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Total Hip Arthroplasty for Patients Who Have Ankylosing Spondylitis: Is Postoperative Irradiation Required for Prophylaxis of Heterotopic Ossification?

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ABSTRACT

Postoperative radiation for prevention of heterotopic ossification (HO) has been proven effective for the patients with ankylosing spondylitis (AS) after total hip arthroplasties (THA). This study aims to evaluate the effect of postoperative radiation in HO formation following THA in patients with AS. We retrospectively reviewed 129 hips from 91 patients with AS receiving primary THA from July 2004 to December 2012. There were total 38 patients (53 hips) did not receive postoperative prophylaxis in Group I. Moreover, 53 patients (76 hips) received postoperative single-fraction radiotherapy of 500 cGy in Group II. After a minimum 12-month follow-up, there was no significant difference in HO formation between the two groups ($P = 0.210$). This study suggests that postoperative radiation may not be necessary in Asian patients.

Ankylosing spondylitis (AS) is a type of seronegative spondyloarthropathy. The most common clinical manifestations are inflammation of sacroiliac joints, axial spine, and peripheral joints [1]. Peripheral joint involvement has been reported in 20% to 73% of patients and hip joint is the most commonly affected [2]. Currently, total hip arthroplasty (THA) is a well-accepted treatment of choice for advanced ankylosing hip [3,4]. Several studies have found that the incidence of HO is much higher, ranging from 65% to 81% specifically in high-risk patients [5–7]. Patients at risk for developing HO after THA include men with AS, and those with diffuse idiopathic skeletal hyperostosis, Paget's disease, or unilateral hypertrophic osteoarthritis. Previous studies have reported that the patients with hip ankylosis undergoing THA are predisposed to have incidence rate, 40% to 76%, of HO formation [3,4,8–10].

HO is one of the most common complications after THA [5,7,9,11–14]. The clinical manifestations of HO include diminished range of motion and pain secondary to inflammation process [12,15,16]. Once HO has formed and affected patients' quality of daily life, surgical excision of heterotopic bone is the only treatment [17]. Thus, prophylaxis for HO formation becomes clinically meaningful.

There are a variety of prophylactic methods to prevent HO, including postoperative prophylactic drug regimens, preoperative and postoperative radiation treatments. Radiotherapy has been proven effective for preventing HO formation since 1981 [18]. The radiation dosage has been reduced over time, from 2000 cGy to 500 cGy [7]. However, controversy still exists about the role of low-dose radiation in the prevention for HO in the patients with hip ankylosis who underwent THA. Bone ingrowth and post-radiation complications are the major concern of the radiotherapy [13,19,20]. To our knowledge, there is no study that compares the use of prophylactic radiotherapy to prevent HO. The purpose of this study was to compare the primary outcome of presence or absence of HO in two groups of Asian patients who underwent THA for hip ankylosis, in which one group received no specific drug regimen or radiation and the other received only post-operative radiation.

Materials and Methods

From July 2004 to December 2012, 91 patients with AS hip who received 129 primary total hip arthroplasties were included in this study. Of the patients, 38 underwent bilateral total hip arthroplasties. All the patients met the diagnostic criteria of AS [21] based on the assessment of their clinical histories and preoperative radiographs. All patients underwent the procedures of THA by two experienced surgeons, WMC and THC. Cementless THA was performed on all patients through

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anterolateral approach with the prostheses of Trident PSL acetabular shells and Secur-Fit stems (Stryker Orthopaedics, Mahwah, NJ).

The patients were divided into two groups according to the prophylactic treatment. The first group (Group I) consisted of 53 hips in 38 patients who did not receive any prophylactic treatment, including medication and radiation to prevent HO. Group I comprised 37 males and one female, with a mean age of 42.5 years. Group II included 76 hips in 53 patients receiving post-operative single-fraction radiotherapy with 500 cGy within two days after THA [7]. The patients in Group II did not receive any prophylactic medication, either. Group II comprised 47 males and 6 females, with a mean age of 39.6 years. The demographics of the two groups are shown in Table 1.

Concerning the bone ingrowth, NSAIDs were not prescribed and acetaminophen only or acetaminophen/tramadol combination tablets, and morphine were used for postoperative pain control in all patients.

The protocol of postoperative rehabilitation was partial weight bearing for the first postoperative 6 weeks, followed by progressive weight bearing to increase the strength. Full weight bearing was achieved in the third month. Preoperative and postoperative Harris hip scores (HHS) were evaluated. The conditions of postoperative wound healing and complications were also assessed. The radiographs, including anteroposterior and lateral view, were examined for the first, second, third and sixth months, and then annually. All the radiographs were reviewed by an independent orthopedic surgeon. HO was identified and graded according to the Brooker's classification. Bone ingrowth to the prostheses was also presented in the radiographs. The outcomes between the two groups were compared, including the HO formation shown on radiographs, preoperative and postoperative Harris hip scores, the wound condition, and the complications. All the patients were followed up for at least 12 months for recognizing the formation of HO [9].

Statistical analysis with independent student t test and chi square test were used to determine the differences between two groups. In the same group, preoperative and postoperative Harris hip scores were compared by using paired student t test. All statistical analysis was performed using SPSS Statistics 21.0. Results with P values of less than 0.05 were considered statistically significant. The power analysis was preformed to accurately determine the sample size for presence or absence of HO. The incidence of HO formation after total hip arthroplasty in AS patients varied a lot in the previous literature. The average incidence of HO formation for the patient without prophylaxis was about 40% and for the patient with postoperative prophylactic radiation was about 10%. The power we chose was 0.8. Thus, the number was suggested to be 27 in Group I and 41 in Group II. There were 53 hips in Group I and 76 hips in Group II. Regression analysis was used to adjust for age and gender. We performed logistic regression to assess the association between postoperative radiation and HO. While measuring Harris hip scores, multiple linear regressions were performed.

Table 1
Patient Demographics, and Pre-Operative and Post-Operative Harris Hip Scores.

	Group I	Group II	P
Patients (n)	38	53	
M/F	37/1	47/6	0.058
Mean Operation Age (years)	43.9 ± 14.1	39.5 ± 14.2	0.083
No. of Hips Involved (n)	53	76	
Postoperative Pain Control			
Acetaminophen Only	15	17	
Combination Tablets (Acetaminophen/Tramadol)	23	36	
Mean Follow-Up (years)	6.7 ± 3.1	8.1 ± 2.4	
Harris Hip Score			
Pre-Operative	51.3 ± 2.6	51.6 ± 2.5	0.964
Post-Operative	93.4 ± 3.1	93.1 ± 2.4	0.471

Results

No statistically significant difference was observed between the two groups, including gender ($P = 0.058$) and mean age at operation ($P = 0.083$). The patients receiving bilateral total hip arthroplasties were also in proportion (Table 1).

Of the 53 hips in Group I, after mean duration of follow-up of 6.7 years (range, 1 to 10), according to Brooker's classification, 39 hips (73.6%) with class 0, 13 hips (24.5%) with class I (Fig. 1), 1 hip (1.8%) with class II, and none with class III or IV were found. All patients' wounds healed without specific complication were identified. Postoperative radiographs confirmed good bone ingrowth to prostheses in all the patients of Group I after operation for 3 months. The HHS was improved from 51.3 points (range, 46 to 57) to 93.4 (range, 86 to 97) points.

Of the 76 hips in Group II, after a follow-up period of 8.1 years in average (range, 1 to 10), 49 (64.4%) hips were graded as class 0 (Fig. 2), 20 (26.3%) hips with class I, 7 (9.2%) hips with class II (Fig. 3), and none with class III or IV HO were found. No wound dehiscence was noted. Bone ingrowth of all the patients in Group II had confirmed as shown on the three-month postoperative radiographs. The HHS was also improved from 51.6 points (range, 46 to 58) to 93.1 points (range, 87 to 96).

Of the 129 hips, 41 (31.7%) hips developed HO. However, none with class III or IV HO could be identified on radiographs and none has functional impairment.

Results of analysis also showed no significant difference in the development of HO between the two groups according to Brooker's classification ($P = 0.210$, Table 2). No significant differences between the two groups were found in preoperative and postoperative Harris hip scores

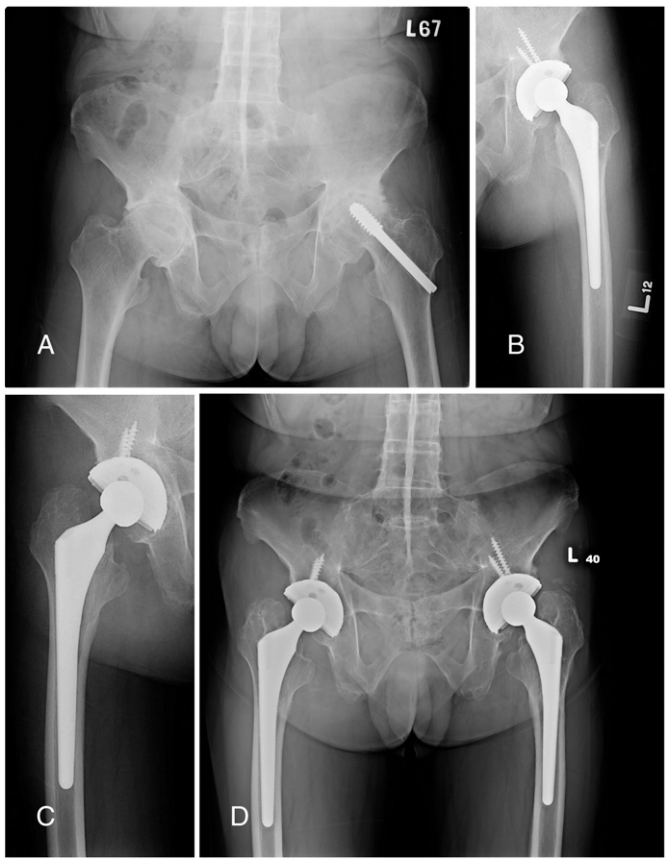

Fig. 1. Preoperative radiographs of a 50-year-old man with bilateral hip ankylosis in Group I (A). The patient underwent left total hip arthroplasty (THA) first and followed right THA 7 months later without postoperative radiation (B and C). The radiographs obtained at the fourth year, showing no heterotopic ossification (HO) at right side and bone island near the greater trochanter at left side (class I HO) (D).