knees (Kuchinad et al., 2014; Kim et al., 2000).

This report describes the case of a 72-year-old male from Uzbekistan who presented with a stiff right knee following a history of post-infectious fusion secondary to septic arthritis. The patient had undergone two debridement procedures and received long-term intravenous antibiotic therapy for infection control. Despite infection resolution, he experienced persistent knee stiffness, with a

preoperative ROM of 0-10 and jog of movements present at the knee joint and significant pain that severely impaired his daily activities. Imaging studies confirmed joint fusion with severe degenerative changes and soft tissue fibrosis, necessitating surgical intervention. Total knee arthroplasty was performed using a constrained hinge prosthesis to restore joint mobility and stability, achieving an intraoperative ROM of 0-90°. Preoperative planning for TKA in cases of ankylosed knees requires careful evaluation to ensure the eradication of active infection and address the technical challenges posed by extensive fibrosis and bone erosion. In this case, the absence of functional collateral ligaments and significant joint deformity necessitated the use of a constrained hinge prosthesis, which provided stability and facilitated a functional ROM (Wood & Conway, 2015). The surgical procedure involved extensive soft tissue release, removal of fused bone, and careful alignment of the prosthetic components to achieve a pain-free and functional joint. Postoperatively, the patient demonstrated significant pain relief and improved mobility, highlighting the potential of constrained hinge implants in managing such complex cases (Cameron & Hu, 1996). Conversion from a stiff knee to total knee arthroplasty (TKA) following post-infectious fusion represents a formidable challenge in orthopedic surgery. Knee stiffness, particularly when compounded by joint fusion resulting from septic arthritis, significantly limits a patient's quality of life by causing chronic pain, restricted mobility, and functional disability. The management of such cases requires addressing complex issues such as infection eradication, extensive soft tissue fibrosis, and joint instability, all of which demand a multidisciplinary approach and meticulous surgical planning (Henkel et al., 2001). In cases of post-infectious complications, the priority is to restore a pain-free, functional range of motion (ROM) while ensuring mechanical stability and preventing recurrence of infection.

This case adds to the growing body of evidence supporting the feasibility of converting stiff, ankylosed knees to functional joints through total knee arthroplasty. While infection recurrence and implant failure remain potential risks, thorough preoperative preparation and meticulous surgical execution can lead to excellent outcomes. In this instance, the use of a constrained hinge prosthesis, combined with aggressive rehabilitation, enabled the patient to regain a significant range of motion, dramatically improving his quality of life (Kim et al., 2003).

2. Case History

Patient Details:

The patient, a 72-year-old male from Uzbekistan, presented with a complex clinical background that required meticulous preoperative planning and surgical precision.

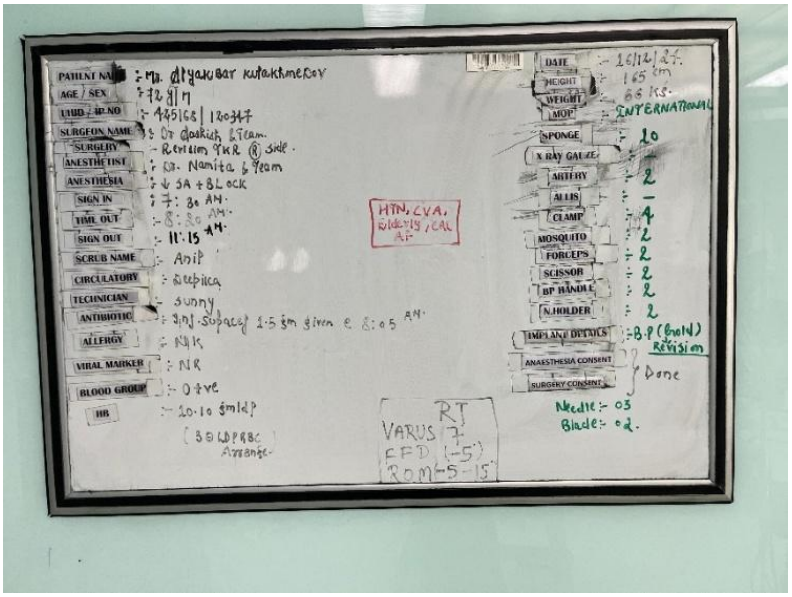

Figure 1: Preoperative Whiteboard Summary

Clinical Background:

His clinical history was marked by significant challenges, including septic arthritis following a Platelet-Rich Plasma (PRP) injection in the right knee two years prior. This led to severe complications, including infection and eventual ankylosis. The patient underwent two debridement surgeries, followed by prolonged intravenous antibiotic therapy to eradicate the infection. Despite these interventions, he continued to experience persistent pain and stiffness, which resulted in a complete loss of functional mobility in the knee. Preoperatively, the knee exhibited a range of motion (ROM) of only 0-10°, effectively classifying it as fused.

The whiteboard provides a comprehensive summary of the patient's demographic details, clinical history, and surgical checklist. Notable highlights include the diagnosis of ankylosis secondary to septic arthritis and the preoperative ROM, which was critically limited to 0-10°. The operative plan outlined in the summary highlights the complexity of the case, including the anticipated need for extensive soft-tissue release and the use of constrained implants to restore joint function.

Radiological Assessment:

- X-rays and intraoperative imaging revealed joint ankylosis, erosion, and loss of ligamentous integrity.
- No signs of active infection were observed.

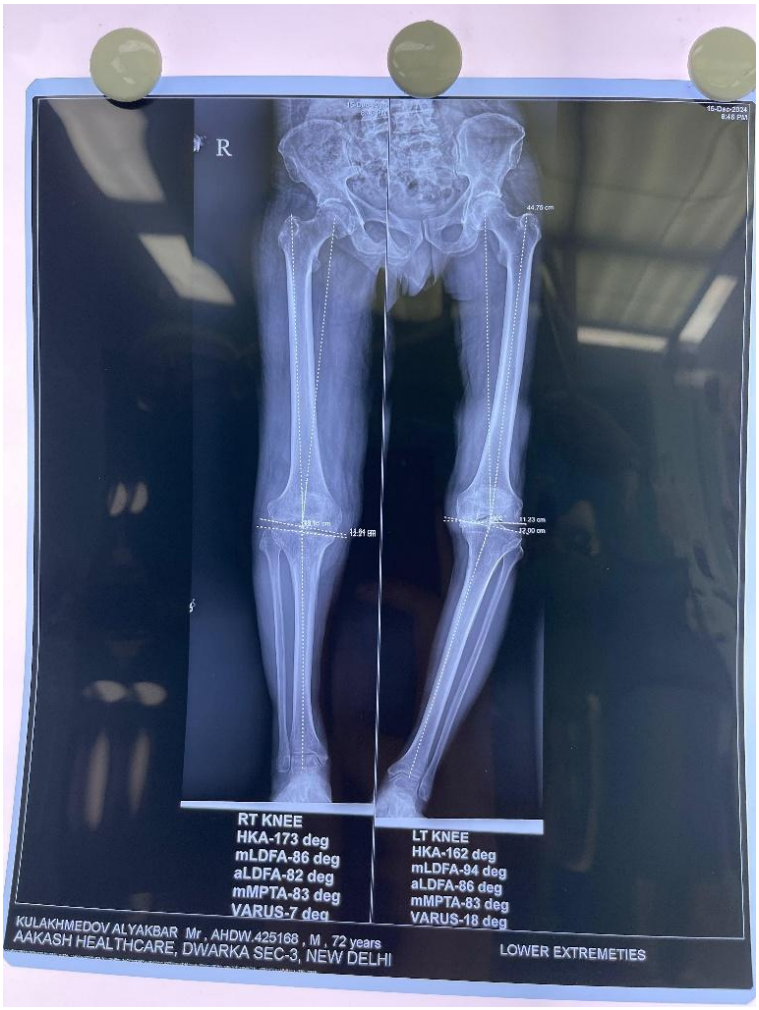

Figure 2: Preoperative Standing Full-Length X-ray

Demonstrating varus deformity of the right knee with a mechanical axis deviation and angular deformities (HKA, mLDFA, aLDFA, mMPTA).

The full-length standing X-ray reveals a significant varus deformity of the right knee with a mechanical axis deviation. Quantitative angular measurements include a HKA angle of 173°, an mLDFA of 86°, an aLDFA of 82°, and an mMPTA of 83°, all indicating substantial malalignment and deformity. These angular deformities emphasize the biomechanical challenges in restoring proper alignment and functionality during the procedure. The contralateral knee (left) displays less severe angular deformities but serves as a baseline reference for comparison.

Figure 3: Preoperative Right Knee X-rays (Anteroposterior and Lateral Views)

The anteroposterior (AP) and lateral X-rays of the right knee depict advanced degenerative changes, joint ankylosis, and extensive bony fusion. The obliteration of the joint space and osteophyte formation are indicative of chronic inflammation and disuse. The lateral view further emphasizes the fibrotic and bony structures that contributed to the limited ROM. Importantly, there are no radiological signs of active infection, a critical consideration for proceeding with total knee arthroplasty (TKA).

The clinical and radiological findings highlight the multifaceted challenges of this case. The complete ankylosis of the right knee resulted in severe functional impairment, compounded by biomechanical malalignment and deformities. The absence of active infection, confirmed through thorough preoperative workups, provided the foundation for proceeding with a complex conversion to TKA. The identified angular deformities and fused joint underscored the need for constrained hinge prosthesis to ensure joint stability and mobility postoperatively. This case required a multidisciplinary approach, integrating advanced surgical techniques, precise implant selection, and a tailored rehabilitation plan to achieve the desired outcomes.

3. Treatment Concept

3.1 Preoperative Planning:

Prior to surgery, a meticulous preoperative plan was devised to ensure optimal outcomes:

- **Infection Clearance:** A thorough workup, including laboratory tests, joint aspiration, and imaging, confirmed the absence of active infection. This was critical to avoid postoperative complications such as reinfection or prosthesis failure.

- **Counseling:** The patient and family were counseled extensively about the complexity of the procedure, potential risks, and the rehabilitation process. The challenges of converting a fused, post-infectious knee into a mobile joint were explained in detail, alongside the importance of postoperative physiotherapy.

3.2 Surgical Procedure:

The surgical correction of a stiff, post-infectious knee into a functional joint through total knee arthroplasty (TKA) is a highly intricate process requiring precise planning, extensive intraoperative maneuvering, and meticulous postoperative care. In this case, a 72-year-old patient with a completely fused right knee and minimal preoperative range of motion (0-10°) underwent TKA using a constrained hinge prosthesis. The overarching goal of the procedure was to restore joint mobility, relieve pain, and correct significant angular deformities caused by prior infection and fibrosis.

3.2.1 Anesthesia and Approach:

- **Anesthesia:** The first step in the surgical management involved administering spinal anesthesia and regional blocks. Spinal anesthesia was chosen for its advantages, including reduced intraoperative blood loss, stable hemodynamics, and effective postoperative pain relief. This technique proved ideal in managing a high-risk patient with significant pre-existing comorbidities, as indicated by the patient's clinical history. Preoperatively, comprehensive counseling sessions were held with the patient to ensure understanding of the complexity of the surgery and the extended rehabilitation process necessary for optimal outcomes.
- **Surgical Approach:** The surgical procedure began with a standard medial parapatellar approach, a widely accepted method for gaining access to the knee joint in TKA procedures. This approach allowed sufficient exposure of the fused knee joint, enabling the surgeon to perform a thorough evaluation of the extent of fibrosis, ankylosis, and bony deformity. Upon exposure, the surgical team encountered dense fibrotic tissue and severe joint ankylosis, which had resulted from the patient's prior infectious complications. Extensive soft tissue dissection was performed to release adhesions and restore mobility to the joint capsule. This step was crucial for creating space and mobility within the joint, setting the stage for successful prosthesis implantation.

3.2.2 Intraoperative Views: Soft Tissue Exposure and Bone Preparation

Figure 4: Initial exposure of the stiff knee joint showing fibrosis and bone structure.

The intraoperative phase of this complex total knee arthroplasty involved meticulous exposure and preparation of the stiff knee joint. Upon incision and dissection, the initial view revealed extensive fibrosis and deformity within the knee joint (Figure 4). The dense, scarred tissues surrounding the joint required careful removal to expose the underlying osseous structures. This step was critical to address the severe post-infectious changes, which included thickened soft tissues and obliterated joint spaces.

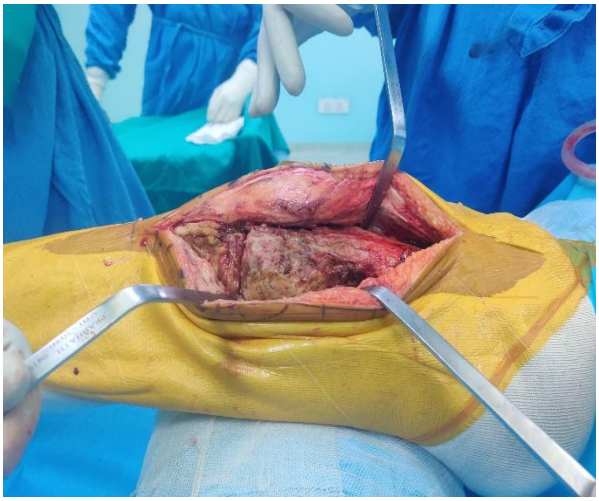

Figure 5: Dissection to reveal underlying osseous changes and joint adhesions.

Further dissection allowed the surgical team to identify and address the significant osseous changes and adhesions present due to the prolonged ankylosis of the joint .

Figure 6: Visualization of joint with extended soft tissue clearance and ligament release.

A systematic soft tissue clearance followed, during which joint contractures were released and fibrotic tissue removed to restore mobility. Extended soft tissue dissection was carried out to enable proper visualization of the joint, as the patient's fused knee offered little flexibility or space for surgical maneuvering (Figure 6).

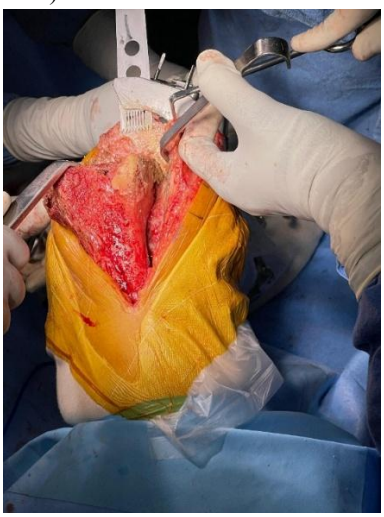

Figure 7: Bone preparation for placement of the hinge implant with guides in place.

Bone preparation began once adequate exposure was achieved. Using specialized cutting guides, the tibial and femoral surfaces were meticulously shaped to accommodate the hinge prosthesis. Proper alignment and precision were crucial to ensuring that the prosthesis would function effectively and restore the mechanical axis of the knee (Figure 7).

Figure 8: Use of Antero-Posterior Resection Block .

Throughout this process, cutting blocks and alignment guides were used to assess the final positioning and ensure that the knee joint would be anatomically aligned post-implantation (Figure 8).

3.2.3 Intraoperative Views

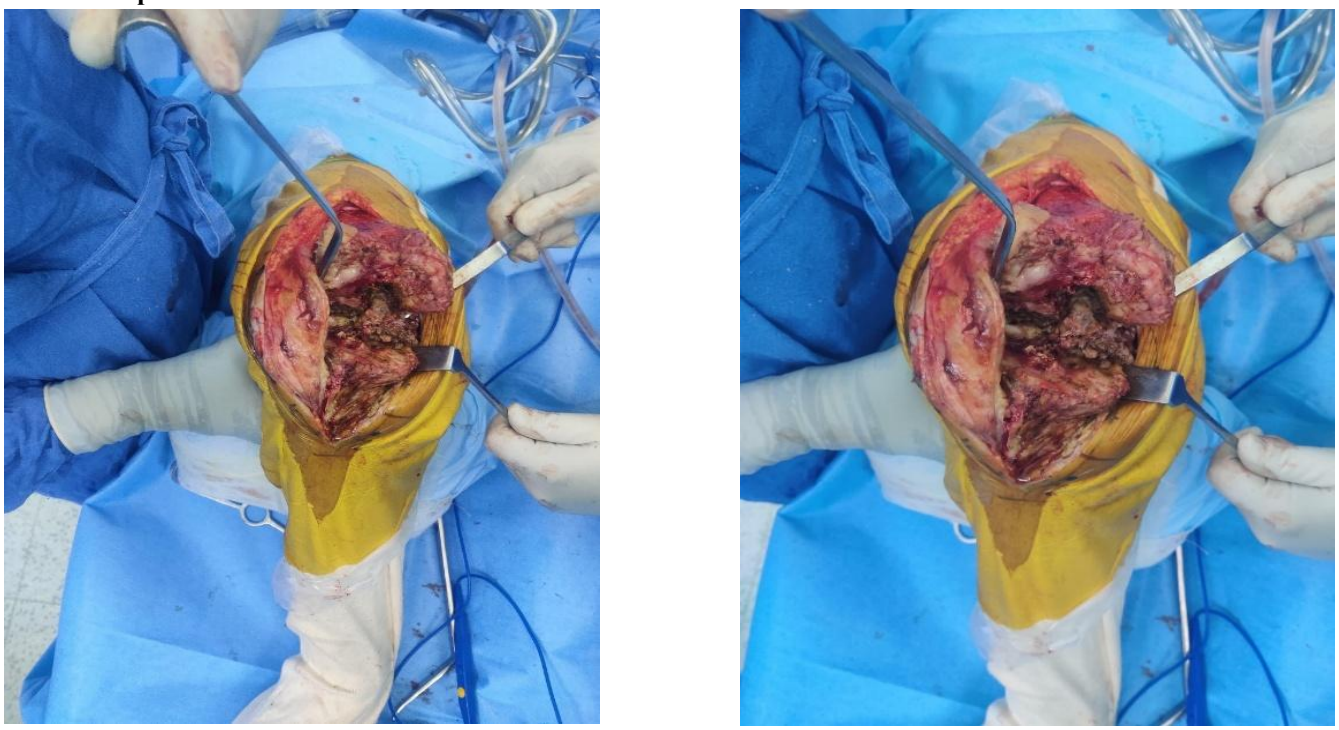

Figure 9: Assessment of gaps (Large Flexion – Extension gaps)

Figure 10: Final Prepared cuts after thorough wash and lavage ready for implantation

Figure 11: Assembled hinge knee implant components shown on sterile drape.

Following the preparation of the joint, attention turned to the placement and assembly of the constrained hinge implant. The individual components of the prosthesis were first prepared and assembled under sterile conditions (Figure 11).

Figure 12: Completed implant assembly for hinge total knee arthroplasty.

The constrained hinge design, which included femoral and tibial components as well as a polyethylene insert, was specifically chosen for its ability to provide stability in the absence of functional collateral ligaments. Once assembled, the implant components were systematically introduced into the prepared bone surfaces.

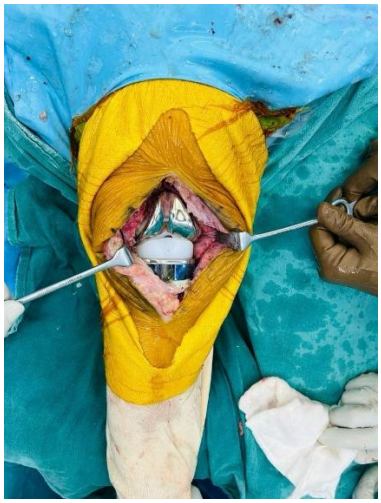

Figure 13: Placement of the tibial and femoral hinge components into the prepared bone.

With the femoral and tibial components in place, careful testing of the joint's stability and range of motion was performed. The constrained hinge mechanism allowed for controlled articulation while ensuring stability against shear forces, making it ideal for this complex case. Intraoperative testing revealed a restored range of motion (ROM) from 0° to 90°, an impressive outcome considering the preoperative ROM was only 0° to 10°. The image (Figure13) demonstrates the proper alignment and fixation of the prosthetic components, ensuring rotational stability and controlled articulation. The constrained hinge design compensates for ligamentous deficiencies, making it an ideal choice for restoring joint functionality in cases of severe deformity and ankylosis. The implantation of the constrained hinge prosthesis was a pivotal aspect of this case, providing the stability and mobility required for the patient's fused knee.

Given the complete ankylosis of the knee and the absence of functional ligaments, a constrained hinge prosthesis was deemed the most suitable option. The prosthesis allowed for controlled articulation while compensating for the lack of collateral ligament support.

During the procedure, the prosthesis components were meticulously aligned to ensure proper articulation and stability. The femoral and tibial components were secured to the prepared bone using cement, creating a stable foundation for the polyethylene insert to articulate. The hinge mechanism restored the knee's ability to flex and extend while maintaining alignment of the mechanical axis. Intraoperative testing confirmed a range of motion of 0-90°, a remarkable improvement from the preoperative state of 0-10°

Figure 14: Meticulous closure of arthrotomy.

The final steps involved meticulous closure of the surgical site (Figure 14). After confirming the implant's stability and proper alignment, the wound was closed layer by layer. Intraoperative imaging and assessment confirmed that the prosthesis was properly positioned, and the joint's functionality had been restored.

3.2.4 Intraoperative ROM: A ROM of 0-90° was achieved, demonstrating the effectiveness of soft tissue release and prosthesis placement.

Figure 15 : Postoperative Clinical Flexion (On Table)

Figure 16: Postoperative Radiograph: Anteroposterior View

Fig. 16, AP X-ray demonstrating the final placement of the hinge prosthesis with restored alignment of the femoral and tibial components.

Figure 17: Postoperative Radiograph: Lateral View

Fig. 17, Lateral X-ray showing proper positioning and alignment of the hinge knee prosthesis, confirming stability and fixation.

Postoperative radiographs were performed to confirm the correct positioning and alignment of the constrained hinge prosthesis. The lateral radiograph demonstrated proper placement of the femoral and tibial components, with the hinge mechanism securely seated and aligned to restore joint articulation. Similarly, the anteroposterior (AP) view highlighted the corrected mechanical axis, with the prosthesis components in optimal alignment relative to the tibia and femur. The imaging confirmed the absence of complications such as loosening, malalignment, or inadequate fixation, which validated the success of the surgical intervention.

3.2.5 Postoperative Care

Postoperative management was crucial to maintain the achieved mobility and prevent complications:

- **Rehabilitation:** Immediate passive and active ROM exercises were initiated under supervision. This helped to maintain mobility and prevent scar formation.
- **Antibiotics:** A tailored antibiotic prophylaxis regimen was continued to minimize the risk of infection recurrence, given the patient's history of septic arthritis.

Postoperative management was critical to maintaining the intraoperatively achieved outcomes. The patient was started on a supervised rehabilitation protocol immediately after surgery. Passive and active range of motion exercises were initiated on the first postoperative day, focusing on maintaining joint mobility and preventing scar tissue formation. These exercises were essential to preserving the functional range of motion achieved intraoperatively (0-90°).

In addition to rehabilitation, antibiotic prophylaxis was tailored to the patient's history of septic arthritis to minimize the risk of infection recurrence. The antibiotic regimen was closely monitored and adjusted based on clinical and laboratory parameters. The multidisciplinary approach to postoperative care ensured a smooth recovery process, with no signs of infection or complications observed during the early follow-up period.

4. Outcome

The intraoperative findings during the total knee arthroplasty were significant, revealing the severity of the patient's condition and the challenges addressed throughout the surgery. The joint was found to be completely ankylosed, with severe bone erosion resulting from the prolonged period of immobility and the prior infectious process. Additionally, the soft tissues surrounding the joint were fibrotic, dense, and adherent, requiring extensive release to enable adequate exposure and mobility. The extent of these changes underscored the complexity of the surgical intervention and the importance of precise surgical execution. These findings necessitated a systematic approach to soft tissue clearance and careful bone preparation to accommodate the hinge prosthesis, ultimately allowing for the restoration of mobility and alignment.

Postoperatively, the range of motion (ROM) achieved intraoperatively was remarkable, progressing from a preoperative ROM of 0-10° to 0-90°. This achievement highlighted the success of the extensive soft tissue release, joint preparation, and the use of a constrained hinge prosthesis. The restoration of this level of ROM provided the patient with the potential for functional mobility, a significant improvement from his preoperative condition. This intraoperative success emphasized the critical role of careful prosthesis selection and meticulous surgical technique in achieving such outcomes in complex cases of joint ankylosis.

The postoperative recovery was carefully managed to ensure the preservation of the intraoperative outcomes and to minimize the risk of complications. The patient demonstrated significant pain relief, an essential outcome given his prior history of chronic pain associated with the stiff knee. His mobility improved substantially, and he was able to initiate movement early in the recovery process under the guidance of an intensive rehabilitation program. This program included passive and active range-of-motion exercises designed to prevent scar formation and ensure the maintenance of the achieved ROM.

A tailored antibiotic prophylaxis regimen was implemented postoperatively, taking into account the patient's history of septic arthritis. This regimen was essential in mitigating the risk of reinfection, a potential complication in cases of prior infectious processes. Close monitoring of the patient's clinical and laboratory parameters during the postoperative period ensured early detection of any adverse events, enabling prompt intervention if needed. The combination of surgical success, rehabilitation, and infection prevention strategies contributed to a smooth recovery, with no complications reported during the early follow-up period.

5. Discussion

The successful conversion of a stiff, ankylosed knee to a functional joint through total knee arthroplasty (TKA) highlights the remarkable advancements in prosthetic design and surgical techniques that make such procedures feasible today. This case underscores the complexities associated with addressing post-infectious fusion and demonstrates the critical role of a multidisciplinary approach in achieving positive outcomes. Several key points merit discussion.

5.1 Challenges in Infection Control and Preoperative Planning

Managing a post-infectious ankylosed knee requires stringent infection control as a cornerstone of successful outcomes. In this case, the patient's history of septic arthritis, compounded by severe fibrosis and bony ankylosis, posed significant challenges. Thorough preoperative evaluations, including joint aspiration, laboratory tests, and imaging studies, were essential to confirm the absence of active infection (Henkel et al., 2001; Kim et al., 2003). The use of long-term intravenous antibiotics following earlier debridement procedures played a critical role in eradicating the infection, paving the way for safe TKA. Counseling the patient and family about the complexity of the procedure and the need for an intensive rehabilitation program was equally important in setting realistic expectations and ensuring compliance.

5.2 Soft Tissue Management and Surgical Complexity

The surgical management of this case was particularly challenging due to the extensive soft tissue fibrosis and complete joint ankylosis. Dense fibrotic tissue surrounding the joint required extensive soft tissue release to enable adequate exposure and restore joint mobility. Achieving this level of clearance while preserving essential structures required a meticulous and systematic approach, as described in previous studies on similar cases (Cameron & Hu, 1996; Kuchinad et al., 2014). The careful preparation of the bone to accommodate the hinge prosthesis further emphasized the technical difficulty of the procedure. Without functional collateral ligaments, the constrained hinge implant was the only viable option to ensure joint stability, a solution supported by Wood and Conway (2015).

5.3 Prosthetic Design and Outcomes

The use of a constrained hinge prosthesis was pivotal in this case. These implants are designed to compensate for the absence of ligamentous support and provide rotational stability, making them ideal for managing severe deformities and joint ankylosis. The intraoperative achievement of 0-90° range of motion (ROM) was a testament to the effectiveness of the prosthesis and the meticulous surgical execution (Kim et al., 2000). This outcome is consistent with other studies that have highlighted the utility of constrained hinge designs in similar scenarios (Cho et al., 2008; Kim et al., 2003). Radiographic assessments postoperatively confirmed proper prosthesis alignment and fixation, which are critical to ensuring long-term implant survival and function (Kernkamp et al., 2016).

5.4 Rehabilitation and Postoperative Care

Early and aggressive rehabilitation played a crucial role in maintaining the achieved ROM and preventing scar tissue formation. The initiation of passive and active range-of-motion exercises on the first postoperative day helped to preserve joint mobility and prevent stiffness, a common postoperative complication in cases involving extensive fibrosis (Brown et al., 2018). The tailored antibiotic regimen addressed the patient's history of septic arthritis and minimized the risk of reinfection, which remains one of the most significant concerns in post-infectious arthroplasty cases (Parvizi et al., 2018; Renz et al., 2016). Close monitoring during the postoperative period ensured early detection and management of potential complications, contributing to the patient's smooth recovery.

5.5 Broader Implications and Future Considerations

This case adds to the growing evidence that TKA can successfully convert stiff, ankylosed knees into functional joints, even in patients with a history of severe post-infectious complications. However, the procedure remains technically demanding and requires careful patient selection, comprehensive preoperative planning, and meticulous surgical execution. Long-term follow-up studies are needed to assess the durability of constrained hinge implants in such challenging cases, particularly in preventing late complications such as loosening, infection recurrence, or prosthesis failure (Zimmerli et al., 2004; Abdel et al., 2018). As prosthetic designs and surgical techniques continue to evolve, the success rates of such complex reconstructions are expected to improve further.

6. Conclusion

This case demonstrates that total knee arthroplasty using a constrained hinge prosthesis is an effective treatment for patients with post-infectious stiff knees, even in severe cases with ankylosis and deformity. Through meticulous surgical planning and a multidisciplinary approach, significant functional improvement and pain relief can be achieved. The absence of active infection, confirmed preoperatively, was critical for the success of the procedure, allowing for safe surgical intervention without compromising long-term outcomes. The constrained hinge prosthesis proved pivotal in compensating for ligamentous instability and restoring joint alignment and mobility, achieving an impressive intraoperative ROM of 0–90°. Postoperative rehabilitation played a vital role in preserving these gains and preventing stiffness recurrence. Despite the inherent challenges of such procedures, this case adds to the growing evidence supporting TKA as a viable option for reversing knee fusion in select patients. Future advancements in implant design and perioperative care are expected to further improve outcomes in similar complex cases. This report underscores the need for a collaborative, patient-centered approach to address post-infectious knee stiffness and restore functional independence.

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