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Heterotopic ossification after total hip arthroplasty

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Abstract We studied 178 patients undergoing total hip arthroplasty (66 men and 112 women) retrospectively, with regard to the incidence and severity of heterotopic ossification and the significance of postoperative prophylaxis with non-steroid anti-inflammatory drugs. The overall incidence of heterotopic ossification was 32% 1 year after surgery. The factors increasing the incidence were male gender, previous arthroplasty of the contralateral hip joint, previous surgery on the hip, absence of preoperative treatment with non-steroidal anti-inflammatory drugs and an operating time of more than 100 min. The incidence of heterotopic ossification was lower in the patients of 0 blood group.

Résumé Nous avons étudié la fréquence et la sévérité d'ossification hétérotopique dans 178 cas d'arthroplastie totale de la hanche avec une prophylaxie postopératoire par AINS. Une année après la chirurgie la fréquence totale était de 32%. Les facteurs qui augmentent le risque étaient le sexe masculin, une arthroplastie de la hanche contrelaterale, des antécédents chirurgicaux sur hanche, l'absence de traitement préopératoire par AINS et une durée opératoire de plus de 100 min. La fréquence d'ossification hétérotopique était inférieure chez les patients du groupe sanguin 0.

Introduction

Heterotopic ossification (HO) is a significant complication of total hip arthroplasty (THA). An incidence, without prophylaxis, has been reported of between 8% and 90% [1, 13]. Two methods of treatment are commonly used, non-steroidal anti-inflammatory agents (NSAID) and irradiation [5]. The aim of this study was to record

the incidence and severity of HO after THA and to determine the relevance of risk factors.

Materials and methods

The notes of 178 patients (66 men and 112 women) who underwent THA in the Clinic of Traumatology and Orthopaedics, Tartu University, between 1995 and 1996 were reviewed retrospectively. The requirement for THA was degenerative arthritis in 160 cases, rheumatoid arthritis in nine cases and trauma of the hip in nine. All patients were treated prophylactically with NSAIDs up to 30 days postoperatively. All patients also received antithrombotic prophylaxis with 0.3 ml (2500 IU) fractionated heparine (Fraxiparine) daily. The prostheses used were all cemented; Lubinus IP in 120 cases, Lubinus SP II in 51 cases and the Link Dysplasia hip prosthesis in seven. In all cases the posterolateral approach was used.

The data collected included age, gender, diagnosis, surgery on the ipsi- and contralateral hip performed before or after THA, the operating time, the type of anaesthesia, blood loss and preoperative treatment with NSAIDs. The preoperative anteroposterior radiographs were reviewed, and those taken on the 1st postoperative day and at 3, 6, 9 and 12 months postoperatively, and were assessed according to the Brooker classification, in which HO is classified at stages I–IV, of which stages III and IV are clinically and functionally significant [4].

The analysis of preoperative radiographs included the assessment of osteophytes and the site of subchondral sclerosis. Dysplastic hip joints were included as a specific category. With regard to osteophyte formation patients were divided into three groups: (1) absence of osteophytes, (2) moderate osteophyte formation and (3) marked osteophyte formation with lateral subluxation of the femoral head. The patients were divided into two groups for the analysis of risk factors: group A – those who had any HO (Brooker's grade I–IV) – and group B – those without HO (Brooker's grade 0).

The statistical analysis of parametric data was performed by ANOVA analysis, and for the analysis of non-parametric data and ranker parametric data the chi-square test was used with $P < 0.05$ as the level of significance.

Results

The overall incidence of HO 1 year after THA was 32% (57 cases). In men the incidence was 50% (33 cases) and in women 21% (24 cases); and thus the relative risk of the development of HO in males was 2.3 times higher than that

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Table 1 Distribution of patients by the grade of HO

HO grade by Brooker	Female	Male
0	88	33
I	19	15
II	2	5
III	2	7
IV	1	6

in females ($P<0.001$). The distribution of patients according to the grade of HO is shown in Table 1. The incidence of significant ossification in men was 4.5 times higher than that in women ($P=0.026$). The average age of men without HO was 62 years and that of women was 63 years. These were lower than in patients with grade I–IV HO (average age in men 65 years and in women 66 years) but this difference was not statistically significant. The rank analysis of average age showed no significant difference (Table 2).

Table 2 Distribution of patients by rank analysis

Character	Rank	Group A (n)	Group B (n)
Age (years; $P>0.05$)	Under 50	1	11
	50–60	12	32
	60–70	32	52
	Over 70	12	26
Diagnosis ($P>0.05$)	Traumatic injury	5	4
	Coxarthrosis	50	110
	Rheumatoid arthritis	2	9
Type of acetabular subchondral sclerosis in ipsilateral joint ($P>0.05$)	Absence of sclerosis	0	3
	Apical	3	13
	Lateral	35	74
	Fibrous ankylosis	7	6
	Dysplastic joint	4	10
Type of acetabular subchondral sclerosis in contralateral joint ($P>0.05$)	Absence of sclerosis	10	22
	Apical	0	4
	Lateral	26	46
	Fibrous ankylosis	2	1
	Dysplastic joint	1	10
Osteophytes of ipsilateral joint ($P>0.05$)	Absence of osteophytes	5	19
	Moderate osteophytes	27	58
	Excessive osteophytes	16	29
Osteophytes of contralateral joint ($P>0.05$)	Absence of osteophytes	24	49
	Moderate osteophytes	13	27
	Excessive osteophytes	5	5
Volume of transfused blood (ml; $P>0.05$)	Up to 350	7	6
	350–750	8	23
	750–1100	25	50
	1100–1500	6	21
	More than 1500	10	19
Type of anesthesia ($P>0.05$)	Spinal	17	31
	General	39	89
Duration of operation (min; $P=0.016$)	Up to 80	10	14
	80–100	8	43
	100–120	22	29
	120–180	15	23
	More than 180	2	10
NSAIDs used for postoperative prophylaxis of HO ($P>0.05$)	Diclophenac sodium 75 mg×2	20	47
	Indomethacin 50 mg×2	10	27
	Acetylsalicylic acid 250 mg×1	9	22
	Acetylsalicylic acid 125 mg×1	46	92
Duration of postoperative prophylaxis (days; $P>0.05$)	Up to 5	2	7
	6–10	26	62
	11–15	25	40
	More than 15	4	12
Treatment protocol ($P>0.05$)	Monotherapy	30	54
	Polytherapy	27	67
AB0-system blood groups ($P=0.016$)	0	10	48
	A	26	37
	B	18	26
	AB	3	10

The distribution of patients according to the type of acetabular subchondral sclerosis and the extent of osteophyte formation was similar in groups A and B, as was the incidence of joint dysplasia. The difference of distribution of patients by diagnosis, amount of transfused blood and type of anaesthesia did not affect the incidence of HO (Table 2). The relationship between patients in groups A and B according to the length of the operation was statistically significant. The incidence of HO was increased if the length of the operation was more than 100 min. This occurred in 18 patients of 57 in group A and in 57 patients of 121 in group B. The risk of developing HO was thus increased by a factor of 1.9 ($P=0.041$).

Nine patients in group A and 22 patients in group B had undergone previous surgery to the ipsilateral hip, usually an intertrochanteric osteotomy, without an increased incidence of HO. However, there was a significant difference in the incidences when considering previous surgery other than THA to the contralateral hip. This occurred in ten patients of group A and nine patients of group B. The risk of the development of HO in these patients was increased by a factor of 2.3 ($P=0.042$). The risk of the development of HO was also increased in patients who had undergone contralateral THA. There were ten such patients in group A and five in group B, and the risk of the development of HO was increased in these patients by a factor of 4.9 ($P=0.003$). Contralateral THA, however, after ipsilateral THA did not increase the risk. There were ten such patients in group A and 12 in group B.

If NSAIDs were used preoperatively, the incidence of HO was reduced. They were used preoperatively in 29 patients of group A and 85 in group B. In those patients who did not receive preoperative NSAIDs the risk of developing HO was increased by a factor of 2.2 ($P=0.012$). The development of HO was not influenced by the type of NSAID, the duration of treatment or the treatment programme (monotherapy or polytherapy) which was used postoperatively for prophylaxis (Table 2). There was a statistically significant difference in the distribution of patients by blood group (Table 2); the incidence in patients with non-0 group was three times higher than those with the 0 group ($P=0.003$).

Discussion

We have found an increased incidence of HO in association with the following factors: male gender, THA of the contralateral hip, previous surgery to the hip, lack of preoperative treatment with NSAIDs and the length of operation of more than 100 min. We have also observed a lower incidence of HO in patients of the 0 blood group. Many authors have reported a higher incidence of HO in males [1, 2, 6, 7, 11, 15, 16], as was confirmed in this study. The influence of age on the development of HO is controversial. A higher incidence has been reported in elderly women [2], and other authors have reported no

correlation with age [15], as is suggested by our study. Group A patients were only a little older. There are reports of an increased incidence of HO in association with extensive osteophytosis and hypertrophic type of osteoarthritis [1, 2, 8]. This was not evident in our study, nor in the report by Pedersen et al. [15]. Many authors have shown that pre-existing HO after contralateral hip surgery is associated with an increased incidence [1, 7, 11, 12, 15, 18, 20]. DeLee et al. [6] report an incidence of 92% in patients who developed HO after contralateral THA. Grade IV HO occurred in seven cases in this study, of which four had developed grade II or grade III ossification 6 months after THA, and had developed grade IV ossification after contralateral THA. The presence of significant differences in distribution among the patients who had previously undergone surgery on the contralateral hip – and in fact there was no difference in distribution among the patients who had previously undergone surgery to the ipsilateral hip – may be related to the nature of the procedures. The contralateral operations were mainly arthroplasties (15 cases out of 19), whereas none of the previous ipsilateral procedures was a THA. A similar pattern of HO was demonstrated by Sodemann et al. [18], but not, however, by Vastel et al. [19].

Many reports have shown a causal relationship between tissue trauma and the formation of HO [10], probably related to local vascular disturbance and necrosis [3, 9, 16]. The effect of these factors is increased with a longer operating time, which has also been shown to be associated with a higher incidence of HO [17, 18]. There are, however, other reports showing no relationship between the incidence of HO and the length of the operation [14, 19].

The connection between the development of HO and the AB0-antigen system is interesting; there are no other reports concerning this relationship, and it does not seem possible to explain it.

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