

Meeting Reports/Abstracts

Screw Thread Configuration Has No Effect on Operative Outcomes of Slipped Capital Femoral Epiphysis

Garrhett Glenn Via¹, David Brueggeman², Joseph G Lyons¹, Derrek Edukugho¹, Andrew W Froehle¹, Melissa A Martinek¹, Michael C Albert¹

¹ Orthopedic Surgery, Boonshoft School of Medicine, ² Orthopedic Surgery, Boonshoft School of Medicine

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INTRODUCTION

The current "gold standard" treatment for slipped capital femoral epiphysis (SCFE) is insertion of a single cannulated screw down the epiphyseal center. Debate remains as to whether partially- (PTCS) or fully-threaded (FTCS) cannulated screws, and what number, are optimal. The present retrospective cohort study compares such constructs in a clinical model.

METHODS

IRB approval was obtained. Patients (N=158) presenting to a level-one pediatric trauma center for in situ pinning of SCFE between January 2005 and April 2018 were included. Covariates analyzed were sex, race, BMI, history of endocrinopathy, and preoperative designation of unstable SCFE. Outcomes included return to the operating room (OR), avascular necrosis (AVN), hardware failure/removal, and the sequelae of femoroacetabular impingement (FAI). Multivariable logistic regression models included covariates with significant univariate effects, as well as thread configuration, number of screws, preoperative instability, and the screw*thread and screw*instability interactions.

RESULTS

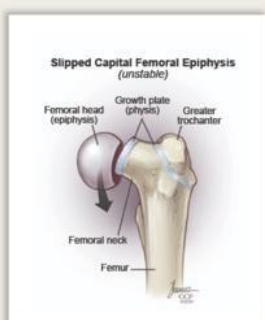
Average patient age at surgery was 12.3±1.9 years; 63% of patients were male; 68% of patients were White/Caucasian and the remaining 32% were Black/African American. Mean BMI was 28.4±6.4 kg-m⁻². PTCS were utilized in 81.0% of constructs and 1 screw was placed in 83.5% of hips. Outcome rates were as follows: return to OR=15.8%, AVN=7.6%, FAI=7.0%, hardware failure/removal=9.5%. Univariate modeling demonstrated no significant covariate effects on return to OR (each P≥0.181) or AVN (each P≥0.099). Sex had a significant effect on FAI (P=0.012). Age and bilateral SCFE were significantly related to hardware failure/removal (P=0.039 and P=0.015, respectively). Multivariable models found that 2 screw constructs were associated with increased odds of return to OR [P=0.027; OR=3.01 (1.13-7.98)]. Odds of AVN were increased by older age (P=0.024; OR=1.45 [1.03-2.03]) and 2 screw constructs in stable SCFE [screws*stability interaction: P<0.001; OR=60.5 (5.60-652.31)]. Female sex increased odds of FAI (P=0.012; OR=5.17 [1.31-20.36]). Finally, odds of hardware failure/removal were increased by 2 screw constructs [P=0.038; OR=3.64 (1.13-11.70)] and bilateral SCFE [P=0.027; OR=3.51 (1.15-10.74)].

DISCUSSION AND CONCLUSION

A single, PTCS comprises the majority of SCFE constructs, and this construct carries the least risk for negative outcomes in cases of stable SCFE. These data demonstrate no significant effects of thread configuration on outcomes. The authors caution orthopaedic surgery providers against using more than one screw in cases of stable SCFE, as well as to monitor older, female, and/or bilateral SCFE patients more closely due to an increased risk for complications.

This is the fourth of four award-winning presentations from the inaugural Medical School Orthopedic Society (MSOS) sym-

Background



- Slipped Capital Femoral Epiphysis is a common condition without a current consensus on optimal surgical management
- Treatment goals include preventing slip progression and avoiding conditions such as avascular necrosis
- Various factors associated with surgical implants can influence patient outcomes
- This present study investigates the effect of screw thread configuration and the number of screws on surgical outcomes in SCFE patients

Slide 1. Background

Slipped capital femoral epiphysis (SCFE) happens when the femoral head slips off the growth plate. It is a common condition without a current consensus on optimal surgical management. Treatment goals include preventing slip progression and avoiding conditions such as avascular necrosis (AVN). Various factors associated with surgical implants can influence patient outcomes. This study investigates the effect of screw thread configuration and the number of screws on surgical outcomes in SCFE patients.

posium. MSOS is a medical student-run initiative with a mission to support “research and educational opportunities for students interested in orthopedic surgery.”

This presentation was given by Derrek Edukugho, a fourth-year medical student at Boonshoft School of Medicine.

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DISCLOSURES

None of the presenters or authors listed have a financial disclosure or conflicts of interest with the material in this presentation.

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Purpose



- Previous studies have explored the implant placement location and the amount of implants used in treatment
- Effects of screw thread configuration (partial/fully threaded) have not been extensively analyzed leading to lack of data on it's clinical impact
- Inconclusive human data and mixed in vitro results led us to **hypothesize** that there is no difference in outcomes between partially or fully threaded screw constructs

Slide 2. Purpose

In other studies, the majority of data has been obtained regarding the placement and amount of implants used in treatment. There has not been extensive data on the screw thread configuration, whether it is partially or fully threaded. In this study, we hypothesized there would be no difference in the surgical outcomes between partially or fully threaded screw constructs.

Materials & Methods

- Retrospective study including (n=158) patients undergoing cannulated, stainless steel, in situ screw fixation of a SCFE affected hip between January 2005 and April 2018
- Outcomes studied included return to OR, avascular necrosis, hardware failure/removal, and femoroacetabular impingement recorded as binary variables (no/never, yes/ever)
- Univariate logistic analysis was used to test for effects on outcomes of covariates, included in subsequent multivariable logistic regressions where $P < 0.150$
- Multivariate logistic regression analyses was used to test for the main effects of each primary surgical detail and preoperative stability, as well as the number of screws
- Initial multivariable models were made using the main effects and all relevant covariates

Slide 3. Materials and Methods

This was a retrospective study of n = 158 patients who underwent cannulated, stainless steel, in situ screw fixation of a SCFE affected hip between January 2005 and April 2018. The major variables we considered included return to the operating room (OR), AVN, hardware failure removal, and femoroacetabular impingement (FAI) recorded as binary variables (no/never, yes/ever).

We used univariate logistic analysis to test for the effects of covariates on outcomes. Multivariate logistic regression analysis was used to test for the main effects of each primary surgical detail and preoperative stability, as well as the number of screws.

Results

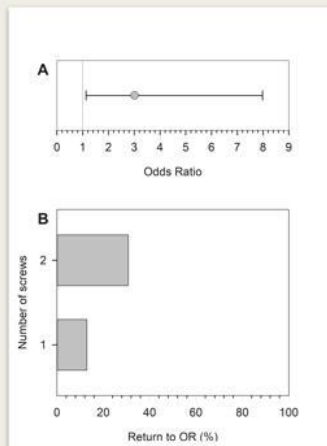


Table 2. Surgical details and outcomes

Variable	Result ^a
Thread configuration (% partially threaded, % fully threaded)	81.0%, 19.0%
Number of screws (% 1 screw, % 2 screws)	83.5%, 16.5%
Length of follow-up (y)	2.0 ± 2.7
Return to OR (% yes)	15.8%
AVN (% yes)	7.6%
FAI (% yes)	7.0%
Hardware failure/removal (% yes)	9.5%

a. Mean±SD for continuous variables; frequencies for categorical variables.

- 81% of patients treated with partially-threaded screws
- 15.8% of patients returned to the OR, 7.6% exhibited AVN, 7.0% exhibited FAI, and 9.5% experienced hardware failure/removal
- Number of screws was the main predictor of return to the operating room
- Screw thread type had negligible effect on any adverse post-surgical outcome

Slide 4. Results

81% of patients were treated with partially-threaded screws, which could suggest a bias or preference of the surgeon. 15.8 . Other results show that 15.8% of patients returned to the OR, 7.6% of patients exhibited AVN, 7.0% of patients exhibited FAI, and 9.5% of patients experienced hardware failure and removal. Overall, the number of screws was the main predictor of return to the OR (Figure B). Screw thread type had negligible effect on adverse operative outcomes.



Discussion

- The results of our study did not provide evidence for an effect of thread configuration on surgical outcomes
- Screw number pointed to as the most important factor but additional factors on outcomes include physcal stability, laterality of diagnosis, and to a lesser extent age and sex
- Adding implants increases the intraarticular penetration and improper placement, which increases the risk of serious complications
- In types of cases such as those with unstable slips, fear of complications alone should not prevent surgeons from utilizing an extra screw
- Limitations for our retrospective single institution study is that data wasn't available for all patients leading to the exclusion of some patients

Slide 5. Discussion

A common theme we observed was that the effect of thread configuration was very minimal. The most important factor was rather the number of screws to achieve fixation. Additional factors on outcomes included physcal stability, laterality of diagnosis, and, to a lesser extent, age and sex. Females had a preponderance of post-surgical complications. The reason that the number of screws had such a large role is that the more screws used increases the intra-articular penetration and the chance of improper placement, which then increases the risk of serious complications. It should be noted that in cases with unstable slips, a surgeon might need to use more than one screw to achieve adequate fixation. The fear of complications should not prevent the utilization of an extra screw if deemed necessary. Limitations for our retrospective single institution study is that data was not available for all patients. This led to the exclusion of some patients and introduction of potential bias.

Conclusion

- Rates of hardware failure, return to the operating room, avascular necrosis, and femoracetabular impingement did not differ between screw type
- Use of 2 screws was associated with increased likelihood of return to OR, hardware failure, and AVN (when used in a stable slip) compared to single-screw fixation
- Findings suggest that screw thread configuration has no impact on complication rates, whereas screw number is an important consideration in SCFE fixation

Slide 6. Conclusion

In conclusion, the rates of hardware failure, return to the OR, AVN, and FAI did not necessarily differ between partially or fully threaded screws, but rather between the number of screws used. When compared to single-screw fixation, the use of 2 screws was associated with an increased likelihood of return to the OR, hardware failure, and AVN (when used in a stable slip). Our findings suggest that screw thread configuration has no impact on complication rates, whereas screw number is an important consideration in SCFE fixation.



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