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Retrospective Cohort Study

Pre and post-operative risk factors for Periprosthetic Joint Infection in primary total hip arthroplasty: the experience of one year.

PJI in our department in 2016

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Abstract

BACKGROUND

Periprosthetic joint Infection (PJI) in primary total hip replacement (THR) is one of the most important threats in orthopedic Surgery, so one important surgeon's target is to avoid or early diagnose a PJI. Although the incidence of PJI is very low (0,69%) in our department, with an average f.u. of 595 days, this infection poses a serious threat due to the difficulties of treatment and the lower functional outcomes after healing ^[1].

AIM

We studied the incidence of PJI in all operations occurred in the year 2016 in our department trying to look for predictive signs of potential infection.

METHODS

We counted 583 THR for 578 patients and observed only 4 cases of infection (0,69%) with a mean f.u. of 596 days (min 30 max 1451). We reviewed all medical records to collect the data: duration and time of the surgery, presence, type and duration of the antibiotic therapy, preoperative diagnosis, blood values before and after surgery, transfusions, presence of preoperative drugs (in particularly anticoagulants and antiaggregants, corticosteroids and immunosuppressants), presence of some comorbidities (high BMI, blood hypertension, CODP, cardiac ischemia, diabetes, rheumatological conditions, previous local infections).

RESULTS

No preoperative, intra operative and postoperative analysis showed a higher incidence of PJI. We didn't find any class with evident major odds of PJI. In our study we did not find any border value to predict PJI and all the patients had similar values in both groups (non-PJI and PJI). Only some categories, such as female patients, have shown more frequency of PJI, but this difference related to gender it is not statistical significative.

CONCLUSION

We didn't find any category with a higher risk of PJI in THR probably due to the lack of few cases of infection.

Key Words: Primary total hip replacement; Periprosthetic joint infection; Pre operative risk factors; Post operative risk factors; Pre and post operative blood value; Total Hip Arthroplasty.

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Core Tip: In this article we studied the incidence of Periprosthetic joint Infection in all interventions occurred in the year 2016 at our department at IRCCS Istituto Ortopedico Rizzoli. We reviewed all operated patients trying to look for predictive signs of potential infection aiming at exploring methodological approaches that could better inform everyday orthopedic practice.

We reviewed duration and time of the surgery, presence, type and duration of the antibiotic therapy, preoperative diagnosis, some blood values before and after surgery, transfusions, the presence of preoperative drugs and the presence of some comorbidities.

INTRODUCTION

Periprosthetic joint Infection (PJI) in primary total hip replacement (THR) is one of the most important threats in Orthopedic Surgery. When it occurs, many types of treatment are proposed [2]-[6] and different studies have reported similar odds of healing [1]. In this article, we studied the incidence of PJI in all interventions occurred in the year 2016 at our department. We counted 583 primary THR in 578 patients. We observed only 4

cases of infection with a minimum of 20 days to a maximum of 390 days after the THR. We reviewed all operated patients trying to look for predictive signs of potential infection. We reviewed duration and time of the surgery, presence, type and duration of the antibiotic therapy, preoperative diagnosis, blood value before and after surgery, transfusions, presence of preoperative drugs (in particularly anticoagulants and antiaggregants, corticosteroids and immunosuppressants), presence of some comorbidities (high BMI, blood hypertension, CODP, cardiac ischemia, diabetes, rheumatological conditions, previous local infections). We tried to identify some values to predict or early diagnose PJI analyzing all data collected from surgeries occurred in one year.

MATERIALS AND METHODS

With the agreement of the ethic committee of the Rizzoli Institute, we reviewed all the patients that have undergone Total Hip Replacement (THR) in 2016.

Categorical data were analyzed with the use of Fisher test and Chi-square test and continuous data with t-test. Level of significance was set at 0.05.

There were 583 THR on 578 patients. Only 4 cases reported PJI (0,69%) and were re-operated. We reviewed all medical records to collect the data. All these patients were visited at the hospital and in all authorized external clinics with the presence of a Rizzoli's doctor for the follow-up. We had a mean f.u. of 595 days (min 30 max 1451).

There were 320 females 54,9% and 263 males 45,1%, the mean age was 62,2 years (min 17 max 88). The mean age for the 4 patients with infection was 62,8 age (min 51 max 69) ($P = 0.98$, t test) and they were 3 females and 1 male ($P = 0.63$, Fisher test).

Differences in frequencies of infection for different BMI groups were not statistically significant ($P = 0,455$; Chi square test).

All the patients received preoperative antibiotic therapy, 564 with Cefazolin 2 g (96,9%) and 18 with Clindamycin (3,1%), one case was lost. In the PJI group all the patients were treated with Cefazolin ($P = 1.00$, Fisher test). 21 patients underwent further antibiotic

treatment (see table 1) with different types of drugs and doses. 1 of those 21 patients have had a PJI.

In the PJI group (see table 1) 3 patients underwent THR for primary arthrosis and 1 for hip dysplasia ($P = 1.00$, Fisher test).

Considering the bearing: 526 were ceramic on ceramic (90,2%), 8 ceramic on polyethylene (1,4%), 49 metal on polyethylene (8,4%). In the PJI group, they were all in cer-cer ($P = 0,001$, Chi-square test). 570 stems were uncemented (98,4%) and only 9 were cemented (1,6%). All the PJI occurred in the prosthesis with uncemented stems. ($P = 1,000$, Fisher test).

Considering the use of drugs: 565 patients (97,4%) didn't use steroids and only 15 (2,6%) did it before operation. In the PJI group, only 1 patient used drugs before intervention ($P = 0.1$, Fisher test).

568 patients (97,8%) didn't use immunosuppressants and only 13 (2,2%) did it before and after the intervention. In the PJI group, nobody was using immunosuppressants ($P = 0.1$, Fisher test).

463 patients (79,8%) didn't use antiaggregants and 117 (20,2%) did it before intervention. In the PJI group, only one was using antiaggregants ($P = 1.000$, Fisher test)

511 patients (88,6%) didn't have local surgery before the operation and 66 did (11,4%). In the PJI group, none did ($P = 1.000$, Fisher test).

Considering the preoperative hemoglobin value, we founded that it was less than 12 g/dL in 25 cases (4,3%) and higher in 557 cases (95,7%). In the PJI group all the patients had a value superior than 12 g/dL.

We considered the incidence of PJI in relation to COPD and there were 504 cases (86,6%) without lung disease and 78 with COPD (13,4%). The PJI occurred in all patients without COPD ($P = 1.000$, Fisher test).

561 patients (96,4%) didn't have chronic renal insufficiency (CRI) and 21 had CRI (3,6%); for one patient the data is missing. In the PJI group, 3 patients suffered from CRI and one did not ($P = 0.137$, Fisher test).

Considering the incidence of PJI in relation to pre-existing heart ischemic conditions, 530 patients (91,1%) didn't have heart disease before and after the operation, 52 patients (8,9%) had different degree of ischemic condition preoperatively. For one patient the data is missing. Only one patient with this comorbidity have had PJI and the other 3 didn't have any heart disease ($P = 0.313$, Fisher test).

Considering the incidence of PJI in relation of Diabetes, there were 537 cases (92,4%) without diabetes and 44 with the disease (7,6%). The data is missing for 2 patients. We were not able to recognize the degree and the type of the disease. PJIs occurred in all patients without diabetes ($P = 1.000$, Fisher test).

Considering the incidence of PJI in relation to rheumatological conditions, there were 569 cases (97,9%) without and 12 with rheumatological disease (2,1%). The data is missing for 2 patients. PJI patients didn't suffer from/have any rheumatological condition ($P = 1.000$, Fisher test).

Considering the incidence of PJI in relation to previously local septic conditions: there were 575 cases (99%) without previously septic conditions and 6 with it (1%). The data is missing for 2 patients. PJI was present in all patients without previously septic conditions ($P = 1.000$, Fisher test).

Laboratory data are all summarized in table 1.

For the ESR value, the preoperatively mean was 11,1 mm (the data is missing in 2 cases); respectively 11,1 mm for all the cases without PJI and 11 mm for the cases with PJI.

For the CRP value, the preoperatively mean was 0,9 mg/dL (data is missing in 16 cases); respectively 0,9 mg/dL for all the cases without PJI and 0,5 mg/dL for the cases with PJI.

For the WBC count, the preoperatively mean was $7199,5 \cdot 10^6/L$ (the data is missing in 20 cases); respectively $7192,5 \cdot 10^6/L$ for all the cases without PJI and $8177,5 \cdot 10^6/L$ for the cases with PJI.

For the Hb value, the preoperatively mean was 13,9 g/dL (the data is missing in 16 cases); respectively 13,9 g/dL for all the cases without PJI and 14,6 g/dL for the cases with PJI.

We analyzed the same parameters in the postoperative period: the day after surgery, the last day of hospitalization and a random day between these days. We do not have these three parameters for all patients and many others had more than three values. In the last case we picked up the lowest data.

The analysis of the data showed that the average Hb value the day after the operation was 11,1 g/dL, respectively 11,1 g/dL for all the cases without PJI and 11.0 g/dL for the 4 cases with PJI (the data is missing for 2 patients). The average of WBC count was $9804,5 \cdot 10^6/L$, respectively $9821.5 \cdot 10^6/L$ for the cases without PJI and $7360.0 \cdot 10^6/L$ for the cases with PJI.

The analysis of the data showed that the average Hb value of the intermediate sample was 10,0 g/dL, respectively 10,0 g/dL for all the cases without PJI and 10.6 g/dL for the 4 cases with PJI (for 33 patients the data is missing). The intermediate average of WBC count was $8984.9 \cdot 10^6/L$, respectively $8997.6 \cdot 10^6/L$ for the cases without PJI and $7257.5 \cdot 10^6/L$ for the cases with PJI.

The samples of the last day of hospitalization showed that the average Hb value for all patients was 10,1 g/dL, respectively 10,1 g/dL for all the cases without PJI and 10,7 g/dL for the 4 cases with PJI. On the last day of hospitalization, the average of WBC count was $7759,1 \cdot 10^6/L$, respectively $7764,4 \cdot 10^6/L$ for the cases without PJI and $7764,4 \cdot 10^6/L$ for the cases with PJI (in 42 patients the data is missing). (See table 1)

Regarding blood transfusion, 450 patients (77,2%) didn't have any blood transfusion, 3 of whom are part of the PJI group, 133 (22,8%) had one or more homologous blood sack, only one have had PJI ($P = 1.000$, Fisher test).

The average time of operation was 01:17:42 (min 00:37:00 max 04:03:00), respectively 01:17:38 (min 00:37:00 max 04:03:00) for the patients without PJI and 01:26:45 (min 00:56:00 max 02:31:00) for the patients with PJI.

446 (76,5%) were operated between 07:00 and 12:00 and 137 (23,5%) between 12:00 to 19:00. All the PJI patients were operated from 07:00 to 12:00.

RESULTS

Infections are classified according to their temporal appearance ^[4], even though many systems proposed are not always accepted ^[8]. We defined acute infection when new symptoms last less than 4 wk, chronic when they last more than 4 wk. Many kinds of treatments have been proposed with different indications and results ^{[2]-[6]}. All surgeons agree with the difficulties of the different approaches to treat a PJI (surgery and drugs with multidisciplinary approaches) ^{[4]-[6], [9]}. For these reasons, we reviewed all the cases of THR treated in 2016 in our department of Orthopedic Surgery trying to identify preoperative and postoperative risk factors to predict a PJI.

All the cases were operated by no more than 10 different surgeons of our department in the same operating room with laminar airflow. All the cases were treated with the same kind of surgery: lateral approach with detachment of Minimus and Medius gluteus and reconstruction of hip capsule. All the cases had the drainage removed within 24 h after surgery. Standard procedures of antibiotic prophylaxis were followed: Cefazolin 2gr in most of the patients and Clindamycin 600mg in allergic patients.

Four patients had a PJI: two within 30 days, one 6 mo later and one 13 mo later. All patients were surgically treated with deep or superficial debridement first ^[2]. One of these patients underwent a two-stage revision after this surgical procedure.

Analyzing gender, we founded that PJI incidence is higher in females than men (see table 1), but data is not statistically significant as in many other studies ^[10].

Regarding age (see table 1), no differences were observed between the two groups, as reported also by other authors ^[11].

Analyzing antibiotic therapy (see table 1), all the patients with PJI were treated with single-dose Cefazolin 2gr before surgery. After surgery many patients had a postoperative antibiotic treatment (see table 1), one of them developed a PJI. Even in this case, we didn't find any difference between the two groups.

Concerning the indications that have led to the operation, there is no category showing a higher risk than another (see table 1).

Analyzing bearings and different types of prosthesis, no relevant data show a difference on the incidence of PJI (see table1).

Analyzing the use of drugs such as steroids, immunosuppressors and anticoagulant, PJI did not have a higher incidence in any kind of patients (see table 1) and this disagrees with other studies [12].

As for the Hb values and the WBC count, we didn't find any difference between the two groups of patients. We didn't analyze the CRP and ESR due to the lack of values for many patients.

In the analysis of blood transfusions in relation to PJI, 133 patients were transfused with one or more blood sacks, 450 didn't receive any transfusion. PJI occurred in 3 of the non-transfused patients and in one transfused patient (See table 1). The analysis of the blood transfusions shows a higher incidence of PJI in patients transfused but it is not statistically significant (see table 1), in disagreement with other studies [13]. Analyzing the time of surgery, we divided patients in two groups: 7.00 am to 12.00 and 12.00 to 19.00. All the PJI occurred in the patients of the first group (7.00-12.00). There were no statistically significant differences in any of those groups, in disagreement with other authors [12].

DISCUSSION

One of the most difficult and important surgeon's targets is to avoid or early diagnose a PJI. Although the incidence of PJI is very low (0,69%) in our department, with an average f.u. of 595 days, this infection poses a serious threat due to the difficulties of treatment and the lower functional outcomes after healing [1]. Analyzing our data, we didn't find any class with an evident major odd of PJI. In our study we didn't find any border value to predict PJI and all the patients had similar parameters in both groups (non-PJI and PJI patients), contrary to what other authors state [14]. Only for some categories, such as gender, we observed more frequency of PJI in female than in male,

but this difference is not statistically significant in our experience. Other authors report higher incidence in male^{[12], [15]}. We didn't find other studies with the control of blood values pre and postoperatively in relation to the likelihood of PJI. Due to the lack of a sufficient number of patients, especially in the PJI group, we cannot demonstrate a statistically significant difference between non-PJI patients and PJI ones. Maybe a PJI has a multifactorial etiology^[16] and our few cases of PJI cannot demonstrate a real higher incidence despite the data reporting in other studies^{[9], [14], [17], [18]}. Furthermore, we were unable to analyze other data like urinary screening^[19] that may also play a role in the prediction of a PJI, even though some authors express doubts about it^{[20], [21]}. Some studies^[21] underline the increasing baseline risk of PJI with the increasing number of comorbidities. Another limit is the inability to grade the severity of comorbidities. Many studies report different prognosis for different types and degrees of preexisting diseases^[22]. All these detailed analyses couldn't be carried out in our study and this could place a limit. PJI percentage is very low in our patients and all over the world its incidence is decreasing because of all the surgical and drug managements. Nonetheless, pre and postoperative THR surveillance needs to be more accurate in the future^[23].

CONCLUSION

From the experience of all operations for THR performed at our department in the year 2016 we didn't find any data that can help us avoid, predict or early diagnose a PJI. This disagrees with many other studies^{[14], [16]} and many accepted and undiscussed scientific convictions. Probably the low number of cases, especially in the PJI group (only 4 cases), do not allow us to reach the same results as other authors.

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