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# Predicting a Contralateral Slip after Unilateral Slipped Capital Femoral Epiphysis: Is the Posterior Sloping Angle Useful?

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Prophylactic pinning of the uninvolved side after unilateral slipped capital femoral epiphysis (SCFE) is controversial. The posterior sloping angle (PSA) has previously been proposed to predict contralateral slip. The purpose of this study was to determine whether the PSA can predict subsequent slip after unilateral SCFE, and if so, whether a gender difference exists. A retrospective case-control study was performed comparing 51 patients who initially presented with unilateral SCFE and subsequently developed contralateral slip (Bilateral) with 51 patients who had unilateral SCFE only (Unilateral). Data collected include age, sex, ethnicity, and PSA. The patients in the Bilateral group had significantly higher PSA (14.5 $\pm$ 6.1 vs. 10.6 $\pm$ 5.3, P = 0.001) and were younger (11.3 $\pm$ 1.5 vs.12.3 $\pm$ 1.2, P $<$ 0.001) than the patients in the Unilateral group. A receiver-operating characteristic (ROC) curve demonstrated that the threshold for pinning a contralateral hip with PSA > 12.66 yields an area under the curve (AUC) of 67%. When the analysis was repeated with respect to gender, girls in the Bilateral group had significantly higher PSA (15.9 $\pm$ 6.3 vs. 10.1 $\pm$ 6.0, P = 0.002) and were younger (10.7 $\pm$ 1.1 vs.11.9 $\pm$ 1.0, P $<$ 0.001) than the girls in the Unilateral group. Among boys, these associations were not significant. An ROC curve demonstrated that the threshold for pinning a contralateral hip with PSA $>$ 13 in girls yields an AUC of 76%. PSA is predictive of contralateral slip in patients presenting with unilateral SCFE. However, it is more predictive in girls, and we recommend prophylactic pinning in girls with PSA $>$ 13.

Slipped capital femoral epiphysis (SCFE) is the most common hip disorder in adolescents. Various epidemiologic risk factors such as age, gender, duration of symptoms, race, geographic variation, and seasonal variation have been described and suggest that genetic and environmental factors may play a role in the disease[1]. In addition, biomechanical factors such as femoral retroversion, physeal obliquity, and obesity have been reported to lead to abnormal stresses on the physis and anterolateral displacement of the femoral metaphysis away from the epiphysis[2-5].

A significant proportion of children presenting with SCFE have bilateral involvement or have unilateral involvement and later develop contralateral SCFE, with the incidence of bilateral SCFE reported to be between 22 to 67% of patients[6-14]. An epidemiologic study by Castro et al reported that patients with unilateral SCFE are 2,335 times more likely to develop a SCFE on the contralateral side[15]. Loder et al described 82 children with bilateral SCFE, and found that bilateral slips were diagnosed simultaneously in 50% and sequentially in 50%[10]. When these two groups were compared, the sequential slips showed a significantly shorter duration of symptoms, younger age, and increased obesity at time of diagnosis of first slip. The vast majority of contralateral slips presented within 18 months of the first slip.

Pinning of the contralateral hip in a unilateral SCFE has been controversial. Proponents of prophylactic pinning cite the high prevalence of contralateral slip and complications including osteonecrosis and chondrolysis[14], while others argue that close follow-up and observation is adequate and preferable given the complications related to the additional procedure, such as infection, chondrolysis, osteonecrosis, and other pin complications[15-16]. Decision analyses have attempted to quantify the risks and benefits of prophylactic pinning but have come to opposite conclusions[17-18].

Recent studies have investigated radiographic parameters which could predict contralateral slip in patients with unilateral SCFE. Barrios et al compared 11 different radiographic parameters between controls and SCFE patients[19]. They found the posterior sloping angle of the physis (PSA), defined as the angle between the line along the plane of the physis and the line perpendicular to the femoral neck-diaphyseal axis on an axial radiograph (Figure 1), to be the only radiographic parameter which differed significantly between the two groups. It was significantly higher in SCFE patients, with even higher PSA seen in those who developed sequential slips. They recommended prophylactic pinning at 12 degrees. Zenios et al subsequently reported that the PSA can be reliably measured and recommended prophylactic pinning of the contralateral hip with a PSA of greater than 14.5 degrees[20].

The two studies addressing the use of PSA in predicting a subsequent slip in patients presenting with unilateral SCFE differ in regards

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to the threshold angle at which prophylactic pinning is recommended. Moreover, the number of patients in both studies is relatively small. The purpose of our study is to replicate whether the PSA predicts a sequential slip in patients presenting with unilateral SCFE in a larger sample of patients with an adequate power, and if so, to determine the angle at which prophylactic pinning should be recommended. In addition, because a gender difference in the incidence of SCFE has been reported in multiple studies[13, 21], we sought to determine whether a gender difference exists in the use of PSA in predicting bilateral SCFE.

## Methods

Institutional review board approval was obtained prior to this retrospective case-control study. Power analysis performed based on the results of Barrios et al[19] revealed that a sample size of 51 patients was needed in each group with significance and power set at 0.05 and 80% respectively. A chart review was performed to identify all patients between January 1, 1990 and February 29, 2008 who underwent pinning for SCFE. Fifty-one cases were selected and were identified as those who underwent unilateral pinning for SCFE and subsequently returned to our institution for contralateral slip which required pinning. This group was designated as the Bilateral group. Fifty-one controls were also selected and were identified as those who only underwent unilateral pinning, had no problems with the contralateral hip at the time of latest follow-up, and never returned to our institution for any problems with the contralateral hip. This group was designated as the Unilateral group. Because the contralateral hip was shown to slip as late as 40 months after the initial slip in our cases, the Unilateral group excluded patients who were pinned within 40 months of December 31, 2008. Initially, an attempt was made to contact all the patients in the Unilateral group by telephone in order to confirm the lack of involvement of the contralateral hip. However, a large number of patients were not able to be contacted, and this was abandoned.

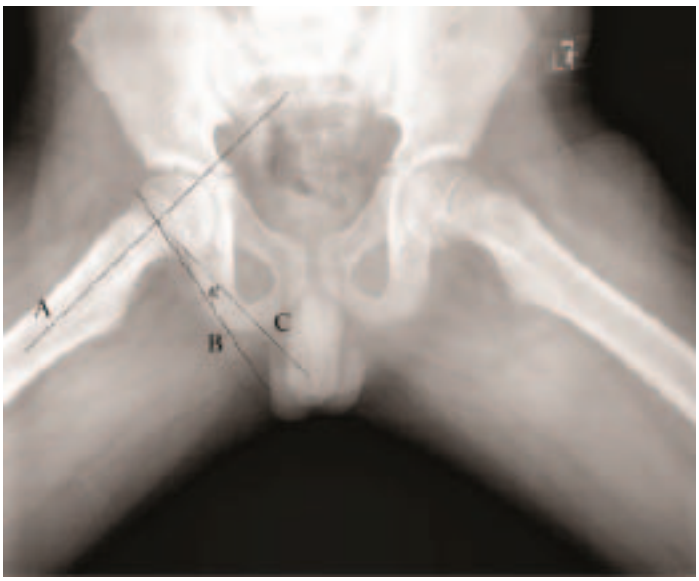


**Figure 1.** The posterior sloping angle (PSA). Line A is along the femoral neck – diaphyseal axis, Line B is the plane of the physis, and Line C is perpendicular to A; $\alpha$ is the angle between Lines B and C and defines the PSA.

The relevant data collected during the chart review included sex, ethnicity, age at the time of slip (initial slip for the Bilateral group), and time interval between the dates of surgery (for the Bilateral group). Patients with endocrine or metabolic disease, those presenting with bilateral slips, contralateral hip pathology, and those with unavailable or incomplete charts or radiographic images were excluded.

In the Unilateral group, the radiographic images used to measure the PSA were the axial radiographs of the unaffected contralateral hip at the time of diagnosis or immediately after pinning of the unilateral SCFE. In the Bilateral group, the radiographic images used to measure the PSA were the axial radiographs of the unaffected contralateral hip at the time of diagnosis or immediately after pinning of the initial slip.

At our institution, the axial radiographs of the hip are taken in a supine position with the feet together and the hip abducted as maximally tolerated by the patient. The PSA was measured as described by Barrios et al[19] and Zenios et al[20] and is the angle between the line along the plane of the physis and the line perpendicular to the femoral neck-diaphyseal axis (Figure 1).

All PSA measurements were performed in a blinded fashion by one investigator (SP) using the ImageJ software, a free image analysis software downloadable from the NIH (http://rsbweb.nih.gov/ij). The measurements were performed 3 times for each patient on 3 separate occasions, and the mean value for each patient was used for data analysis.

### *Statistical Analysis*

The independent samples t-test was used to compare age and PSA between the unilateral and bilateral groups and to compare PSA by sex. Univariate analysis of variance (ANOVA) was used to compare PSA by ethnicity. The chi-square test or Fisher's exact test, as appropriate, was used to compare sex and ethnicity between the unilateral and bilateral groups. Pearson's correlation was used to examine the association between age and PSA. Multivariate binary logistic regression was performed for those variables that were significant predictors of bilateral slip at the univariate level. A receiver operating characteristic (ROC) curve was generated to identify the optimal threshold angle at which prophylactic pinning should be performed. Sensitivity, specificity, number needed to treat (NNT), positive predictive value (PPV), and negative predictive value (NPV) were calculated for this threshold. A subgroup analysis based on gender was performed in a similar manner as above. A p-value $<$ 0.05 was considered statistically significant. Statistical analysis was performed by a statistician in our department using SPSS version 16.0 (SPSS, Inc. Chicago, IL).

## Results

### *Patient Demographics*

Table I shows the demographics of the study population (both Unilateral and Bilateral). There were an equal number of

males and females in the study group with an overall average age of 11.8 years. Our overall study group was predominantly African American (61/102, 59.8%), followed by Caucasian (35/102, 34.3%). For the Bilateral group, the mean time between the initial slip and subsequent slip was 10.38 months (range 0.93 to 40.4 months).

Table II compares demographic characteristics based on gender. Boys and girls differed with respect to age, with girls significantly younger than the boys (11.3 ± 1.2 vs. 12.3 ± 1.5, $p > 0.001$). The two gender groups did not differ with respect to PSA, ethnicity, or allocation into Unilateral or Bilateral groups.

### *Comparison between Unilateral and Bilateral Groups*

The patients in the Bilateral group had significantly higher PSA (14.5 ± 6.1 vs. 10.6 ± 5.3, $p = 0.001$) and were significantly younger (11.3 ± 1.5 vs. 12.3 ± 1.2, $p < 0.001$) than the patients in the Unilateral group (Table III). Sex and ethnicity were similar between the two groups ($p \geq 0.55$).

Table IV summarizes the subgroup analysis comparing Unilateral and Bilateral groups based on gender. Girls in the Bilateral group had significantly higher PSA (15.9 ± 6.3 vs. 10.1 ± 6.0, $p = 0.002$) and were younger (10.7 ± 1.1 vs. 11.9 ± 1.0, $p < 0.001$) than the girls in the Unilateral group. However, boys in the Bilateral group did not differ significantly from the boys in the Unilateral group with regards to PSA ($p = 0.18$). Boys in the Bilateral group were slightly younger than boys in the Unilateral group. This difference approached significance (11.9 ± 1.6 vs. 12.7 ± 1.3, $p = 0.06$).

### *Association between PSA and Age, Sex, and Ethnicity*

When PSA was compared to both sex and ethnicity, the PSA was not significantly related to either ($p \geq 0.33$) as shown in Table V. PSA and age were also compared using Pearson's correlation analysis and revealed no significant association ($r = 0.14$, $p = 0.17$).

**TABLE I. Demographics of the Study Population†**

| | |
|---|---|
| **Age*** | 11.8 (1.4) |
| **PSA*** | 12.6 (6.0) |
| **Sex**** | |
| Male | 51 (50.0%) |
| Female | 51 (50.0%) |
| **Ethnicity**** | |
| African American | 61 (59.8%) |
| Caucasian | 35 (34.3%) |
| Other | 6 (5.9%) |
| **Group**** | |
| Unilateral | 51 (50.0%) |
| Bilateral | 51 (50.0%) |

† Includes both Unilateral and Bilateral groups

* Data given as the mean with standard deviation in parentheses

** Data given as the number with percent total in parentheses

### *Multivariate Analysis*

The results of the multivariate analysis showed that younger age (OR: 0.45; 95% CI: 0.30-0.66; $p < 0.001$) and higher PSA (OR: 1.21; 95% CI: 1.10-1.34; $p < 0.001$) remained significant predictors of bilateral slip (Table VIa). When this analysis was applied to the cohort of girls, a higher PSA (OR: 1.34; 95% CI: 1.12-1.61; p=0.002) and younger age (OR: 0.23; 95% CI: 0.10, 0.53; $p = 0.001$) were significant predictors for bilaterality (Table VIb).

### *ROC Curve and Threshold PSA*

The ROC curve in Figure 2 demonstrates that the PSA of 12.66 best optimizes the rate of true positives (sensitivity) and false positives (1-specificity). With this threshold, the positive predictive value (PPV) is 67%. The number needed to treat (NNT) is 3.4 for this cut-off, meaning that if one were to pin all hips presenting with unilateral SCFE in which the PSA is greater than 12.66 degrees, 3.4 hips would need to be pinned to prevent one hip from progression to bilateral slip. This model showed fair discrimination of bilateral slip with an area under the curve (AUC) of 67%.

In the subgroup analysis of girls, a threshold PSA of 13 degrees corresponded to an AUC of 76% and a PPV of 76% (Figure 3). With this threshold, the NNT was 2.2, meaning that pinning all hips in girls in which the PSA is greater than 13 degrees would mean pinning 2.2 hips to prevent one hip from progression to bilateral slip.

## Discussion

Prophylactic pinning for asymptomatic contralateral hips in patients with unilateral SCFE remains controversial. Although Castro et al reported that patients with unilateral SCFE are 2,335 times more likely to develop a SCFE in the contralateral hip when compared to the general population[15], frequent observation is thought to carry a favorable prognosis. However, a conservative approach to an asymptomatic contralateral hip carries the risk of subsequent slip with resultant chondrolysis and osteonecrosis, and undiagnosed slips may later present with osteoarthritic changes and evidence of femoracetabular impingement[22]. The associated morbidity of a late contralateral slip is difficult to quantify. Prophylactic pinning avoids the risk of a possible subsequent slip but is also associated with complications from the procedure such as infection, hardware problems, fracture, chondrolysis, and osteonecrosis[14].

To help optimize management of patients with unilateral slipped capital femoral epiphysis based on the most recent evidence, decision analyses have attempted to quantify the risks and benefits of observation versus prophylactic pinning. A decision analysis model by Schultz et al utilized the Iowa hip-rating system to describe long-term functional outcome for the hip. This model favored prophylactic pinning of the contralateral hip[18]. An expected-value decision analysis by Kocher et al represented decision-making from the patient's perspective, as opposed to the functional perspective reported by Schultz et al, and favored observation as the optimal management strategy[17]. In this study, however, the

**TABLE II. Comparison of Demographic Characteristics Based on Gender**

| | Boys (n=51) | Girls (n=51) | p-value |
|---|---|---|---|
| **PSA*** | 12.0 (5.2) | 13.2 (6.7) | 0.33 |
| **Age*** | 12.3 (1.5) | 11.3 (1.2) | <0.001 |
| **Ethnicity**** | | | |
| African American | 32 (62.7%) | 29 (56.9%) | 0.69 |
| Caucasion | 17 (33.3%) | 18 (35.3%) | |
| Other | 2 (3.9%) | 4 (7.8%) | |
| **Group**** | | | |
| Unilateral | 27 (52.9%) | 24 (47.1%) | 0.55 |
| Bilateral | 24 (47.1%) | 27 (52.9%) | |

* Data given as the mean with standard deviation in parentheses
** Data given as the number with percent total in parentheses

**TABLE III. Comparison between Unilateral and Bilateral Groups**

| | Unilateral | Bilateral | P-Value |
|---|---|---|---|
| **PSA*** | 10.6 (5.3) | 14.5 (6.1) | 0.001 |
| **Age*** | 12.3 (1.2) | 11.3 (1.5) | <0.001 |
| **Sex**** | | | |
| Male | 27 (52.9%) | 24 (47.1%) | 0.55 |
| Female | 24 (47.1%) | 27 (52.9%) | |
| **Ethnicity**** | | | |
| African American | 31 (50.8%) | 30 (49.2%) | 0.65 |
| Caucasian | 16 (45.7%) | 19 (54.3%) | |
| Other | 4 (66.7%) | 2 (33.3%) | |

* Data given as the mean with standard deviation in parentheses
** Data given as the number with percent total in parentheses

**TABLE IV. Subgroup Analysis Based on Gender**

| | Boys (n=51) | | | Girls (n=51) | | |
|---|---|---|---|---|---|---|
| | **Unilateral** | **Bilateral** | **p-value** | **Unilateral** | **Bilateral** | **p-value** |
| **PSA*** | 11.1 (4.6) | 13.0 (5.7) | 0.18 | 10.1 (6.0) | 15.9 (6.3) | 0.002 |
| **Age*** | 12.7 (1.3) | 11.9 (1.6) | 0.06 | 11.9 (1.0) | 10.7 (1.1) | <0.001 |
| **Ethnicity**** | | | | | | |
| African American | 15 (46.9%) | 17 (53.1%) | 0.39 | 16 (55.2%) | 13 (44.8%) | 0.35 |
| Caucasian | 10 (58.8%) | 7 (41.2%) | | 6 (33.3%) | 12 (66.7%) | |
| Other | 2 (100.0%) | 0 (0.0%) | | 2 (50.0%) | 2 (50.0%) | |

* Data given as the mean with standard deviation in parentheses
** Data given as the number with percent total in parentheses

difference in expected value between in situ pinning and observation was small. In the sensitivity analysis by Kocher et al, they found prophylactic in situ pinning to be favorable if the risk of contralateral SCFE was greater than 27.3%. Given this data, clinical or radiographic methods of quantitatively assessing risk of contralateral SCFE would be helpful to the clinician in deciding whether to observe or prophylactically pin the contralateral hip.

The concept of posterior migration of the head on the neck and displacement of the physis in the axial plane was first described by Alexander[23] and Billing and Severin[24], then was more recently revisited in an investigation by Barrios et al[19]. In this study, multiple radiographic parameters, including the physis-diaphysis angle, physeal AP sloping angle, neck shaft-plate shaft angle, and Wiberg angle, were analyzed in an attempt to determine which measurements could predict the development of SCFE in healthy adolescents and the development of bilaterality in unilateral SCFE. Thirty-six hips with no hip pathology were compared to 47 healthy hips of patients with unilateral SCFE, eight of which went on to slip on the contralateral side. Significant differences in the PSA were found between the various groups, with an average contralateral hip PSA of 5 degrees, 12 degrees, and 18 degrees for the control group, unilateral SCFE group, and bilateral

**TABLE V. Association between PSA and Sex, Ethnicity**

| | PSA | p-value |
|---|---|---|
| **Sex*** | | |
| Male | 12.0 (5.2) | 0.33 |
| Female | 13.2 (6.7) | |
| **Ethnicity**** | | |
| African American | 12.2 (6.3) | 0.73 |
| Caucasion | 13.2 (5.6) | |
| Other | 12.8 (6.3) | |

* Independent samples t-test, data given as the mean with standard deviation in parentheses

** Univariate Analysis of Variance, data given as the mean with standard deviation in parentheses

**TABLE VIa. Multivariate Analysis Using PSA and Age to Predict Bilateral Slip†**

| | Odds Ratio | 95% CI | p-value |
|---|---|---|---|
| PSA | 1.21 | 1.10 to 1.34 | <0.001 |
| Age | 0.45 | 0.30 to 0.66 | <0.001 |

†Analysis of Bilateral group in reference to Unilateral group

**TABLE VIb. Multivariate Analysis to Predict Bilateral Slip in Girls†**

| | Odds Ratio | 95% CI | p-value |
|---|---|---|---|
| PSA | 1.34 | 1.12, 1.61 | 0.002 |
| Age | 0.23 | 0.10, 0.53 | 0.001 |

†Analysis of Bilateral group in reference to Unilateral group using age and PSA.

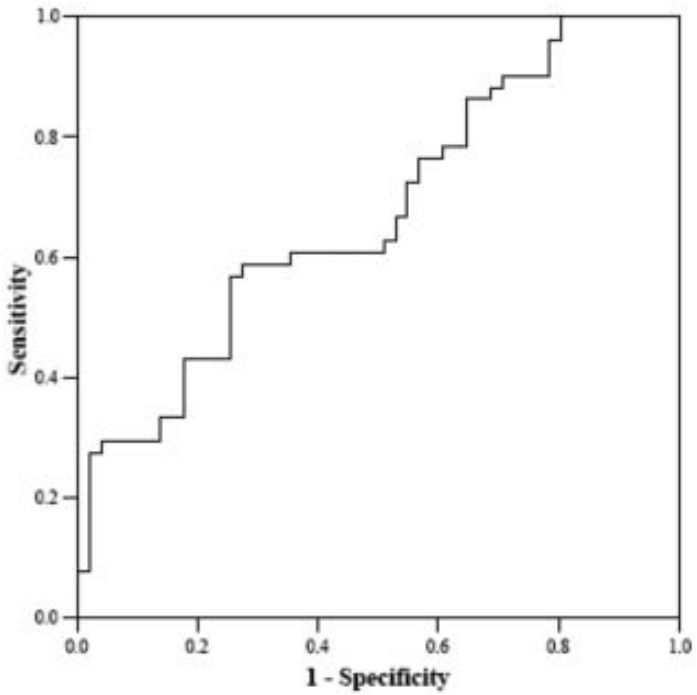


**Figure 2.** Receiver operating characteristic (ROC) curve for posterior sloping angle (PSA) threshold of 12.66 degrees.

**FIGURE 2. ROC Curve and Threshold PSA**

| | Bilateral | Unilateral | |
|---|---|---|---|
| PSA > 12.66 | 30 | 15 | 45 |
| PSA ≤ 12.66 | 21 | 36 | 57 |
| | 51 | 51 | |

| | |
|---|---|
| Area Under the Curve (AUC) | 67% |
| Sensitivity | 59% |
| Specificity | 71% |
| Number Needed to Treat (NNT) | 3.4 |
| Positive Predictive Value (PPV) | 67% |
| Negative Predictive Value (NPV) | 63% |

SCFE group, respectively. No other radiographic parameters showed significant differences between the groups. The authors recommend prophylactic pinning of asymptomatic hips with a PSA of greater than 12 degrees. These conclusions, however, were based on a relatively small sample size of eight patients who progressed to slip on the contralateral side.

Zenios et al conducted a follow-up study to further evaluate the utility of the posterior sloping angle originally reported by Barrios et al[20] and to assess the intraobserver and interobserver reliability. The posterior sloping angle was measured in the initial axial radiographs of 14 control patients and 47 children with unilateral SCFE, 13 of which later presented with a contralateral slip. Results were similar to those of Barrios et al, with PSA measurements of 3.9, 13.9, and 18.8 degrees for control group, unilateral SCFE, and bilateral SCFE, respectively. They constructed a ROC curve which revealed an optimal cutoff of 14.5 degrees with an area under the curve (AUC) of 83% and a number needed to treat (NNT) of 1.9. The intraobserver and interobserver reliability was reported to be good to excellent between four different surgeons on two occassions. However, as with the study by Barrios et al, this conclusion was based on a small sample size of 13 patients who progressed to slip on the contralateral side. In our study, we similarly found a significantly higher PSA in the Bilateral group as compared to the Unilateral group (14.5 ± 6.1 vs. 10.6 ± 5.3). Based on the ROC curve, the optimal threshold cutoff to prophylactially pin the contralateral side was found to be 12.66 degrees. This value was associated with an AUC of 67% and NNT of 3.4, showing only fair discrimination and potential difficulty in clinical use. Pinning every 3.4 hips to prevent one occurrence can be considered relatively high. However, when subgroup analysis based on gender was performed, we found that the threshold PSA of 13 degrees in girls yielded an ROC curve with AUC of 76% and NNT of 2.2. This shows better predictive performance and lower NNT. In boys, however, PSA was not found to be significantly different between the Unilateral and Bilateral groups. From this, we conclude that PSA is more predictive of contralateral slip in girls presenting with unilateral SCFE

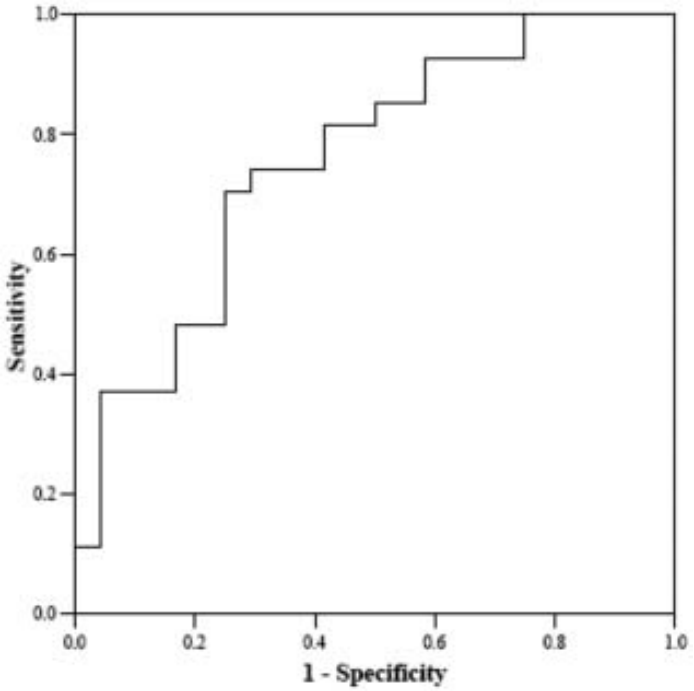


**Figure 3.** Receiver operating characteristic (ROC) curve for posterior sloping angle (PSA) threshold of 13 degrees in girls.

**FIGURE 3. ROC Curve and Threshold PSA in Girls**

| | Bilateral | Unilateral | |
|---|---|---|---|
| PSA > 13 | 19 | 6 | 25 |
| PSA ≤ 13 | 8 | 18 | 26 |
| | 27 | 24 | |

| | |
|---|---|
| Area Under the Curve (AUC) | 76% |
| Sensitivity | 70% |
| Specificity | 75% |
| Number Needed to Treat (NNT) | 2.2 |
| Positive Predictive Value (PPV) | 76% |
| Negative Predictive Value (NPV) | 69% |

and recommend prophylactic pinning of the contralateral side in girls with PSA greater than 13 degrees. We cannot make any recommendation in boys regarding prophylactic pinning based on PSA.

Our study shows that younger age is a significant predictor of contralateral slip independent of the PSA. Current literature is not definitive regarding the optimal age at which prophylactic pinning should occur. In a study by Riad et al investigating the predictive factors for contralateral slip, chronological age was found to be the only significant predictor for development of contralateral slip in children with unilateral SCFE with a mean age of 11.0 years for girls and 12.1 years for boys[13]. All girls younger than 10 years and all boys younger than 12 years with unilateral SCFE slipped on the contralateral side, while no contralateral slip occurred in a girl older than 13 and a boy older than 14. In our study, the mean age of the Bilateral group was 11.3 vs. 12.3 years in the Unilateral group, and this was statistically significant. Subgroup analysis also revealed a significant difference in girls; the mean age of the Bilateral group was 10.7 years while that of the Unilateral group was 11.9. In boys, the difference showed a trend but was not significant (11.9 vs. 12.7, $P = 0.06$). Loder et al also found age at presentation to be a significant predictor of contralateral slip with an average age of 12 years for sequential slips and 13 years for bilateral simultaneous slips[10]. Further complicating the issue of finding an appropriate age cutoff for prophylactic pinning of the contralateral hip is recent epidemiologic data suggesting that the average age of initial SCFE for children is trending towards a younger age[25]. The factors for this age shift are unclear but may be related to the increasing incidence of obesity in children. Although these studies suggest that younger age is a risk factor for future development of contralateral SCFE, there is still insufficient data to determine at what age the risks of prophylactic pinning begin to outweigh the benefits of preventing a contralateral slip. In our study, we were not able to generate a ROC curve based on age due to lack of sufficient sample size.

There are several limitations to this study. Patients in our Unilateral group may have progressed to contralateral SCFE and followed up at an outside institution. However, given the fact that our institution is a prominent regional center, we anticipate this number to be relatively small. More importantly, patients in this group also could have had asymptomatic slips at a time after latest follow-up. A prospective study incorporating physical examination and radiographs until skeletal maturity in the Unilateral group would have allowed for detection of all subsequent slips, whether symptomatic or silent. Despite our having performed a power analysis prior to our study, it is possible that it was not adequately powered to perform subgroup analysis based on gender and could explain the lack of statistical significance of PSA in boys. Our power analysis was performed to allocate patients into Unilateral and Bilateral groups only. A larger sample size would also have allowed for combined predictive rule utilizing age, gender, and PSA in predicting contralateral slip.

In summary, this study provides data which confirms the utility of the posterior sloping angle as a predictor of contralateral slip in patients presenting with unilateral SCFE. This radiographic tool can be utilized by clinicians as an aide in deciding whether to pursue a conservative or surgical approach to the contralateral hip. Based on our data, PSA is more predictive in girls than in boys, and we recommend prophylactic pinning of the contralateral hip in girls with PSA greater than 13 degrees.

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