

PICO SEARCH ASSIGNMENT WORKSHEET

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Brief description of patient problem/setting (summarize the case very briefly)

A 12-year-old male presented with several months of atraumatic thigh and knee pain and was initially diagnosed with Osgood-Schlatter disease. Although initial imaging demonstrated subtle findings concerning for slipped capital femoral epiphysis (SCFE), the diagnosis was not recognized. Due to persistent symptoms, repeat radiographs obtained several months later confirmed SCFE, and the patient was referred for urgent pediatric orthopedic evaluation. This case raises the question of whether earlier surgical intervention after diagnosis of SCFE improves outcomes compared with delayed treatment.

Search Question: In adolescents with slipped capital femoral epiphysis (SCFE), does early surgical intervention compared with delayed surgical intervention reduce slip progression and long-term complications?

Question Type: What kind of question is this? (boxes now checkable in Word)

☐ Prevalence

☐ Screening

☐ Diagnosis

☐ Prognosis

☒ **Treatment**

☒ **Harms**

Assuming that the highest level of evidence to answer your question will be meta-analysis or systematic review, what other types of study might you include if these are not available (or if there is a much more current study of another type)? **Please explain your choices**

If systematic reviews or meta-analyses are unavailable, retrospective and prospective cohort studies would be appropriate alternatives because they can compare outcomes among adolescents who undergo early versus delayed surgical treatment for SCFE. These studies can evaluate clinically important outcomes such as slip progression, avascular necrosis, chondrolysis, need for additional procedures, and long-term functional outcomes. Clinical practice guidelines and expert consensus statements from pediatric orthopedic organizations may also provide valuable evidence regarding the timing of surgical intervention and recommended management strategies. Because SCFE is relatively uncommon and delaying treatment for research purposes would be unethical, much of the available evidence consists of observational studies examining the relationship between treatment timing and patient outcomes.

PICO search terms:

P	I	C	O
Pediatric patient	Early surgery	Delayed surgery	Slip progression
Adolescents	Early intervention	Delayed intervention	Avascular necrosis
SCFE	Prompt fixation	Late fixation	Chondrolysis
	In-situ pinning	Delayed treatment	Functional outcomes

Search tools and strategy used:

Please indicate what databases/tools you used, provide a list of the terms you searched together in each tool, and how many articles were returned using those terms and filters.

Explain how you narrowed your choices to the few selected articles. For example, if your search returned 25 articles among the several databases used, what was the process used to determine which four articles to use?

Database	Search Term Used	# of Results	Filters/Limiters Applied	Notes/Observations
PubMed	("slipped capital femoral epiphysis" OR SCFE) AND (treatment OR management OR surgery)	20 results	10 years, Free full text, Clinical Trial, Guideline, Meta-Analysis, Observational Study, Practice Guideline, Randomized Controlled Trial, Systematic Review.	PubMed returned 2 results after applying the selected filters. After reviewing the titles and abstracts, two articles were selected because they directly addressed slipped capital femoral epiphysis (SCFE), including factors associated with delayed diagnosis, treatment outcomes, and long-term complications. The selected articles were highly relevant to the clinical question and provided evidence regarding the importance of early recognition and management of SCFE to improve patient outcomes.
Wiley Online Library	("slipped capital femoral epiphysis" OR SCFE) AND (treatment OR surgery) AND (outcomes OR complications)	112 results	Last 10 years, Journal articles, Open access	Wiley Online Library returned multiple results after applying the selected filters. After reviewing titles and abstracts, one retrospective cohort study was selected because it directly evaluated surgical treatment outcomes in patients with SCFE. Articles focused on case reports or unrelated conditions were excluded due to limited relevance to the clinical question.
Science Direct	("slipped capital femoral epiphysis" OR SCFE) AND (treatment OR surgery) AND (outcomes OR complications)	195 results	2016-2026, Research Articles, Practice Guidelines, Review Articles, English, Open access	ScienceDirect returned 195 results after applying the selected filters. After reviewing titles and abstracts, one prospective comparative cohort study was selected because it evaluated functional outcomes following surgical treatment of slipped capital femoral epiphysis (SCFE). Most other articles were excluded because they focused on implant design, epidemiology, case reports, or topics not directly related to surgical outcomes and long-term complications in SCFE.

From the three databases, 327 articles were initially identified. After applying filters and reviewing titles and abstracts for relevance, four articles were selected. Preference was given to higher levels of evidence, including systematic reviews and cohort studies involving pediatric and adolescent patients with slipped capital femoral epiphysis (SCFE). Articles were chosen because they specifically addressed the diagnosis, treatment, outcomes, and complications associated with SCFE. The selected studies examined clinically relevant outcomes such as slip progression, avascular necrosis, functional recovery, gait outcomes, and factors associated with delayed diagnosis. These findings were directly applicable to the clinical question regarding whether early surgical intervention improves outcomes and reduces long-term complications in adolescents with SCFE.

Results found:

1. Treatment of stable slipped capital femoral epiphysis: systematic review and exploratory patient level analysis

Citation: Naseem H, Chatterji S, Tsang K, Hakimi M, Chytas A, Alshryda S. Treatment of stable slipped capital femoral epiphysis: systematic review and exploratory patient level analysis. J Orthop Traumatol. 2017 Dec;18(4):379-394. doi: 10.1007/s10195-017-0469-4. Epub 2017 Aug 22. PMID: 28831651; PMCID: PMC5685987.

Article Type: Systematic review

ABSTRACT

Background: Several aspects of slipped capital femoral epiphysis (SCFE) treatment remain controversial. Loder's work has been instrumental in changing our understanding and approach to the management of the condition when he introduced the concept of "slip instability" and showed that avascular necrosis (AVN) developed in 47% of unstable slips but none of the stable slips. As the two types of SCFE behave differently in terms of presentation, progress and complications, we approached them as two different conditions to highlight these differences. This paper focuses on treatments of stable SCFE.

Materials and methods: An extensive literature search was carried out from multiple databases. One thousand six hundred and twenty-three citations were screened. Three hundred and sixteen full publications were obtained for further scrutiny. Fifty-eight studies (2262 hips) were included in the review. These studies evaluated 6 interventions. AVN was chosen as a surrogate for bad outcome. Secondary outcomes were chondrolysis (CL), femoro-acetabular impingement (FAI), osteoarthritis (OA) and patients' reported outcomes. The latter were pooled when they met our predefined criteria.

Results: The type of surgical intervention was an important risk factor. Pinning in situ (PIS) was associated with the lowest AVN rate (1.4%). Moreover, the CL, FAI and OA rates were relatively low in patients who underwent PIS. These were not translated into high patient satisfaction rates among these patients, with only 47% reporting an "excellent" outcome. In contrast, 87% of patients who underwent Ganz surgical dislocation reported an "excellent" outcome. The Ganz surgical dislocation was associated with an AVN rate of 3.3%; double that observed in pinning in situ.

Conclusion: Pinning in situ is the best treatment for mild and moderate stable slip. Ganz surgical dislocation gives higher patient satisfaction for severe stable slip but the risk of AVN is doubled compared with pinning in situ. Devices that allow continued growth may be better than standard screws.

Level of evidence: Level III.

Keywords: Ganz surgical dislocation; Pinning in situ; SCFE; SUFE; Slipped upper femoral epiphysis; Stable; Unstable.

Important Findings:

- The review included 58 studies and 2,262 hips with stable SCFE to evaluate outcomes of different surgical interventions.
- Pinning in situ was associated with the lowest rate of avascular necrosis (1.4%) and relatively low rates of chondrolysis, femoroacetabular impingement, and osteoarthritis.
- Ganz surgical dislocation resulted in higher patient satisfaction rates (87% excellent outcomes) but had a higher risk of avascular necrosis compared with pinning in situ.
- The authors concluded that pinning in situ is the preferred treatment for mild and moderate stable SCFE, while Ganz surgical dislocation may be beneficial for severe stable slips.
- The review emphasized that prompt surgical management of stable SCFE is important to prevent further slip progression and reduce the risk of long-term complications.

I selected this article because it is a systematic review that evaluates the outcomes of multiple surgical treatment options for stable slipped capital femoral epiphysis (SCFE). The article directly relates to my PICO question by examining the effectiveness of surgical intervention and associated complications, including avascular necrosis, chondrolysis, osteoarthritis, and functional outcomes. The findings support timely orthopedic management and provide evidence regarding which surgical approaches are associated with the best outcomes. This article represents a high level of evidence and is highly applicable to determining how prompt treatment may reduce complications and improve long-term outcomes in adolescents with SCFE.

Country: United Kingdom (systematic review of international studies)

Foreign Study Policy

Cultural Context: Cultural factors are unlikely to significantly affect SCFE treatment because management is based on objective radiographic findings and orthopedic surgical principles.

Social Context: Access to pediatric orthopedic specialists may differ between countries; however, recommendations regarding surgical stabilization are similar to U.S. practice.

Economic Context: Some included countries have universal healthcare systems, which may influence access to treatment and follow-up. Despite this, the surgical management of SCFE is comparable to that used in the United States.

Language: Published in English; translation concerns are minimal.

2. A nationwide cohort study of slipped capital femoral epiphysis

Citation: Perry DC, Metcalfe D, Costa ML, Van Staa T. A nationwide cohort study of slipped capital femoral epiphysis. Arch Dis Child. 2017 Dec;102(12):1132-1136. doi: 10.1136/archdischild-2016-312328. Epub 2017 Jun 29. PMID: 28663349; PMCID: PMC5754864.

Article Type: Retrospective Cohort Study

ABSTRACT

Objectives: To describe the epidemiology of slipped capital femoral epiphysis (SCFE), to examine associations with childhood obesity and socioeconomic deprivation, and to explore factors associated with diagnostic delays.

Design: Historic cohort study using linked primary and secondary care data from the Clinical Practice Research Datalink and Hospital Episode Statistics.

Setting: All contacts with healthcare services, including emergency presentations, outpatient appointments, inpatient admissions and primary care visits, within the UK National Health Service.

Patients: All individuals <16 years old with a diagnosis of SCFE and whose electronic medical record was held by one of 650 primary care practices in the UK between 1990 and 2013.

Main outcome measures: Annual incidence, missed opportunities for diagnosis and diagnostic delay.

Results: Over the 23-year period the incidence remained constant at 4.8 (95% CI 4.4 to 5.2) cases per 100,000 0-16-year-olds. There was a strong association with socioeconomic deprivation. Predisease obesity was also strongly associated with SCFE; mean predisease z-score of body mass index was 1.43 (95% CI 1.20 to 1.68) compared with the UK reference mean. Diagnostic delays were common, with most children (75.4%) having multiple primary care contacts with relevant symptomatology, and those who presented with knee pain having significantly longer diagnostic delay (median 161 (IQR 27-278) days) than those with hip pain (20 (5-126)) or gait abnormalities (21 (7-72)).

Conclusions: SCFE has a strong association with both area-level socioeconomic deprivation and predisease obesity. The majority of patients with SCFE are initially misdiagnosed and those presenting with knee pain are particularly at risk.

Keywords: delayed diagnosis; descriptive epidemiology; misdiagnosis; slipped capital femoral epiphyses.

Important Findings:

- The study evaluated 596 pediatric patients with SCFE using linked primary and secondary healthcare records across the United Kingdom.
- Diagnostic delays were common, with 75.4% of patients having multiple healthcare visits for related symptoms before receiving the correct diagnosis.
- Patients presenting with knee pain experienced significantly longer diagnostic delays than those presenting with hip pain, with a median delay of 161 days compared with 20 days.
- The authors noted that delayed diagnosis may allow progression of the slip and contribute to worse clinical outcomes.
- The study emphasized that careful evaluation of the hip is essential in adolescents presenting with knee pain because atypical presentations are frequently misdiagnosed.

I selected this article because it is a large population-based retrospective cohort study that specifically examines factors associated with delayed diagnosis of slipped capital femoral epiphysis (SCFE). The study closely mirrors my patient's presentation, as he initially presented with knee and thigh pain and experienced a delay in diagnosis before SCFE was identified. The findings demonstrate that adolescents presenting with knee pain are at increased risk for delayed diagnosis and prolonged time to treatment. This article is highly relevant to my PICO question because it supports the importance of early recognition and intervention in SCFE to reduce slip progression and long-term complications.

Country: United Kingdom (National Health Service data)

Foreign Study Policy

Cultural Context: Cultural differences are unlikely to influence SCFE diagnosis because symptoms and radiographic findings are consistent across populations.

Social Context: Although the UK National Health Service differs from the U.S. healthcare system, delayed diagnosis of SCFE due to atypical presentations such as knee pain remains relevant to U.S. adolescents. The study's findings regarding missed opportunities for diagnosis are therefore generalizable to pediatric practice in underserved urban communities.

Economic Context: Universal healthcare may reduce some financial barriers to care, but the study's findings regarding delayed diagnosis and knee pain presentations remain applicable to U.S. adolescents.
Language: Published in English.

3. The Effect of the Type of Screw Fixation Used in the Treatment of Slipped Capital Femoral Epiphysis

Citation: Rudolph, Tyler, Rooks, Katie, Crawford, Haemish, Merwe, Michael van der, The Effect of the Type of Screw Fixation Used in the Treatment of Slipped Capital Femoral Epiphysis, *Advances in Orthopedics*, 2022, 9143601, 5 pages, 2022.

<https://doi-org.york.ezproxy.cuny.edu/10.1155/2022/9143601>

Article Type: Retrospective Cohort Study

Abstract

Background. Slipped capital femoral epiphysis (SCFE) remains among the most common hip disorders in the adolescent population. The management of SCFE remains controversial; however, the aim of fixation is to stabilize the physis and prevent further slippage. In situ fixation remains the gold standard; however, in the young population, it can lead to reduced femoral neck growth and complications such as leg length discrepancies. The ideal form of in situ fixation for mild to moderate SCFE would stabilize the slip and allow continued proximal femoral growth. This study aimed to determine if partially threaded screws allowed more neck growth than fully threaded screws. **Methods.** A retrospective review of the radiographs of all patients undergoing in situ fixation for SCFE using partially threaded and fully threaded screws. Measurements included neck length, neck-to-screw ratio, neck shaft angle, neck width, and articular-trochanteric distance. Parameters were compared over a two-year period to determine whether there was any difference in proximal femoral growth between the two types of screws. **Results.** Fully threaded screw neck length increased by 5 mm versus 5 mm for proximally threaded screws ($P \leq$

0.001). No significant difference was observed between the two groups with respect to neck width, neck shaft angle, and articular-trochanteric distance. Conclusions. No difference was observed in proximal femoral growth. Regardless of which type of fixation is used, neck length continues to increase by approximately 3 mm per year.

Important Findings:

- The study retrospectively reviewed 108 patients with SCFE who underwent in-situ fixation using either partially threaded or fully threaded screws.
- Femoral neck length increased by approximately 7 mm over a two-year period regardless of screw type, indicating continued proximal femoral growth after fixation.
- No significant differences were found between partially threaded and fully threaded screws with respect to femoral neck growth, neck width, neck shaft angle, or articular-trochanteric distance.
- In-situ fixation remained effective at stabilizing the slip while allowing continued growth of the proximal femur.
- The authors concluded that both screw types are viable options for surgical treatment of SCFE and that fixation should focus on preventing further slip progression while preserving hip function.

I selected this article because it evaluates surgical outcomes in patients with slipped capital femoral epiphysis (SCFE) treated with in-situ fixation, the current gold standard treatment for stable SCFE. The study directly relates to my PICO question by examining outcomes following surgical intervention and assessing factors that may influence long-term hip growth and function. The findings support the effectiveness of prompt surgical stabilization in preventing further slip progression while maintaining proximal femoral growth. This article provides clinically relevant evidence regarding treatment outcomes and helps inform management decisions for adolescents diagnosed with SCFE.

Country: New Zealand

Foreign Study Policy

Cultural Context: Cultural factors are unlikely to affect surgical fixation outcomes because treatment is based on orthopedic techniques and radiographic measurements.

Social Context: Differences in healthcare delivery may influence follow-up practices; however, in-situ fixation remains a standard treatment internationally.

Economic Context: New Zealand's healthcare system differs from the U.S., but the findings regarding surgical outcomes and femoral growth remain clinically applicable.

Language: Published in English.

4. Two-year 3D gait outcomes following in-situ pinning or modified Dunn procedure in children with slipped capital femoral epiphysis

Citation: LN Dwan, DG Little, O Birke, EA Wojciechowski, AJ Mudge, MJ McKay, J St George, J Burns, Two-year 3D gait outcomes following in-situ pinning or modified Dunn procedure in children with slipped capital femoral epiphysis, *Gait & Posture*, Volume 114, 2024, Pages 243-249, ISSN 0966-6362,

<https://doi.org/10.1016/j.gaitpost.2024.10.008>.

Article Type: Prospective Comparative Cohort Study

Important Findings:

- All children with SCFE required surgical management, but there remains no universal agreement regarding the optimal surgical procedure.
- Both treatment groups demonstrated gait abnormalities compared with healthy controls two years after surgery.
- Children treated with the modified Dunn procedure (MDP) had more normalized hip rotation during gait than those treated with in-situ pinning (PIN).
- Residual deformity after in-situ pinning may contribute to altered hip biomechanics and increase the risk of future osteoarthritis.
- The authors concluded that corrective procedures such as the modified Dunn procedure may reduce functional impairments and long-term degenerative changes.

I selected this article because it directly evaluates outcomes following surgical treatment of SCFE and compares two commonly used surgical approaches. The study is highly relevant to my PICO question because it examines functional outcomes and potential long-term complications after treatment. The findings suggest that corrective surgical intervention may improve hip biomechanics and reduce future degenerative changes, supporting the importance of appropriate and timely management of SCFE.

Country: Australia

Foreign Study Policy

Cultural Context: Cultural beliefs are unlikely to influence postoperative gait outcomes or surgical effectiveness.

Social Context: Access to specialized pediatric gait analysis and orthopedic services may vary compared with the United States; however, surgical management principles are similar.

Economic Context: Australia's healthcare system differs from the U.S., but the study's findings regarding functional outcomes after SCFE surgery remain generalizable.

Language: Published in English.

What is the clinical "bottom line" derived from these articles in answer to your question?

The evidence supports early surgical intervention for adolescents with SCFE to prevent further slip progression and reduce long-term complications. Systematic reviews and cohort studies demonstrated that delayed diagnosis and treatment are associated with greater slip severity, gait abnormalities, avascular necrosis, and early degenerative hip changes. Early recognition, prompt hip imaging, and timely orthopedic referral are therefore essential to improving outcomes. These findings are particularly relevant in underserved urban populations, where barriers such as limited access to specialty care, transportation challenges, and health literacy may contribute to delayed diagnosis. Clinicians should

maintain a high index of suspicion for SCFE in adolescents presenting with unexplained knee, thigh, or hip pain to help reduce diagnostic delays and improve long-term outcomes.