Clinical Research

Slipped capital femoral epiphysis with coexisting pituitary tumor

Ifran Saleh,1,2 Andika Dwiputra Djaja,2 Elizabeth Yohmi,3 Maria Florencia Deslivia1

1 Department of Orthopaedic Surgery, St. Carolus Hospital, Jakarta
2 Department of Orthopaedic and Traumatology, Dr. Cipto Mangunkusumo General Hospital - Faculty of Medicine Universitas Indonesia, Jakarta
3 Department of Pediatric, St. Carolus Hospital, Jakarta

ABSTRACT

Introduction: Slipped Capital Femoral Epiphysis (SCFE) is well associated with an underlying endocrine pathology. The clinical implication is multiplied: avoiding anesthesia complication in SCFE surgical treatment, assessing the need of prophylactic pinning at contralateral hip, and early detection of underlying disease. This case report will discuss the lessons learned from the management of endocrine-related SCFE with coexisting pituitary tumor, along with the long-term clinical outcome.

Methods: A 17-year-old male was diagnosed with unstable SCFE and underwent in situ pinning of the femoral head using 3 cannulated screws.

Results: Hormonal examination showed hypogonadism, hyperprolactinemia, and growth hormone deficiency. Brain scan displayed macroadenoma of pituitary gland. Five years later, the patient reported overall satisfaction of the treatment.

Conclusion: Clinical manifestation of delayed sexual maturation was the result of deficiency of the sex hormones and also related to the pathogenesis of SCFE. It is recommended to screen for endocrine disorders in SCFE patients.

Keywords: Slipped Capital Femoral Epiphysis, endocrine dysfunctions, management

Corresponding author: Andika Dwiputra Djaja, MD. andika_dwiputra@rocketmail.com

ABSTRAK

Pendahuluan: SCFE sangat erat kaitannya dengan kelainan endokrin. Perhatian klinisi pada kasus SCFE menjadi beberapa kali lipat karena perlu diperhatikan komplikasi anestesi intraoperatif, kebutuhan pinning profilaksis pada panggul kontralateral, dan deteksi dini kelainan. Laporan kasus ini akan membahas mengenai SCFE dengan kelainan endokrin berupa tumor kelenjar pituitary lengkap dengan follow up nya.

Metode: Seorang pria berusia 17 tahun yang didiagnosis SCFE tidak stabil telah menjalani prosedur in situ pinning kaput femoral menggunakan 3 buah cannulated screw.


Kesimpulan: Manifestasi klinis maturasi seksual yang terlambat adalah hasil dari defisiens kelenjar hormon dan juga berkaitan dengan patogenesa SCFE. Disarankan melakukan pemeriksaan hormonal pada pasien SCFE.
INTRODUCTION

Slipped capital femoral epiphysis (SCFE) is a common musculoskeletal problem in adolescents with reported incidence of 0.2-17.5 per 100,000 population.1,2 Even though the etiology remains to be elusive; it is well associated with an underlying endocrine pathology. Therefore, the highest incidence was found in obese adolescent male, followed by unusually tall and thin adolescent.3 Recognizing the relationship between SCFE and endocrinopathy is crucial to avoid the mistake of ignoring possible coexisting endocrine conditions in the SCFE patients and to devise the best treatment plan.

In principle, the treatment of SCFE involves surgical stabilization of the proximal femoral epiphysis. The overall complication rate is relatively high, alerting a meticulous clinical consideration upon recommending operative treatment. The complications after SCFE treatment include osteonecrosis of femoral head, chondrolysis, SCFE-induced impingement with associated articular cartilage damage and labral injury, fixation failure and deformity progression, growth arrest, and development of bilateral disease.4,5 On the other hand, the prevalence of bilaterality in proven endocrine-related SCFE varied from 70% to 100% 6,7, supporting the idea of prophylactic pinning on the contralateral hip. Therefore, the cost and benefit of performing prophylactic pinning for endocrine-related SCFE need to be assessed carefully.

Many researches related to SCFE and the underlying endocrine pathology. However, research is lacking in hormonal studies for SCFE patients and the possible complications of the SCFE surgery. We presented this case report to review the hormonal studies, complications and the follow up after the treatment.

In 2013, an adolescent male presented to our hospital with SCFE, he underwent in situ fixation, and was subsequently found to have concurrent brain tumor resulting in hormonal imbalance. The existence of endocrine disorder in relation to SCFE alerts special consideration. This case report will discuss the lessons learned from the management of this patient, along with the long-term clinical outcome.

Case Report

We reported a 17-year-old male patient reported pain...
of the thigh. The patient’s height was 173 centimeters and weighed 69 kilograms (BMI = 23.05 kg/m²). MRI imaging displayed distraction of epiphyseal plate of the right femoral head, indicating fissure fracture (Figure 1). MSCT Scan confirmed the appearance of slipped epiphyseal plate of the right femoral head (Figure 2).

The patient was diagnosed with unstable SCFE and underwent in situ pinning of the femoral head using 3 cannulated screws (Figure 3). During surgery, it was accidentally found that the patient had no obvious sign of secondary sexual development. After the surgery, the patient was referred to pediatrics for further examination. From physical examination, the patient was concluded to be in the Tanner 1 stage. Bone age showed patient to be of 14-year-old chronological age.

Subsequent hormonal examination showed hypogonadism (LH: <0.07 with normal value of 0.9 – 4.5 mIU/mL, FSH: <0.30 with normal value of 1.4 – 18.1 mIU/mL, testosterone: <2.5 with normal value of 28 – 1.110 ng/mL), hyperprolactinemia (>1,000 ng/mL with normal value of 2.5 – 14.8 ng/mL), and growth hormone deficiency (<0.05 ng/mL with normal value of 0.22 – 12.2 ng/mL). Brain scan displayed macroadenoma of the pituitary gland, which occupied the space of optic chiasm. The tumor was then removed surgically, followed by radiotherapy and antiprolactin therapy. Other pharmacological therapy was received, including thyroid hormone replacement therapy (euthyrax) and corticosteroid.

One year after primary surgery, the patient was scheduled for screws removal. There were no further slips from both femoral heads. Only 1 screw could be removed while the other 2 had been integrated to the surrounding cancellous bone (Figure 4). There was no sign of avascular necrosis or other complications.

As for postoperative clinical outcome, the patient had no significant complaint other than 3-cm-shortening of the affected leg. Limping is not readily apparent. Five years after the initial treatment, the patient reported of being able to perform daily tasks, yet relatively unable to perform vigorous exercise. Overall, the patient was satisfied with the treatment outcome.

DISCUSSION

As the scope of orthopaedics treatment spans from surgical, physical, to medical means\(^2\), physicians should look beyond a specific anatomic location for a
systemic underlying pathology. The SCFE case reported herein illustrated the importance of such observation in improving a patient’s quality of life. The patient was initially admitted for a pathognomonic sign of common adolescent hip condition, and later endocrine pathology rooting from an intracranial tumor was discovered and treated. Is it necessary to screen for endocrine abnormalities in SCFE patients? Can it be performed in a cost-effective manner?

Endocrine dysfunctions that were found to be associated with SCFE included, but not limited to, disorders in abnormalities in testosterone or estrogen levels, 1,25-dihydroxyvitamin D, hypothyroidism, growth hormone deficiency, growth hormone treatment, panhypopituitarism and hypogonadism, growth hormone deficiency, growth hormone treatment, panhypopituitarism and hypogonadism, pituitary gigantism, and pituitary tumor. Enormous endocrine changes also happen during puberty. Puberty reactivates gonadal axis, resulting in increment of levels of sex hormones. These hormones exert direct growth-stimulating effect on physis and indirect effect through growth hormone secretion from the pituitary gland.

**Detecting endocrine disorders in SCFE**

SCFE can be divided by its etiology: idiopathic and atypical, with the latter one associated with renal failure, radiotherapy effects, and endocrine disorders. The difference between these 2 types of SCFE is important. The main concern is the underlying medical problems, which might complicate the process of anesthesia, and for deciding the need to perform prophylactic fixation on the contralateral hip.

Until now, there is no clear clinical practice guideline on purposefully investigating coexisting endocrine abnormalities in SCFE patients. The general consensus is that routine hormonal examination is not indicated in SCFE patients without any clinical evidence. A number of studies reported that the proportion of SCFE patients with significant endocrine disorders is so minuscule that it does not require hormonal screening in all patients.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Examination</th>
<th>Definition</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burrow SR, et al (2001) [7]</td>
<td>Height test</td>
<td>Positive for endocrine-type SCFE if the child’s height is ≤10th percentile and negative if &gt;10th percentile of age.</td>
<td>If positive, screen for a possible endocrine abnormality using measurement of thyroid-stimulating hormone and free thyroxine as a preliminary screening test</td>
</tr>
<tr>
<td>Loder RT, et al (2006) [25]</td>
<td>Age-weight test</td>
<td>A patient of the same age is 8.4 times more likely to have an atypical slip if they are less than the 50th percentile of weight.</td>
<td>NA</td>
</tr>
<tr>
<td>Current case (2018)</td>
<td>Sexual maturation signs</td>
<td>Lack of age-appropriate secondary sexual characteristics in patients with SCFE.</td>
<td>If positive, this should alert physicians to screen for specific hormones involved in gonadal axis.</td>
</tr>
</tbody>
</table>

**Table 1.** Summary of targeted examinations, which can be performed based on clinical markers alone, thus ensuring cost-effectiveness.

Clinical manifestation of delayed sexual maturation was the result of deficiency of the sex hormones, which, in this patient, first triggered the cascade of hormonal investigations and the later finding of pituitary tumor.

The practice is considered as not cost-effective and thus, unfavorable in the era of Universal Health Coverage.
On the other hand, previous literatures reported decreased T3, GH, FSH, LH, and testosterone among SCFE patients. In our case, the possibility of missing hypogonadism, and hence the pituitary tumor, would be catastrophic. It would delay the necessary treatment on the enlarging mass. Thus, what is the best practice recommended to detect any coexisting endocrine disorders, while remaining to be cost-effective? In SCFE cases, a targeted history-taking, and physical examination should be considered for early screening. Burrow et al found that short stature (below the tenth percentile of height) had a high sensitivity in detecting an underlying endocrinopathy, thus the formulation is of age-height test. Another possible screening method is age-weight test, even though it has lower positive predictive value compared to age-height test. Hypothyroidism is known to be the most common endocrinopathy associated with SCFE, accounting for 95% of all cases, with short stature as one of the most obvious clinical signs. As for hypogonadism, screening of sexual maturation signs according to age could be a cost-effective early screening tool. Summary of targeted examination to screen for endocrine-related SCFEs is displayed in Table 1.

Figure 5. Systematic investigation of atypical SCFE consists of focused history-taking and physical examination.
Based on literature review, we also proposed an algorithm (Figure 5) to exclude atypical SCFE through cost-efficient procedure. Considering the grave consequences of ignoring a possibly serious comorbidity in SCFE patients, adhering to a systematic investigation starting with history-taking and focused physical examination is beneficial to both patients and physicians. Focused physical examination here includes the examination of sexual maturation signs to exclude disorders in gonadal axis, and height test based on previous evidence. The algorithm was designed so as not to miss any possible disorders before concluding that the etiology of SCFE is idiopathic. It also factors in the possibility of more than one etiology in one single patient. Only when it is truly necessary, a costlier investigative effort, such as laboratory examination, is advised. Prospective studies should be conducted in the future to validate this recommendation.

Systematic investigation of atypical SCFE consists of focused history-taking and physical examination. The algorithm considers the possibility of one patient having more than one comorbidities. More costly procedures such as laboratory examination (blue boxes) are only performed based on sufficient evidence. The objective is to detect any possible comorbidity in SCFE case without carelessly resorting to unnecessary diagnostic tests and to advise best treatment plan for patient (e.g. anesthesia options, prophylactic pinning on contralateral hip, etc)

The patient for our study was diagnosed with unstable SCFE and underwent in situ pinning of the femoral head using 3 cannulated screws, the patient also did not exhibit any abnormalities in the contralateral hip. The bone age at that time was according to a 12-year-old and the patient was supported by a complete hormonal therapy. During surgery, it was accidentally found that the patient had no obvious sign of secondary sexual development. After surgery, the patient was referred to pediatrics for further examination. From physical examination, the patient was concluded to be in the Tanner 1 stage. Bone age showed patient to be of 14-year-old chronological age. The screws removal was scheduled one year after the primary surgery. There were no further slips from both femoral heads. Only 1 screw could be removed while the other 2 had been integrated with the surrounding cancellous bone. Avascular necrosis or other complication for this patient was not presented. As for postoperative clinical outcome, the patient reported that there was no significant complaint other than 3-cm-shortening of the affected leg. Limping is not readily apparent. Five years after the initial treatment, the patient reported of being able to perform daily tasks, yet relatively unable to perform vigorous exercise.

Clement ND (2015) recommended prophylactic pinning as a cost-effective procedure as it limits complications of further slip and poor functional outcome. However, that study was performed in subjects with a mean age of 12.3 years. In our case, the patient was 17-year-old, about the age of adulthood. The patient’s good compliance allowed for a regular follow-up, so we recommended only close observation. When sequential SCFE can be detected and treated early, close follow-up and not prophylactic pinning are supported by literature.

When patients come with SCFEs, it is recommended to screen for endocrine disorders, as it will influence the surgery and to rule out other possible existing illness. In order to be cost-effective, it is recommended to perform targeted history-taking and physical examination. Prior evidence supports the examination for height, weight, and sexual maturation signs.

Acknowledgement

We would like to thank the patient who provided the informed consent for participation and publication, including the use of accompanying images. The authors declare that they have no conflicts of interest.

REFERENCES

Slipped capital femoral epiphysis with coexisting pituitary tumor


