

# Bilateral Spontaneous Osteonecrosis of Knee with Concomitant Medial Femoral and Tibial Condyle Involvement – A Rare Presentation and Short Review

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## Learning Point of the Article:

Concomitant SPONK of MFC and MTP in bilateral knee is very rare. In advanced stages, TKR with revision augments can provide good radiological and functional outcome.

## Abstract

**Introduction:** Osteonecrosis of knee is classified as primary spontaneous osteonecrosis of knee (SPONK) and secondary osteonecrosis of knee. Primary SPONK usually involves medial femoral condyle (MFC). Incidence of medial tibial plateau (MTP) is only 2% among the patients with SPONK and simultaneous involvement of MFC and MTP is very rare.

**Case Report:** We report a very rare case of 45-year-old female with SPONK affecting both MFC and MTP simultaneously with subchondral insufficiency fractures. She presented with pain in both the knees and difficulty in walking since 1 year. Physical examination revealed decreased range of motion and local tenderness over MFC and medial tibial condyle. Subchondral fracture with articular surface collapse of MFC with joint space narrowing and varus deformity was seen on X-ray in both the knees. Sclerosis was seen in the medial tibial condyle bilaterally. Magnetic resonance imaging showed characteristic focal hyperintense areas surrounded by band like hypointense areas in both MFC and MTP which was suggestive of subchondral collapse with ill-defined bone marrow changes. X-ray of both knees revealed SPONK in Koshino's Stage IV and Carpintero's Stage IV. Bilateral total knee replacement (TKR) was planned. First left knee was operated. A cruciate retaining type of TKR was done. Two weeks later right side TKR was operated. MFC of right side also had a large osteochondral fragment which was excised to leave defect with depth more than 2 cm. Defect was reconstructed with bone graft obtained from posterior condylar cuts. Posterior stabilized type of knee replacement component was used along with femoral extender stem. Histopathological examination revealed necrotic bone surrounded by an area of fibrovascular granulation tissue on both the femoral and tibial sides. Patient has good functional outcome at 2 years follow-up.

**Conclusion:** Concomitant SPONK of MFC and MTP in bilateral knee is very rare and in advanced stages TKR can provide good radiological and functional outcome. Furthermore, pre-operative assessment of bone defects is necessary and appropriate use of augments (extender stem or metal wedges) is crucial.

**Keywords:** Spontaneous osteonecrosis of knee, osteonecrosis, total knee replacement.

## Introduction

Osteonecrosis of knee is classified as primary spontaneous osteonecrosis of knee (SPONK) and secondary osteonecrosis of knee [1]. Primary SPONK usually involves medial femoral condyle (MFC) and occurs in patients older than 55 years of age. It is not associated with risk factors for osteonecrosis. On the other hand, secondary osteonecrosis of knee involves multiple condyles and occurs in patients younger than 55 years

of age and is associated with risk factors such as alcohol, and corticosteroids [2, 3]. SPONK can rarely involve lateral femoral condyle, medial tibial plateau (MTP), or patella. Incidence of MTP is only 2% among the patients with SPONK and simultaneous involvement of MFC and MTP is very rare [2, 4]. SPONK may sometimes extend to lateral aspect of knee in end-stage disease and when significant degenerative changes occur it is difficult to differentiate end-stage SPONK from severe

Access this article online

Website:  
www.jocr.co.in

DOI:  
10.13107/jocr.2020.v10.i07.1904

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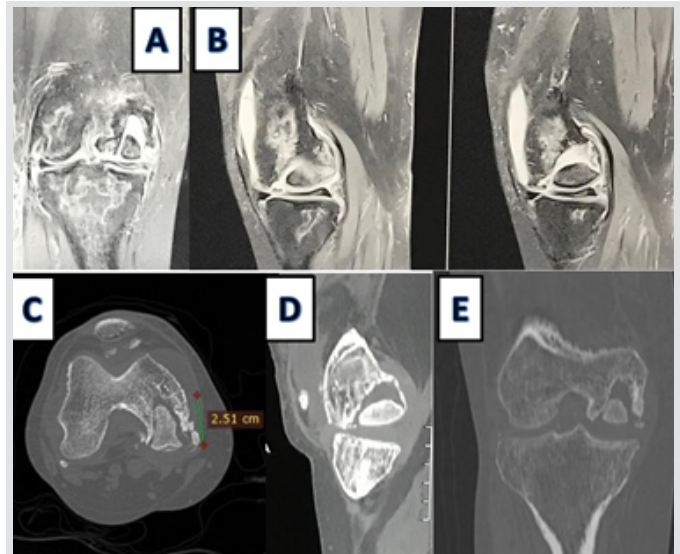


**Figure 1:** (a) X-ray right knee anteroposterior view showing large osteochondral fragment with sclerosis of medial femoral condyle and medial tibial plateau and varus deformity, (b) X-ray right knee lateral view, (c) X-ray left knee Anteroposterior view showing medial femoral condyle collapse and varus deformity, (d) X-ray left knee lateral view.

osteoarthritis (OA) [5]. Yamamoto and Bullough reported that SPONK may result from subchondral insufficiency fractures [6]. Early diagnosis is difficult as X-ray may look normal initially but magnetic resonance imaging (MRI) can detect early changes in subchondral region. Here, we report a very rare case of SPONK affecting both MFC and MTP simultaneously in both knees with subchondral insufficiency fractures.

### Case Report

A 45-year-old female patient presented to us with pain in both the knees since 1 year. She also had difficulty in walking. Pain had gradually increased over the period of 1 year. She had no history of the previous trauma, steroid use, meniscus surgery, alcohol intake, or smoking. Physical examination revealed local tenderness over MFC and medial tibial condyle and decreased range of motion. Laboratory investigations showed no specific findings. Subchondral fracture with articular surface collapse of MFC with joint space narrowing and varus deformity was seen on X-ray in both the knees. Sclerosis was seen on X-ray in the medial tibial condyle on both the sides. X-ray of both knees revealed SPONK in Koshino's Stage IV and Carpintero's Stage



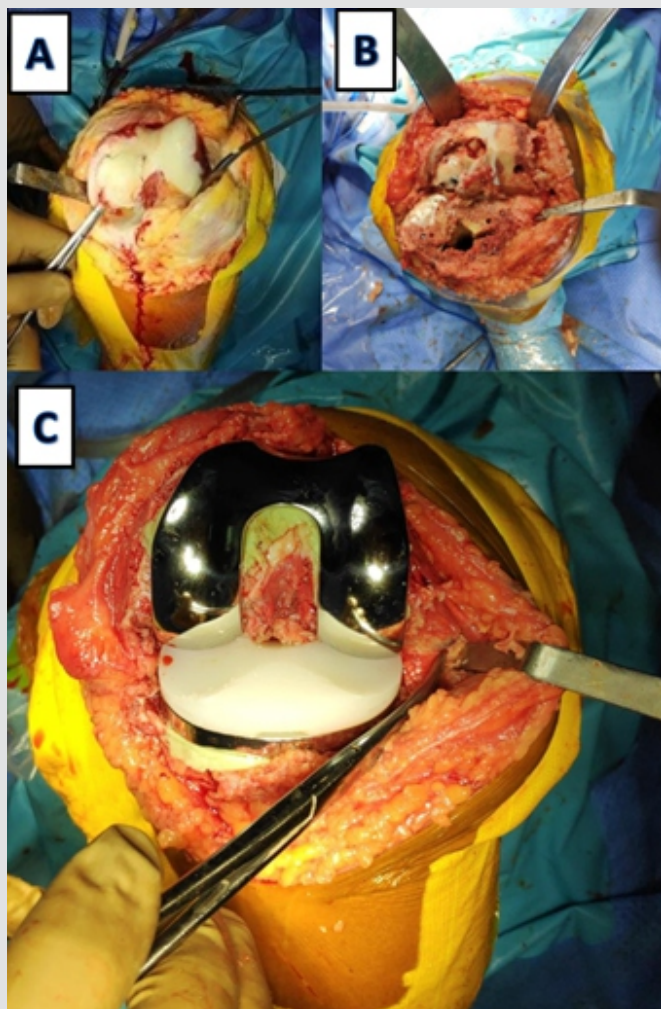
**Figure 2:** (a) Magnetic resonance imaging (MRI) T2 coronal image of right knee showing hypointense area surrounded by hyperintense band, (b) MRI T2 sagittal image of right knee, (c) computed tomography (CT) scan axial image of right knee showing bony defect in medial femoral condyle, (d) CT scan right knee sagittal image, (e) CT scan right knee coronal image.

IV (Fig. 1). MRI of right knee showed characteristic focal hyperintense areas surrounded by band like hypointense areas in both MFC and MTP which was suggestive of subchondral collapse with ill-defined bone marrow changes (Fig. 2). Computed tomography (CT) scan of both knees was done to



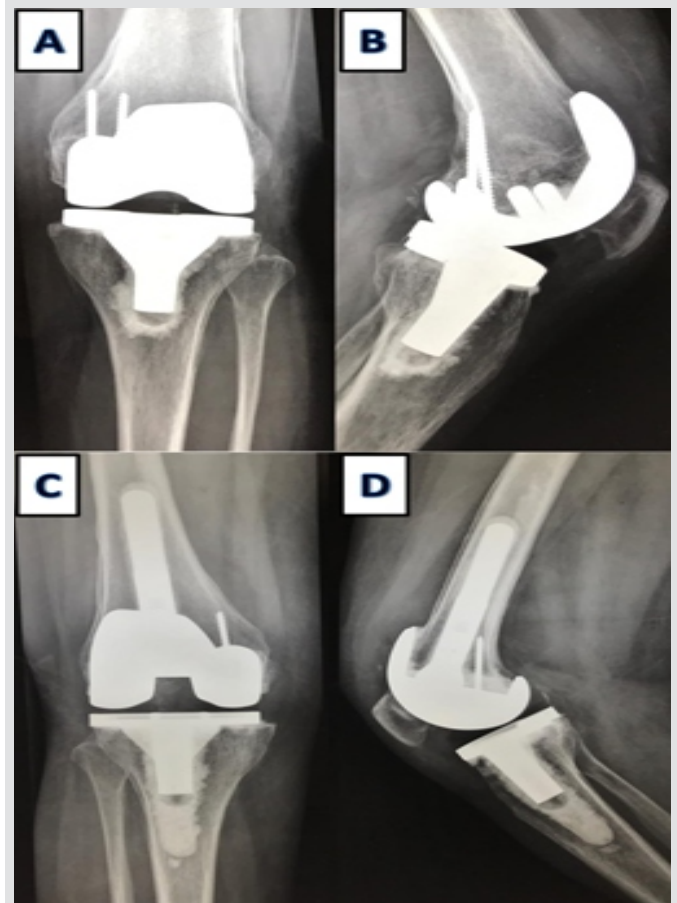
**Figure 3:** (a) Computed tomography (CT) scan sagittal image of the left knee showing osteochondral fragment in medial femoral condyle, (b) CT scan coronal image of left knee, (c) CT scan axial image of the left knee (yellow arrow showing osteochondral fragment).



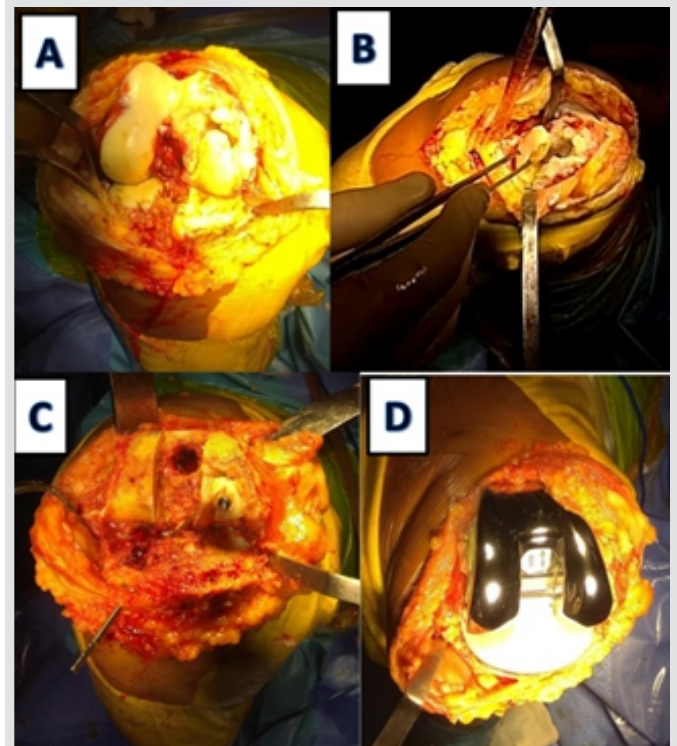


**Figure 4:** (a) Intraoperative image of the left knee with artery forceps behind the detached osteochondral fragment, (b) intraoperative image after the bone defect was reconstructed with auto-graft and fixed with two screws, (c) intraoperative image showing left side total knee replacement done with cruciate retaining type of implant.

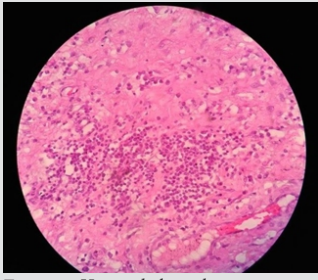
assess the deformity. Right knee showed a defect measuring 2.51 cm in the MFC (Fig. 2). Left knee CT scan also showed defect in MFC (Fig. 3). Taking the deformity and disability into consideration, total knee replacement (TKR) was planned for both sides. Initially, left knee was operated. Large longitudinal osteochondral flap was seen intraoperatively on MFC's extensor surface. The MTP was depressed and cartilage fibrillation was seen. After excising the flap, there was defect seen in medial condyle with sclerotic bone at base. An auto-bone graft obtained after cutting posterior condyle was used to build up the defect (Fig. 4). A cruciate retaining type of TKR was done (Fig. 5). Two weeks later, right side TKR was done. MFC of right side also had a large osteochondral fragment which was excised to leave defect with depth more than 5 mm. This defect was reconstructed with bone graft obtained from posterior cuts. MTP of right side had similar findings as left side (Fig. 6). Posterior stabilized type of knee replacement component was used along with femoral extender stem (Fig. 5). Histopathological examination was done of the excised osteochondral fragments and tibial cuts. It revealed necrotic



**Figure 5:** (a) X-ray left knee anteroposterior view, (b) X-ray left knee lateral view, (c) X-ray right knee anteroposterior view, (d) X-ray right knee lateral view.



**Figure 6:** (a) Intraoperative image of the right knee with large loose osteochondral fragment seen in medial femoral condyle, (b) intraoperative image of right knee showing osteochondral fragment lifted with forceps, (c) intraoperative image after the bone defect was reconstructed with auto-graft and fixed with screw, (d) intraoperative image showing right side total knee replacement with femoral extender.



**Figure 7:** Histopathology showing necrosis surrounded by fibrovascular tissue.

bone, surrounded by an area of fibrovascular granulation tissue on both the femoral and tibial sides (Fig. 7). Patient was mobilized full weight bearing after surgery and has good functional outcome at 2 years follow-up.

### Discussion

SPONK has been well described radiologically and pathologically. During the early stage, the radiographs are normal, even if patients are having severe symptoms [7]. Later on radiolucent shadow is seen in the subchondral bone of weight bearing area of MFC. This later expands and is surrounded by sclerotic halo. Because of these structural changes in the MFC, MTP is affected, leading to sclerosis, narrowing of joint space, and formation of osteophytes. In late stages, it becomes difficult to even differentiate it from severe OA [5, 8]. MRI helps in early diagnosis of SPONK as it is more sensitive and specific and provides extensive information. In early SPONK, T1 imaging shows focal hypointense lesion while T2 imaging shows hyper-intense lesion surrounded by band of low intensity signal in the subchondral region [9].

Our patient presented with Koshino's Stage IV in both the knee which was difficult to distinguish from severe OA on radiographs but was diagnosed on MRI with typical findings on T2 and T1 imaging. To the best of our knowledge, there are case reports with MFC and MTP simultaneous involvement, but they show unilateral knee involvement [10, 11]. Our case is the first ever documented report of SPONK with simultaneous involvement of MFC and MTP in bilateral knees.

In MFC SPONK, lesion size is the prognostic factor for OA. If the lesion size is more than 40% of joint surface then it is reported to develop OA. In contrast, natural course of SPONK in MTP may range from complete resolution to progressive joint degeneration. Extensive collapse of MTP is rare [8]. The characteristic crescent like subchondral collapse is a finding in SPONK [3, 7, 8]. In contrast, our case has longitudinal track like

subchondral collapse due to advanced stage.

Our patient had bilateral SPONK affecting both MFC and MTP. There was severe collapse of MFC and sclerosis of MTP in both the knees. Mont et al. have reported good functional outcome in patients with extensive bone collapse at 9 years follow-up in 97% of patients with total knee arthroplasty. Other option available in early stages of SPONK is unicompartmental knee arthroplasty.

SPONK is frequently associated with medial meniscal tears (50–75%) [9]. Meniscal damage leads to increased contact stresses in medial compartment. This leads to subchondral overload predisposing to development of osteonecrosis. Meniscal root injuries are reported in 80% of patients with SPONK [12]. Our patient presented in late stage of SPONK resembling OA with degenerative tears in meniscus.

The formation of unstable fragment distal to fracture and its loss of blood supply are due to impaired healing after subchondral fractures which result in osteonecrosis. This suggests that subchondral insufficiency fractures are the underlying cause. Histology of early stages of SPONK is identical to that of subchondral fractures with no evidence of necrosis and in advanced SPONK resembles that of delayed union or nonunion with fibrovascular tissue and cartilage [6]. Histological examination in our patient revealed subchondral crack and bone healing reaction. Fibrous granulation tissue and necrosis were seen.

### Conclusion

Concomitant SPONK of MFC and MTP in bilateral knee is very rare. In advanced stages, TKR can provide good radiological and functional outcome. Furthermore, pre-operative assessment of bone defects is necessary and appropriate use of augments (extender stem or metal wedges) is crucial.

### Clinical Message

Concomitant SPONK of MFC and MTP in bilateral knee is very rare. In advanced stages, TKR with revision augments can provide good radiological and functional outcome.

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**Conflict of Interest:** Nil  
**Source of Support:** Nil

**Consent:** The authors confirm that Informed consent of the patient is taken for publication of this case report

#### How to Cite this Article

Shah KA, Desai MM, Shah SS, Kuruwa DR. Bilateral Spontaneous Osteonecrosis of Knee with Concomitant Medial Femoral and Tibial Condyle Involvement – A Rare Presentation and Short Review. *Journal of Orthopaedic Case Reports* 2020 October;10(7): 25-29.

