REVIEW OF KNEE TOTAL ARTHROPLASTY IN TWO STEPS: THE VALUE OF CULTURE OBTAINED THROUGH ARTHROSCOPIC BIOPSY

MARCOS DE CAMARGO LEONHARDT[1], CAIO OLIVEIRA D'ELIA[2], ALEXANDRE LEME GODOY DOS SANTOS[2], ANA LÚCIA LEI MUNHOZ DE LIMA[3], JOSÉ RICARDO PÉCORA[4], GILBERTO LUIS CAMANHO[5]

SUMMARY

Objective: The most commonly used treatment for deep infections in knee total arthroplasties has been the two-steps review. Even following the steps recommended for this kind of treatment, still doubts exist about the right period to perform the second step of the review without risks of placing a new implant in an infected area. Our paper was aimed to determine the value of culture obtained through arthroscopic biopsy, in order to establish the appropriate moment for performing the second review step, and also the adequate time of spacer maintenance. Materials and Methods: Twelve patients diagnosed with deep infection following primary knee total arthroplasty were submitted to the two-steps review protocol, and after six weeks of spacer placement and antibiotic therapy, the patient was submitted to arthroscopic biopsy of the infected knee through which samples were collected for culture in order to check if that was the appropriate moment to perform the second step of the review. Results: The results of cultures for all patients submitted to arthroscopic biopsy were negative, with all patients being submitted to the second review step. From cultures collected during the new prosthesis implant, eleven confirmed the inexistence of active infectious process at surgical site; one culture was positive, with Staphyloccocus aureus sensitive to oxacilin being isolated in this patient. Conclusion: Although the small number of cases, we concluded that the culture obtained through arthroscopic biopsy is valuable and showed that six weeks is the adequate time for maintaining the spacer.

Keywords: *Arthroplasty; Knee; Infection; Arthroscopy; Treatment.*

INTRODUCTION

Osteoarthrosis is the most prevalent joint disease in the elderly, occurring as a result of a degenerative process on joint cartilage.

Knee arthroplasty is a surgical technique employed in the treatment of osteoarthrosis at late stages, being increasingly used due to its good outcomes in pain relief and function reestablishment. Since the mid-19th Century, attempts of arthroplasty have been made, such as the resection performed by Fergusson in 1861 and the soft parts interposing recommended by Verneil in 1863. In the 1940's, surface replacement techniques were introduced and, with the development of an appropriate technology, triple-compartmental knee prosthesis as we currently known them have emerged, with the first being developed by Freeman, ultimately resulting in today's models [(1)].

As in every surgical procedure, knee total arthroplasty is subjected to complications, among which we can mention: thromboembolic phenomena, complications reaching femoropatellar joint, neurovascular injuries, periprosthetic fractures, implanted components loose, and infection, which is highly feared by orthopaedic surgeons.

Infections in knee total arthroplasties may be divided into superficial and deep. The incidence of deep infections in primary arthroplasties ranges from 0.5% to 5%[(2)]. Regarding infection treatment, a number of procedures exist, namely: antibiotic therapy, surgical cleaning with implant maintenance; 1-step review, consisting of implant removal, rigorous surgical cleaning and placement of a new prosthesis; 2-step review, in which implant is removed, followed by surgical cleaning and placement of a cement spacer with antibiotics, subsequently placing a new prosthesis in an extra surgical procedure; and, in unsuccessful cases, the so-called saving procedures are used, such as arthrodesis and amputation.

Today, the most commonly used treatment for deep infections has been the 2-step review, following a protocol proposed by Insall et al.[(3)] and Windsor et al.[(4)], which consists of femoral and tibial implant removal; rigorous débridement including synovectomy, all cement and unviable tissues removal, and; placement of a cement spacer with antibiotics, aiming to keep soft parts tension and a high level of local antibiotic release [(5)]. Then, a period of antibiotic therapy follows (initially endovenous, for two weeks), and supplement-

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Correspondences to: José Ricardo Pécora - Av. Pacaembú, 1003 - Pacaembú - SP - CEP: 01234-001 - E-mail: jpecora@uol.com.br

1 - Resident Doctor at Orthopaedics and Traumatology Institute, Hospital das Clínicas, Medical College, University of São Paulo (IOT-HC-FMUSP)
2 - Preceptor Doctor at Orthopaedics and Traumatology Institute, Hospital das Clínicas, Medical College, University of São Paulo (IOT-HC-FMUSP)
3- Head of the Hospital Infection Control Group, Orthopaedics and Traumatology Institute, Hospital das Clínicas, Medical College, University of São Paulo (IOT-HC-FMUSP)
4 - Head of Knee Group, Orthopaedics and Traumatology Institute, Hospital das Clínicas, Medical College, University of São Paulo (IOT-HC-FMUSP)
5 - Associate Professor, Medical College, University of São Paulo

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ed by oral antibiotics, totaling six weeks of therapy. After that period, the patient is clinically re-evaluated, laboratory tests are collected (hemogram with leukocytes count, hemosedimentation speed, reactive C protein), and joint puncture is performed for obtaining synovial fluid culture. When tests results are normal and the culture result is negative, the patient is submitted to a review, when the spacer is removed and a new prosthesis is inserted.

Even when the steps recommended by those authors are followed, nonetheless a question remains regarding the right period to perform the second step of the review, not incurring in the risk of placing a new implant in an area still potentially infected.

Our study is aimed to determine the usefulness of a culture obtained from arthroscopic biopsy versus a culture obtained from joint puncture, in order to determine the appropriate time to perform the second review step and also the appropriate time to maintain a spacer.

MATERIALS AND METHODS

Between the years of 2003 and 2004, twelve patients diagnosed with deep infection secondary to primary knee total arthroplasty were hospitalized at the Orthopaedics and Traumatology Institute of Hospital das Clínicas, Medical College, University of São Paulo (IOT/HC/FMUSP) and submitted to a protocol, as previously described, differing only for the fact that after six weeks of antibiotic therapy, the patient was submitted to arthroscopic biopsy of infected knee through which samples were collected for culture analysis in order to check if that moment was appropriate to perform the second review step.

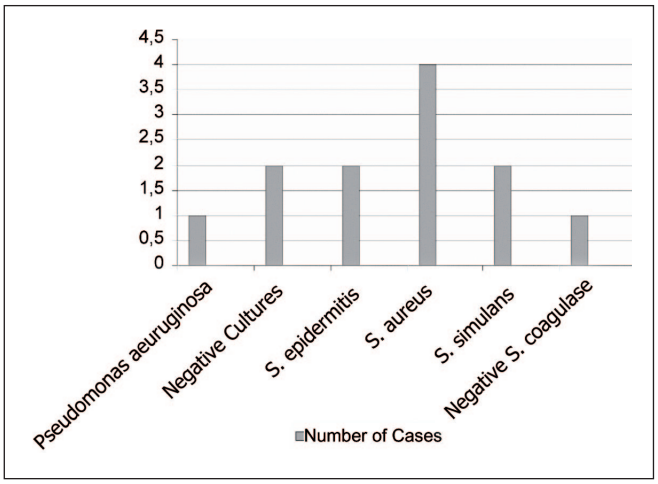
Of the twelve patients assessed in this study, nine were females and three were males, with mean age of 67 years old. The average follow-up time was 20 months.

Diagnostic of deep infection was provided upon clinical evaluation of the patient, as well as his/ her laboratory and X-ray tests results. Then, the patients were submitted to implant removal and joint débridement, with cement spacer impregnated with antibiotic agents being placed (1 gram of vancomycin was used for each orthopaedic cement pack). Antibiotic therapy started immediately after diagnosis, as per the protocol established by IOT's Committee for Hospital Infection Control, which consists of endovenous administration of vancomycin 500 mg at each 6 hours, combined with cephefime 2 g at each 12 hours. At the moment the patent infection etiologic agent and the antibiogram were determined, the antibiotic therapy was determined according to pathogen sensitiveness.

Six weeks after prosthesis removal and spacer placement, the patients were hospitalized again and submitted to arthroscopic biopsy for obtaining culture matter, with synovial fragments being collected. If the culture result was negative, review prosthesis was implanted; if the culture was positive, a new surgical cleaning and spacer replacement were performed again, with new culture matter being collected in order to compare the results to the culture previously obtained through arthroscopic biopsy.

RESULTS

Results of baseline cultures, that is, those obtained at the first review step, showed a prevalence of infection caused by *Staphyloccocus aureus* and *Staphyloccocus epidermidis* (50%), followed by other less common agents, highlighting two patients in whom baseline culture results were negative (Graph 1).



Graph 1 - *Prevalence of most common etiologic agents.*

Result	Number of Patients
No re-surgeries	10
Deep infection	1
Superficial infection	1

Note: Deep infection by S. aureus
(same agent of baseline culture)
Superficial infection by S. epidermidis
(different agent from baseline culture)

Table 1 - *Culture results.*

Results of cultures in all patients submitted to arthroscopic biopsy were negative, with all of them being submitted to the second review step. From the cultures collected during new prosthesis implant, eleven confirmed inexistence of overt infectious process at surgical site, and one culture was positive, with oxacillin-sensitive *Staphyloccocus aureus* being isolated in this patient (Table 1).

DISCUSSION

Treating infections of knee total arthroplasties remains as a great challenge for orthopaedic surgeons, besides being highly costly, estimated in approximately US$ 50,000/ patient in the United States[6].

The major difficulty in treating infections in knee total arthroplasties is due to the formation of a biofilm on implant's surface, which is composed by bacteria, glycocalix and débris, creating a favorable environment for bacterial proliferation, while resistant to antibiotics and to host's defenses [7].

Among the several treatments proposed for these conditions, the 2-step review is the most advocated one because it has been showing better results. In a literature review presented in 1994 at the Annual Congress of the Society

of Musculoskeletal Infections, 308 cases were treated only with antibiotic therapy, reaching an infection control rate of 27%; a combination of surgical cleaning and the previous procedure with implant maintenance achieved an infection control rate of 29% in 337 cases; the one-step review achieved infection control rate of 77% in 24 cases; the two-step review with the insertion of a spacer impregnated with antibiotics achieved an infection control rate of 94% in 64 cases[8]. Windsor et al.[4] confirmed this protocol's success after performing a two-step review in 38 knees presenting with deep infection, in a follow-up time of 4 years. Only one case presented with infection caused by the same agent and three cases presented with infection caused by agents different from baseline, thus determining a deep infection eradication rate of 97.4% (37 patients) and an infection recurrence rate of 10.5% (4 patients).

Culture	Positive	Negative
Arthroscopic Biopsy	0	12
2nd Step Review	1	11

Note : isolated – Staphyloccocus aureus

Table 2 - *Results after review.*

Other studies stressed the same data as those by Rosenberg et al.[9] which reported an infection recurrence rate of three patients out of 24 submitted to two-step review, which corresponds to 12.5%[9], similar results to those by Hanssen et al.[10] which had an infection recurrence rate of 11%.

Regarding those patients' evolution after review, ten had a satisfactory evolution, with no further signs of infection and a good functional recovery. One patient, whose arthroscopic biopsy and review cultures were negative, presented with a new deep infection after five months of evolution, being submitted again to treatment protocol, with prosthesis removal and spacer with antibiotics placement (*Staphyloccocus aureus* isolated, the same agent of baseline infection), currently asymptomatic, waiting for the second review step. The patient whose culture was positive to *S. aureus* at the second review step was submitted to six months of antibiotic therapy, presenting with no infection signs and a good functional outcome, not requiring further surgical procedures. Another patient, also with previous negative cultures, presented with superficial infection signs at the first postoperative week, being then submitted to surgical cleaning with implant maintenance, complemented by six months of antibiotic therapy, currently showing no signs of overt infection and a good functional status (*Staphyloccocus epidermidis*, isolated, a different etiologic agent from baseline, which was Pseudomonas aeruginosa) (Table 2).

Following the protocol proposed at the beginning of this article, we achieved an initial infection eradication rate in 11 patients (91.66%). A single patient presented with deep infection after the review, in whom an etiologic agent identical to the one at baseline was isolated, showing a little lower rate than the one described by Windsor. Regarding the superficial and deep infection recurrence rate, we could note two cases (16.66%), a result slightly above those reported in literature.

In the present study, we concluded that six weeks is an adequate time to keep the spacer in a patient, after which period all cultures of arthroscopic biopsies were negative. After the initial period of two weeks when the spacer with antibiotics has a high local bactericidal power, it starts to progressive lose its ability to locally mitigate infection and assumes an unique function of occupying spaces, avoiding soft parts retraction. And around the 6th - 8th week, there isn't local antibiotic release any longer, thus justifying its removal and replacement by a new spacer or by a review prosthesis [5].

The negative result of cultures obtained whether by puncture, biopsy, or in open surgical procedures, despite of the existence of infection, is something relatively common and described in literature, being a major confusing factor concerning the exact moment of indicating a review prosthesis implantation [11].

In 91.66% of the cases, we noticed that the result of the culture collected by arthroscopic biopsy matched the result of cultures obtained during the second review step, showing that, in these cases, the arthroscopic biopsy correctly indicated the right time to perform the second review step.

CONCLUSION

In spite of the small number of cases, we concluded that the culture obtained by arthroscopic biopsy is useful and showed that six weeks is an appropriate time for spacer maintenance.

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