AVITUS ORTHOPAEDICS

CASE STUDY:

MYCOBACTERIAL COMPLICATED DISTAL FEMORAL OSTEOMYELITIS TREATED WITH AGGRESSIVE RADICAL DEBRIDEMENT UTILIZING AVITUS® SUCTION CURETTAGE AND DISTAL FEMORAL REPLACEMENT

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MYCOBACTERIAL COMPLICATED DISTAL FEMORAL OSTEOMYELITIS TREATED WITH AGGRESSIVE RADICAL DEBRIDEMENT UTILIZING AVITUS® SUCTION CURETTAGE AND DISTAL FEMORAL REPLACEMENT - A CASE STUDY

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INTRODUCTION

The following is a case report of a patient requiring multiple surgeries following an open intra-articular distal femur fracture complicated by mycobacteria osteomyelitis and septic arthritis requiring serial debridements and eventual distal femoral replacement.

CASE PRESENTATION

A 31-year-old male patient had sustained severe poly-trauma following a motorcycle accident. Initial orthopaedic injuries included left forearm fracture, right acetabular fracture, and a Grade III open right comminuted distal femur fracture. The patient underwent initial treatment of all fractures at an outside facility. This case report focuses on the treatment of his right leg which included Irrigation with Debridement (I&D) and Open Reduction with Internal Fixation (ORIF) of his open intra-articular right distal femur fracture. He was hospitalized for nearly one month following the primary ORIF procedures. The intra-articular right distal femur fracture was complicated by early infection and subsequent osteomyelitis. The patient returned to the operating room at the initial facility and had partial removal of hardware of the right distal femur with debridement and placement of a knee spanning external fixator. Cultures subsequently confirmed the diagnosis of osteomyelitis (OM) and septic arthritis (SA) of the right distal femur. Bacterial isolates were found to be *polymicrobial, including mycobacterium fortuitum.*

After a prolonged period with an external fixator and persistent drainage of the wound, the patient was offered an above knee amputation (AKA). The otherwise healthy young patient was adamantly interested in exploring any limb salvage option. The patient was referred and presented to the primary author's office for consultation. Upon physical examination, there were several open, draining wounds around the right distal femur and knee joint. Retained absorbable antibiotic beads were visible within the wound and extruding through multiple open sinus tracks. Other than a right-sided foot drop, the operative extremity was neurovascularly intact.

Radiographs were obtained during initial consultation [Figure 1]. The right distal femur fracture revealed presence of retained hardware and minimal callus formation without radiographic evidence of union. The fracture was significantly displaced and also showed radiographic evidence of osteomyelitis.

After discussion the patient decided to undergo a limb salvage procedure. The procedure would entail: resection of his distal femur, aggressive and radical I&D of the surgical field, and placement of an antibiotic spacer as a staged approach for eventual right distal femur replacement. Given the high possibility for residual infection, all available tools were utilized to ***aggressively reduce bacterial load***. An interdisciplinary approach was employed due to the complex nature of the case, including infectious disease consultation for antibiotic directed therapy.

METHODS & OPERATIVE TECHNIQUE

Overall the patient underwent three surgeries by the primary author. All three surgeries included thorough debridement of the bone and surrounding soft tissues with exchange of the antibiotic eluting cement spacer. Furthermore, the intramedullary canals were aggressively debrided at each operation to remove nonviable tissue, bone, and psuedomembrane that could provide an infectious nidus which could harbor bacterial load and hinder subsequent distal femoral replacement.

A novel suction curettage device (i.e., the Avitus® Bone Harvester) was utilized for aggressive radical debridement of the entire soft tissue envelope as well as the intramedullary canals [Figure 2]. The device connects to standard operating room suction to enable simultaneous scraping, aspiration, and containment of contaminated tissue during debridement. The device has a sharp cutting edge that can easily debride infected bone, pseudomembrane, and intramedullary canals. The continuous suction traps all the aspirated infectious material within the device handle, allowing easy retrieval for specimen testing or diagnosis and reducing the likelihood of contaminated material being seeded to other parts of the body. The ability to debride and remove the infectious material from the surgical field at the same time reduces operating room time and increases efficiency. At the third and final surgery, a distal femoral replacement was placed after I&D. Video link of intraoperative debridement with the Avitus® Bone Harvester.

POST-OPERATIVE FOLLOW UP

The patient was followed at regular intervals with 9 months of total follow-up to date. Despite post operative heterotopic ossification, there was no radiographic or examination-based evidence of loosening or osteomyelitis [Figure 3]. To date, the patient has had normal lab values, namely: erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and white blood cell count (WBC). The patient underwent formal physical therapy and then transitioned to a home exercise program. He has progressed well and ambulates well with use of a cane and an ankle foot orthosis (AFO). There is an expected leg length discrepancy which is easily addressed with shoe modifications. The patient has returned to daily activities, including driving a car and even riding his motorcycle. The most recent 9-month clinical exam revealed a well-healed wound without any erythema, fluctuance, or tenderness. He has appropriate muscle strength and knee motion of 0-90 degrees. Overall, the patient is very pleased with his progress and progression to this point. The most recent follow-up plain radiographs demonstrate a stable distal femoral replacement [Figure 4]. Video link of patients' post operative ambulation progression at 4 months and 9 months follow up.

DISCUSSION

Open fractures of the extremities present treatment challenges for orthopaedic surgeons. These injuries notoriously pose a high risk for infection even when treated rapidly and aggressively with surgery and intravenous antibiotics. The classification of open fractures is commonly described by the Gustillo-Anderson Classification, being divided into Grade I, II, or III.[1] The literature demonstrates infection rates of 0-2% for type I, 5-12% in Grade II, and 10-50% in Grade III.[2,3]

Complex open fracture traumas, especially those with joint involvement in a weight bearing extremity, represent a significant risk of functional impairment and even limb loss. The knee comprises more than 50% of all lower extremity joint open injuries.[4]

During higher grade open fractures, osteomyelitis is an unfortunate and not infrequent complication arising from direct inoculum and is often polymicrobial. In this specific patient who sought to avoid amputation, distal femoral replacement reconstruction allowed immediate postoperative weight bearing. Relying upon instruments and techniques that help provide a surgical field more amendable to joint reconstruction was of utmost value. Mycobacterium is usually considered a surgical infection often requiring aggressive and radical serial debridements.

We performed serial debridements to remove residual grossly infected bone and tissue followed by usage of antibiotic eluting cement spacers to provide adjunct local antibiotic delivery. Traditional means of surgical debridement include manual cutting instruments, different types of rongeurs and curettes, power instruments such as burrs or saws, and specialized reamers to attempt intramedullary lavage. These techniques and tools have limitations: they can leave residual infected tissue or bone

behind; embolize bacteria to other locations of the body; and create potential for thermal injury. Furthermore, many of the common instruments used for debridement are re-used after sterilization and therefore become dull with use over time. This hinders their ability to effectively debride. It is paramount to employ techniques that reduce the time of surgery in joint surgery. In 2019, Parvizi et al. reviewed nearly 20,000 joint arthroplasties and found that for every 20 minutes of operative time, the risk of 1 year Prosthetic Joint Infection (PJI) increased by 25%. Any techniques surgeons can employ to decrease operative times can result in better outcomes. [6-7]

The Avitus® Bone Harvester overcomes many of the deficiencies of conventional debridement techniques. It is a closed capture suction curettage system that simultaneously cuts, aspirates, and contains. The unique cutting edge is new and sharp each use, facilitating ease of debridement. The manual cutting nature of the device avoids the risk of thermal necrotic tissue damage that can be found with conventional powered debridement techniques.[8-10] Utilizing the Avitus® novel suction curettage device, one can debride infected tissue efficiently and quickly capture the aspirated tissue in the closed capture receptacle. This can reduce the risk of contamination of other instruments and allow for ease of obtaining specimens for culture or pathology examination. The Avitus® Bone Harvester reduces overall operative time with debridement and joint revision procedures.

CONCLUSION

This patient presented with polymicrobial osteomyelitis with an open displaced fracture and significant bone loss. The ability to salvage the patient's lower extremity, restore function, and allow return to pain-free ambulation was challenging. The Avitus® Bone Harvester benefited our patient's outcome by reducing operative time by streamlining the debridement process, containing contaminated tissue, reducing leave-behind infectious materials, and enabling radical debridement. We will continue to utilize it when aggressive infection control measures are needed, including staged revision infection arthroplasty and osteomyelitis cases.

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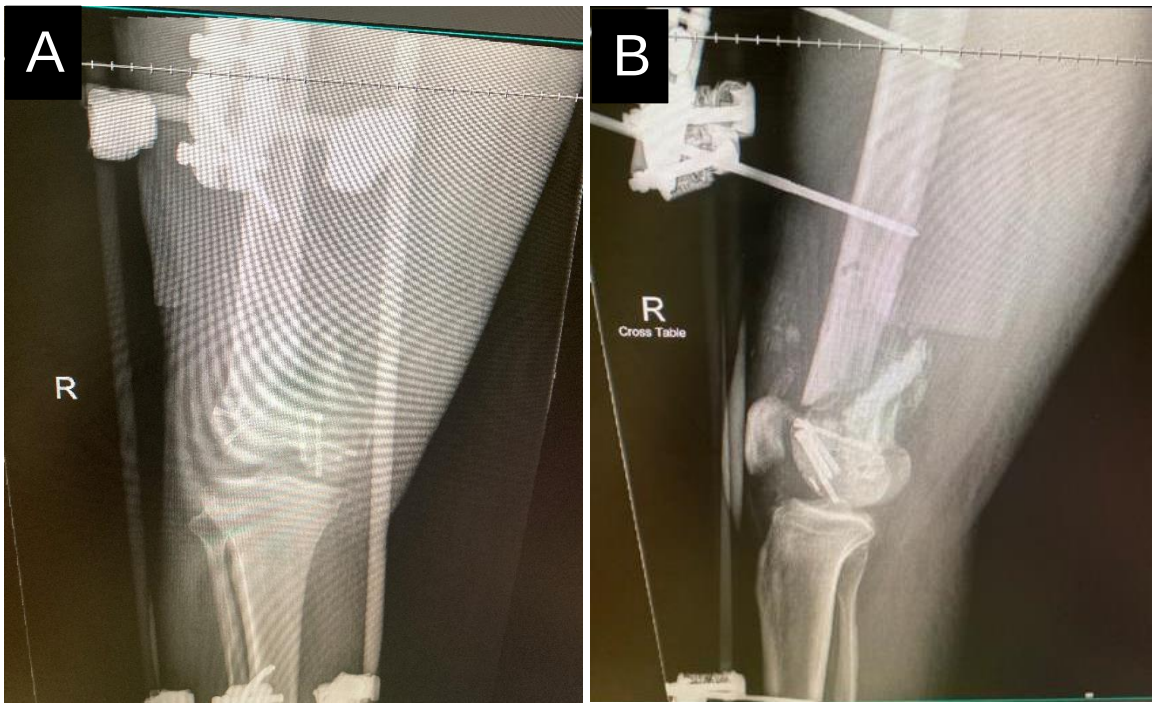

Figure 1 :: Pre-Operative Radiographs (A) AP (B) Lateral RIGHT knee showing retained internal fixation, external fixator, and radiographic evidence of osteomyelitis.

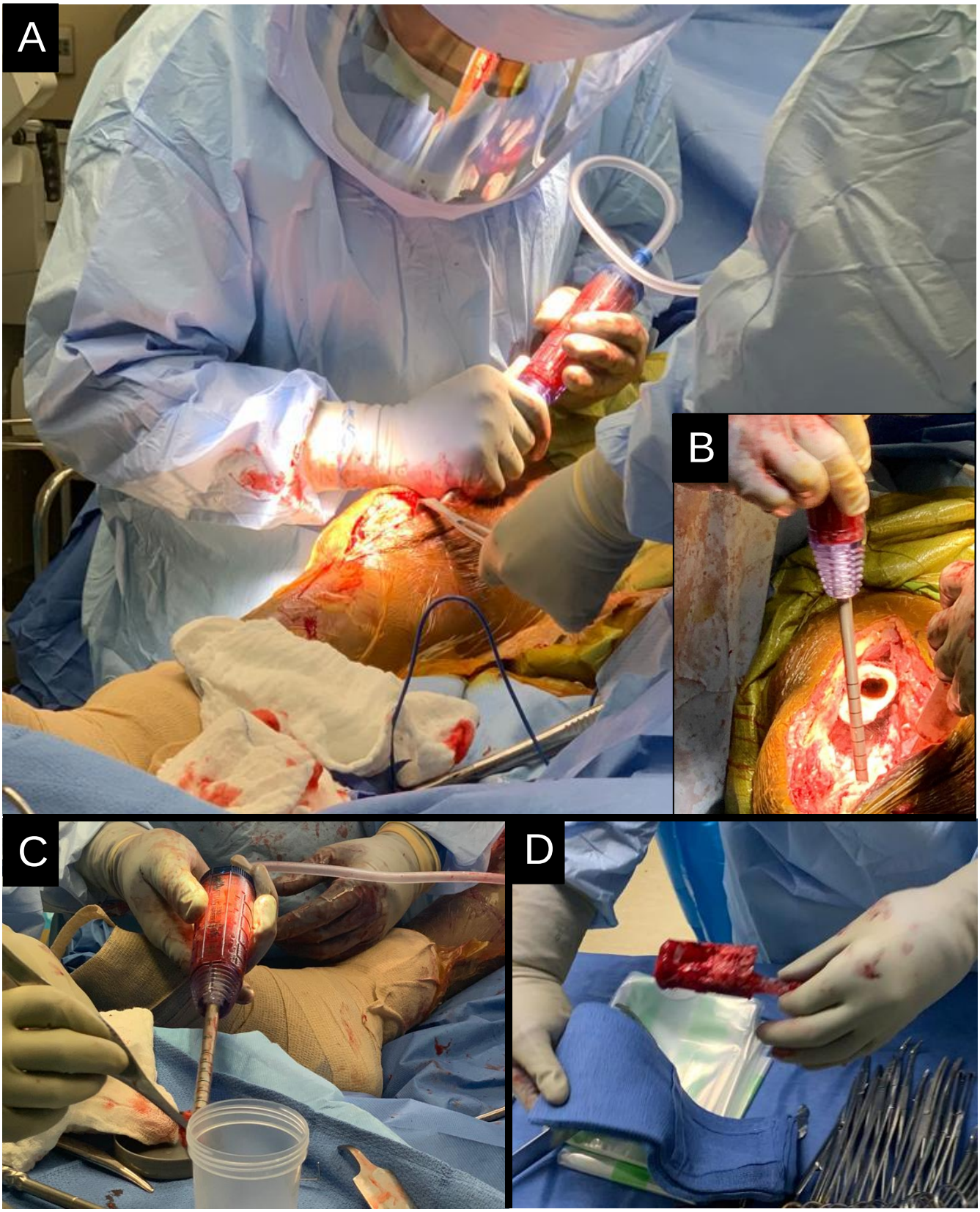

Figure 2 :: A) Intraoperative radical debridement utilizing the Avitus® Bone Harvester B) Intraoperative cross section of the femoral medullary canal. C) Closed capture system containing contaminated tissue. D) Specimen retrieved from Avitus®. Video link of intraoperative debridement with the Avitus® Bone Harvester.

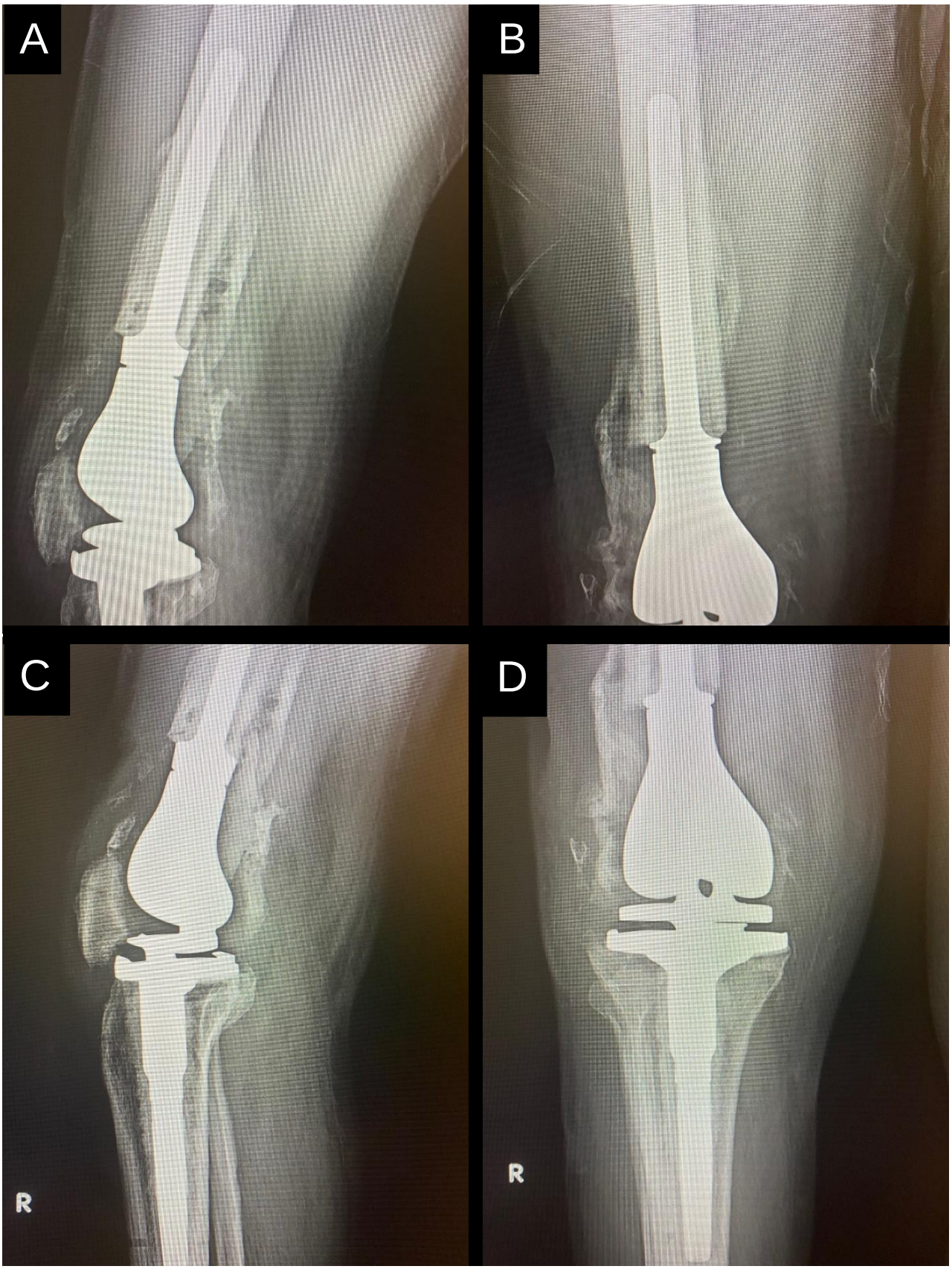

Figure 3 :: 4 month post operative radiographs A) Lateral femoral component B) AP femoral component C) Lateral tibial stem and tray D) AP tibial stem and tray

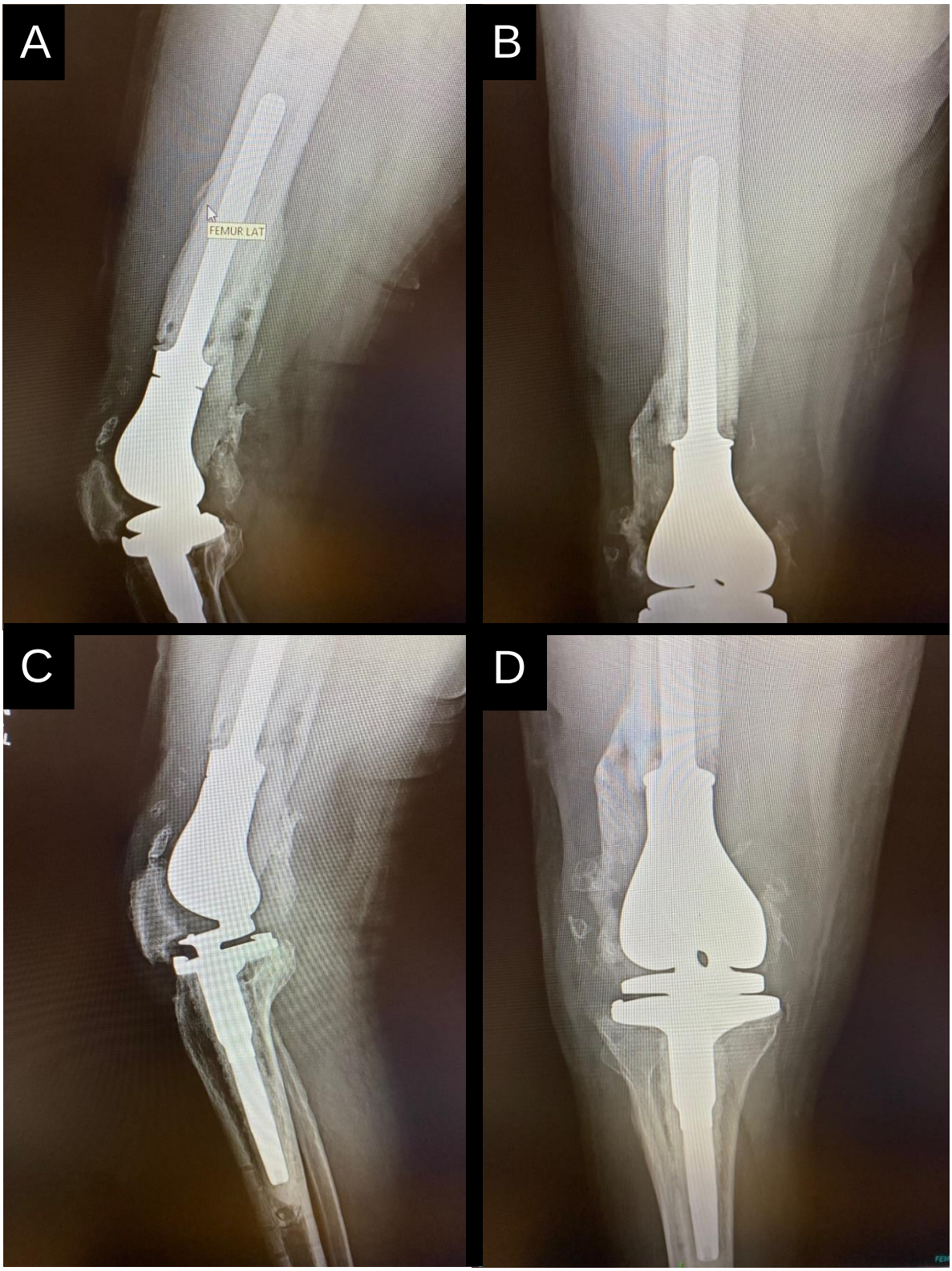

Figure 4 :: 9 month post operative radiographs A) Lateral femoral component B) AP femoral component C) Lateral tibial stem and tray D) AP tibial stem and tray. LINK: Video showing post operative ambulatory progression from 4 month to 9 month.

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