

*Case Report***Adolescence Tibial Tubercle Avulsion Fracture: Option of Surgical Treatment in Worsening Condition of Pre-Existing Osgood-Schlatter Disease (OSD)**Fira Soraya<sup>1</sup> , Ritzky Pratomo Affan<sup>2</sup>, Bagus Danu Hariyanto<sup>3</sup><sup>1</sup>Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia<sup>2</sup>Department of Orthopedic and Traumatology, Dr. R. Koesma General Hospital, Tuban, Indonesia<sup>3</sup>Department of Radiology, Dr. R. Koesma General Hospital, Tuban, Indonesia

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**ABSTRACT**

**Background:** Osgood-Schlatter disease (OSD) is the most frequent cause of chronic knee pain in adolescents. Tibial tubercle avulsion fractures are an infrequent injury, approximately between 0.4-2.7% of all epiphyseal injury. Even though the relation between OSD and tibial tubercle avulsion fracture is still controversial, there are cases previously reported with this presentation.

**Case Report:** A 16-years-old boy complained of pain on his left knee, significantly below the patella with ambulation limitation. He had a two-months history of knee pain in the same location and prominence on the area below the patella that was getting more significant over time. The patient was actively involved in volleyball in his school. The radiographic findings show fragmented tubercle fractures on the left tibial, soft tissue swelling in the tubercle's anterior side, and increased density of the infrapatellar fat pad. The patient underwent ORIF with screws. After a one-month post-surgery, the patient felt minimal pain when bending his left knee.

**Discussion:** Male adolescents (12-15 years) and repetitive sprinting and jumping sports are the risk factors for OSD. About 90% of cases show a complete resolution, but some conditions make the OSD worse, such as low compliance at exercise avoidance. Surgery is rarely indicated for OSD, but in the condition of, even though very uncommon, tibial tubercle avulsion fracture, surgery gives a better outcome and resolution.

**Conclusion:** All Osgood-Schlatter disease' patients should temporarily restrict sports activities to prevent tibial tubercle avulsion fractures.

Keywords: Tibial Tubercle Avulsion Fracture; Osgood-Schlatter Disease; Knee Pain; Adolescent; Human and Medicine

**INTRODUCTION**

Osgood-Schlatter disease (OSD) is a tibial tubercle avulsion caused by repetitive strain on the quadriceps femoris muscle. OSD also called as traction apophysitis of the tibial tubercle was first narrated in 1903 by an American orthopedic surgeon Robert Osgood and a Swiss Physician Carl Schlatter.<sup>1-3</sup>

This condition is usually found in male adolescents, mostly between 10-15 years old.

Affected adolescents generally experience pain under the patella at the patellar tendon insertion, and the pain is often aggravated by running, jumping, and kneeling, and relieved by rest. The physical examination findings involve soft tissue swelling and prominence over the tibial tubercle and also patellar tendon tenderness.<sup>4-6</sup>

OSD generally is self-limiting along with the maturity of bone. Approximately one year after the onset of symptoms, 90% of

patients are symptom-free. However, a few patients may have problems with kneeling and may also have residual anterior knee pain.<sup>4,6</sup>

Generally, the incidence of OSD is still unknown, yet some authors have reported an incidence of OSD is 14,3% among male teenage soccer players through a 1-year cohort study.<sup>1,4</sup>

The etiology of OSD remains controversial. Patellar tendonitis and microfracture or micro avulsion in the apophysis of tibia caused by patellar tendon traction are some of the documented hypothesis of the OSD etiology.<sup>1,7,8</sup>

Tibial tubercle avulsion fractures are an infrequent injury, approximately between 0.4 - 2.7% of all epiphyseal injury. Based on the variations in the identification of the injury pattern, however, the prevalence of tibial tubercle avulsion fractures is uncertain. For example, the well-localized tibial tubercle avulsion fractures are sometimes interpreted as variants of OSD. Tibial tubercle avulsion fractures are usually found more frequently in the male adolescent. These fractures are also found more often in sports that involve jumping and sprinting like football, basketball, and volleyball. These fractures can occur with some predispositions, such as OSD. Tibial tubercle avulsion fractures can happen when there is unexpected knee flexion in opposition to a contracted quadriceps muscle or immoderate contraction of the quadriceps during the knee extension. Both situations are usually found during sports, such as jumping and sprinting.<sup>9-14</sup>

There are several classification systems of tibial tubercle avulsion fractures, such as Watson-Jones classification and Odgen

classification. Watson-Jones classification system categorized tibial tubercle avulsion fracture into three types: type I or where the fracture location is distal to the ossification center, type II, or where the fracture is through the ossification center and type III or where the fracture is extending proximally through the joint. Odgen classification then divided the Watson-Jones classification system into the noncomminuted fracture or called type A and comminuted fracture or called type B. Ryu and Debenham later added fracture of the tibial epiphysis that extending posteriorly as type IV fracture. McKoy and Stanitski then added type V fracture or "Y"-shaped fracture pattern in the knee's proximal region. Davidson and Letts later added periosteal lifting of the patellar tendon insertion as a nonphyseal variation of type V and related to small subchondral bone fragments.<sup>9, 13-16</sup>

OSD is the primary cause of knee pain in adolescents. Although OSD's role in the occurrence of tibial tubercle avulsion fracture is controversial, tibial tubercle avulsion fractures alone are an infrequent injury. This case report shows the uniqueness and educational review of the pathology of tibial tubercle avulsion fracture of pre-existing OSD. In this case, due to the worsening condition of pre-existing OSD in a short time (one month since the diagnose of OSD was made), such as conservative treatment failure and displacement of tibial tubercle because of an avulsion fracture, surgery was performed.



## CASE REPORT

A 16-years-old teenage boy was referred to the Department of Orthopedic and Traumatology, Dr. R. Koesma General Hospital, with pain on his left knee with limitation of ambulation. He had a two-months history of knee pain in the same location as the current condition. Further historical evaluation revealed that the episodes of pain were quick and exacerbated by strenuous movements. A prominent area below the patella co-occurred with the pain and was getting more significant for a long time. The patient was also actively involved in volleyball in his school. One month before the current consult, a plain radiograph [Figure 1] and musculoskeletal USG was done by another orthopedic, and diagnosis of Osgood-Schlatter disease was made and placed on the oral non-steroidal anti-inflammatory drug (mefenamic acid) and was suggested to take a rest and avoidance of sports. Unfortunately, the patient did not avoid sporting activity and overdid any activity that involves the knee in the meantime between the last consult and current consult. He also stated that the pain went worse after exercising and if he did not consume the painkiller.

Physical examination on current consult revealed a healthy male adolescent in no noticeable distress. Apparent tenderness was found at the left knee, especially at the tibial tubercle, with limitation of movement around the knee joint shown in Figure 2. A repeated plain radiograph of the left knee was done. It showed visible fragmented tubercle fractures on the left tibial, soft tissue swelling in the tubercle's anterior side and increased density of

the infrapatellar fat pad as shown in Figure 3. The fracture of the left knee was classified as Odgen type IIB with pre-existing Osgood-Schlatter.

The patient received reassurance and underwent open reduction internal fixation (ORIF) with screws for fracture fixation. The surgery option was taken because of the worsening condition such as conservative treatment failure and the tibial tubercle displacement because of an avulsion fracture.



**Figure 1.** AP and lateral view of the left knee in February 2019



**Figure 2.** The patient's left knee shows tenderness at the left tibial tubercle.



**Figure 3.** AP and lateral view of the left knee in March 2019 shows visible fragmented tubercle fractures on the left tibial (green arrow), soft tissue swelling in the anterior side of the tubercle (blue arrow), and increased density of the infrapatellar fat pad (red arrow).

### Post-Operative Evaluation

At one month postoperatively, our patient was evaluated by assessment of the patients' pain level. On physical examination, the surgical wound was healed and also felt minimal pain when bending the knee. The follow-up plain radiograph of the left knee was performed and showed that the callus started to perform and faint fracture line as shown in Figure 4. He, unfortunately, did not show up for another follow-up evaluation before this report.



**Figure 4.** The left knee's AP and lateral view in March 2019 shows callus starts to perform and faint fracture line.

### DISCUSSION

Osgood Schlatter disease (OSD) usually occurs in adolescents with occurrence tendency in male adolescents aged 13 - 14 years old and female adolescents aged 10 - 11 years old. Since the first reports, some clinical presentation characteristics such as knee pain, especially in the area lower of the patella and tibial tubercle, have been observed. Knee pain is bilateral in 25 - 50% of cases. The pain is aggravated by exercise or activity involving the knee, such as running, jumping, kneeling, and relieved by rest. The pain firstly occurs only after exercise or other activity that involves the knee, but over time the pain becomes permanent even though without exercise. There is also prominence and soft tissue swelling at the tibial tubercle, and it can get more significant over time. The symptoms gradually improve over time, and it usually becomes symptoms-free when the adolescent reaches skeletal maturity.<sup>4-6, 17, 18</sup>

The diagnosis of OSD can be made from a relevant history and plain radiography. Plain radiography shows changes that depend on the stage of presentation, such as acute, sub-acute, or late. The acute phase findings are soft tissue swelling, indistinct edges of the patellar tendon, and the tibial tubercle fragmentation. Soft tissue swelling anterior to the tibial tubercle is not usually seen in the sub-acute phase. In the late phase, findings are soft tissue osseous fragments that may persist or unite to form a normal-looking tibial tubercle. Ultrasonography and MRI are more effective modalities to diagnose OSD early.<sup>1, 6, 17-19</sup>

Even though generally, 90% of patients with OSD can be symptoms free, not all OSD



cases can resolve completely after reaching skeletal maturity. The treatment of OSD is symptomatic that includes the administration of NSAID and physical therapy. Prolonged hyperflexion of the knee or kneeling can make OSD worse, and in this condition, it may need surgery even though surgery is rarely indicated in OSD. Patients with large ossicle and an overlying bursa that experience intolerable pain upon kneeling may be candidates for surgery. Complications such as avulsion fracture of the tibial tubercle or epiphyseal fracture following OSD condition are indicated for surgery.<sup>1,4,20</sup>

The treatment of OSD is consists of conservative treatment, medication, injection, surgical treatment, physiotherapy, and rehabilitation, and the treatment is given to the patients based on the severity of the symptoms. Restriction of pain-producing activities, proper padding of tubercle, and, if restriction cannot be done, adjustment to pain-reducing activities are the examples of conservative therapy. Approximately 10% of patients experience persistent symptoms into adulthood, even though conservative treatment has been done. Medication such as Non-steroidal anti-inflammatory drugs (NSAID), including ibuprofen, naproxen, and ketoprofen, can be given in a short period. Because of its deleterious effect that can cause subcutaneous atrophy and patellar tendon rupture, a corticosteroid injection into the patellar tendon is no longer recommended. Surgical treatment of OSD can be done through open, arthroscopic, or bursoscopic procedures. Surgical in OSD is usually done in adults because it can damage the growth plate area in children. Rehabilitation,

including placement of a hinged knee brace, locked extension, and full weight-bearing can be given following surgery treatment. It is mandatory to do weight-bearing extension in the first 3-4 weeks for bone-tendon healing. A passive knee range of motion can be done if allowed but should be limited if it puts the bone-tendon unit at risk. Active range motion and strengthening are allowed once tendon healing is complete, usually 4 - 6 weeks after surgery.<sup>6, 21, 22</sup>

The majority of orthopedic trauma surgeons support conservative and non-operative treatment for OSD. The advantages of these treatments are such as improvement of the hamstrings, quadriceps, and gastrocnemius muscles from the limitation of physical activities and exercise, no or less scar tissue, which may be the issue on delayed sports activities return if the surgery is performed, less risk of iatrogenic damage to the patellar tendon rather than surgery option and less kneeling pain that often caused by the scar location in the anterior aspect of the knee when the surgery is performed.<sup>6, 18</sup>

Tibial tubercle avulsion fractures are an infrequent injury, approximately between 0.4 - 2.7% of all epiphyseal injury. It can occur in situations where there is unexpected knee flexion in opposition to a contracted quadriceps muscle or immoderate contraction of the quadriceps during the knee extension. Both cases are usually found during sports, such as jumping and sprinting. The mechanisms that occur more in tibial tubercle avulsion fracture are hyperextension trauma of the knee when jumping and called hyperextension type, and





forced flexion of the knee when landing and called flexion type. The flexion type usually occurs in late adolescence. OSD is reported to be the risk factor of tibial tubercle avulsion fracture; even scientific correlation is still inconclusive. Mosier and Stanitski reported a case of tubercle avulsion fracture that occurred three weeks after the diagnosis of OSD had been made. Chow *et al.* also reported a tibial tubercle avulsion fracture that occurred six months after OSD diagnosis had been made. Gowda and Kumar reported a case of tibial tubercle avulsion fracture after two months of diagnosis of OSD.<sup>9,11, 23-25</sup>

In our patient, the combination of age, gender, relevant history such as chronic knee pain, active in sporting (volleyball), and radiographic findings of the infrapatellar fat pad, fragmented tubercle fractures, and soft tissue swelling in the anterior side of the tubercle made a straight-forward diagnosis. The patient showed relatively low compliance, supported by the data that the patient did not avoid exercise or sports activity, and overused his knee because he thought that he had no limitation inactivity when the pain was gone. This low compliance impacted his condition and worsened his OSD and indicated that conservative treatment and medication were failed. The patient later suffered left tibial tubercle avulsion fracture Odgen classification type IIB following his worsening OSD condition and underwent ORIF with screws for fracture fixation. Even it was rare to happen at the age of adolescent, our patient condition was indicated to undergo surgical treatment. The one-month post-operative evaluation showed a

good outcome where the patient felt minimal pain when bending his knee. It was presumed that our patient had made the complete recovery even though he did not report for the next follow-up review.

Our case promotes that patients with OSD have a risk for tibial tubercle avulsion fracture to develop. In our case, tibial tubercle avulsion fracture occurred one month after the diagnosis of OSD had been made. Variation of time three weeks to 1 year between diagnosis of OSD is made, and tibial tubercle avulsion fracture has been reported. Sports restriction until the physeal fusion or complete radiological healing of the primary OSD should be done to avoid tibial tubercle avulsion fracture or any other complications of OSD to occur. This case report's limitation is the short-term follow-up that could not provide more data and calculations about the limb's function after surgery. Further research should follow the patient for a long-term period, so more data and calculations can be gathered for a more objective conclusion.<sup>9, 23</sup>

## CONCLUSION

All orthopedic trauma surgeons should be aware of Osgood-Schlatter disease, and restriction of sports activities temporarily to prevent tibial tubercle avulsion fracture should be done. Once a tibial tubercle avulsion fracture occurs, surgical treatment can achieve an excellent outcome.



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