# Sequelae of Pediatric Hip Disorders: Survey Responses From Experts in Adult Hip Reconstruction

Gregory A. Lundeen, MD, John L. Masonis, MD, and Steven L. Frick, MD


## Abstract

**Questions persist concerning the incidence of total hip arthroplasties (THAs) attributable to secondary osteoarthrosis and the impact of corrective pediatric hip surgeries and retained internal fixation on subsequent THAs.**

**Hip reconstruction fellowship directors (N = 72) were mailed a survey of multiple-choice questions about pediatric hip disorders (PHDs) in their THA populations, the influence of hip osteotomies on subsequent THAs, and the recommendation to routinely remove pediatric hip internal fixation.**

**Forty-five surgeons (62.5%) responded. The majority reported that a small proportion of hip arthrosis in their practice was attributable to PHDs (10-30 cases per 100-200 annual cases). Fifty-seven percent indicated that hip surgery performed during skeletal immaturity made THA more difficult. Twenty-eight surgeons (62% of respondents) said that they remove implants from fewer than 10% of cases with previous pediatric surgery. Sixty-eight percent felt that removal of pediatric hip implants, particularly those in the proximal femur (83% of respondents), should be routine.**

**Survey results showed that the majority of experts in adult hip reconstruction (a) do not identify PHDs as a significant factor in most of their patients with end-stage hip arthrosis and (b) believe in routine removal of pediatric hip implants, particularly those in the proximal femur. The impact of performing corrective hip surgery during skeletal immaturity—whether such surgery increases the difficulty of or diminishes the effectiveness of subsequent THA—remains controversial.**


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The prevalence of osteoarthrosis (OA) of the hip is increasing, and the number of total hip arthroplasties (THAs) is expected to rise accordingly.[1] Secondary OA results from an identifiable anatomical or physiologic condition, such as trauma, autoimmune diseases, infection, or a developmental hip disorder. Pediatric hip disorders (PHDs) are well recognized causes of OA, with developmental dislocation of the hip (DDH), Legg-Calvé-Perthes disease (LCPD), and slipped capital femoral epiphysis (SCFE) being the most common.[2,3] Together, PHDs have been reported to result in as much as 30% to 75% of THAs performed.[4] These estimates, however, may be inflated if subtle anatomical changes are attributed to PHD. The true incidence of PHD remains unknown.

Primary OA is a diagnosis of exclusion, implying that no causative entity can be identified. The etiology of primary OA remains unknown, despite abundant investigation. As a result, some researchers and surgeons are skeptical of its prevalence in the population and believe it to be an uncommon cause of hip arthrosis.[4-6] Researchers have reported that careful scrutiny of x-rays from patients with OA and previously unreported PHD reveals anatomical changes consistent with mild forms of unrecognized disease. Others researchers have refuted these statements and claimed that these anatomical changes are a remodeling response in the natural history of OA.[7] In addition, the correlation between radiographic measurements and symptoms is poor, particularly for minor abnormalities.[8-10] There is increasing evidence that OA has a genetic predisposition independent of identifiable causes.[11] Thus, in the literature there is no clear consensus concerning the underlying etiology in most cases of hip OA.

Natural history studies of PHD have demonstrated that patients with severe hip deformity develop OA at an early age, and patients with moderate to mild deformity develop OA late in life or perhaps not at all.[3,4,8,9,12,13] Therefore, the goal in treating a child with an identifiable hip abnormality is to restore the anatomy; doing so often requires surgical alteration of the anatomy with internal fixation. Data on the influence of these corrective pediatric surgeries on subsequent THAs are limited.

There are no clear guidelines for the removal of internal fixation about the hip in the pediatric population. Studies have identified the rate of complications for removal as relatively low (<10%), and the complications that do arise are minor.[14-17] In adults, internal fixation about the hip is

1. How many years have you been in practice? _____
2. How many total hip arthroplasties do you perform annually?
   a. <100 b. 100-200 c. 200-300 d. >300
3. In approximately how many of your annual total hip arthroplasties is the arthritis caused by a pediatric hip disorder (hip dysplasia, Perthes disease, slipped capital femoral epiphysis)?
   a.< 10 b. 10-30 c. 30-50 d. 50-100 e. >100
4. What is the approximate average age (years) of the patients in question 3 at the time of total hip arthroplasty?
   a. 20-30 b. 30-40 c. 40-50 d. 50-60 e. >60
5. What percentage of the patients in question 3 had previous surgery for a pediatric hip disorder?
   a. <10% b. 10%-50% c. 50%-90% d. >90%
6. From what percentage of the patients in question 5 do you remove previous internal fixation?
   a. <10% b. 10%-50% c. 50%-90% d. >90%
7. Does femoral or pelvic hardware retained from pediatric procedures typically make hip arthroplasty significantly more difficult?
   Yes No
8. Is the success of late arthroplasty in these patients influenced negatively by the previous orthopedic surgical intervention?
   Yes No
9. Would you recommend that pediatric orthopedic surgeons routinely remove all internal fixation from the proximal femur or pelvis?
   Yes No
10. Which internal fixation devices would you recommend be routinely removed from the pediatric hip region? *(Please circle all that apply)*

| | |
|---|---|
| Blade plate | Single cannulated screw for |
| Hip screw and side plate | slipped capital femoral epiphysis |
| Pelvic screws or pins | Flexible intramedullary nails |
| Rigid, interlocked intramedullary nails | |

**Figure 1.** Survey on the consequences of pediatric hip disorders for adults.

generally not routinely removed, as risks may be higher, complications more detrimental, and removal perhaps of less benefit for subsequent surgeries.[18,19] In the literature on reconstruction in adults, recommendations regarding removal of pediatric internal fixation are limited, but removal is generally encouraged.[20] No investigators have specifically evaluated the consequences of removing pediatric implants during reconstructive procedures in adults.

The objective of the current study was to survey THA experts regarding the incidence of secondary OA caused by PHDs, the influence of femur or pelvis osteotomies on the difficulty of subsequent THAs, and the recommendation to routinely remove pediatric hip internal fixation. We wanted to better understand the prevalence of underlying PHDs in patients with hip arthrosis and to develop pediatric orthopedic guidelines regarding implant removal about the hip.

## Methods

Hip Society members and hip reconstruction fellowship directors were mailed a survey with multiple-choice questions about years in practice, THA volume, number of THAs in which secondary OA was thought to be the cause, percentage of adult THA patients previously treated for a PHD, and impact of and recommendations for various retained internal fixation devices (Figure 1). We disregarded an answer when a respondent gave a nonstandardized answer or more than one answer to the question.

Data were compiled with standard statistical methods of means, SDs, and percentages. In addition intrasurvey relationships were investigated with a $\chi^2$ contingency table with a Bonferroni correction of $P<.001$.

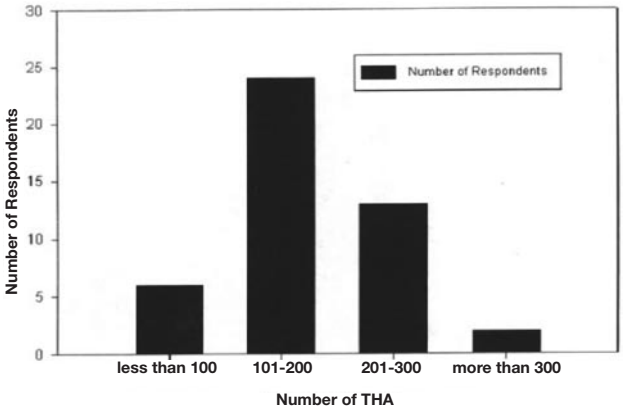


**Figure 2.** Number of total hip arthroplasties performed per year by surgeons who responded to the survey (N=45).

## Results

Seventy-two surveys were mailed, and 45 surgeons (62.5%) responded. Mean time in practice was 18.8 years (range, 5-50 years). The most common range of volume was 100 to 200 THAs per year (Figure 2). The most common range of number of THAs annually performed for OA secondary to PHDs was 10 to 30 (Figure 3). THA for secondary OA was most often reported to occur between the ages of 40 to 50 years (Figure 4). In general, the percentage of THA patients with previous corrective hip surgery was low (Figure 5), less than 30% according to 30 respondents and less than 10% according to 20 respondents. Fifty-seven percent of respondents felt that any previous surgical intervention for PHD negatively influenced the success of THA.

Twenty-eight surgeons reported removing internal fixation from fewer than 10% of cases involving previous pediatric hip surgery (Figure 6). However, 83% of surgeons felt that any retained fixation made THA more difficult. Sixty-eight percent felt that pediatric orthopedic surgeons should remove all internal fixation. The Table lists the specific devices that the surveyed experts in adult hip reconstruction felt are important to remove to reduce the difficulty of subsequent THAs.

Statistically significant intrasurvey correlations were associated with the recommendations for removal of specific internal fixation devices. Respondents who thought that retained internal fixation makes THA more difficult were more likely to recommend removing blade plates and hip screws and side plates ($P<.001$); respondents who recommended implant removal specifically stated that blade plates, hip screws and side plates, flexible intramedullary nails, and interlocked intramedullary nails should be routinely removed ($P<.001$).

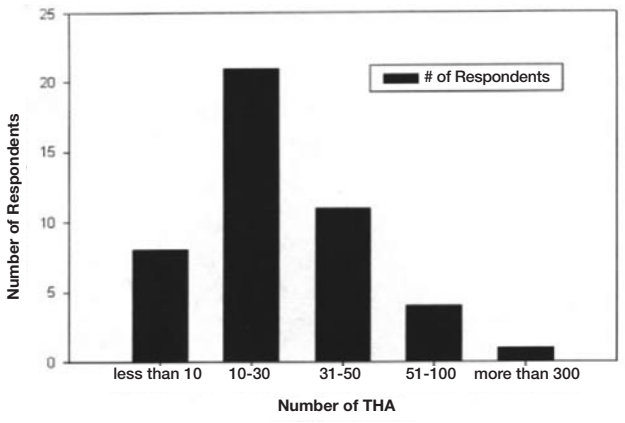


**Figure 3.** Number of annual total hip arthroplasties attributable to pediatric hip disorders.

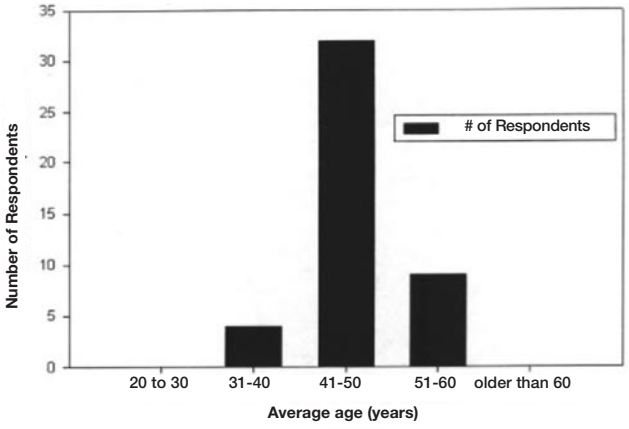


**Figure 4.** Mean age of adult patients at time of total hip arthroplasty for a pediatric hip disorder.

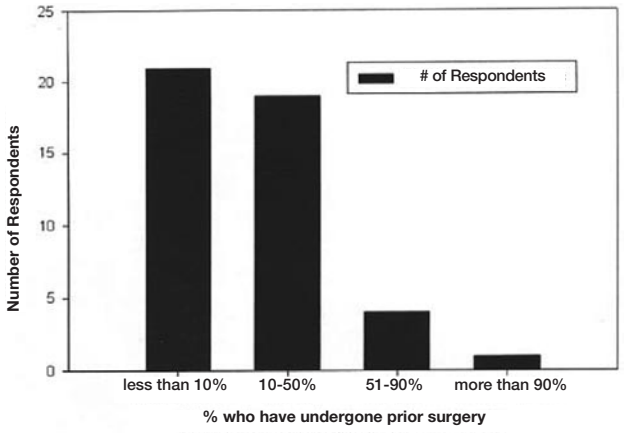


**Figure 5.** Percentage of adult patients who had a previous corrective surgery for a pediatric hip disorder.

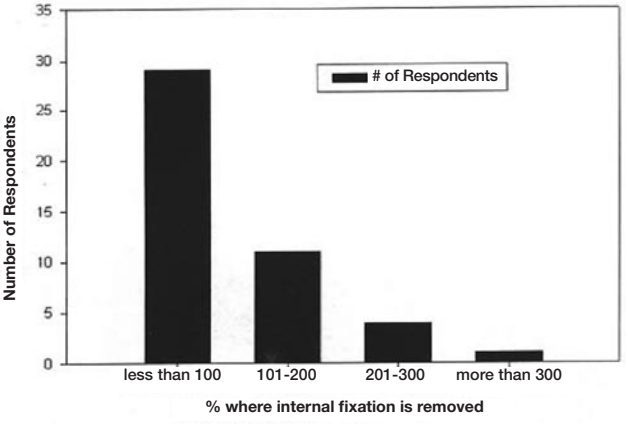


**Figure 6.** Percentage of cases in which implants from previous pediatric corrective surgery had to be removed at time of total hip arthroplasty.

## Discussion

The surveyed practicing experts in adult hip reconstruction reported that only 10 to 30 of their THA patients each year have secondary OA from an underlying PHD. These numbers represent a small portion of the overall practice of these surgeons, as the median number of THAs performed annually was between 100 and 200. This rate of secondary OA is much lower than that reported in the literature. Aronson,[4] analyzing 5 large series to identify the etiology of end-stage OA, found that the mean contributions of DDH, SCFE, LCPD, and primary OA were 20%, 5.4%, 4.5%, and 59%, respectively. On the basis of an investigation by Stulberg and colleagues,[13] who reported that 76% of primary OA was attributable to either mild acetabular dysplasia (39%) or pistol grip deformity of SCFE or LCPD (40%), Aronson[4] modified the results of his collected series and stated that underlying deformity was attributable to DDH in 43% of cases, SCFE in 11% of cases, and LCPD in 22% of cases. Primary OA thus represented only 12% of end-stage OA. This significant contribution of PHD to end-stage OA has been supported by results from other investigations.[5,6] Our results do not support these claims, as the majority of our surveyed experts in adult hip reconstruction believed that most of their THAs were not the result of PHDs.

Natural history studies have found that incongruence within a developing hip can ultimately lead to arthritic changes at the hip joint later in life. Surgeons have designed procedures to restore normal hip anatomy and prevent further deterioration. These procedures have been shown to improve the longevity of the native hip in long-term follow-

**Table. Internal Fixation Devices Recommended by Reconstructive Surgeons for Routine Removal From Pediatric Hips**

| Device | Respondents Recommending Routine Removal (%) |
|---|---|
| Blade plate | 84 |
| Hip screws/side plate | 82 |
| Rigid interlocked intramedullary nail | 63 |
| Flexible intramedullary nail | 56 |
| Single cannulated screw for slipped capital femoral epiphysis | 38 |
| Pelvic screws/pins | 25 |

up studies.[3] In our study, 40 respondents reported that fewer than half their patients with PHDs had previous surgeries; 21 of these respondents felt that previous surgeries were performed in fewer than 10% of their patients. In respondents' practices, mean decade of age of THA patients with PHDs was the fifth decade, which corresponds to reports in the literature.[3,4]

The surveyed experts in adult hip reconstruction were divided in their opinion of previous surgical intervention. Forty-three percent felt that the success of late THA in these patients was influenced negatively by previous orthopedic surgical procedures. Reports in the literature have suggested that THA becomes more technically demanding and that unusual implant sizes may be needed. This difficulty and the altered anatomy may result from the primary disorder, not from surgical attempts to correct it. Outcomes of these THAs, however, are similar to those of primary THAs.[2,18-20]

Adult hip reconstruction surgeons reported removing internal fixation from pediatric procedures infrequently, with 65% removing implants in less than 10% of cases involving previous surgical intervention. It is generally accepted practice in the pediatric orthopedic community to remove internal fixation; reported reasons include uncomplicated healing, pain prevention, implant prominence, infection, stress shielding with late fracture, possibility of malignant degeneration, and potential adverse effects on bone growth.[14-17] Complication rates after removal of internal devices from children are low (11%-14%).[15,16] The majority of these complications were considered minor and were not expected to influence outcomes. The highest complication rate was found for removal of screws placed in the proximal femur for SCFE. No controlled clinical studies have been conducted with adults to evaluate removal of implants that had been placed before skeletal maturity.

Eighty-three percent of our surveyed adult hip reconstruction surgeons felt that the need to remove internal fixation from the pelvis or proximal femur made THA more difficult. Most respondents (68%) recommended that pediatric orthopedic surgeons routinely remove internal fixation from the proximal femur and pelvis. Asked about specific devices, respondents indicated that they were most concerned about blade plates, hip screws and side plates, and intramedullary nails—implants that interfere with the greater trochanter and the proximal diaphyseal region of the femur. There appeared to be relatively less concern about cannulated screws for SCFE and pelvic screws/pins—implants placed primarily within the femoral neck and head and pelvis. The perception may be that the incidence of complications is higher in these anatomical areas and that internal fixation here does not significantly interfere with THA. Thus, adult hip reconstruction surgeons recommend routine removal of most pediatric implants about the hip.

## Conclusions

In the absence of scientifically validated data, physicians rely on the opinions of experts. In surveying adult hip reconstruction specialists, we attempted to gain insight into questions concerning PHD and subsequent THA. Respondents reported performing THAs associated with PHDs at rates lower than those previously reported in the literature. The influence of pediatric hip surgery on THA remains unclear. Finally, the surveyed adult hip reconstruction surgeons felt that removing internal fixation about the hip, particularly from the proximal femur, should be routine practice for pediatric orthopedic surgeons.

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The authors report no actual or potential conflict of interest in relation to this article.

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