

Management of Unstable/Acute Slipped Capital Femoral Epiphysis

Results of a Survey of the POSNA Membership

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Abstract: There is limited literature regarding the treatment of unstable slipped capital femoral epiphysis (SCFE). The Evidence Analysis Work Group (EAWG) initiated a questionnaire assessing management of unstable SCFE by the members of the Pediatric Orthopaedic Society of North America (POSNA). All members were surveyed by e-mail and fax. The survey was accessible through the POSNA web site. One third of the members responded. Seventy-three percent of members used the “stable/unstable” classification, while 27% used the “acute/chronic” terminology. Thirty-one percent of respondents felt that an unstable SCFE is an emergency, while 57% felt that treatment could be on an urgent (<8 hours) basis. Fifty-seven percent reported use of a single threaded screw for fixation for an unstable SCFE, and 40.3% recommended two threaded screws. There seems to be agreement on methods of patient evaluation, but discrepancies remain in classification and fixation methods. The EAWG recommends development of multicenter studies to evaluate the treatment of unstable SCFE.

Key Words: unstable SCFE, survey results

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Slipped capital femoral epiphysis (SCFE) is a relatively common diagnosis facing the practicing orthopaedic surgeon. Little controversy exists in the diagnosis and treatment of the more common stable, or chronic, SCFE (stable/chronic SCFE).¹⁸ However, considerable disagreement exists regarding those patients with unstable, or acute, SCFE (unstable/acute SCFE).^{1,2,4,7,8–10,12,17,19,22,27,29} A study undertaken by the Evidence Analysis Work Group (EAWG) of the Pediatric Orthopaedic Society of North America (POSNA) regarding management of SCFE consisted of two parts. The first

involved an extensive review and analysis of the literature regarding unstable/acute SCFE. All articles were assessed critically and subsequently categorized according to the Oxford Center for Evidence-Based Medicine scoring system. The second portion of the study consisted of the formulation and analysis of a survey of the POSNA membership that assessed management of patients with unstable/acute SCFE. The goal of the survey was to use the experience and practice methods of the POSNA membership as that of an expert panel.

MATERIALS AND METHODS

A computerized medical database was searched for citations regarding acute or unstable SCFE. Each article was analyzed for content, type of study, volume of patients, potential bias, and other criteria.^{1,2,4,7–10,17,19,20,22,27,29} In addition, each was assigned a grade of 1 to 5 based on the level of evidence as described by the Oxford Center for Evidence-Based Medicine.^{21,23} After analysis of the literature, a survey was composed by the EAWG in an attempt to obtain basic demographic and volume data and also to address areas of controversy in the management of patients with an unstable/acute SCFE. All members of POSNA were notified of the survey by e-mail (if an e-mail address was known) and by fax. The survey was made accessible online through the POSNA website and was forwarded to those without e-mail addresses by fax. Multiple reminders were sent by e-mail and by fax to ensure the greatest possible response. E-mail survey responses were entered automatically, and surveys returned by fax or by traditional mail were added to the online database by hand. At the end of the survey period all data were reviewed by the EAWG and an external statistician.

RESULTS

A total of 15 citations were located through the search of the computerized database. Each was reviewed by the six members of the EAWG using a standardized series of criteria adapted from a previous EAWG survey project.²⁴ Eight of the 15 reports were classified as retrospective case-control series studies. One of the studies could be categorized as a prospective, non-consecutive case series. Of these nine reports, none detailed any comparison to controls, either concurrent or historical. Most of the remaining citations fell in the category of expert opinion or review articles. When classified for levels of evidence as described by the Oxford Center for

Study conducted at Children's Hospital of Michigan, Detroit, Michigan, by the Evidence Analysis Work Group.

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Evidence-Based Medicine, all reports met criteria for only levels 4 or 5, the lowest grades possible within the system. In addition, the number of cases in most of the studies was relatively small, and in many the EAWG members noted problems with potential selection and treatment bias. Due to the quality of the existing literature, the survey was conceived and instituted in an attempt to obtain more clinically relevant information.

Data were compiled from all responses to the survey. A complete review of the responses to all questions is presented in Table 1. Two hundred sixty-three POSNA members responded of the 794 surveyed (33.1%). Responses were received from all geographic areas, including North America, South America, Europe, and Asia. Most of the responses were from North American members (92.4%). Demographic information showed a wide range of years in orthopaedic practice (1–42 years, median 15 years). Respondents indicated a range of 0 to 50 unstable/acute SCFE cases per year (median 2) and a range of 0 to 100 stable/chronic SCFE cases per year (median 10).

There appeared to be general agreement regarding the preoperative radiographic evaluation of patients with suspected unstable/acute SCFE. Most of respondents used plain radiographs (97.0%), and the most common combination of views used included an AP image of the pelvis and frog-lateral views of each hip (53.6%). Bone scans, MRI, and CT were part of the workup for only 3.0% of POSNA members responding.

The classification and terminology used for these injuries provided more variability. Twenty-seven percent of respondents reported using the “acute/chronic” classification system, while 73% reported adopting the newer “unstable/stable” system described by Loder et al¹⁹ in 1993. Correlative analysis showed that of those respondents reporting less than 15 years in practice, 83.4% used the Loder system, while only 63.1% of those with more than 15 years in practice used this method ($P = 0.0002$). In addition, when classification method was correlated with the number of unstable/acute SCFE cases treated per year, the data revealed that 80.0% those respondents treating less than two unstable/acute SCFE cases per year used the newer system, while only 68.5% of those treating more than two cases per year favored the “unstable/stable” system ($P = 0.046$).

Specific issues regarding treatment of patients with unstable/acute SCFE were also assessed with the survey. These issues included timing of surgery, intraoperative patient positioning, type of procedure, fixation method, use of capsular decompression procedures, and hardware removal. Fifty-seven percent of respondents felt that an unstable/acute SCFE could be managed in an urgent but not necessarily emergent (31%) fashion, while 12% felt that such patients could be added to the elective schedule. There was greater agreement regarding patient positioning: 65.8% of respondents used a fracture table, a radiolucent OR table was recommended by 32.7%, and 1.5% of surgeons used another positioning method.

Responses to the question regarding method of treatment revealed that most (84.0%) use in situ fixation after positioning the patient, while 11.8% recommend formal manipulation or reduction followed by in situ stabilization. Open reduction was favored by only 3.0% of those responding.

Other methods of treatment are listed in Table 1. Fifty-seven percent of respondents reported use of a single threaded screw for fixation for an unstable/acute SCFE, and 40.3% recommended two threaded screws. When correlations were made between volume of procedures and fixation methods, members who reported management of more than 10 stable/chronic SCFE cases per year were significantly less likely to use a single threaded screw for a patient with an unstable/acute SCFE than those treating fewer than 10 stable/chronic SCFE cases per year ($P = .039$).

Capsular decompression was not recommended by 64.6% of respondents, and 35.4% performed decompression as part of the management of these injuries. Twenty-six percent of those recommending decompression performed it as an open procedure, while 73.4% used a closed aspiration and drainage technique. Prophylactic pinning of the contralateral hip was recommended by 12.2% of surgeons, while the remaining 87.8% did not use routine prophylactic stabilization.

Finally, the survey assessed attitudes toward elective removal of hardware in patients with SCFE. Eighty-eight percent of those responding did not recommend elective removal of implants in this patient population. Of respondents with less than 15 years in practice, only 4.5% responded affirmatively to the question of elective removal, while 19.2% of those with more than 15 years in practice favored removal ($P = 0.0002$).

DISCUSSION

Unstable/acute SCFE cases account for approximately 10% to 15% of all cases of SCFE, but management of these deformities is associated with most of the complications.^{18,22} Complications include avascular necrosis (AVN) and less frequently chondrolysis. Successful management of unstable/acute SCFE involves both deformity stabilization and avoidance of complications. The literature on the subject is far from thorough and is limited in its usefulness in guiding treatment. As part of the initial evaluation of this problem, the EAWG undertook a systematic and comprehensive assessment of the literature. Review of the literature revealed a small number of studies that assessed the management of unstable/acute SCFE, and the overall value of the reports was hampered by the relatively small number of patients studied and the nature of the studies themselves.

Responses to the survey provided a great deal of information and generated further questions for future study. Clearly, there is general agreement among the membership regarding a limited number of issues in the management of patients with unstable/acute SCFE. One area of relative agreement involves the classification system most commonly used to describe these lesions. Most respondents appear to have adopted the newer “unstable/stable” classification system proposed by Loder et al in 1993.¹⁹ Basic demographic data and frequency information obtained as part of the survey allowed correlation of certain results with time in practice and volume of SCFE managed per year. It is not surprising that those members who completed training more recently, and thus who had fewer years in practice, are more likely to use the newer classification system. It is a little more difficult to make conclusions regarding the correlation of the newer system with

TABLE 1. Survey Results

Members surveyed = 794
Respondents = 263 (33.1%)
Demographics
Location of Practice
North America = 243 (92.4%)
South America = 2 (.8%)
Europe = 9 (3.4%)
Asia = 4 (1.5%)
Other = 5 (1.9%)
Years in Practice
Range 1–42 years (median 15)
Unstable/Acute SCFE/year
Range 0–50 (median 2)
Chronic/Stable/year
Range 0–100 (median 10)
Evaluation/Radiographic
Radiographic studies preop/unstable SCFE
Plain radiographs = 97.0%
Bone scan = 1.5%
MRI = 1.1%
CT scan = .4%
Combination of plain radiographs
AP pelvis/frog-lateral bilateral hips = 53.6%
AP pelvis/cross-table/true lateral hip in question = 19.0%
AP pelvis/cross-table lateral/frog = lateral both hips = 16.7%
All other combinations = 10.7%
Classification/Terminology Utilized
Acute/chronic = 27%
Unstable/stable (2) = 73%
Of those respondents with <15 years in practice, 83.4% used the unstable/stable classification, while this classification was used by 63.1% of those with >15 years in practice ($P = 0.0002$).
Of respondents treating <2 unstable SCFE per year, 80.0% used “unstable/stable,” while of those treating >2 unstable SCFE per year, 68.5% used “unstable/stable” ($P = 0.046$).
Treatment—Timing
Emergent = 31%
Urgent (8 hours) = 57%
Add to elective schedule = 12%
Treatment—Method
In situ after positioning = 84.0%
In situ after manipulation/reduction = 11.8%
Open reduction = 3.0%
Bone peg epiphysiodesis = .4%
Osteotomy = .4%
Spica cast = .4%
Treatment—Positioning
Fracture table = 65.8%
Radiolucent OR table = 32.7%
Other = 1.5%
Treatment—Fixation
Single screw, threaded = 57.4%
Two screws, threaded = 40.3%
Smooth pin(s) = 1.5%
Threaded pin(s) = 0.4%
More than 2 screws threaded = 0.4%

TABLE 1. (continued) Survey Results

Members reporting treatment of more than 10 stable SCFE per year were significantly less likely to use a single threaded screw for an unstable SCFE than those treating fewer than 10 stable SCFE per years ($P = 0.039$).
Treatment—Capsular Decompression
Not performed = 64.6%
Performed via aspiration = 25.9%
Performed open = 9.5%
Treatment—Prophylactic Pinning of Contralateral Hip
Would be performed = 12.2%
Would not be performed = 87.8%
Treatment—Elective Removal of Hardware
No = 88.2%
Yes = 11.8%
Of respondents with <15 years of practice, 4.5% responded “yes” to elective hardware removal. Of respondents with >15 years of practice, 19.2% responded “yes” to elective hardware removal ($P = 0.0002$).

the frequency of unstable/acute injuries managed per year, as noted in the reported results.

Responses regarding the radiographic evaluation of patients with suspected unstable/acute SCFE provided little new information. Most of the respondents reported using plain radiographs as their primary radiologic assessment, which reflects the opinions in most of the literature.¹⁸ The most commonly reported combination of views obtained as part of the evaluation process included AP and frog-lateral views of the hips. Personal and anecdotal experience makes it clear that generating a frog-lateral or any type of lateral view in a patient with a truly unstable/acute SCFE is extremely difficult due to patient discomfort with even minimal movement of the extremity. In this situation, the respondents may be reporting their ideal method of evaluation, which may differ somewhat from that used in actual day-to-day patient management.

To date, there is extremely limited information in the literature regarding the timing of treatment of patients with these injuries. Only two reports specifically assess this issue, and the results are somewhat contradictory to the other. Peterson et al reported a 7% rate of AVN in patients with unstable/acute SCFE reduced and treated less than 24 hours after presentation, while there was a 20% rate in patients who underwent similar treatment at greater than 24 hours.²⁰ In contrast, Loder et al found AVN in seven of eight patients with stabilization less than 48 hours after onset of symptoms, while this occurred in only 32% of those receiving operative care more than 48 hours after onset.¹⁹ It is difficult to compare these two studies directly, as there are questions regarding bias in treatment that preclude the determination of any specific cause-and-effect relationships. The responses of the membership reveal that management of an unstable/acute SCFE is considered emergent by only 31% of those participating in the survey. Most members feel that these patients may be treated as urgent cases (<8 hours), and 12% of respondents feel that these patients may be treated on the elective operative schedule. As such, there is similar disagreement in current clinical practice, and no strong conclusions can be made based on the results of the survey.

Questions regarding issues relating to the treatment of unstable/acute SCFE generated an area of general agreement. Eighty-four percent of those responding felt that management should include in situ pinning after positioning and that there should not be any type of active manipulation or forceful reduction maneuver. This method of treatment is supported by the majority of the literature on the subject. A few respondents reported management using open reduction (3.0%). This technique is not widely reported in the literature and appears to be used more frequently in European centers.²⁸

There was relative disagreement regarding the most appropriate method of fixation: 57.4% of respondents recommended a single threaded screw, while 40.3% reported using a second threaded screw. This is an area of controversy in the literature as well. Review of the literature shows both biomechanical and clinical evidence of successful treatment of unstable/acute SCFE with a single screw.^{1,6,12,16,29} Multiple screws are associated with a greater number of actual and potential complications, and it appears that the literature supports the use of a single percutaneous screw as part of the management protocol.¹⁹ However, it is apparent from the responses that a large number of POSNA members feel that these injuries warrant the additional stability afforded by the second screw despite the potentially increased risk of complications.

Capsular decompression is recommended widely as part of the surgical management of adults with femoral neck fractures. It is felt that the release of increased intracapsular pressure secondary to retained fracture hematoma may lessen the risk of postinjury AVN.^{3,5,14,15} There is no literature addressing this issue specifically in patients with SCFE. It is interesting, then, that 35.4% of members responded affirmatively to either percutaneous or open capsular decompression as part of the management of unstable/acute SCFE. It appears that a significant number of members have extrapolated this method of treatment from care of the adult fracture patient, even though there is no literature to support or refute its use in this specific pediatric population.

Prophylactic pinning of the contralateral, uninvolved hip is recommended in many European centers but has not been routine in North America. Proponents of prophylactic pinning feel that SCFE is a result of physeal abnormalities that are generally bilateral in nature, and that patients with unilateral SCFE are at substantial risk of eventual bilateral deformities and as such benefit from prophylactic stabilization.^{11,13} The majority of the North American literature recommends close monitoring of the contralateral hip rather than prophylactic pinning, except in patients with endocrinopathies, renal failure, or very young age at presentation, due to the low but real risk of potential complications of surgery on the seemingly normal extremity. Recently Schultz et al evaluated the long-term outcome of prophylactic pinning using a decision analysis technique.²⁶ They found that prophylactic pinning is beneficial to the long-term outcome of the hip, and that predictions determined by the study support the safety of the procedure. In light of these differences, the 12.2% affirmative response to the question of prophylactic pinning is of interest, as this is far beyond the number of respondents from European centers, and as such requires that some portion, possibly the

largest portion, originates from North American POSNA members.

In contradistinction to the question of prophylactic pinning, the issue of elective removal of hardware in patients with SCFE appears to be settled. In the past, elective removal of metallic implants was essentially universal for skeletally immature patients. However, as there have been more reports of complications and difficulties with removal, particularly in patients with SCFE, it appears that the majority of fixation devices in these patients are left in place at this time.²⁵ In addition, correlative analysis showed a statistically significant difference in response to this question between more senior and junior POSNA members (based on a median of 15 years in practice) who took part in the survey, further reflecting this changing opinion over recent years.

Management of unstable/acute SCFE remains controversial, and there is little compelling evidence in the literature to guide treatment. The literature is hampered by the relative infrequency of unstable/acute SCFE compared with the far more common stable/chronic type. The results of this survey show some agreement among POSNA members regarding radiographic evaluation and general method of treatment of patients with unstable/acute SCFE. However, discrepancies exist regarding classification, timing of treatment, fixation methods, and the need for capsular decompression. The survey also revealed an unexpectedly high rate of prophylactic pinning of the uninvolved hip, particularly when one considers that the majority of respondents identified themselves as North American-based practitioners. Review of the literature and results of the survey show the continued need for prospective, multicenter studies to assess the most effective management of patients with unstable/acute SCFE.

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