Ectopic ossification in hip arthroplasty

A retrospective study of predisposing factors in 637 cases

Ad J G Nollen and Florens Q M P van Douveren

We investigated predisposing factors for the development of heterotopic ossification in a retrospective study of 637 hip arthroplasties, of which 484 were unilateral, 62 bilateral and 29 revision operations. The frequency of heterotopic ossification after a primary hip arthroplasty was 57 percent. In a univariate analysis, men, patients with hypertrophic arthrosis, and cemented arthroplasty were all at risk of developing heterotopic ossification. After a multivariate analysis, the male sex and the cemented arthroplasty remained as significant factors.

In bilateral operations, the contralateral side developed heterotopic ossification in 82 percent when the primary hip operation had already caused ossification. There was no increase in ossifications after the contralateral operation. Half of the revision operations had an increase of heterotopic ossification from 1 to 4 Brooker classes.

Department of Orthopedics, St Joseph Hospital, Veldhoven, The Netherlands
Correspondence: Dr. Ad J G Nollen, Dommelstraat zuid 40, P.O. Box 7777, 5500 MB Veldhoven, The Netherlands
Tel +31–40 588600. Fax –40 588607
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Heterotopic ossification as a complication of hip arthroplasty has been reported in between 8 and 90 percent (Lazansky 1973, Rosendahl et al. 1977). Preoperative identification of the high-risk patients would make it possible to institute prophylactic therapy. The most effective prophylaxes are radiotherapy and the use of NSAIDs, notably indomethacin and ibuprofen. Predisposing factors for the development of heterotopic ossification include overweight, male sex, previous operations on the same hip, preoperative function restrictions, degree of arthrosis, heterotopic ossification on the contralateral side and the type of prosthesis (Jowsey et al. 1977, Ritter and Vaughan 1977).

These factors have previously been examined in a relatively small number of patients. We have evaluated these factors in a larger survey.

Patients and methods

All hemi- and total hip arthroplasty operations performed in the St. Joseph Hospital in Eindhoven between 1982 and 1989, have been investigated retrospectively. Of 967 operations, 330 were excluded from the analysis, 102 due to the use of indomethacin, 158 due to inadequate radiographic data, and 70 due to death of patients during the follow-up period. Our study therefore comprised 637 hip arthroplasties, of which 484 unilateral, 62 bilateral, and 29 revision operations.

The predisposing factors were investigated in patients who had a unilateral operation or the first operation of those with bilateral involvement. The contralateral hip in the bilateral group and the revision operations were investigated separately.

The preoperative diagnoses were divided into 6 categories (Table 1). The remaining group consisted of patients suffering from Bechterew's disease, Paget's disease, metastases, congenital dysplasia and acetabulum fracture.

Weight, sex, age, degree of arthrosis, previous operations on the same hip, preoperative function and postoperative complications, such as blood loss, infection, the occurrence of hematoma and dislocation, were recorded. The type of prosthesis, including the approach and the use of cement, heterotopic ossification in the contralateral hip, uni- and bilateral involvement and postoperative medication, were also recorded.

The degree of arthrosis was classified according to the biological reaction of the joint (Bombelli 1983). Of the 546 primary operations, 270 were on the left and 276 on the right side. The male:female ratio was 132/414 in primary arthroplasties and in 62 bilateral operations 15/47. The average age was 71 (28–97) years. The average weight for women was 69 (35–106) kg and for men 75 (50–105) kg.

Heterotopic ossification was classified by the authors according to Brooker et al. (1973) before medical data had been collected. Both hemi- and total hip prostheses were inserted by a dorsolateral approach.

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Table 1. Preoperative diagnosis and heterotopic ossification according to Brooker in primary arthroplasties

	None	I–II	III–IV	Total
Hypertrophic arthrosis	24	19	19	62
Primary arthrosis	118	95	47	260
Femoral neck fracture	77	58	39	174
Osteonecrosis	8	9	8	25
Rheumatoid arthritis	6	8	1	15
Other diagnoses	5	5	0	10
Total	238	194	114	546

Table 2. Type of prosthesis and heterotopic ossification according to Brooker in primary arthroplasties

	None	I–II	III–IV	Total
Hemi-arthroplasty	51	31	15	97
Cemented total arthroplasty	167	154	94	415
Uncemented total arthroplasty	20	9	5	34
Total	238	194	114	546
Percentage	43	36	21	100

The Protek prosthesis was used in all hemi-arthroplasties as well as total hip arthroplasties.

The postoperative plan followed a strict schedule, anticoagulants were given by means of Sintromitis and the patient was mobilized after the fifth postoperative day. All available radiographs up to 1 year postoperatively were used. Follow-up data were recorded 6 weeks, 6 months, and 1 year after the operation.

The accumulated data were processed statistically by the Medical Statistics Department of the Catholic University in Nijmegen. The various parameters were viewed in relation to the degree of heterotopic ossifications by means of Chi-square tests and/or Kendall correlation coefficients. A logistic regression analysis was done.

Results

The incidence of heterotopic ossification in the group of 546 primary hip operations was 57 percent with 36 percent Brooker Class I–II and 21 percent Class III–IV. Heterotopic ossification was detected in the first 6 months and increased in the Brooker classification during the second half of the follow-up period (P 0.004).

Men formed ossification in 68 percent and women in 53 percent (P 0.002). Men were more often represented in Classes III and IV than women, 36 percent and 16 percent, respectively; men had more Class IV ossification ($P < 0.001$).

Weight or age did not influence the development of heterotopic ossification. The 62 patients suffering from hypertrophic arthrosis showed a correlation between the preoperative hip function restrictions and the degree of heterotopic ossification (Kendall correlation –0.25, P 0.02). The remaining preoperative diagnoses showed no correlation with heterotopic ossifications.

Postoperatively, 27 hips dislocated, 8 became infected and in 11 cases a hematoma developed. None of these complications had an effect on the development of heterotopic ossification. Blood loss during or after the operation also had no relation to heterotopic ossification. In 31 cases with previous operations on the ipsilateral hip, 10/17 with trochanter osteotomy and 7/14 with osteosynthesis developed ossification.

There was no difference between a hemi-arthroplasty and total hip arthroplasty with regard to the development of heterotopic ossification. However, the uncemented total hip arthroplasty developed less heterotopic ossification (P 0.02, Table 2). Out of 62 bilateral operations, 32 developed heterotopic ossification in the index as well as the contralateral hip, 14 did not develop heterotopic ossification in either operation. In the 29 revision operations there was an increase in the Brooker classification in 16. The multivariate analysis of primary hip operations showed significance for sex (P 0.002), type of arthroplasty (P 0.02) and length of follow-up ($P < 0.001$).

Table 3. Brooker classification of heterotopic ossification in bilateral hip arthroplasties

	1 st hip		
2nd hip	None	I–IV	Total
None	14	9	23
I–IV	7	32	39
Total	21	41	62

Discussion

Taking into account the large variety of percentages of heterotopic ossifications reported in the literature, our finding of 57 percent does not seem extreme (Lazansky 1973, Rosendahl et al. 1977). Earlier studies have shown that there is no indication of a correlation between heterotopic ossifications and age, weight, postoperative complications and an ipsilateral operative history or a fracture (Lazansky 1973, DeLee et al. 1976, Ritter and Vaughan 1977, Hierton et al. 1983, Pedersen et al. 1989).

Our finding that ossification occurred less often in uncemented arthroplasties should be interpreted with caution; the number of uncemented cases was rather small. The data in the literature often point in a different direction (Hartwig et al. 1989, Kjaersgaard-Andersen et al. 1990). The risks are considerably higher in those patients who have developed heterotopic ossifications after their first hip operation; the contralateral hip developed heterotopic ossifications in 82 percent, confirming DeLee et al.'s (1976). The application of prophylaxis should be useful in males and in use who have developed heterotopic ossifications after a primary operation and who have to be operated on the contralateral or ipsilateral side. Possibly a hereditary aspect is also involved (Nollen 1986).

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