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Neglected SCFE Treated with Modified Dunn Procedure: A Case Series

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ABSTRACT

Introduction: Slipped Capital Femoral Epiphysis (SCFE) is a condition of the proximal femoral physis that causes metaphyseal displacement that can lead to femoroacetabular impingement and premature osteoarthritis. The management of SCFE so far had significant complications of avascular necrosis so that the Modified Dunn procedure was developed to allow the visual control of the epiphyseal vascular blood supply. Cases Description: We report 2 cases of SCFE in two 14-year-old males who had previous trauma and then underwent open epiphyseal reduction and fixation with modified Dunn procedure. Postoperative evaluation showed there were no cases of avascular necrosis. In addition, the anatomy of the femoral epiphysis was successfully restored, as indicated by a residual slip angle ranging from 4° to 8°, which was considered minimal and not clinically significant. Discussion: The modified Dunn procedure with a retinacular soft tissue flap approach provides the opportunity to perform anatomical reduction of the displaced femoral epiphysis while allowing visual monitoring of femoral head perfusion through the retinacular tissue. When performed by an experienced operator and with careful and precise surgical technique, this procedure has been shown to produce favorable outcomes, both in terms of low AVN rates, functional improvement, and prevention of osteoarthritis progression. Conclusion: These findings suggest that the modified Dunn technique may be an effective and safe option in the management of SCFE, especially in patients with moderate to severe degrees of slippage. With this approach, not only joint stability can be maintained, but also the anatomical shape of the femoral head can be restored as close to normal as possible.

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INTRODUCTION

The hip joint is one of the joints that experiences the greatest physical pressure compared to other joints in the limbs (1). During the adolescent growth period, weakness of the epiphyseal plate may occur and stress bearing may occur so that the femoral caput can be released from the femoral neck or known as Slipped capital femoral epiphysis (SCFE) (2). The incidence of SCFE in the adolescent population, with an annual incidence reported at 10 cases per 100,000 children aged 9 to 16 years (3).

SCFE patients may develop early degenerative joint disease secondary to abnormal joint kinematics or femoral acetabular impingement. In addition, Chondrolysis and osteonecrosis of the hip can accelerate hip degeneration related to SCFE, leading to end-stage hip disease (4).

There is no clear context regarding the best approach in the management of SCFE, although various surgical procedures have been described, including in situ fixation, corrective osteotomy, arthroscopic offset correction, and osteotomy with correction of the femoral head-neck deformity. Currently, the modified Dunn procedure is the standard of care for SCFE because it allows anatomical repositioning of the femoral head without increasing the high risk of avascular necrosis (AVN). Although long-term data are limited, recent

studies have shown that this procedure is associated with a low incidence of osteoarthritis (OA) and AVN (5).

Case 1

G, a 14-year-old boy came with complaints of pain in the left hip that had been felt since January 2024. This complaint arose after the patient experienced a trauma of falling in the bathroom in a sitting position. After the incident, the patient only rested at home without immediate medical treatment.

General physical examination showed a relatively stable systemic condition. Local examination found deformity of the left hip in the form of shortening of the leg, external rotation, and swelling without any wounds or hematomas. There was tenderness and limitation of active movement of the left hip joint due to pain, while the knee, ankle, and toes still had normal movement. Peripheral perfusion was good with CRT <2 seconds and palpable peripheral pulses. Sensibility remained within normal limits.

Surgery using cannulated screws with a modified dunn procedure was performed the next day, and the patient was discharged a few days later. The operation is performed through a lateral incision and followed by a greater trochanteric osteotomy to gain access to the hip joint. After the joint capsule is opened in a z-shaped manner, the epiphysis is gradually separated from the metaphysis, the callus is cleaned, and the femoral head is reduced to its original position without putting pressure on the vascular structures. The head is then fixed with Kirschner wires, and all soft tissue structures are sutured back without tension. The greater trochanter is also repositioned with screw fixation. A control visit to the orthopedic polyclinic went smoothly, and the patient was able to return to activities as before experiencing SCFE. In the follow-up evaluation after three weeks, no signs of avascular necrosis or femoroacetabular impingement were found.

Figure 1. Patient's clinical manifestation

Figure 2. Patient's x-ray findings A. Preoperative, B. Postoperative

Figure 3. Postoperative clinical manifestation

Case 2

A 14-year-old male teenager D came with complaints of pain in the right thigh that had been felt since September 2019, after playing wrestling with his friend at the Islamic boarding school. After the incident, the patient was taken to the hospital and advised to be referred to a tertiary hospital at Jakarta to consult a pediatric orthopedic doctor, but the referral was delayed because the patient's parents were performing the Umrah pilgrimage. At the end of December 2019, the patient experienced another trauma in the form of a fall, which worsened the pain to the point that the patient was unable to walk and had to use crutches. The patient then referred to H. Adam Malik General Hospital for further evaluation. The patient is the second of three children, born through a cesarean section, with no history of delayed walking since birth.

Physical examination found an antalgic gait, mild external rotation, deformity, and shortening of the right extremity. Pain was felt on palpation, with normal saturation in all toes and CRT <2 seconds. The range of motion of the right hip joint was limited due to pain and stiffness, while the knee, ankle, and toes were normal. A positive Drehmann sign was found. Extremity length measurements showed that the anatomical and functional length of the right side was 1 cm shorter than the left side. These findings led to the suspicion of SCFE as the working diagnosis.

Surgery was then scheduled with the Modified Dunn Procedure, a surgical technique that allows direct anatomical repositioning of the femoral head while preserving blood supply through a retinacular soft tissue flap. The procedure was performed through a lateral approach with a greater trochanteric osteotomy and a z-shaped opening of the joint capsule to expose the femoral epiphysis. After the epiphysis was carefully separated from the metaphysis and the callus tissue was cleaned, the femoral head was reduced to the anatomical position and fixed using Kirschner wires. All soft tissues, including the retinacular flap and capsule, were loosely sutured back without tension, and the greater trochanter was repositioned with screw fixation. Postoperatively, patients underwent controlled passive mobilization with a continuous passive motion device and were restricted to partial weight bearing for eight weeks, before gradually returning to full functional activity.

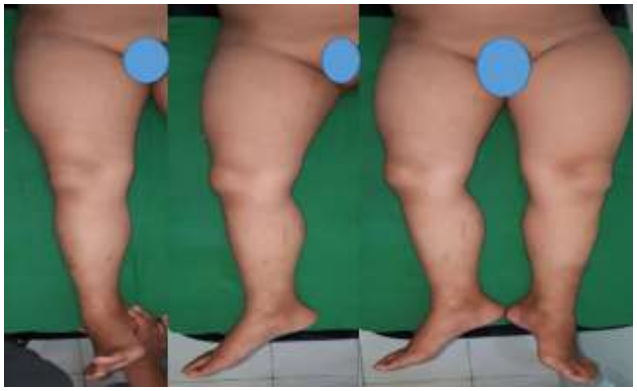

Figure 4. Patient’s clinical findings

Figure 5. Patient's x-ray findings

Figure 6. Modified Dunn Procedure

Figure 7. Post operative clinical manifestation

DISCUSSION

Displacement of the proximal femoral epiphysis known as epiphysiolysis is rare and is actually limited to children who are entering puberty (between the ages of 9 - 16 years). Boys (usually at the age of 14-16 years) are more often affected than girls (who are on average 2-3 years younger), especially in boys with a fat body (obesity) (6).

The etiology of SCFE is multifactorial and may include obesity, trauma and, less frequently the role of endocrine disruption remains controversial. Sometimes SCFE occurs suddenly after a minor fall or trauma. More often, the condition develops gradually over several weeks or months, with no previous injury (6,7).

Injuries usually caused by high physical activity or sports play a role mainly in 30% of cases of acute displacement. In the remaining 70% there is a slowly progressive displacement or a series of small displacements sometimes sometimes causing a large displacement after being exposed to relatively light mechanical stress (acute displacement in chronic). The femoral epiphysis usually The femoral epiphysis usually will shift slowly and pro and progressively and will cause progressive coxa vara deformity followed by secondary remodeling of the femoral neck; the posterior periosteal attachment remains intact. This chronic shift is a stable condition. Usually the femoral neck shift occurs upward and forward towards the epiphysis and the epiphysis shifts posteriorly and downward. Sometimes there can be a shift of the femoral head upward. Acute injury that occurs in this condition of femoral head shift will cause further sudden shifting or acute shifting in chronic shifting. So that in the end the epiphysis will separate from the femoral neck completely, and will cause severe damage to the blood supply vessels of the femoral head, which will result in avascular necrosis (8).

Early diagnosis is very important so that surgical therapy can be performed in the early stages of this shift. The most common initial symptom is discomfort that arises from the pelvis but spreads towards the knee. At this stage, the patient's knee can be assessed clinically and radiologically, which even if repeated will show negative results. There will be a continuation of the shift in the upper femoral epiphysis, which was previously undetected. In the early stages, there will usually be a limping movement of the patient's legs, which is especially clearly visible when the patient is in a state of fatigue. fatigue. And along with the process of the shifting process that is increasingly occurring, there will be the formation of a Trendelenburg type gait pattern (The patient's body will be more protruding towards or on the side where the shift in the femoral epiphysis occurs, because body weight will be supported on this side) (9).

In the anterior-posterior photo, the epiphyseal plate appears too wide and loose. A line drawn along the superior surface of the neck remains superior to the caput, where it should pass through the femoral head (Trethowan's sign). On the lateral radiograph, the epiphysis of the femur is raised posteriorly; this is a more reliable x-ray marker and the abnormality is small. Radiography is used to grade the severity of the slip in SCFE. On an AP radiograph, a line along the superior margin of the femoral neck (Klein's line) should intersect the lateral corner of the epiphysis. As the epiphysis slips, the metaphysis can be divided into thirds. mild: lateral edge of the epiphysis is within the lateral third of the metaphysis, moderate: middle third, and severe: medial third (9).

The goals of therapy are (1) to maintain the blood supply to the epiphysis, (2) to stabilize the physis, and (3) to correct any remaining deformity. Because blood flow to the slipped epiphysis can be compromised if there is a continued shift of the epiphyseal plate (physis), strong manipulation of this epiphyseal shift must be avoided because it carries a high risk of avascular necrosis and this must be avoided (10).

Open reduction by Dunn's method gives good results but should be left to a specialist. The greater trochanter is elevated and the femoral neck exposed. By gentle subperiosteal dissection, the posterior retinacular vessels are maintained while moving the epiphyses (which are usually compressed by young callus). A small segment of the femoral neck is then removed, allowing the epiphyses to be repositioned without tension on the posterior structures, once reduced and secured with two or three pins (11). The patient is placed in the lateral decubitus position with the leg to be operated on a special pillow. The entire leg is sterilized and prepared, with a sterile bag on the opposite side to allow for hip dislocation. A lateral incision is made over the greater trochanter, and the gluteus muscles are exposed through the Gibson interval. The epifascial vessels are used as anatomical landmarks. The trochanteric bursa is opened, and the piriformis and gluteus minimus muscles are identified. A trochanteric osteotomy is performed, leaving some of the gluteus medius fibers intact so as not to damage the deep branches of the middle femoral circumflex artery. After the trochanteric fragment is moved, the joint capsule is exposed and a Z-shaped capsulotomy is performed. If unstable epiphysiolysis is present, the epiphysis is temporarily fixed with pins. The femoral head is then dislocated to check for acetabular damage, which is often severe despite a mild degree of slippage. A retinacular soft tissue flap is developed, encompassing important vessels, periosteum, and surrounding muscles. The epiphysis is released in stages and temporarily moved into the acetabulum to clear metaphyseal callus. The epiphysis was then manually reduced and fixed using Kirschner pins. Epiphyseal perfusion was checked by means of a small drill. All soft tissues were sutured back without tension and the trochanter was re-fixed with screws. Postoperative care included continuous passive mobility, partial immobilization for eight weeks, and full immobilization after three months (12).

The reported outcomes from different centers performing this procedure vary widely. The results may also be influenced by the surgeon's experience. The reported risk of osteonecrosis ranges from 0% to 25.9%. Most studies are retrospective and lack a control group (13).

CONCLUSION

Management aims to maintain epiphyseal vascularization, stabilize the physis, and correct deformity. The Dunn method of open reduction, although promising good results, requires special expertise. The results of this surgical technique in this case gave good results without the occurrence of avascular necrosis.

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