Persistent knee pain following unicompartmental knee arthroplasty despite no identified cause and proactive patient use of standard and alternative therapies.

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Abstract
A 63-year-old fit male reported medial knee pain of 6/10 following a season of indoor soccer in 2018. Despite cessation of soccer, the pain continued and in October 2019 an X-ray showed moderate osteoarthritis in the medial compartment. In 2020, MRI showed a tear in the medial meniscal body. Arthroscopy was performed with partial medial meniscectomy and debridement of the medial compartment with the aim of reducing the pain. However, neuropathy arose at the intrapatellar branch of the saphenous nerve, and this was not offset by recommended treatment using Durolane injection, physiotherapy and local use of CBD and pregabalin, gabapentin triple cream. Due to the medial bone on bone contact, it was decided that a unicompartmental knee arthroplasty (UKA) would be sufficient to reduce the pain on walking. This was performed using a polyethylene implant in January, 2021. The patient had no chills, fever or night sweats but experienced unexpected severe peripheral neuropathy for several months post-op that was not relieved by physiotherapy, use of a pro-preceptor sleeve, ibuprofen or Lyrica. Follow-up X-rays and CT scan showed no obvious implant damage, displacement or loosening. Ultrasound guided nerve blocks of a neurovascular bundle in the peripatellar nervous plexus subjacent to the scar from the scope port insertion super-medial, and of the medial genicular branches, provided no relief from knee pain or parasthesia. He has full extension and flexion to 120. Using a metal artefact reduction sequence, MRI showed medial tibiofemoral arthroplasty with mild to moderate edema adjacent to both components, and small to moderate knee joint effusion. Blood work showed no elevation of ESR or CRP, and aspiration of the synovial fluid was negative for bacteria and with a cell count of 2.6 with only 4% neutrophils. With no explanation for the continuous discomfort on the medial compartment, the only remaining option appears to be total knee arthroplasty. Apart from this case demonstrating the merits of metal suppression for MRI to visualize the area in question, it provides a cautionary tale that emphasizes the need for surgeons to express to patients that outcomes following partial menisectomy and UKA may lead to more procedures, patient dissatisfaction and lack of relief of the original pain.
Introduction

Osteoarthritis (OA) of the knee occurs in over one third of subjects over 60 years of age and consists of joint damage and cartilage loss. The chronic degenerative condition results in pain, reduced joint motion, stiffness and can cause an inability to participate in certain sports. An association with co-factors such as obesity, depression and injury have led to interventions that address these issues, including diet, exercise, topical and oral pharmacotherapy, intraarticular glucocorticoid and hyaluronic acid injections, strength and pain-coping training, behavioural interventions, use of wedge insoles and acupuncture. Arthroscopic partial meniscectomy is often performed but as with all the approaches listed here, the clinical effects are marginal at best (1). Injection with embryonic stem cells into the joint is designed to improve cartilage recovery but clinical evidence remains to be persuasive (2).

Unfortunately, various factors including an ageing and overweight population have resulted in high rates of occurrence and persistence. The present case illustrates a range of investigative and treatment options that failed to provide satisfactory resolution of knee pain and agility.

Patient

A 63-year-old, fit and active Caucasian male reported medial knee pain of 6/10 following a season of indoor soccer in 2018. Despite subsequently stopping the sport, the pain continued, and his limping became persistent. His BMI was 25.5, barely in the overweight range. His blood pressure and pulse were in the normal range. He had no history or presentation of psychological issues that would explain the localized pain. Being keen to continue his sporting activity which was interrupted by this discomfort, he sought surgical advice.

Clinical assessed and treatments

An X-ray in October 2019 showed moderate osteoarthritis in the medial compartment. On March 9th, 2020, MRI showed a tear in the medial meniscal body (Figure 1). Arthroscopy was performed to investigate the persistent pain that was restricting walking and running. Partial medial meniscectomy and debridement of the medial compartment was performed during the procedure, but with no improvement in symptomatology.

Peripheral nerve pain that arose after the arthroscopy was assessed using electrodiagnostic investigation. This raised the suggestion of neuropathy of the intrapatellar branch of the saphenous nerve. The patient exercised daily and started swimming once or twice daily during the Canadian summer. Ibuprofen (400mg) taken irregularly did not provide relief from the reported feeling of bone-on-bone contact.
An intraarticular injection of durolane, physiotherapy for several months and local use of CBD cream, or pregabalin, gabapentin triple cream had no impact on the pain, peripheral nerve sensation or mobility.

The bone-on-bone contact at the medial compartment is illustrated by X-ray taken in January 2021 (Figure 2), days before a unicompartmental knee arthroplasty (UKA) was performed using a polyethylene implant at London Health Sciences. This surgical option was chosen as the patient was active, living on a farm and wishing to recover mobility. He wanted to delay a full knee replacement if possible, and because the problem was on the medial side rather than the whole knee, the hope was that a UKA could delay the need for a TKA.
The operation went without any complications or blood transfusion. The patient returned home the same day and had no chills, fever or night sweats. However, he experienced severe peripheral neuropathy for several months post-op that was not relieved by physiotherapy, use of a pro-preceptor sleeve, ibuprofen or Lyrica (Figure 3). Follow-up X-rays and CT scan showed no obvious implant damage, displacement or loosening (Figures 4,5).

Ultrasound guided nerve blocks of a neurovascular bundle in the peripatellar nervous plexus subjacent to the scar from the scope port insertion super-medial, and of the medial genicular branches, provided no relief from knee pain or parasthesia.

The patient had full extension and flexion to 120. 3T MRI (Siemens Biograph mMR) was acquired with a transmit/receive 15-channel knee coil in October 2021 (10 months post-UKA) at Lawson Imaging in St. Joseph’s Hospital in London Ontario. MRI consisted of sagittal and coronal T1- and T2-weighted turbo spin echo (TSE) acquisitions with and without short-T1 inversion recovery (STIR) fat suppression applied. All TSE acquisitions included metal artefact reduction of in-plane and through-plane distortion using the slice encoding for metal artifact correction (SEMAC) technique (Siemens Advanced WARP)(3). MRI showed medial tibiofemoral arthroplasty with mild to moderate bone marrow edema adjacent to both components. There was mild patchy fluid signal between both components and the adjacent bone. Many bony articular bodies were noted in a Baker’s cyst unchanged from previous imaging. The small to moderate knee joint effusion was expected post arthroplasty (Figures 6,7).

Blood work showed no elevation of ESR or CRP, and aspiration of the synovial fluid was negative for bacteria and with a cell count of 2.6 with only 4% neutrophils.

At 24 months, the area is painful to touch (5/10); the patient has difficulty kneeling without pain and discomfort; the patient reports stiffness, particularly after lying or sitting; and the skin above and around the implanted zone is reported as a painful tingling upon touch, with some numbness on the lateral region.

Second opinion

The patient sought a second opinion with an orthopedic surgeon at Mt. Sinai Hospital in Toronto. An X-ray (Figure 8) and physical exam showed moderate degenerative change at the lateral and patellofemoral compartment on the right. Probable tiny effusion. A standing view demonstrated a biomechanical axis of the right lower extremity which passed immediately adjacent to the lateral tibial spine. Although there was no definitive explanation for the pain there was suspicion of potential contact between the patella and implant upon walking. Options of arthroscopy and total knee arthroplasty (TKA) were discussed, with the latter offered if the patient was unable to cope with the symptoms and reduced mobility.

Discussion

An inability to resolve pain and discomfort with non-surgical and surgical treatments is unfortunately not an uncommon clinical outcome of knee osteoarthritis (4). A clinical practice guideline recommends strongly against arthroscopic partial meniscectomy in almost all knee OA cases (5). However, the investigative findings in this case identified an arthritic knee that was unlikely to improve without surgical intervention. Thus, the surgical procedures was undertaken.

The option of a unicompartmental procedures was recommended as it would allow for separation of the medial bone-on-bone contact and retention of the unaffected bone and ligaments. A systematic review suggested some advantages of UKA over high tibial osteotomy, with respect to functional results, pain assessment, and complications (6). In the present case, function was improved but surgical complication of peripheral neuropathy for several months post-op occurred, and pain persisted to 24 months.

Daily walking, swimming and bi-weekly yoga along with physiotherapy did not alter the pain and discomfort.

None of the reported complications of UKA (7), namely dislocation, prosthesis loosening or fracture, occurred. No further follow-up was arranged. However, this left the patient in limbo with limited options. It has become a management issue for failed medial UKA (8) for which remaining options are limited.

A review of 432 cases performed using robotic arm assistance showed only 13 revisions due mostly to aseptic loosening (9). Four of those were due to unexplained pain. Eleven converted to total knee arthroplasty while two had revised UKA. An additional 14 reoperations were reported due to lateral meniscal tear, chondromalacia of the patella, a condition not diagnosed in the patient described herein. Another patient in the review had synovitis, one had a loose body, one had limited range of motion, and another severe lateral OA. Again, the current case had none of these issues. Of the unrevised cases, 91% of the patients were either very satisfied or satisfied with their function.

The one similarity with the causes of the 14 reoperations was a patient with nerve neuritis. This is caused by irritation or compression at the adductor canal or at other sites along the saphenous nerve. The burning and electric type dull and achy medial pain in the current case appears to have been...
associated with surgical trauma to the nerve, following initial arthroscopy and worsened by the UKA. Although not clinical proven, this condition is the closest cause of the patient’s continuous discomfort. Treatment of refractory neuritis is currently an unmet clinical need, though the use of 25 mg amniotic and umbilical cord (AMUC) particulate injection (CLARIX FLO, Amniox, Miami, FL) in three cases resulted in a reduction in pain  (painDETECT questionnaire) from 7.3 to 0.3 at 6 weeks follow-up (10), with two reporting complete pain relief at 63 weeks. Another study of 20 knee OA patients with ultrasound-guided intra-articular injection of 50mg of AMUC particulate showed significant pain relief and improved physical function (11). These results were further supported by a retrospective study of 42 patients with knee OA, whereby 74% reported significant clinical improvement twelve months after 100mg injection (12).

Given the failure of nerve blocks, physiotherapy, nonsteroidal anti-inflammatory drugs, analgesics, light therapy(https://international.celluma.com/pages/led-light-therapy-science) (13) and exercise, the use of commercially available AMUC particulate could be considered due to their anti-inflammatory, anti-scarring, and pro-regenerative properties. Although its effectiveness is not fully proven in UKA patients, it is an option for the patient reported herein. However, upon a second opinion, this option was ruled out for lack of sufficient data and not being available in Canada.

Other management options include cooled radiofrequency ablation (CRFA) or TKA. CRFA of targeted genicular nerves can be an effective therapeutic option for pain management and knee function (14). Although this specific method has not been used in the present case, attempts to identify the nerves causing the symptoms failed on two occasions, including with use of ultrasound guidance. The option of reverting to a TKA is available, but up to 30% patients are reported to be dissatisfied with the outcome in terms of quality of life, pain and mobility (15). The reasons are many, from patient factors to the method of surgery, implant design and post-operative rehabilitation. Having stated that, chronic persistent pain is poorly understood. It is not known why pre-operative pain is a predictor of post-operative pain, given that the TKA removes many of the structurally damaged areas (16). Given the findings of a study on 222 knees showed 28% of patients with moderate-to-severe pain post-operatively and 9% with unclear pain (17), more scientific studies are clearly warranted in order to explain this discrepancy. A study of 15 patients with unexplained pain underwent revision of their unsatisfactory UKA to TKA (Group A) compared the outcomes to 15 revised with defined pain (Group B) (18). After twelve months, the mean Oxford knee score improved from 19 to 25 in group A and from 23 to 38 in group B. The mean visual analogue scale of pain improved more for Group B (7.4 to 1.7) than Group A (7.7 to 5.4). This emphasizes that the option for the patient described here to have a TKA carries the risk of not reducing pain.

The predicted number of these procedures in the US alone is expected to rise from one to four million annually. But with such poor outcomes, a re-assessment is needed to try and reduce the percentage with persistent post-operative pain. Alternative therapies such as acupuncture and transcutaneous electrical nerve stimulation show promise (19) but clinical trials are often not of sufficient quality and sample size, and the long term benefits for recalcitrant patients like the one presented here, remain to be proven.

In summary, this case provides several important lessons. Firstly, it shows that none of the potential complications of UKA occurred, yet the outcome was far from optimal from a patient perspective. Secondly, it outlines the range of investigative procedures on a patient with knee osteoarthritis. This included traditional and complementary interventions, used by many patients, but also more novel techniques, such as metal artefact reduction sequences for MRI that improved visualization of the area in question. This provides a cautionary tale that emphasizes the need for surgeons to express to patients the potential full range of outcomes following partial meniscectomy and UKA, and which even TKA may not resolve. Thirdly, it illustrates that further research is required to determine if the persistent pain is caused by structural or nerve placement issues, and if procedures such as AMUC particulate injection have any value.

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References