Total Knee Arthroplasty under Local Anaesthesia - Surgical Technique and Clinical Results: A Case Report

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ABSTRACT

Total knee arthroplasty (TKA) is usually performed under general or spinal anaesthesia. This report presents the case of an 82-year-old female patient with severe osteoarthritis of both knees who underwent right knee TKA under local anaesthesia. The initial plan was to perform surgery on both lower extremities one week apart. The left TKA was completed in 3 hours and 5 minutes with a blood loss of 20mL, and the post-operative course was uneventful. However, severe deep vein thrombosis developed in left lower limbs, and general anaesthesia was deemed impossible due to bilateral pleural effusion. The patient was on anticoagulant therapy with a PT-INR of 7.63, and nerve block anaesthesia was also not feasible. Despite these challenges and the patient's decreased activities of daily living, the right TKA was performed 30 days after the left TKA. Surgery took 2 hours and 18 minutes with a blood loss of 140mL. The patient was able to walk immediately after surgery and was discharged two weeks later. During a two-year follow-up, no significant limitations in walking or stair climbing were observed. This case demonstrates the efficacy of TKA under local anaesthesia in high-risk patients.

Keywords:
total knee arthroplasty, local anaesthesia, high-risk patients, osteoarthritis

INTRODUCTION

Total knee arthroplasty (TKA) is a standard orthopaedic surgery generally performed under general or spinal anaesthesia. Managing severe knee osteoarthritis in patients with multiple comorbidities is challenging. Although TKA improves mobility and quality of life, it poses significant risks, especially for patients with surgical or anaesthetic complications. This report presents a rare case of TKA performed under local anaesthesia in a high-risk patient, highlighting the successful outcome. Prolonged bed rest can worsen health, and while various analgesic methods exist for post-TKA pain management, this case required a unique primary anaesthesia method[1,2]. The efficacy and feasibility of this method underscore its potential as an alternative when conventional methods are unavailable. The long-term prognosis in such circumstances is uncertain, necessitating meticulous post-operative follow-up.

This report contributes to the limited literature on alternative approaches for high-risk TKA patients and encourages discussion on the risks and benefits of surgical intervention in complex cases.

CASE REPORT

An 82-year-old woman presented with rapidly worsening bilateral knee pain and difficulty walking following discharge from the hospital after prolonged bed rest due to rectal cancer surgery. The pain had been present for over 10 years but had worsened significantly over the past three months post discharge. She had visited various medical institutions and received treatment including rest, pain medication, rehabilitation, and intra-articular knee injections, but there was no improvement. At the time of presentation to our hospital, the pain was described as deep, dull, and persistent, with sharp exacerbations during activities such as stair climbing and initiating walking. The intensity of the pain was rated as 8/10 on the visual analogue scale (VAS) during episodes. The patient reported morning stiffness lasting approximately 15 minutes, and swelling of both knees was noted after prolonged activity. Factors contributing to worsening included walking and standing up. The patient reported being unable to climb stairs for over 10 years. The patient's mobility was significantly impaired, and even with family assistance, she could only walk 10 meters and required a walker outdoors. She reported difficulties with activities of daily living (ADL) due to pain and restricted range of motion (ROM). The knee social score and ADL score were both 20 (Fig. 1a).

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The patient had a history of myocardial infarction in 2007 and was diagnosed with severe osteoarthritis of the knee (Kellgren–Lawrence classification grade ≥ 4) in 2012. Initially, symptoms were managed with intra-articular injections and analgesics, but the condition gradually worsened. The patient underwent rectal cancer surgery, and prolonged bed rest further exacerbated knee symptoms. Family history included a mother with severe knee osteoarthritis; however, TKA was not a common surgical procedure at that time, so she did not undergo the procedure. Other past medical history included cedar pollen allergy and moderate osteoporosis.

On visual inspection, mild swelling, marked varus deformity, and significant atrophy of the quadriceps femoris muscle were noted in both knees. On palpation, tenderness was present in the medial joint space on both sides, and crepitus was heard during movement. There was no redness or heat suggestive of infection. Pre-operative ROM was significantly limited, with the right knee at 15° – 45° and the left knee at 10° – 30°. Varus/valgus stress tests revealed marked varus instability (+++/++++) in both knees, with no valgus instability noted. A 5° extension lag was observed bilaterally. Due to severe varus deformity in both lower limbs, there was no lower limb length discrepancy. Neurovascular examination was unremarkable, with normal distal pulses and sensation in both lower limbs. Imaging studies revealed severe osteoarthritis (Kellgren–Lawrence classification grade ≥ 4) in both knees, with severe varus deformity, internal rotation, and severe loss of the medial joint space in both knees (Fig. 1b, 1c, 1d, and 1e).

Chest radiograph showed a cardiothoracic ratio of 50%, and respiratory function was normal. Echocardiography revealed a left ventricular ejection fraction of 62% with no evidence of cardiac wall motion abnormalities. Blood tests were unremarkable. Bone density testing confirmed moderate osteoporosis.

In July 2022, the patient underwent TKA under general anaesthesia. Based on the ROM under pre-operative anaesthesia (Fig. 1f and 1g) and intra-operative findings, the knee was diagnosed as contracted (Fig. 1h). The surgical procedure took 3 hours and 5 minutes, with a tourniquet applied at 300mmHg for 120 minutes. Immediately after tourniquet release, haemostasis was prioritised using an electrosurgical knife. Immediately before surgery, 250mg of tranexamic acid was administered intravenously, followed by implant insertion. After irrigation with 2,000mL of isotonic saline solution containing iodine, an additional 250mg of tranexamic acid was administered intra-articularly following joint capsule closure. As a result, intra-operative blood loss was minimal (20mL). ROM of 0° – 120° was achieved under anaesthesia, (Fig. 1i and 1j) and No drain was required. Post-operative radiograph taken immediately after surgery confirmed the insertion of the implant without any complications (Fig. 2a and 2b). Post-operative rehabilitation began the following day. However, deep vein thrombosis developed in the left thigh and lower leg on the seventh post-operative day. Despite anticoagulant therapy with heparin continuous infusion (15,000 units) and warfarin (5mg), the thrombus persisted, leading to transfer to another hospital where an inferior vena cava (IVC) filter insertion procedure was performed. During the IVC filter insertion at that hospital, pleural effusion due to heart failure, presumed to be caused by excessive intravenous fluid administration, developed (Fig. 2c).

Upon readmission to another hospital, owing to persistent pleural effusion and worsening of the patient's functional status, treatment included diuretics (intravenous furosemide 80mg/day and oral spironolactone 25mg/day), which showed slight improvement in pleural effusion. However, the patient's dyspnea persisted, and oxygen mask use maintained SPO_2 at 98%. During rehabilitation walking exercises, the patient's left lower limb was straight, with no anterior-posterior or lateral instability in the left knee. However, the right knee, which had not yet undergone surgery, exhibited approximately 4cm of shortening due to varus deformity compared to the left knee. During parallel bar walking training, significant varus instability persisted, with the trunk swaying significantly to both sides, leaving the patient nearly wheelchair dependent. TKA was considered, but the patient discontinued heparin and continued oral warfarin 5mg daily, with PT-INR values increasing (7.63), raising concerns about bleeding complications associated with spinal anaesthesia or nerve blocks. The anaesthesiologist emphasised that rapidly lowering the PT-INR for surgery could increase the risk of thrombosis and, given the patient's pulmonary edema due to heart failure, concluded that general anaesthesia was not feasible[3]. Given the patient's history of prolonged bed rest following rectal cancer surgery, bilateral knee pain, and impaired mobility, the patient and family strongly desired early surgery by any means necessary. Following a comprehensive risk-benefit analysis, it was determined that delaying surgery under the current conditions of persistent pleural effusion would not improve walking ability. Therefore, the patient and family were informed of the proposed right knee TKA under local anaesthesia, and informed consent was obtained.

Pre-operative right knee under no anaesthesia became stiffer because of long-term bed rest. ROM was 30° – 35° (Fig. 2d). Right knee total arthroplasty was performed under local anaesthesia using 0.75% ropivacaine (40mL), methylprednisolone (3.3mg), and ketoprofen (50mg). The anaesthetic agents were administered subcutaneously and into the posterior medial joint capsule to minimise peroneal nerve palsy (Fig. 2e). The surgical procedure took 2 hours and 18 minutes, with a blood loss of 140mL. A tourniquet was not used, and tranexamic acid was not administered due to the patient's anticoagulant therapy. Intra-operative pain

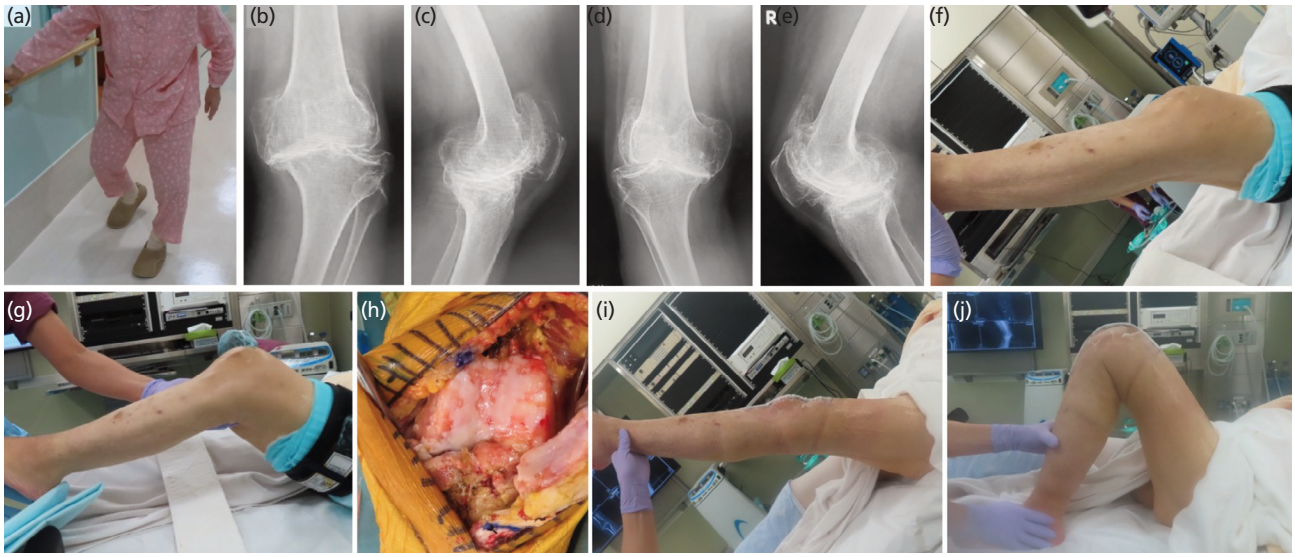

Fig. 1: Pre-operative knee joint ROM 15° – 35° under general anaesthesia. Post-operative knee joint ROM 5° – 125° under general anaesthesia. (a) Walking condition immediately before surgery. (b) Pre-operative left knee radiograph front view. (c) Pre-operative left knee radiograph lateral view. (d) Pre-operative right knee radiograph front view. (e) Pre-operative right knee radiograph lateral view. (f) Pre-operative left knee extension under general anaesthesia. (g) Pre-operative left knee flexion under general anaesthesia. (h) Left knee joint under general anaesthesia. (i) Post-operative left knee extension under general anaesthesia. (j) Post-operative left knee flexion under general anaesthesia.

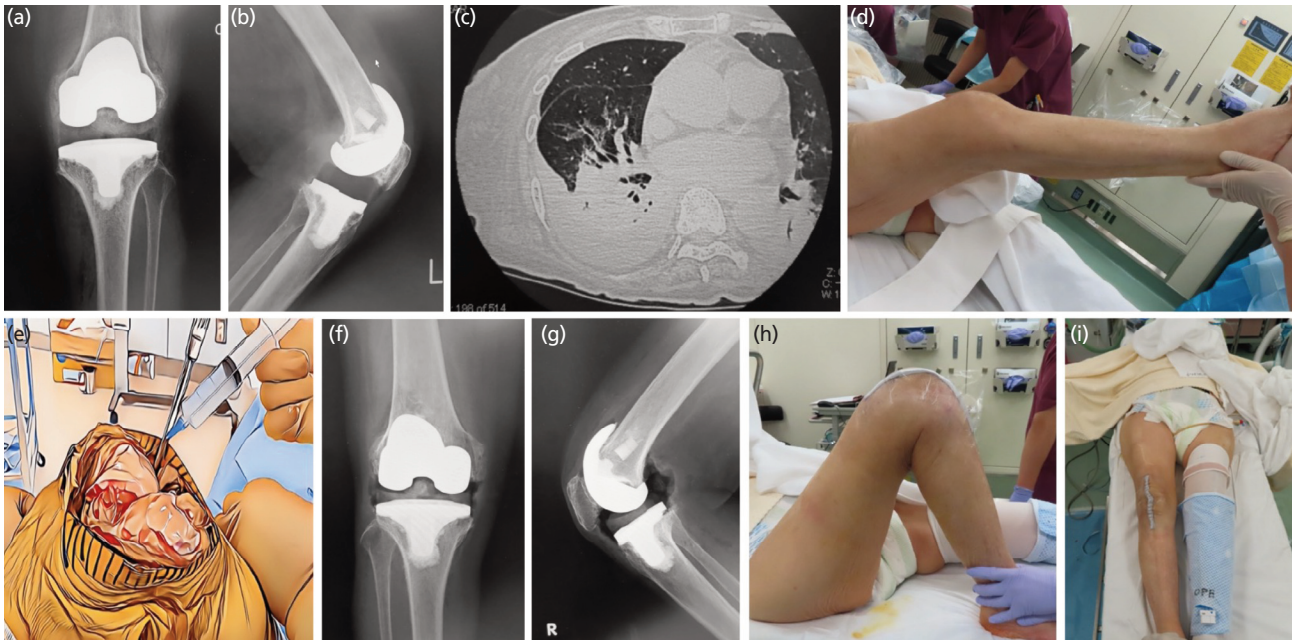

Fig. 2: On the 7th post-operative day, left knee radiographs and chest computed tomography (were taken CT) under general anaesthesia. Subsequently, right knee post-operative radiograph under local anaesthesia and chest CT on post-operative day 7 during 28 days of hospitalisation. (a) Left knee radiograph after operation front view. (b) Left knee radiograph after operation lateral view. (c) Immediately before R.TKA She caused heart failure at another hospital. (d) Pre-operative right knee under no anaesthesia. Right knee has become stiffer due to long-term bed rest. ROM was 30° – 35°. (e) Right knee joint under local anaesthesia image. (f) Right knee radiograph after operation front view. (g) Right knee radiograph after operation lateral view. (h) Post-operative right knee flexion under local anaesthesia. (i) Post-operative right knee extension under local anaesthesia.

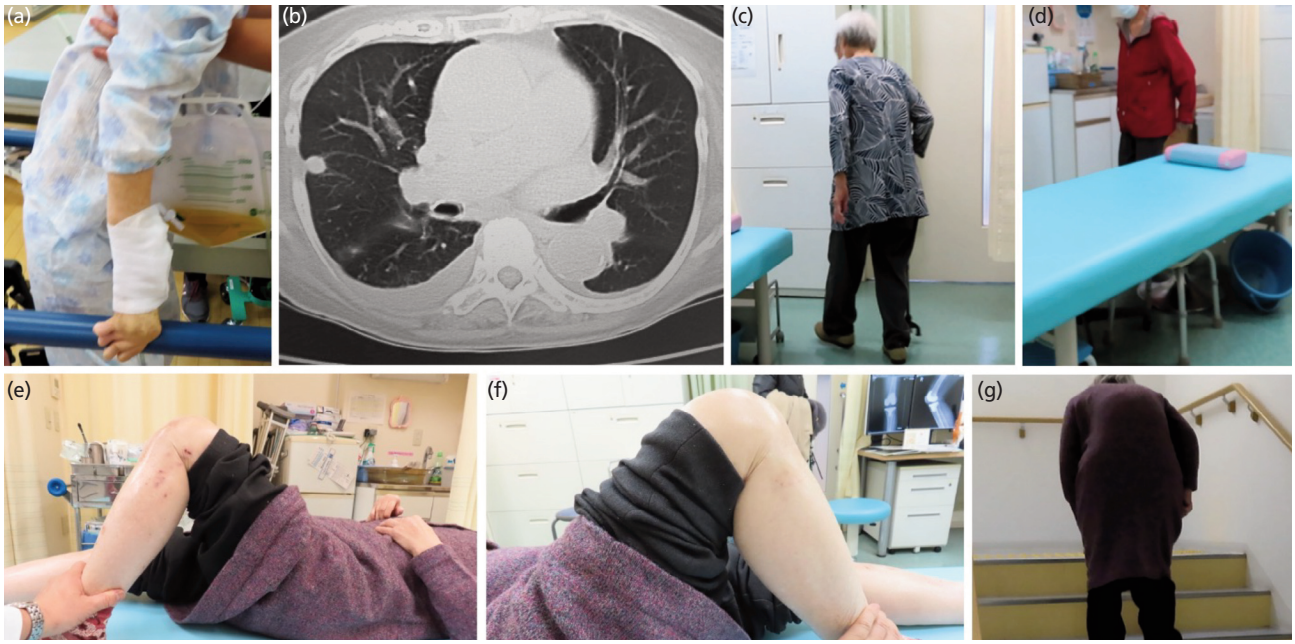

Fig. 3: Patient gait from pre-operative left up to right up handrail walking, parallel bar walking the day after surgery, cane walking two weeks after surgery, independent walking three surgery months after, and finally stair climbing two years after surgery. (a) Post-operative day 1, she was able to walk using parallel bars while taking oxygen through her nose. (b) Post-operative day 7 after R. TKA Her heart failure was cured. (c) Post-operative week 3, she had already been discharged from the hospital and was visiting the outpatient hospital walking with a cane. (d) Post-operative one month, she was walking normally and steadily, without the use of a cane. (e) Post-operative month 3, her left knee ROM was 0° – 110°. (f) Post-operative month 3, her right knee ROM was 0° – 120°. (g) Post-operative month 6, she was able to go up and down stairs without using her hands to support herself.

was adequately managed, but the patient reported intermittent discomfort (VAS: 8.0), which was alleviated by providing communication and reassurance. Post-operative radiograph performed immediately after surgery confirmed that the implant had been inserted without any complications (Fig. 2f and 2g), and ROM of 0° – 120° was achieved under anaesthesia (Fig. 2h and 2i).

The patient received a cocktail injection (0.75% ropivacaine 40mL, methylprednisolone 3.3mg, ketoprofen 50mg) into the quadriceps femoris muscle 15 hours after surgery. Half of the dose was injected into the vastus medialis muscle 7cm proximal to the knee joint, and the remaining half was injected into the vastus lateralis muscle 7cm proximal to the knee joint[4]. Pain was well controlled, with a VAS score of 0 on the first post-operative day. Rehabilitation was initiated the day after surgery, and the patient began walking with parallel bars despite residual pleural effusion (Fig. 3a). Following surgery on the right lower limb, the patient's lower limb length discrepancy resolved, trunk sway was reduced, and walking ability improved significantly. Oxygen supplementation was discontinued on post-operative day 3 as oxygen saturation improved to 98% and the patient reported no dyspnea. A CT scan performed one week post-operatively showed that the pleural effusion had resolved (Fig. 3b), but edema in both lower limbs persisted, so diuretic therapy (furosemide 20mg and spironolactone 25mg) was continued. The patient was discharged with cane-assisted walking three weeks post-operatively (Fig. 3c).

One month post-operatively, the patient had complete improvement in trunk stability and was able to walk independently (Fig. 3d). At 3 months post-operatively, the ROM in both knees improved to 0° – 120° (Fig. 3e and 3f). At 6 and 18 months post-operatively, the patient could climb stairs independently and without assistance, respectively (Fig. 3g). At two years post-operatively, the patient maintained excellent functional outcomes, including pain-free walking and improved quality of life.

DISCUSSION

To the best of our knowledge, there are no reports in the literature regarding TKA performed under local anaesthesia. It is important to emphasise that the authors do not actively recommend TKA under local anaesthesia as a standard procedure. The primary concern is intra-operative safety. In cases where general anaesthesia or spinal anaesthesia is contraindicated, femoral nerve or sciatic nerve blocks are strongly recommended as alternative methods[5]. In this case, the decision to perform surgery under local anaesthesia was made as a last resort, and routine use in future patients is not recommended.

This case demonstrates a successful outcome under special circumstances. In particular, the patient was able to walk on the first post-operative day, which is believed to have contributed to the resolution of pleural effusion within one

week. Additionally, at the two-year follow-up, normal walking, including stair climbing without assistance, was confirmed, indicating a favourable long-term prognosis.

However, recognising limitations to performing TKA under local anaesthesia is crucial. These limitations include the high risk of patient movement during surgery, inadequate pain management, and the potential for insufficient administration of anaesthetic agents.

This tolerance may be attributed to the patient's strong motivation and determination to regain mobility post-operatively. The decision to perform TKA under local anaesthesia should always be based on a thorough risk-benefit analysis. Guidelines established by the American Society of Anaesthesiologists and the European Society of Anaesthesiologists (EASA) emphasise the need for individualised treatment plans, particularly for high-risk patients with comorbidities such as heart disease[3].

In this case, the patient had severe deep vein thrombosis and pleural effusion, and was complicated by heart failure, making conventional anaesthesia methods particularly risky. Kerr and Kohan's study demonstrated the efficacy of anaesthetic drug combinations in post-operative pain management following TKA[1]. However, TKA under local anaesthesia carries inherent risks, including inadequate pain control, patient anxiety, the possibility of conversion to general anaesthesia, and anaesthetic drug toxicity.

Therefore, it should only be considered in exceptional situations where surgery is unavoidable and urgent. Further research is needed to establish clear guidelines for appropriate patient selection and the safe application of this method. Conventional anaesthesia options should always be considered first. Although not recommended as standard practice, TKA under local anaesthesia may serve as a viable option as a last resort.

In conclusion, this case report describes an instance where TKA under local anaesthesia was accidentally successful in an elderly patient for whom general anaesthesia, spinal anaesthesia, epidural anaesthesia, or nerve blocks were not suitable. We hope this report will contribute to future medical practice.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest.

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