



Risk Factors of Heterotopic Ossification Following Total Hip Arthroplasty in Patients With Ankylosing Spondylitis



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ARTICLE INFO

Article history:

Received 31 December 2014

Accepted 9 June 2015

Keywords:

heterotopic ossification
risk factor
total hip arthroplasty
ankylosing spondylitis
fused hip

ABSTRACT

This study was to identify the risk factors of heterotopic ossification (HO) after total hip arthroplasty (THA) in ankylosing spondylitis. We analyzed 47 hips (24 patients) with ankylosing spondylitis that underwent primary THA. The incidence of HO was 14.9%. The risk factors were divided into modifiable and nonmodifiable factors. Female gender ($P = 0.008$), preoperative ankylosed hip ($P < 0.001$), occurrence of HO in previous surgery ($P = 0.036$) were nonmodifiable risk factors which increased the prevalence of HO. Of the various modifiable risk factors, elevated preoperative ESR ($P = 0.007$), elevated preoperative CRP ($P = 0.004$) and prolonged duration of surgery ($P = 0.014$) were associated with increased occurrence of HO. Perioperative medical intervention to reduce inflammation (ESR and CRP) may help to decrease HO.

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Ankylosing spondylitis (AS) is one of the major inflammatory arthropathies, within a group of interrelated spondyloarthropathies [1]. The incidence of hip joint involvement in ankylosing spondylitis is around 40% [2,3]. It affects young and active patients [3], resulting in severe limitation of motion, functional disability, affecting posture and gait. Several reports have focused on the management of AS with total hip arthroplasty (THA) showing excellent outcome [4–10].

Heterotopic ossification (HO) is a well-known complication after THA, which can reduce postoperative range of motion [11–13]. The incidence of HO varies widely in different series, ranging from 3% to 90% after THA [11–17]. Surgical excision is the only available treatment, once HO is mature [18,19], with significant risk of recurrence [20]. Many studies reported that the occurrence of HO was higher in AS than in osteoarthritis [4,7,13,21,22], even though some studies refuted this association [12,23].

Various risk factors had been reported by several studies for the development of HO after THA [13,24–26]. Only few studies identified the risk factors of HO after THA in AS. The purpose of this study was to investigate the risk factors that are associated with the occurrence of HO

after THA in patients with AS. We hypothesized that some risk factors for the occurrence of HO after THA may be modifiable and tried to identify them.

Patients and Methods

Between February 2003 and January 2012, 30 patients with AS who underwent primary THA at our hospital were retrospectively reviewed in the study. We excluded patients who could not meet the objective criteria of AS (4 patients) and could not be followed up for more than 2 years after THA (2 patients). Twenty-four patients (47 hips) with AS who underwent primary THA were finally included in the study. All patients met the modified New York diagnostic criteria of AS [27] and had been under treatment by a rheumatologist. Table 1 shows the demographic data of this study. The mean age of patients was 36 years (range, 22–64). Of the 24 patients 6 were females (25%). Mean follow up was 6.7 years (range, 2–10). Prior to surgery 14 hips (29.7%) were ankylosed. Three patients had one-stage bilateral THA. The study had been approved by the local ethical committee.

THAs were performed using a modified Hardinge (30 hips) or posterior approach (17 hips). All were performed without trochanteric detachment. Perioperative parenteral antibiotics and thromboembolic prophylaxis with low molecular weight heparin were given to all patients. Radiographs were obtained prior to surgery, on the same day after surgery, postoperatively at 6 weeks, 3 and 6 months and at annual follow up examinations. Radiologic assessment during each session included a standing anteroposterior radiograph of the pelvis centered at the pubic symphysis and a cross table lateral radiograph of the operated

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <http://dx.doi.org/10.1016/j.arth.2015.06.013>.

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<http://dx.doi.org/10.1016/j.arth.2015.06.013>

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Table 1
Demographic Data in This Study.

Age (years), mean $\pm$ SD	36 $\pm$ 8.75
Gender (male: female)	18: 6
Duration of symptom (years), mean $\pm$ SD	7.2 $\pm$ 1.65
Interval between both THAs (months), mean $\pm$ SD	9.7 $\pm$ 10.30
Duration of surgery (minutes) (n = 47 hips), mean $\pm$ SD	107.7 $\pm$ 15.24

hip joint. Functional outcome before surgery and last follow up was measured using the Harris hip score (HHS).

The HO was classified according to Brooker et al [11], which includes a scale from I to IV to estimate the severity of periprosthetic ossification [28,29]. We adhered to the protocol proposed by Williams et al of comparing immediate postoperative radiographs to subsequent follow up radiographs of minimum 2 years to nullify the interpretation of bone fragments as HO [8]. Two investigators who did not participate in this study measured and classified the formation of HO.

The risk factors were divided into two categories: modifiable and nonmodifiable. The nonmodifiable factors were age, gender, duration of symptoms, preoperative hip ankylosis and occurrence of HO in previous THA. The modifiable factors were elevated preoperative ESR and CRP, interval between both THAs, duration of surgery, type of anesthesia and type of implant fixation.

Statistical Analysis

The data were analyzed using stepwise logistic regression models to identify the risk factors of HO. The results were expressed as an odds ratio (OR) with 95% confidence interval (CI). The risk factors which did not apply for the logistic regression models were analyzed using Fisher's exact test for categorical variables. *P*-values of <0.05 were considered statistically significant, and all tests were performed using SPSS (version 21) for Windows.

Results

Heterotopic ossification occurred in 7 hips (14.9%) among the 47 THAs. All hip joints improved without any serious postoperative complications. The average HHS improved from 52.0 (range: 44.0–65.0) before operation to 81.6 (range: 66.0–88.0) at last follow up. Brooker grade I HO was seen in 2 hips, grade II in 2, grade III in 2 and grade IV in 1 hip. The interobserver and intraobserver correlation coefficients were 0.891 and 0.862. The THA which developed grade IV HO, reankylosed 4 years after surgery and underwent excision of the HO elsewhere. Two patients who developed HO (grade III) after the first THA, also developed HO (grade II) after the contralateral THA (Fig. 1). None of the cases that did not develop HO previously developed HO after the contralateral THA. Two hips showed progressive loss of motion, without any HO. The average duration of surgery in all patients in AS was 107.7 minutes. The operating time in the patients who developed HO was 116 minutes more than those without HO and the difference in time is statistically significant (*P* = 0.014). Preoperative ESR and CRP levels were elevated by more than 30 mm/h and 10 mg/L, respectively, in all patients who developed HO. Superficial wound infection developed in one hip, which improved with debridement, antibiotics and local care, which also developed grade III HO.

There was no significant difference in the prevalence of HO between cemented, hybrid and noncemented THAs in our study. We also did not find any significant correlation with interval in two-stage THA and type of anesthesia.

Nonmodifiable risk factors with increased incidence of HO were: female gender (*P* = 0.008), preoperative hip ankylosis (*P* < 0.001) and occurrence of HO at previous THA (*P* = 0.036) (Table 2). Of the various modifiable risk factors, elevated preoperative ESR (*P* = 0.007), elevated preoperative CRP (*P* = 0.004) and prolonged duration of surgery (*P* = 0.014) were associated with increased occurrence of HO (Table 3).

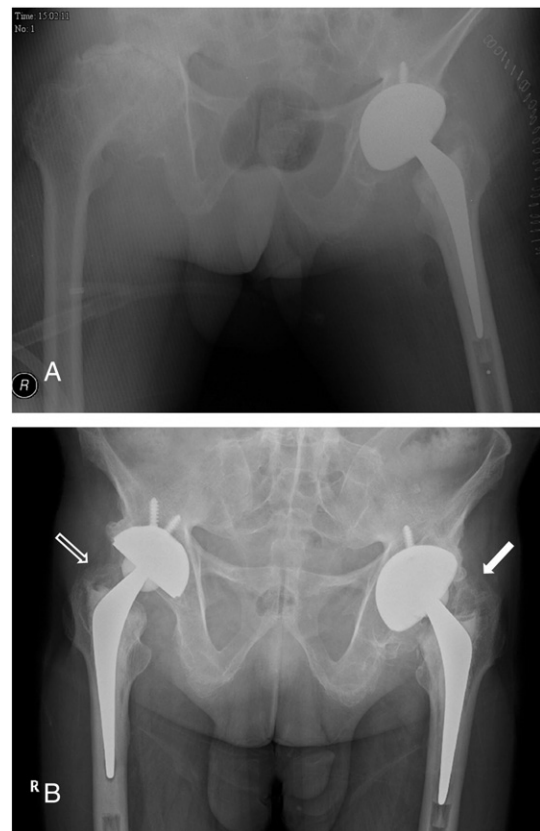


Fig. 1. (A) The patients with ankylosing spondylitis underwent the total hip arthroplasty (THA) in the left side due to the fused hip. (B) At 5 years after surgery of left side THA, heterotopic ossification with Brooker type III (white color filled arrow) could be observed around the left hip joint. Please note that the right hip joint also showed the heterotopic ossification with Brooker type II (black color filled arrow) after the surgery of right side THA.

Discussion

Occurrence of HO after THA can result in limitation of motion and function. Few studies assessed risk factors of HO formation after THA in AS and most studies of HO after THA in AS analyzed the

Table 2
Nonmodifiable Risk Factors for Heterotopic Ossification (HO) After THA in Ankylosing Spondylitis.

Characteristics	Heterotopic Ossification		OR (95% CI)	P-Value
	No (n = 40)	Yes (n = 7)		
Age (years)	36.6 $\pm$ 8.6	31.4 $\pm$ 8.0	0.904 (0.791–1.034)	0.140
Duration of symptom (years)	7.4 $\pm$ 1.6	6.5 $\pm$ 1.9	0.715 (0.386–1.327)	0.288
Gender (cases)			11.786 (1.888–73.577)	0.008
Male	33	2 (5.7%)		
Female	7	5 (41.7%)		
Preoperative hip ankylosis ^a (cases)				<0.001
No	33	0 (0%)		
Yes	7	7 (50%)		
Occurrence of HO in previous THA ^a (patients)				0.036
No	19	0 (0%)		
Yes	3	2 (40%)		

HO: heterotopic ossification; THA: total hip arthroplasty.

^a Fisher's exact test.

* *P* < 0.05.

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