Role of Spacers in Treatment of Periprosthetic Infection: A Systematic Review and Meta-analysis

Essay

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بسم الله الرحمن الرحيم

﴿وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ وَكَانَ فَضْلُ اللَّهِ عَلَيْكَ عَظِيمًا﴾

صدق الله العظيم

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List of Abbreviations

Abb.	Full term
ALBCs	Antibiotic loaded bone cement
ALC	Antibiotic loaded cement
Copal –P G+V	Copal-p garamycin+ vancomycin
Copal-P G+C	Copal-p garamycin+ clindamycin
CRP	C-reactive protein
CT	Computed topography
ESR	Erythrocyte sedimentation rate
FDG-PET	Fluorodeoxy glucose- Positron emission tomography
HIV	Human immunosuppressive virus
MBC	Minimum bactericidal concentration
MIC	Minimum inhibitory concentration
MRSA	Methicillin-resistant Staphylococcus aureus
PALACOS RG	PALACOS-R garamycin
PMMA	Polymethyl methacrylate
PMN	Poly moroho nuclear leucocytes.
PROSTALAC	Prosthesis of antibiotic-loaded acrylic cement
S.aureus	Staphylococcus aureus
S.epidermis	Staphylococcus epidermidis
S.viridans	Streptococci. Viridans
Simplex PT	Simplex-p tobramycin
THA	Total hip arthroplasty
TKA	Total knee arthroplasty
TTO	Tibial Tubercle Osteotomy

ABSTRACT

Aim of the work: This study aimed to conduct a systematic review of the role of spacers in treatment of periprosthetic infection.

Methods: A retrospective analysis was performed using a prospectively collected data of periprosthetic infection in English language published from 1990 to 2016.656 patients with periprosthetic infection from January 2000 to April 2014 were included in this study. Patients with a clinical, laboratory and radiographic evidence of established periprosthetic joint infection were included in the review, patients with inadequate follow up period or died during follow up were excluded from all of the papers and consequently from the review. Surgical debridement, Antibiotic impregnated spacers and primary wound closure was done to all patients and then all patients were closely followed up postoperatively for a period not less than 24 months to assess healing and detect any recurrence of infection or other complications. Static spacers were used in 142 patients and articulating spacers were used in 514 patients.

Results: A total number of 656 cases were studied in this review, with age ranging from 54-72 years. The average follow-up period in these studies was ranging from 2 years to 7 years. 9 patients didn't complete the follow-up period, 5 patients were lost to follow-up and 4 patients died of unrelated cases. The remaining 647 patients continued to follow-up. Infection was eradicated in 558 patients (86.2%) by two stage revision. Eradication of infection was not achieved by two stage exchange in the remaining 89 patients (13.8%).

Conclusion: There is no significant difference between static and articulating spacers in infection control rate, articulating spacers has the upper hand due to better ROM, less complications and less extensive approaches.

Keywords: Arhroplasty, Periprosthetic infection, Spacers.

INTRODUCTION

Implantation of joint prostheses is becoming increasingly common, especially for the hip and knee. It provides significant reduction in discomfort and immeasurable improvement in mobility for patients. It has been estimated that around 800,000 hip and knee prosthesis implantation procedures are performed only in the USA every year, counting both primary and revision surgery. From reviewing the worldwide literature, it can be seen that from 1 to 5% of these prostheses become infected, and it is important to bear in mind that as the number of operations for implanting these prostheses increases, so does too the number of cases that evolve with infection. Although infection occurs less frequently than mechanical loosening does, infection is considered to be the most devastating of prosthesis-related complications, leading to prolonged hospitalization, repeated surgical intervention, and even definitive loss of the implant, with shortening of the affected limb and significant permanent deformity.[1,2,3]

The main risk factors to periprosthetic joint infections (PJIs) are advanced age, malnutrition, obesity, diabetes mellitus, HIV infection at an advanced stage, presence of distant infectious foci, and antecedents of arthroscopy or infection in previous arthroplasty. Joint prostheses can become infected through three different routes: direct implantation,

hematogenic infection, and reactivation of latent infection [1,2]. Gram-positive bacteria predominate in cases of PJI, mainly Staphylococcus aureus and Staphylococcus epidermidis. [4,5]

PJIs present characteristic signs that can be divided into acute and chronic manifestations. The main imaging method used in diagnosing joint prosthesis infections is X-ray. Computed tomography (CT) scan may assist in distinguishing between septic and aseptic loosening. Three-phase bone scintigraphy using technetium has high sensitivity, but low specificity. Positron emission tomography using fluorodeoxyglucose (FDG-PET) presents very divergent results in the literature. Definitive diagnosis of infection should be made by isolating the microorganism through cultures on material obtained from joint fluid puncturing, surgical wound secretions, or surgical debridement procedures.[6,7,8,9]

Although the use of prophylactic antibiotics and other strategies such as the use of laminar air flow in the operating room have helped reduce the incidence of PJI, they have not eliminated the risk. It has been projected that the incidence of PJI may be increasing. Because of the economic and psychologic burden of this complication, strategies to minimize or prevent PJI may be needed. Therefore, continuous effort and research are necessary to help reduce its incidence to a minimum.[10,11]

The current standard of care for late chronic infection is considered to be two-stage revision arthroplasty including removal of the prosthesis and cement, thorough débridement, placement of an antibiotic-impregnated cement spacer, a course of intravenous antibiotics, and a delayed second-stage revision arthroplasty.[12]

Static antibiotic-impregnated poly methyl methacrylate cement spacers have traditionally been used; increasingly, however, mobile or articulating spacers are being utilized. Advocates of mobile spacers have cited potential advantages, including more effective maintenance of the joint space, allowing for limited weight bearing and facilitating joint motion; possible reduction in bone loss; and local delivery of antibiotics.[13]

During the past two decades, antibiotic-loaded hip and knee spacers have become a popular method of managing such infections with reported success rates of > 90%. Complications are rather infrequent and consist mostly of mechanical (spacer fracture, dislocation, bone fracture) and those related to the antibiotic impregnation of bone cement (reinfection/infection persistence, systemic side effects such as renal or hepatic failure, allergic reactions). [14,15]

Aim of the work

The aim of this study is to conduct a systematic review of the role of spacers in treatment of periprosthetic infection.

Chapter One:

PERIPROSTHETIC JOINT INFECTION

Introduction:

Periprosthetic joint infection after total joint arthroplasty is a catastrophic complication which presents an enormous challenge to the orthopaedic community. Numerous challenges may be associated with PJI that can include the need for multiple operations, a long period of disability for the patient. In the elderly, PJI may result in a higher incidence of mortality. Although the use of prophylactic antibiotics and other strategies such as the use of laminar airflow in the operating room have helped reduce the incidence of PJI, they have not eliminated the risk. It has been projected that the incidence of PJI may be increasing. Because of the economic and psychological burden of this complication, strategies to minimize or prevent PJI may be needed.[16]

Classification:

Periprosthetic joint infection of hip and knee could be classified as[17]:

i- Type 1: positive intraoperative culture which defined as >2 positive intraoperative cultures.

ii- Type 2: early postoperative infection that appear within the first 30 days after surgery. The etiological agents are considered to be of nosocomial origin, since the contamination probably occurred during the act of prosthesis implantation and generally consist of bacteria from the normal microbacteria of the skin, such as S. epidermidis.[18]

iii- Type 3: acute hematogenic infections from hematogenous seeding of site of previously well-functioning prosthesis.

iv- Type 4: late chronic infection. Chronic indolent clinical course; infection present for 30 days [19].

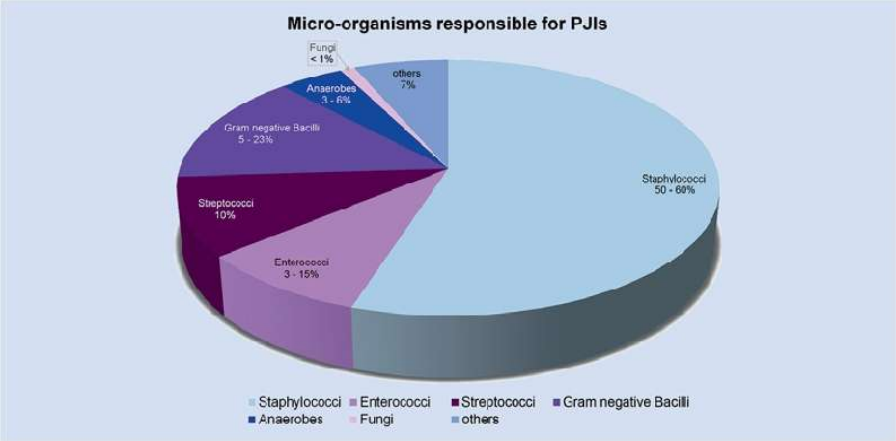

Figure (1): Micro-organisms responsible for PJI

Diagnosis of PJI:

Criteria for diagnosis of PJI:

1- There is a sinus tract communicating with the prosthesis; or

2- A pathogen is isolated by culture from at least two separate tissue or fluid samples obtained from the affected prosthetic joint; or

3- Four of the following six criteria exist:

a. Elevated serum erythrocyte sedimentation rate (ESR>30 mm/h) and serum C-reactive protein (CRP>10mg/L) concentration.

b. Elevated synovial leukocyte count(WBC>3000 cells/ml)

c. Elevated synovial neutrophil percentage (PMN>80%).

d. Presence of purulence in the affected joint.

e. Isolation of a microorganism in one culture of periprosthetic tissue or fluid.

f. Greater than five neutrophils per high-power field in five high-power fields observed from histologic analysis of periprosthetic tissue at 9400 magnification.

PJI may be present if fewer than four of these criteria are met [20,21].