

Case Report

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Delayed Compartment syndrome after total knee replacement: A case report with short review

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Abstract

Purpose: We would like to report a case which developed delay anterior thigh compartment syndrome after total knee replacement surgery and review the underlying risk factors.

Method: A 67years old lady was suffered from delay thigh anterior compartment syndrome 4 days after total knee replacement surgery. Urgent fasciotomy was performed. Later work up showed a large intramuscular haematoma within the anterior compartment which required drainage.

Discussion: Short review was performed to identify the risk factors for developing compartment syndrome after total knee replacement surgery. Management strategy and prognosis was also discussed. Conclusion: Compartment syndrome should be diagnosed and treated promptly. Patient with underlying risk factors must be identified and with close monitoring of this rare complication in post-operative period.

Introduction

Total Knee Replacement (TKR) is more commonly performed nowadays [1,2] and is also in increasing trend [3,6] for treatment advanced stage knee osteoarthritis according to Kellgren and Lawrence system classification [7,9]. It is effective in pain relief and improving mobility status [10]. However, we need to be aware of the possible risks and complications [11,12] of this commonly performed surgery, which included peri-prosthetic joint infection [13,14], fracture [15] and deep vein thrombosis [16]. Compartment syndrome after TKR [17,19] is very rare, but it is a severe complication that needs prompt diagnosis and treatment. We would like to report a case which the patient suffered from compartment syndrome involving ipsilateral anterior thigh compartment 4 days after TKR and required urgent fasciotomy.

Case report

Madam X was a 67 years old lady with past medical history of atrial fibrillation and old ischemic stroke with good recovery who required long term anticoagulation (warfarin 2.5 mg/3 mg

alternative day). International Normalized Ratio (INR) level was maintained around 2-2.5. She had history of hypertension and hyperlipidemia on medical treatment (Diltiazem HCL 24 HR SR 200 mg daily, Frusemide 20 mg daily, Losartan 100 mg daily, Slow K 600 mg twice per day, Prazosin 2 mg twice per day and Simvastatin 10 mg daily). She attended to our clinic around 5 years ago in 2013 for bilateral mechanical knee pain which left knee was more symptomatic. Standing X-rays bilateral knee anteroposterior, lateral and skyline view showed tri-compartmental knee osteoarthritis. Conservative treatment included lifestyle modification, weight reduction, use of walking aids, physiotherapy, and analgesics [20] were exhausted and patient was only able to walk with stick for 15-20 mins due to severe knee pain. She agreed for left side TKR after discussion. Warfarin was withheld 5 days before operation with subcutaneous Low Molecular Weight Heparin (LMWH) (Clexane) injection every 12 hours as bridging therapy [21]. LMWH injection was withheld 1 day before operation as suggested by list Anesthesiologist.

The operation (left TKR) was performed under general anesthesia. Total operation time and tourniquet time was 1 hours

and 45 minutes. Tourniquet with pressure inflated to 250 mmHg was applied to left thigh. The Synthes Attune System and cemented implant (femoral component: left side size 5, tibia component: size 3, patella component: size 32, 9 mm insert) were used and the operation was uneventful. 20 ml Levobupivacaine (5 mg/ml) was injected periarticularly [22] during operation to optimize pain control. We usually would also inject 1 gram Transamin intra-articularly [23,24] to reduce post-operative bleeding which was not performed in this case due to history of ischemic stroke. Drain was inserted, the retinaculum and skin wound was closed tightly in layers. Intraoperative blood loss was around 200 ml. Patient was transferred back to general ward after the operation under closed monitoring. The drain output was around 100 ml on day 1 post operation and was removed. Knee mobilization exercise and full weight bearing walking exercise were started. Warfarin was resumed 24 hours after operation together with subcutaneous LMWH injection as bridging therapy when INR was below 1.8 as suggested by Physicians. Daily blood test was performed. The haemoglobin was static around 10 g/dL initially and the INR level was progressively raised to around 2.

Diffuse left lower limb swelling was noted on day 4 post operation with sudden drop of haemoglobin from 10 g/dL to 8 g/dL while the INR was maintained around 2. The patient was hemodynamically stable. The left knee was non tender and no significant effusion. The Range of movement was around 0-45 degree. No active bleeding site was noted in examination. The calf circumference was around 3 cm larger. 2 units packed cell were transfused and post transfusion haemoglobin level was around 9 g/dL. Urgent ultrasound Doppler showed no deep vein thrombosis. Patient was observed closely, elevation of left lower limb together with ice therapy was prescribed.

However, Patient complained sudden onset rest pain over left anterior and lateral thigh at night on the same day. Tense left anterior thigh was noted. The left knee was non tender and no significant effusion. The main wound was healthy looking. Patient was able to fully extend the knee and abduct the left hip, but severe stretching pain was noted when passive knee flexion was attempted. The neurovascular examination of left lower limb was unremarkable. Compartment pressure was measured which showed 70 mmHg. Patient was all along conscious with blood pressure around 130/80 mmHg. Urgent Fasciotomy was performed together with fresh frozen plasma transfusion. Longitudinal incision was performed along the lateral thigh. Anterior compartment muscle bulging was noted upon fascia incision. Posterior compartment was also released through the same wound which showed soft compartment. No sign of active bleeding or infection was noted. We decided for delayed closure of wound due to significant muscle bulging and swelling. Prophylactic antibiotic was started and warfarin was withheld in view of need of staged surgery. Subcutaneous injection of LMWH was restarted 24 hours after urgent operation.

Computer tomography of abdomen, pelvis and left lower limb with contrast was performed later due to persistent swelling of left thigh which showed large intramuscular hematoma over anterior compartment (14.7 cm x 8.8 cm x 20.4 cm), otherwise no significant finding was noted in intraabdominal and pelvic region. Urgent exploration, drainage and haemostasis was performed 1 week after the fasciotomy. Another anterior

longitudinal incision was used, the intramuscular haematoma was drained, diffused oozing over the intermuscular septum between anterior and medial compartment with noted and coagulated. The swelling and pain resolved afterward. The lateral thigh fasciotomy wound was skin grafted 3 weeks later after the total knee replacement surgery.

Discussion

Compartment syndrome is not an uncommon condition following severe trauma, long bone fracture, crush injury, vascular insult and prolonged tourniquet application [25,28]. But it is quite rare but severe complication after TKR [17]. Its pathoanatomy [29] is due to elevation of interstitial pressure in closed and non-expandable osteofascial compartment, which can be due to increased intra-compartmental content or extrinsic compression, resulting in obstructing the microvascular circulation and lead to neurovascular dysfunction and tissue necrosis. Delayed treatment would lead to lots of complications, include Volkman contracture [30], deformity, neurological deficit or even amputation and death [31]. Compartment syndrome is a clinical diagnosis and requires low threshold of suspicions. Severe pain on passive stretching of the involved compartment (which also presented in our case) and pain out of proportion have been described as the most reliable clinical sign. Other symptoms and signs include pallor, pulselessness, paraesthesia and paralysis, but it is well documented that they are relatively late signs and their presence suggest that compartment ischemia and tissue necrosis already have happened, hence, fully recovery is less likely [25,28]. For unconscious patients, compartment pressure measurement is required to diagnose compartment syndrome. When it is equal or higher than 30 mmHg (absolute value) or difference of intra-compartmental pressure and the diastolic blood pressure is 30 mmHg or less, compartment syndrome is diagnosed and required for fasciotomy [32,34]. Prompt fasciotomy within 6 to 8 hours after presence of symptoms or pain results in a better prognosis. Poor recovery can be predicted if delay diagnosis and treatment due to tissue necrosis and neurovascular damage. Delay fasciotomy is not recommended due to high risk of infection [35,38].

Acute compartment syndrome after TKR is very rare; still some risk factors have been reported. The patients with extensive soft tissue trauma or dissection, or complicated with vessel injury during operation together with hematoma collection, or those suffered from Deep vein thrombosis, on anticoagulation, with prolonged and high tourniquet pressure applied have higher change to develop acute compartment syndrome after the operation [18,19,35,39]. In our case, we believed that the reason for delay onset of acute compartment syndrome related to the anatomy of the thigh. The fascia in thigh is much more elastic than leg compartment together with more voluminous quadriceps and thigh muscle, so the thigh compartment has more potential space for the increased pressure and content before the compartment syndrome established [40]. The cause of anterior thigh compartment syndrome in our case was due to progressive collection of the intramuscular haematoma, evidenced by sudden drop of haemoglobin level in early post-operative period and the contrast computer tomography findings. There were few underlying reasons for the haematoma formation. Firstly, patient was resumed LMWH and warfarin early after operation in order to reduce risk of cerebral vascular

accident, but due to the iatrogenic coagulopathy, some occult bleeding might happen and led to haematoma collection. Secondly, patient with tourniquet applied for 1 hour and 45 mins with pressure set at around 250 mmHg, due to ischemic and reperfusion injury [41,42], together with some stripping of the anterior distal femur muscle during operation, which might lead to muscle damage and bleeding, which contributed the development of haematoma and compartment syndrome. We also thought of the possibility of undiagnosed deep vein thrombosis of left lower limb which might obstruct the outflow of blood and causing progressive increase in intra-compartmental pressure.

The other concern of this case is about the infection risk of TKR. Additional incision in the ipsilateral limb together with prolonged open wound might increase risk of TKR infection. It is well reported that infection is associated with poor outcome and would affect the longevity of the implant due to multiple surgery and revision of the loosened implant [41,43,44]. Regular wound dressing together with prophylactic antibiotic was prescribed in this case. Another possible problem in this case is about rehabilitation. The knee range of movement exercise of this case was affected due to the open wound together with the stretching pain when patient tried to flex the knee. Also if skin grafting is required to close the wound, the training exercise would be further delayed due to the need of protection of the graft.

Conclusion

In conclusion, we described a rare case of acute thigh anterior compartment syndrome with delay presentation after TKR. Patient with underlying risk factors must be identified and with closed monitoring of this rare complication in post-operative period. Low thresholds of suspicion, prompt diagnosis and treatment are required in order to avoid long term complication and even mortality.

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