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RADIOLOGICAL INCIDENCE OF ASYMPTOMATIC HETEROTOPIC OSSIFICATION AFTER HIP REPLACEMENT- THE POSSIBLE INFLUENCE OF FEMORAL OFFSET CHANGES ON HETEROTOPIC OSSIFICATIONS GRADE

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Abstract: *We report a clinical, longitudinal and analytical cohort study, ambispective nature, trying to highlight the relationship between different aspects of hip arthroplasty and heterotypic ossification's grade. We also tried to show the radiological asymptomatic incidence of heterotopic ossification on pelvis X-rays in patients with hip replacement. From a total of 1076 pelvis X-rays performed during the six months of study, a number of 289 patients had hip arthroplasty, the incidence of asymptomatic heterotypic ossification after hip arthroplasty and detected radiologically in varying degrees was 17%. Uncemented screwed cup type, bilateral arthroplasty, postoperative reduced mobility of the hip , X-rays performed at less than 3 years after operation and increased postoperative offset are all risk factors for high grade of heterotopic ossifications compared to the protective role of NSAIDs.*

Key words: *Heterotopic ossification, hip replacement, postoperative hip offset canges.*

1. Introduction

Heterotopic ossification have been described in the literature along the time, according to their etiological form as para osteo-arthropathy, myositis ossificans, periairticular newly formed bone, ectopic ossification, neurogenic osteoma and heterotopic calcifications. The term heterotopic ossification is ultimately the most widely used, accepted and preferred as one precise and descriptive [6].

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Heterotopic ossification was defined as the presence of lamellar bone in ex-trascheletal soft tissue structures where normally it does not exist. The main criteria for morphological diagnosis of heterotopic ossification is the presence of bone cells, collagen matrix, hydroxylapatite crystals and absence of cellular atypicality [2], [4].

An increased incidence of heterotopic ossification development was observed first after hip and knee replacement, but they can develop after shoulder or elbow arthroplasty. In patients with lower limb arthroplastys heterotopic ossification incidence varies between 5% -90% [1, 7]

In case of total hip arthroplasty the incidence varies from 0.6% to 90%, most of them are clinically asymptomatic, only 2%-7% of this patients develop symptomatic heterotopic ossifications that may limit mobility to radiological or clinical ankylosis of the hip, but less than 1% require operations to remove the ossification [5].

2. Patients and Methods

We have proposed a longitudinal analytical cohort study, ambispectiv nature, trying to highlight the incidence of radiological asymptomatic heterotopic ossification after hip arthroplasty in patients presented in our clinic with pain in the lumbar area or contralateral hip, or other than those caused by the presence of heterotopic ossification in artroplastied hip, which performed radiographies of the pelvis and hip.

The aim was to study the impact of different aspects regarding arthroplasty (acetabular component type/femoral component type, total/partial hip replacement, cemented/uncemented hip arthroplasty, NSAIDs profilaxys, effect of offset canges) on the development of ossification heterotopic grade.

Heterotopic ossification grade was classified according to Brooker classification [3].

Grade I - Islands of bone within the soft tissues around the hip joint.

Grade II - Bone spurs from the pelvis or proximal end of the femur (generally greater trochanter), leaving at least 1 cm between opposing bone surfaces

Grade III - Bone spurs reducing the space between opposing bone surfaces (hip and pelvis) to less than 1 cm

Grade IV – Apparent radiological bony ankylosis of the hip.

To more accurately offset measurements all radiographs were performed with the same roentgen device and automatically digitized.

Preoperative femoral offset was defined as the length of the distance from the center of rotation of the femoral head to a point intersecting the long axis of the femur at an angle of 90 degrees.

Postoperative offset was defined as the length of the distance from the center of rotation of the prostetic head to a point intersecting the long axis of the femur at an angle of 90 degrees.

For statistical processing of the data collected was used Epi Info software, version 3.4.3. 2007 - November. The confidence interval was determined with the CI set at 95%.

Statistical processing of quantitative values was preceded by calculating the arithmetic mean (M) and standard deviation (SD) which shows the degree of dispersion of the average value.

To further verify the research hypothesis,

the certainty of conclusions and to determine whether there are significant differences between the two groups (exposed or unexposed), we used $\chi 2$-test method. The calculation result was compared to a risk of 5% (probability 95%).

We chose a significance threshold = 0.05 and c2 with 1 degree of freedom, the Ca 2 = 3.84, so in this case the critical region was the interval (3.84, ¥).

We calculated $\chi 2$, yielding uncorrected value, and if it was greater than 3.84 was considered situation where the null hypothesis Ho was rejected with a lower risk of 5%.

Thus, during the six months of the study, there were carried out a total of 1076 pelvis X-rays, 428 men and 648 women. Out of radiographs made a 27% (289 patients) had hip arthroplasty, cemented or uncemented. Most patients had unilateral arthroplasty 208 patients (72%), while a number of 81 patients (28%) had bilateral hip arthroplasty. Only 49 of the 289 patients developed heterotopic ossification.

3. Results

The incidence of heterotopic ossification after hip arthroplasty and detected radiologically in varying degrees was 17% (49 patients) , 45% of subjects developed low-grade heterotopic ossifications (1 and 2) and 55 % of patients high grade ossifications (3 and 4) with a ratio between the two sexes of 41 % males and 59 % females. Although the male sex is described in the literature as a risk factor for the development of heterotopic ossification, our data are not statistically significant. $\chi 2=0.02$; RR=1.04; (0.6<RR<1.82).

The age of patients who developed heterotopic ossification after hip arthroplasty was between 57 and 91 years, mean age being 74,026 years, mode 77 years with a standard deviation of 9.57. The average age of men was 61.94 years and women 70.53 years, observing a difference of about 8.6 years.

The age distribution of the patients was relevant for heterotopic ossification development, showing a higher frequency in the group over 74 years, which can correlate the degree of activity and early active mobilization of the patients after surgery with heterotopic ossifications risk.

The frequency of bilateral hip replacement in our target group was lower than unilateral hip replacement: 22 patients with bilateral arthroplasty and 27 patients unilateral arthroplasty.

77.27 % of patients in the group with bilateral hip replacement had radiographic evidence of heterotopic ossification on the contralateral hip. The development of heterotopic ossification is quite varied, most patients 88.22% showing radiographic evidence of heterotopic ossification grade 1 and 3 and a small percentage 11.78 % had developed grade 2 and 4. The results of our study show that bilateral prosthesis is a risk factor, with a 5-fold higher probability of developing heterotopic ossifications in both hips, our results are statistically significant. $\chi 2 = 19.31$, RR = 5.22, (2.04 < RR < 13.2).

So far there are no studies linking the development of heterotopic ossification after hip replacement with the operated side. In our study group the incidence of heterotopic ossification was higher on the operated left hip 55.1 % compared to right hip 44.9%.

94 % of patients developed heterotopic ossification after uncemented total hip replacement, 4 % after cemented and hybrid total arthroplasty and only 2% of patients after partial arthroplasty.

Although most patients in the target group developed heterotopic ossification after uncemented arthroplasty, this seems to be a protective factor for high-grade heterotopic ossification (3 and 4) compared to the cemented ones, but statistically insignificant. $\chi 2 = 0.61$, RR = 0.59, (0.12 < RR < 2.98).

A correlation between the degree of development of heterotopic ossification and type of acetabular component used in uncemented total hip arthroplasty, shows that screwed cup type is a risk factor for a high degree of ossification (3 and 4), datas being statistically significant. Patients where screwed acetabular component was used, had a 7.53 times higher risk of developing high-grade heterotopic ossification, compared to those with presfit cup type. $\chi 2 = 12.14$, RR = 7.53, (1.15 < RR < 49.38).

Lateralized type of femoral component compared with the standard component could not be associated epidemiologically with an increased risk of developing high-grade heterotopic ossifications, the risk is non-existent, data are statistically insignificant. $\chi 2 = 0.02$, RR = 1.06, (0.49 < RR < 2.26).

A 1.36 times higher risk of developing high-grade heterotopic ossification in patients operated for secondary osteoarthritis, specifically for aseptic necrosis of the femoral head was observed. Primary osteoarthritis is a protective factor for the development of high grade heterotopic ossifications but statistically insignificant. $\chi 2 = 2.53$.

Reduced mobility of the hip at hospital discharge, increases 2 times the risk of developing high-grade heterotopic ossification compared with patients presenting at hospital discharge normal mobility of the hip. Our data are statistically significant. $\chi 2 = 7.93$, RR = 2.09 (1.21 < RR < 3.59).

Prevention of heterotopic ossification in the target group was performed for 32.65 % of the patients with 7.5 mg Meloxicam for 14 days 1x1/d, 24.5 % of patients not receiving any prophylactic agent and 42.85 % of patients could not receive prophylaxis. Comparing the total group of patients with the target group, it shows that prophylactic treatment with NSAIDs is a protective factor for risk of developing heterotopic ossification, the datas are statistically significant. $\chi 2 = 70.27$, RR = 0.15, (0.09 < RR < 0,24).

The average period from the operation to the radiologcal examination was 65.25 months with a total of 2023 months, a minimum of 11 months and maximum 240 months (standard deviation of 54,135 and modul of 96 months). We mention that in the study group, the 49 patients with heterotopic ossification, only 31 could prove that period. Taking a longer period of 3 years as a risk factor for high mature heterotopic ossification, data obtained demonstrated this hypothesis, being statistically significant. Patients with X-rays performed at less than 3 years after operation are exposed to a 3 times higher risk of radiographic high heterotopic ossification grade. $\chi 2 = 3.95$, RR = 3.03, (0.8 < RR < 11.27).

We hypothesized that an increased postoperative offset is a risk factor for a high degree of heterotopic ossification, our data demonstrating that there is an

epidemiological association in this case. Patients with an increased postoperative offset have a 2-fold higher risk of developing a high degree of ossification than those with reduced offset. $\chi 2 = 7.93$, RR = 2.09, (1.21 < RR < 3.59).

We tried to correlate the degree of heterotopic ossification with a difference between the preoperative and the postoperative offset values expressed in millimeters, resulting in a coefficient of 0.1 (r2 = 0.01) and a weak correlation between the two variables.

4. Conclusion

The incidence of heterotopic ossification after hip replacement and radiologically detected, in varying degrees was 17%, higher rate of heterotopic ossification was observed in age groups over 74 years.

77.27% of patients with bilateral arthroplasty had radiographic evidence of heterotopic ossification on the contralateral hip, grade 1 and 3 (88.22%) and a small percentage 11.78% had grade 2 and 4, bilateral hip replacement being a risk factor, with a 5-fold higher probability of developing heterotopic ossifications in both hips.

Uncemented cup, screwed type are risk factors for developing a high degree of heterotopic ossification (3 and 4) with a 7.53 times higher risk compared to those were presfit cup type was used.

A postoperative hospital discharge reduced mobility increase risk 2 times higher of developing high-grade heterotopic ossification, compared with patients presenting at hospital discharge normal mobility of the hip.

Prophylactic treatment with NSAIDs (Meloxicam 7.5 mg for 14 days is 1x1/d) is a protective factor for developing heterotopic ossification after hip replacement.

Patients with pelvis X-rays, performed at less than 3 years after operation, are exposed to a 3 times higher risk of radiographic high grade of heterotopic ossification (3 and 4), compared with those in whom radiography was performed before this period.

The patients with increased postoperative offset have a 2-fold higher risk of developing high degree of ossification, compared with those with decreased postoperative offset.

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