

Case Report

Managing Knee Arthrodesis Conversion to Arthroplasty in a Young Patient: Surgical Strategy, Challenges, and Functional Recovery After 1 Year

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ABSTRACT

Conversion of knee arthrodesis to total knee arthroplasty is a technically demanding procedure, particularly in young patients with a history of trauma and infection. This report outlines the surgical strategy and 1-year functional outcome of a 24-year-old patient who underwent total knee arthroplasty 4 years after knee fusion. Management included soft tissue reconstruction, tibial tubercle osteotomy, gastrocnemius flap coverage, and rotating hinge knee implantation. At 1-year follow-up, the patient showed marked clinical improvement, with improved in KOOS and WOMAC scores, pain relief, and quality of life. Markerless 3D kinematic gait analysis was also performed post-conversion. This report describes key surgical considerations and preoperative work-up for the successful conversion of knee arthrodesis to arthroplasty.

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Introduction

Knee arthrodesis is a surgical procedure that fuses the femur and tibia at the knee joint [1]. While arthrodesis is considered the last resort option due to loss of movement, it can provide pain relief and stability of the knee in challenging cases [2]. Fusion of the joint is generally deemed necessary when other reconstructive surgeries are not possible or have failed, particularly in cases of severe joint damage, chronic infection, severe knee instability, or tumors [1]. Even though knee arthrodesis is an end-stage procedure, conversion to knee arthroplasty may be considered when potential benefits of restoring joint movement are anticipated, especially in younger individuals [2].

Performing knee arthroplasty on a fused knee requires complex planning and advanced techniques, along with a significant risk of

complications [2-4]. A new joint line must be carefully planned to match the contralateral knee. Restoring motion in a stiff, immobile knee requires extensive release of surrounding soft tissues, especially the extensor apparatus. Scar tissue removed to increase flexion, restricts soft tissue coverage postoperatively, often necessitating muscles and soft tissue flap knee covering techniques. Meta-analysis of 6 studies, including 123 patients, indicated an event-free postoperative course only in 35% of the cases, with an incidence of infection and revision both at 11% [5]. Nevertheless, the procedure may be recommended to improve quality of life and mobility of the patient.

Conversion from knee arthrodesis to knee arthroplasty has been previously reported, with only 1 case involving a patient younger than 30 years old [6]. History of polymicrobial infection, multiple surgeries following knee trauma, and the use of soft tissue flap coverage at the time of the procedure contribute to the distinctive nature of this case. Additionally, the functional postoperative evaluation using a 3D kinematic system after conversion knee arthroplasty has not been reported previously. We present a case of a young male with functional results 1 year after

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conversion knee arthroplasty, contributing to the limited evidence in this area. The patient provided informed consent for publication of these data and images. The manuscript is written according to the Surgical CAse REport (SCARE) 2020 guidelines [7].

Case history

The patient suffered a car accident as a driver in July 1, 2017. Initially taken to the central hospital of the district, afterward was transported to a level III trauma center. The patient underwent examination following the protocol of the polytrauma team. Injuries included a head injury, Glasgow coma scale of 8 (A1 K2 M5) and an open Gustilo-Anderson 3A fracture of the left patella [8]. An open wound measuring 6 × 6 cm was observed on the anterior side of the knee, extending into the joint. Given the open fracture, the patient received prophylactic cefazolin 2 g dose prior to ICU transfer. Additionally, wound debridement, irrigation, closure, and drainage were performed under local anesthesia (Fig. 1a). The timeline to establish the sequence of events in the patient's history is presented (Fig. 2).

While in the intensive care unit, the patient had undergone decompressive craniectomy due to subarachnoid hematoma. When the patient was stabilized and conditioned for non-life-saving surgery, a distal fragment fixation with the patellar tendon was performed using a suture anchor (Corkscrew 5.5 mm) in 2017 July 12 (Fig. 1b). At the time of surgery additional instability of the

cruciate and collateral ligaments was noted. An external fixation system was applied to stabilize the knee, facilitate wound dressing, and ease further transportation of the patient. Postoperatively, a residual soft tissue defect measuring ±1.5 cm remained. The individual proceeded to the neurorehabilitation department in 2017 August 28. Upon return to the orthopedics department for removal of the external fixation apparatus, persistent wounds on the left knee and ankle were observed, along with necrosis in the popliteal region. Management continued in an outpatient setting with appropriate wound care.

Unfortunately, the patient returned 4 months later due to the onset of infectious complication (Fig. 1c). Synovial fluid aspiration for microbiological culture and diagnostic analysis was taken. The identified causative infection agents were *E. cloacae*, *E. faecalis*, *P. aeruginosa*, resistant to multiple antibiotics and known for their biofilm formation properties. Owing to the persistent knee infection, compromised anterior soft tissue of the knee, and damaged patellar ligament, a multidisciplinary team decision was made to perform knee arthrodesis (Fig. 1d). It was achieved in 2018 February 20 using biplane external fixation for over 1 year (Fig. 1e). Postoperatively, a 6-week course of prophylactic antibiotics with vancomycin and cefoperazone/sulbactam was given.

The patient was consulted at our institution outpatient department when he was 24 years old, and his knee had been fused for over 4 years. The main complaint was poor function of the left knee, leading to poor quality of life (EuroQol-5 Dimensions-5 Levels [EQ-5D-5L] Health 50%, Moderate mobility problems and severely anxious, depressed). For the patient, the specific goals of surgery were to relieve pain, walk more comfortably, and regain the ability to climb stairs and perform daily activities.

Intervention

Conversion of knee arthrodesis to arthroplasty requires clinical and technical considerations. Clinically, the evaluation involves ruling out infection, assessing the condition of the anterior soft tissues of the knee using magnetic resonance imaging (MRI), and examining the extensor apparatus. In this case, there were no signs of infection in the soft tissues, the wounds had fully healed, and a previously healed fistula was observed. The patellar tendon, extending from the tibial tuberosity to the patella, was palpated during the clinical examination and subsequently confirmed via MRI scan. Laboratory tests, including C-reactive protein and standard blood panels, yielded normal results. Moreover, a period of over 4 years free from disease supported the exclusion of infection. Aside from these specific concerns, the patient was generally healthy, with no comorbidities, no prescribed medications, and no history of smoking.

Technical considerations for conversion knee arthroplasty included determining the surgical approach, selecting the appropriate implant, and addressing the challenges posed by stiff and possible deficient anterior knee soft tissues after the implantation. The rationale behind our decisions is outlined here, with further detailed discussion provided in the discussion section.

An extension of a previous anterior skin incision and medial parapatellar approach were selected. A tibial tuberosity osteotomy was planned to improve visibility of the former tibiofemoral joint without excessively stressing the already stiff extensor apparatus during surgery. A constrained Rotating Hinge knee prosthesis was chosen to address collateral knee ligament insufficiency. To provide soft tissue coverage for the prosthesis and facilitate unrestricted knee flexion, a medial gastrocnemius muscle flap with free skin graft from the contralateral thigh was planned and performed

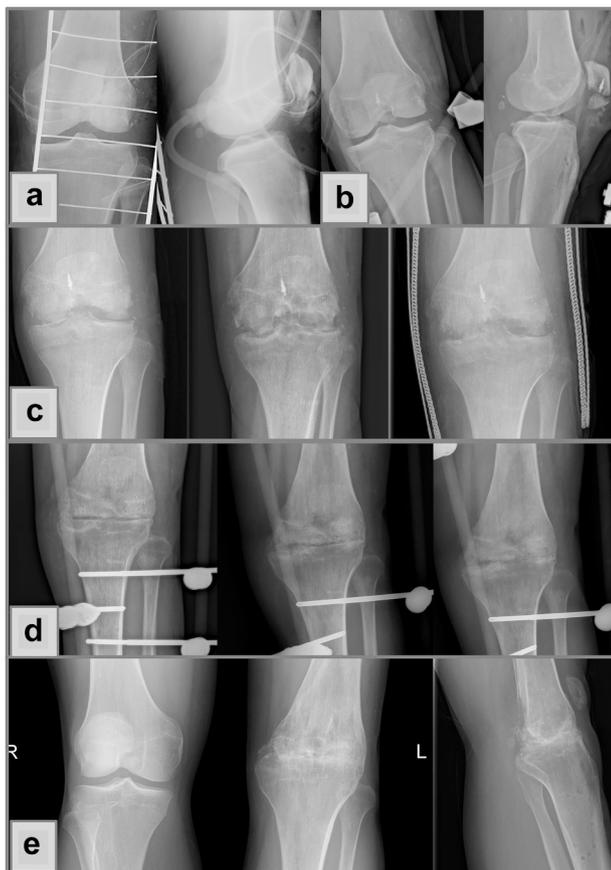


Figure 1. Radiological imaging. Preoperative AP and lateral (L) radiographs showing fracture of the left patella (a). Immediate postoperative AP and L radiographs after distal fragment fixation with suture anchor (b). AP radiographs taken during the course of the infection (c). AP radiographs evidencing the process of arthrodesis with the use of an external fixation apparatus (d). Final AP radiographs of a fused left knee (e). AP, anteroposterior.

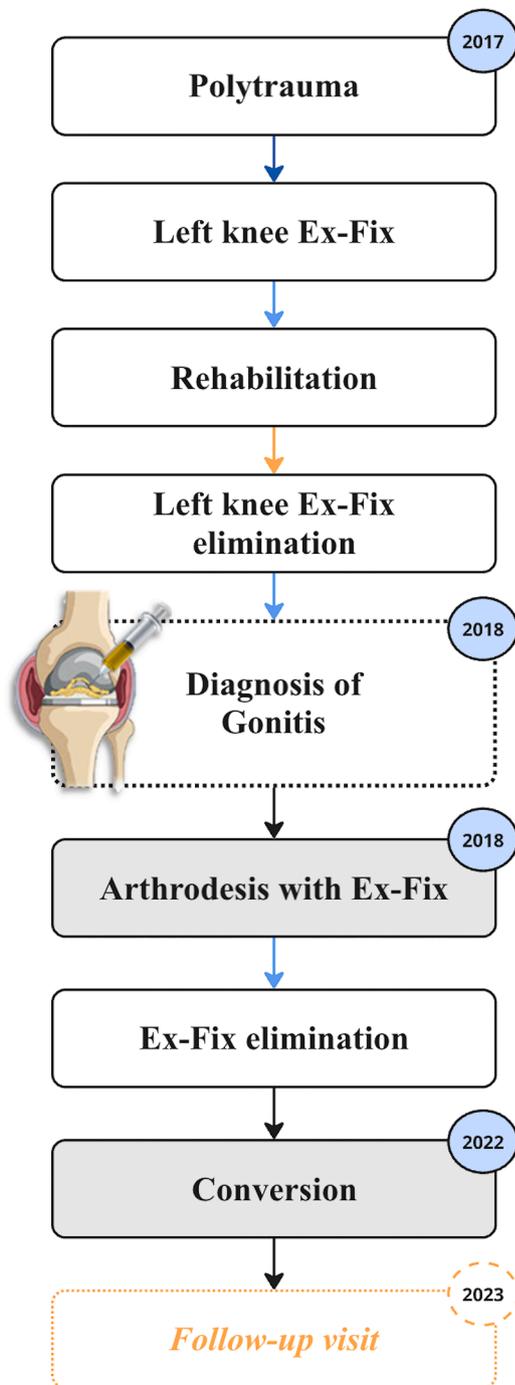


Figure 2. Sequence of events. ➡ Intensive care unit. ➡ Neurorehabilitation department. ➡ Orthopaedics department.

by an orthopedic surgeon. A dermatome was used to cover the flap with the dermal layer of the skin in ~3 mm thickness.

Furthermore, potential complications, including severe outcomes such as rearthrodesis or above-knee amputation, were discussed with the patient preoperatively. As postoperative complications are frequent, ranging from 55%-100% [9]. In the event of success, the patient was informed about the expected survival rates of the constrained-type prosthesis. Given the risk of accelerated wear of the revision implant, the patient was instructed to avoid contact sports, high-level physical activity, and maximum amplitude movements in the long term.

Surgical technique

The patient was positioned supine under spinal anesthesia without the use of a tourniquet. A fluoroscope was prepared for intraoperative determination of the joint line in comparison with the contralateral knee. The surgical site underwent 3 rounds of preparation with antiseptic solution before sterile drapes were applied. An anterior skin incision with excision of pre-existing scars was made. A medial parapatellar arthrotomy followed, extending to the distal tubercle of the tibia. Full consolidation of femur and tibia along with partial consolidation of the distal part of the patella, was observed. The distal tubercle of the tibia was osteotomized using a 0.89 mm thickness saw blade and osteotome. The tibial tubercle was elevated, and the adhesions of the patellar ligament to the former tibiofemoral joint were detached. The quadriceps femoris muscle was dissected free from the femur as proximally as feasible using “Tarabichi maneuver” technique [10]. Using a fluoroscope, a new joint line was established, intraoperatively comparing it to the joint line of the contralateral knee. Osteotomy was done according to the established joint line using fluoroscopy. Intraoperative 3 samples for cultures were taken. Because of observed collateral ligament laxity, bone deficiency at the joint line a decision to use a rotating hinge knee implant was made with 15 × 75 mm tibial and 18 × 100 mm femoral diaphyseal extensions for additional stability. While preparing the tibial canal with sequential reamers, sufficient bone stock for implant stability was confirmed. Our aim was to avoid the use of cones whenever possible, thereby preserving bone stock for potential future revision surgeries. After canal preparation, holes for cerclage wire fixation were drilled, and 3 separate wires were passed around the posterior cortex. The implants were then fixed with cement. The tibial tuberosity was elevated proximally by 1.5 to 2 cm to improve knee flexion. Although cerclage wires alone are described to provide adequate fixation, an additional screw was placed to enhance rotational stability [11]. Intraoperatively, the flexion of 70° was possible. However, inadequate distal anterior soft tissue coverage for closure was confirmed. An additional medial shin incision was made to detach the medial head of the gastrocnemius muscle from the femur and surrounding tissues. The muscle was mobilized, while preserving the sural artery and accompanying veins. The flap was rotated over the medial aspect of the prosthesis and secured with sutures to the soft tissues surrounding the patella and patellar tendon. Subsequently, the subcutaneous tissue and skin were approximated using sutures, leaving an 8 × 3 cm area uncovered by the skin. Using a dermatome 3 mm of donor site skin from the opposite thigh was gathered and transferred on the gastrocnemius flap and fixed to adjacent skin borders. The knee was draped in sterile fashion and immobilized. The patient was instructed to 30 % partially weight bearing since day 1 after surgery. Photographs are provided to depict key surgical considerations (Fig. 3).

Follow-up and outcomes

In 1 out of 3 intraoperative samples *Staphylococcus aureus* susceptible to vancomycin has grown. Targeted 3-week course of intravenous vancomycin for further eradication was administered. The patient was then transferred to the rehabilitation department with the aim to address functional deficits and was instructed to continue per oral antibiotic therapy with ciprofloxacin 500 mg 3 times per day for the following 30 days. For the first 6 weeks, the patient was instructed to use a continuous passive motion machine and a functional knee brace limited to 30° of flexion, with no

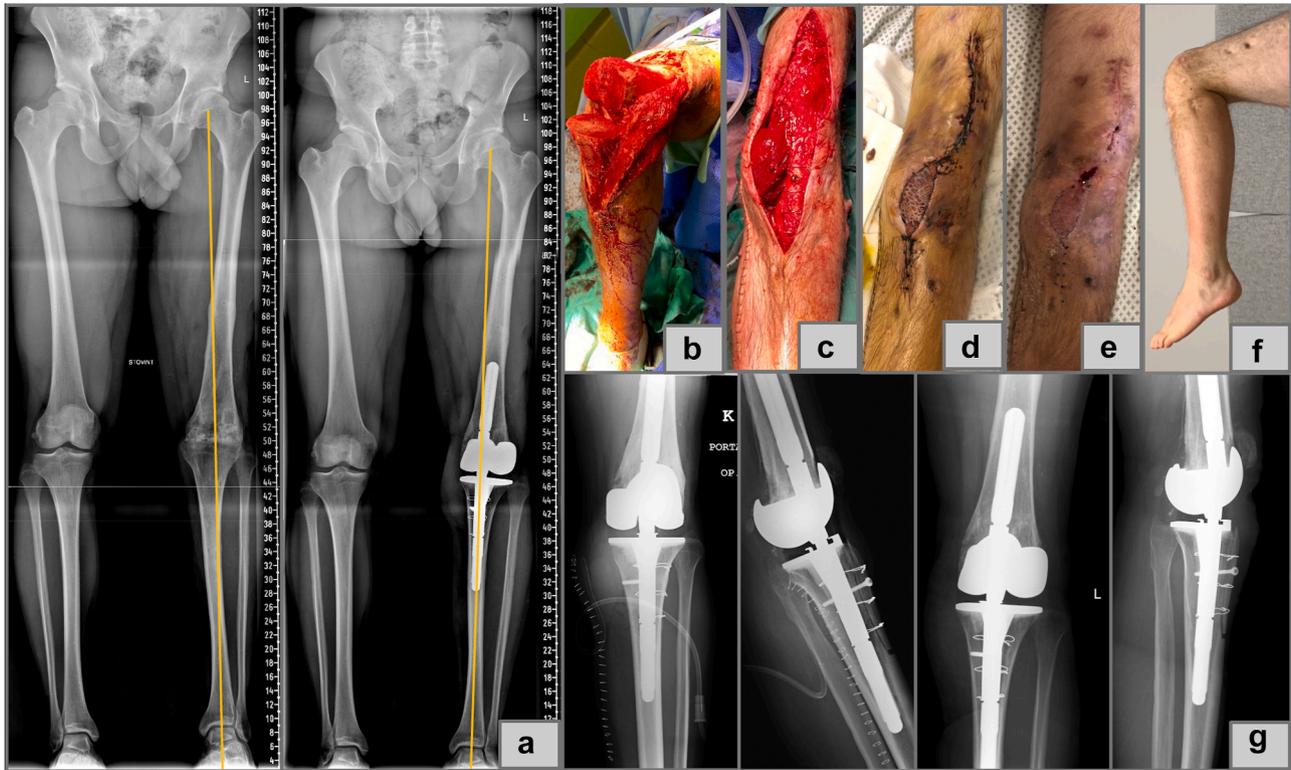


Figure 3. Key surgical considerations. Preoperative and postoperative long standing AP radiographs following arthroplasty takedown. The mechanical axis was measured (a). Clinical photographs taken after osteotomy, aligned with the newly established joint line (b). Medial gastrocnemius muscle flap for soft-tissue coverage (c). Soft tissue defect covered with STSG (d). One-month follow-up image demonstrating well-integrated STSG with re-epithelialization and no evidence of graft loss (e). Assessment of soft tissue at one-month following the procedure (f). AP and lateral (L) radiographs following implantation of a cemented hinged knee prosthesis (g). AP, anteroposterior; STSG, split-thickness skin graft.

weight-bearing permitted. At the 6-week reassessment, the patient demonstrated 70° of flexion and a 10° extension deficit. From that point, the flexion limit of both the continuous passive motion and brace was increased to 50°, and partial weight-bearing with crutches was initiated. At 8 weeks, flexion was further increased to 80°. After 10 weeks, once radiological signs of tibial tuberosity osteotomy healing were observed, gradual progression to full weight-bearing was allowed.

At 1 year follow-up, the knee joint had full passive extension, with 10° active extension lag and 110° of active and passive flexion. There was no varus, valgus instability. The worst possible pain according to visual analog scale (VAS) 0-10 scale during the last week before and a year after surgery was 5 and 0 respectively. Functional assessment was measured using Western Ontario and McMaster Osteoarthritis index (WOMAC) and Knee and Osteoarthritis Outcome Score (KOOS). Pain during function, knee stiffness and difficulty during activities were evaluated with WOMAC score, while lesser score reflects better functional results, and the worst possible score is 96. Preoperative score of 33 was reported, with stiffness, getting in and out of the car and heavy domestic duties. At 1 year after the conversion from knee arthrodesis to total knee arthroplasty (TKA) WOMAC score was 1. KOOS Knee Survey measures stiffness and other symptoms, such as, pain, functional daily life, recreational sports, and the quality of life. The score is a percentage value from 0 to 100, 0 representing worst condition and 100 a healthy knee. KOOS Symptoms improved from 57% to 96%. KOOS Pain before and 1 year after surgery from 75% to 97%. KOOS daily function improved from 49% to 100%, while KOOS sports function from 5% to 90%. KOOS quality of life advanced from 0% to 75%. Quality of life was evaluated using the health questionnaire of EQ-5D-5L mobility, self-care, usual activities, pain and anxiety.

Scores range from 5 to 25, while highest score represent extreme difficulty. Overall health was assessed using VAS 0-100 scale. Before surgery patient reported EQ-5D-5L score of 13 and VAS overall health of 50. At 1-year postsurgery no problems in daily life were reported, while VAS overall health was 100. The patient reported high satisfaction with the procedure and strongly agreed that the treatment met his expectations, that he would undergo the treatment again and would recommend it to others in case of need (Fig. 4).

Kinematic gait tests were performed to investigate whether the patient adapted his walking parameters to normal after the knee had been fused for over 2 years. Biomechanical gait analysis was performed 1 year after conversion surgery. The individual at the time was 24 years old, had a height of 188 cm tall, and weighed 85 kg. The subject was asked to wear comfortable shoes and walk straight for 6 meters at a comfortable chosen speed. The gait was repeated 6 times, with 1-minute breaks between each gait. During the trials, kinematic data were collected using 9 color video cameras (Miquis Hybrid, Qualisys AB, Gothenburg, Sweden) at 120 Hz. Then it was processed by the Artificial Intelligence-based Theia3D motion capture software (Theia Markerless Inc., Kingston, Ontario, Canada) and further evaluated using Visual3D (C-Motion Inc., Germantown, MD). The joint angles for both limbs were time-normalized to the gait cycle. For parameters that are related to the left body side, the left gait cycle is used (red curve). Accordingly, the right gait cycle is used for parameters associated with the right body side (blue curve). The gray band in the background represents the mean and ± 1 standard deviation from the mean of normative data. The vertical line represents the toe-off event. The control group in the system consisted of the gait cycles of 18 healthy adults (10 men, 8 women). The gait analysis

| | Pre-operative | Post-operative 1 year |
|---|--|-------------------------------------|
| EQ-5D-5L Health % | 50 | 100 |
| EQ-5D-5L Mobility | 3 (Moderate problems) | 1 (No problems) |
| EQ-5D-5L Self-Care | 1 | 1 |
| EQ-5D-5L Usual Activities | 2 (Slight problems) | 1 |
| EQ-5D-5L Pain/Discomfort | 3 (Moderate pain) | 1 (No pain) |
| EQ-5D-5L Anxiety/Depression | 4 (Severely anxious/depressed) | 1 (Not anxious/depressed) |
| Pain in VAS (last 5 days) | 5 | 0 |
| KOOS Symptoms | 57 | 96 |
| KOOS Pain | 75 | 97 |
| KOOS Daily Living | 49 | 100 |
| KOOS Sports & Recreation | 5 | 90* |
| KOOS Quality of Life | 0 | 75 |

Figure 4. Comparison of patient reported outcome measures. WOMAC and KOOS scores were standardized as a range from 0 (worst) to 100 (best) according to current guidance. VAS for pain range from 0 (best) to 10 (worst). EQ-5D-5L scores range from 5 (best possible health state) to 25 (worst possible health state).

parameters show that there is asymmetry in step time between the left and right legs. The left leg spends more time on the ground during each step than the right leg. This does not necessarily mean that asymmetry is visible due to leg surgery, it can be influenced by various factors, including biomechanical differences between the legs, muscle imbalances, and other injuries. Left leg hip flexion decreased by 10° during right leg support, and during the left leg support, the right hip flexion is not sufficient. It indicates an imbalance in the subject's weight transfer mechanism. The reduced hip flexion on the left side suggests a potential weakness or restriction in the hip joint, leading to compensatory movements and potentially impacting overall gait efficiency. Looking at the knee flexion graph, there is not enough left knee flexion during the loading response (stance) phase, while the knee flexion should be 15° in normal gait. This discrepancy may result in altered shock absorption and load distribution, potentially leading to further complications if left unaddressed (Fig. 5, Supplementary Video).

Discussion

This case presents a successful outcome after knee arthroplasty on a fused knee in a young male. Good functional outcomes measured by KOOS and decreased pain significantly improved the quality of life. Patients with knee arthrodesis are described to have impaired daily living, such as managing stairs, sitting down or using a small restroom [2]. Quality of life is the main reason patients decide to undergo a conversion arthroplasty, risking severe complications to regain mobility in daily life [2]. While the single presented case yields favorable outcomes, a great number of various complications are reported [12-15]. Despite the complexity of the surgery and threatening risks, patients along with their surgeons may decide to perform conversion knee arthroplasty to increase mobility of the knee with the quality of life [16].

One of the most unfortunate complications after knee arthroplasty is infection, occurring in up to 2 percent of primary cases and reaching 11% in conversion arthroplasty [2,17]. Moreover, in some cases knee fusion is performed due to persisting infection [18]. Additionally, in some patients infection persists after the knee has been fused, leading to an increased risk of periprosthetic infection [19]. Infection after conversion arthroplasty can lead to revision, re-arthrodesis and in severe cases result in an above knee amputation [2]. To mitigate the risk, a workup for infection should be conducted in accordance with established guidelines, such as those provided by the Pro-Implant Foundation [20]. Sinus tracts, purulence, and other clinical signs confirm the presence of infection when positive, but due to their low sensitivity, they have a high chance of missing infected individuals if signs are negative [20]. Preoperative planning, including CRP blood tests and leukocyte counts in the blood, can indicate generalized infection [21], while leukocyte and granulocyte counts in aspirated joint fluid are both sensitive and specific for diagnosing joint infection [22,23]. Periprosthetic tissue histology, obtained through biopsy, offers high specificity but moderate sensitivity, though microbiological cultures from aspirated joint fluid remain the gold standard [24,25]. If all the above findings are normal but clinical suspicion remains high, intraoperative samples should be collected for cultures. In our case, intraoperative sampling was performed, while aspiration from the fused knee was not considered. Even though no clinical or laboratory signs of infection were detected, intraoperative cultures revealed the growth of *S. aureus* susceptible to vancomycin. Prolonged incubation of both aerobic and anaerobic cultures, up to 14 days, is recommended to reduce the risk of false-negative results [26,27]. After the surgery the patient was prescribed 3-week course of intravenous vancomycin followed by 30 days of oral ciprofloxacin for further eradication. Intraoperative data can aid in diagnosing infection and further assist in tailoring postoperative antibiotic therapy [16]. Notably, our preoperative work-up did not capture the infection

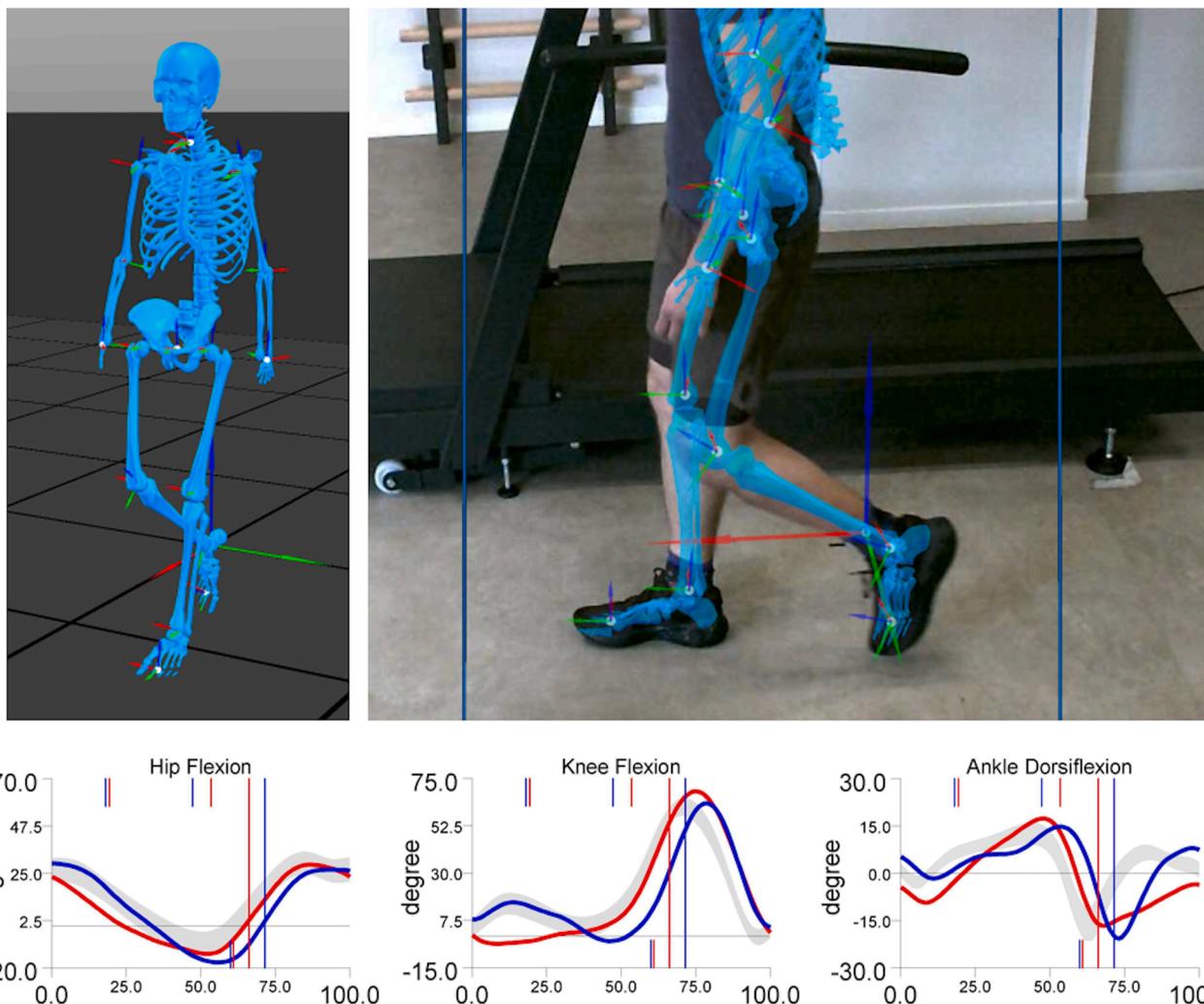


Figure 5. Markerless kinematic assessment. A digital skeleton model is applied to the subject using markerless motion capture. The image shows an overlay of the biomechanical model on the subject during walking. At the bottom: joint angle curves throughout a full gait cycle for the hip, knee, and ankle in the sagittal plane. The red curve represents the left leg, and the blue curve represents the right leg. The gray shaded area represents the normative range (mean \pm 1 standard deviation) from healthy controls. The plots illustrate joint asymmetries, particularly reduced knee flexion on the left side during stance.

later identified on intraoperative cultures. Additional diagnostic modalities, such as nuclear imaging or contrast-enhanced MRI, might have provided further diagnostic value in this context [28]. While these modalities may not provide definitive diagnosis, a heightened preoperative suspicion could have justified additional steps such as open biopsy, potentially altering the diagnostic pathway before conversion surgery. In cases of conversion knee arthroplasty, clinical suspicion for infection should remain high, and the diagnosis should include clinical, laboratory, and intraoperative testing.

The type of the prosthesis plays an important role in achieving good outcomes following conversion knee arthroplasty. The implant must address the unique challenges presented by a fused knee. Due to the lack of anterior soft tissue coverage, care should be taken to avoid anterior overstuffing [5]. Ligament deficiencies and severe bone loss are commonly found in fused knees [29]. Constrained prostheses, such as constrained condylar knee or hinged knee (HK) implants, are often necessary to achieve sufficient joint stability [4]. Stem extensions may be added, as these implants bear greater stress during motion [30]. The CKK implant is preferred for its less invasive design and better midterm survivorship rates [31]. In addition, less required bone resection aids in

future salvage-type procedures, making it an attractive option for individuals prone to repeated surgeries, such as the young patient in this case. However, constrained condylar knee prosthesis relies on residual soft tissue for stability [31]. In conversion procedures a significant collateral ligament insufficiency or lack of extensor mechanism following knee arthrodesis is frequent [32]. In contrast, some reports document the use of PS implants in conversion procedures [29]. In our case, an HK implant was chosen because prior infection and multiple surgeries had compromised both the soft tissue and ligamentous support. The results are favorable, yet only a couple of years have passed. Regardless, while no strong evidence supports a specific implant, it should be tailored to the patient's needs and the clinical status of the knee to achieve optimal results.

Specific technical requirements must be met to perform conversion knee arthroplasty. The mobility of the extensor apparatus must be restored to allow flexion while maintaining proper tension for effective knee extension. Extensile approaches including rectus snip exposure, V-Y quadricepsplasty, or tibial tuberosity osteotomy has been reported [33]. Tibial tubercle osteotomy with adhesiolysis were performed in the presented case. The patellar tendon during osteotomy is preserved as mobilization of it reduces

the risk of damage during attempts to surgically manipulate the knee. Similarly, tubercle osteotomy is performed in 45% to 100% cases when extended approach is needed, with only a few adverse events reported, such as proximal migration or nonunion [9,31,34,35]. While soft tissue is sufficient when the knee is immobile, it lacks mobility in flexion after conversion arthroplasty. High rate of necrosis of skin edges is reported due to tension [2]. In some cases soft tissue expansion with constrained knee prosthesis was reported to be effective, although taking a considerable amount of time [4]. Most data supports the use of flap coverage [36,37]. Due to previous open wound and poor subcutaneous tissue quality we used a pedicled gastrocnemius flap to cover the prosthesis, since it provides immediate soft tissue coverage. Flap failure in the presence of infection can increase up to 52% with limitations to range of motion [38]. Despite the high risk of failure and worse functional outcomes, it was not observed in this case [39]. Various techniques should be considered and readily available for soft tissue management and extensor mechanism restoration to effectively balance mobility, stability, and long-term functional outcomes.

Exceptionally good functional results were observed. The patient-reported KOOS scores of 90 or higher in symptoms, pain, daily living, and even sports and recreation. While young age and former professional sports experience may have contributed to these outcomes, we believe the high satisfaction with the procedure may have led the patient to overestimate his functional state. In the literature, the average KOOS following total knee replacement is reported to be 89 [40]. In contrast, after conversion procedure reached an average of 66.7 at the final follow-up [41]. The reported pain assessed by VAS scale decreased from 5 to 0 at 1 year postsurgery. Noteworthy, only 61% of patients are stated completely pain free at 7.7 years follow-up [9]. The claimed EQ-5D-5L Health improved from 50 to 100 percent. The patient initially did not have problems in self-care and usual activities, as indicated by questionnaires. The greatest improvement was made in EQ-5D-QL anxiety/depression, improving from severely depressed to not depressed. Possibly due to improvement of mobility, resulting in improved quality of life. Overall, improved scores in our study aligns with findings from a systematic review, where postoperative EQ-5D scores averaged 0.7 [5]. Presented results show the potential for significant functional recovery and pain relief after conversion knee arthroplasty at 1 year, which can further enhance results and improve depression scores in a case of success.

The gait analysis results provide valuable insights into the kinematic abnormalities observed in the subject's lower limb movements following conversion knee arthroplasty. Most notably, the left knee demonstrated insufficient flexion during the stance phase, less than the expected 15° seen in normal gait [42]. This reduction may stem from prosthetic constraints, muscle weakness, or joint stiffness, all common after arthrodesis conversion. These findings highlight the potential of markerless motion capture technologies to detect subtle asymmetries and joint-specific kinematic deviations that might be overlooked with conventional assessment methods, although their current use remains largely within research setting. Previous studies have reported comparable decreases in knee flexion post-TKA, with flexion angles reduced to as low as 10.4°, particularly when more constrained designs like rotating hinge knee prostheses are used [42,43]. While patients with HK prostheses may demonstrate altered gait mechanics, attributing these changes solely to reduced prosthetic flexion is overly simplistic. Preoperative factors such as limited soft tissue pliability and existing gait abnormalities play a substantial role and indeed are frequently the reason a hinged implant is selected. From a neuromuscular perspective, it is well

established that TKA alters muscle activation patterns, often increasing co-contraction between the rectus femoris and hamstrings to maintain stability during stance [44]. This heightened muscle demand results in quadriceps activity levels up to 3 times higher than those seen in non-arthroplasty knees [45]. In this patient, quadriceps insufficiency is further evidenced by a 10° extension lag, which is within the expected range for conversion procedures but may still negatively impact function [46]. Such an extension deficit can impair the knee's ability to lock during terminal stance, thus perpetuating compensatory strategies that increase energy expenditure and reduce walking efficiency. Targeted interventions such as physical therapy, muscle strengthening exercises, and gait training can be implemented to improve the subject's gait mechanics, minimize compensatory movements, and enhance overall functional mobility. In addition, quadriceps-strengthening exercises should be continued, as muscle strength impairment continues to be a concern in the long-term follow-up period after TKA.

The strengths of this case report include valuable insight into conversion knee arthroplasty after arthrodesis in a young patient, a scenario rarely described in the literature. A key strength of this study is the use of functional assessment with 3D kinematic gait analysis, offering objective data on postoperative mobility, which has not been previously reported. Additionally, the comprehensive infection workup and soft tissue management strategies, including the use of a gastrocnemius flap, highlight important considerations for complex revision cases. However, this report is limited by its single-case nature and relatively short follow-up period of 1 year, preventing conclusions on long-term prosthesis survival and functional durability.

Summary

Conversion of knee arthrodesis to a TKA is a feasible option for young patients seeking to regain mobility and improve their quality of life. Success depends on careful preoperative planning, appropriate prosthesis selection, and meticulous surgical technique. However, given the high complication rates reported in the literature, a single successful case does not fully capture the complexity of the procedure, and patients should be thoroughly counseled on potential risks.

Conflicts of interests

Aurimas Sirka is on the speakers' bureau of and is a paid consultant for MicroPort Orthopedics and Johnson & Johnson. Donatas Daublys is an employee at "Abili" – Distributor of Qualisys gait analysis equipment. Aurelijus Domeika is an employee at "Abili" – Distributor of Qualisys gait analysis equipment. Augustinas Rimkunas is a member of the Membership Committee of the European Society of Shoulder and Elbow Surgery. The other author declares no potential conflicts of interest.

For full disclosure statements refer to <https://doi.org/10.1016/j.artd.2025.101943>.

Informed patient consent

The author(s) confirm that written informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

CRedit authorship contribution statement

Aurimas Sirka: Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization. **Gintare Lukoseviciute:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation. **Tomas Kadusauskas:** Writing – original draft, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Donatas Daublys:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Software, Methodology, Investigation, Data curation, Conceptualization. **Aurelijus Domeika:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Rimtautas Gudas:** Writing – review & editing, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Augustinas Rimkunas:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.artd.2025.101943>.

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