

## 2.1. TREATMENT: IRRIGATION AND DEBRIDEMENT

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**QUESTION 1:** How many irrigation and debridements (I&Ds) of an infected oncologic endoprosthesis are reasonable before consideration should be given to resection arthroplasty?

**RECOMMENDATION:** Decision to repeat irrigation and debridement and retention of an infected endoprosthesis (DAIR) should be made based on comorbidities of the host, virulence of the organism, complexity of the reconstruction and status of the soft tissues. We believe DAIR performed more than two or three times is unlikely to be successful.

**LEVEL OF EVIDENCE:** Consensus

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

### RATIONALE

The utilization of musculoskeletal tumor surgery has increased through the years thanks to the increase in therapeutic alternatives. One of these alternatives is resection of the tumor and implantation of a tumor endoprosthesis. These surgeries are complex, long and aggressive for the surrounding tissues. There are many possible complications following these procedures, of which periprosthetic joint infection is one of the most feared.

Infection rates in primary musculoskeletal surgeries have been reported from over 5% to over 15% [1,2]. Several risk factors have been identified, including malignancy of the primary tumor, surgical time, previous surgery, the use of chemotherapy and/or radiotherapy, tumor affectation of the skin and skin necrosis [3]. Identification of these factors is crucial because the onset of infection increases the rate of morbidity, mortality, the number of subsequent procedures and amputation [4].

The optimal treatment for oncologic endoprosthesis infection is currently a matter of debate. Several authors have investigated the role of DAIR, including the number of attempts that should be made before undergoing more aggressive surgery.

Dhanoa et al. [5] reviewed 105 patients with oncologic endoprosthesis infections. In their experience, I&D could be performed when the case met the following criteria: acute onset infection (14–28 days), clear-cut diagnosis based on histopathology and microbiology, stable implant and susceptibility of the microorganism to an effective orally-available antimicrobial agent. With this method they reported a 42.8% rate of infection eradication. In those patients in which debridement failed, a two-stage revision surgery would be performed without trying a second debridement. A similar therapeutic strategy was demonstrated by Kapoor et al. [6]. Patients would undergo as much as one surgical debridement before switching to two-stage revision if the debridement had failed. Both authors agree that late prosthetic infections are associated with poor results when treated by lavage, debridement or prolonged antibiotics administration. Therefore, removal of the infected prosthesis either as one- or two-stage procedure, resection arthroplasty or an amputation becomes necessary. Funovics et al. [2] reported a 50% eradication rate after surgical debridement. In

their experience, when debridement alone failed, one-stage revision surgery was performed.

Not all authors view debridement as an inferior method in treating endoprosthetic infection, however. Allison et al. [7] treated 329 musculoskeletal tumors and reported a 13.9% overall infection. Although they did not clarify how patients were selected for each treatment method, they reported a 70% healing rate after single-stage irrigation and debridement with exchange of the modular component and varying degrees of suppressive antibiotics. That healing rate was superior to the one they achieved after revision, antibiotic spacer placement and subsequent reimplantation (62%). On the other hand, Jeys et al. [8] claim that I&D alone has a poor outcome in endoprosthetic infection. After treating 136 patients, they reported only a 6% eradication rate after debridement only. They also state that healing after resection arthroplasty was achieved in 50% of cases, but they do not specify the reason why patients were treated one way or another.

Not all authors believe that surgical debridement should be a step in management of oncologic endoprosthesis infection. Holtzer et al. [9] treated 18 patients with endoprosthetic infection. They considered debridement a poor option and thus performed one-stage revision surgeries in all cases. Infection was eliminated in 14/18 patients (77.78%). In a similar manner, Harges et al. [10] treated 30 patients and developed a therapeutic algorithm for oncologic endoprosthesis infection that did not include I&D. They believed that one-stage revision surgery should be performed whenever possible. If one-stage revision is not possible, then two-stage revision should be performed. If two-stage revision is not possible, then arthrodesis should be performed. Finally, if arthrodesis is not possible, then amputation should be performed. Out of 30 patients, 19 (63.33%) were cured with a one- or two-stage revision. Of the remaining 11, amputation was performed in 6/30 (20%).

In conclusion, it is unclear if I&D serves as a good alternative for the treatment of an infected endoprosthesis. In addition, the number of attempts that should be made towards I&D before revision surgery or amputation is uncertain. It seems that for acute infections with an antibiotic-sensitive microorganism, debridement

may be a good first step in the treatment algorithm, but failure rates are high, and no more than two surgical debridements should be attempted before considering a revision surgery in order to achieve infection eradication.

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## QUESTION 2: How should acute reinfection of an oncologic endoprosthesis be treated?

**RECOMMENDATION:** Acute reinfections in patients with oncologic endoprostheses demand treatment by surgical methods because the long-term administration of antibiotics alone is not sufficient. The most appropriate treatment modality for acute re-infection is debridement, antibiotics and implant retention (DAIR) with exchange of components.

**LEVEL OF EVIDENCE:** Consensus

**DELEGATE VOTE:** Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

## RATIONALE

Oncology patients represent a high-risk subset of the population. The implantation of endoprostheses in this cohort of patients leads to an increased risk of infection due to their immunocompromised state, previous radiotherapy, poor soft tissues, poor nutritional status or significant comorbidities [1].

Many options have been proposed to prevent infections of an endoprosthesis. However, there are no current appropriate guidelines or recommendations to guide optimal management of an acute endoprosthetic reinfection. There is a paucity of literature regarding the results of these different procedures, though it has been shown that irrigation, debridement and prolonged antibiotic administration have the poorest results in treating late prosthetic infections [2]. Therefore, removal of the infected prosthesis either as one- or two-stage procedure or an amputation may be necessary [2].

Allison et al. reviewed 329 patients who had undergone arthroplasty surgery for definitive oncological treatment [3]. Of those that became infected and were treated with irrigation and debridement without component exchange, there was a 42% success rate at eradicating infection. With single stage exchange, this increased to 70%. Two-stage revision led to a 62% success rate. Conversely, previous literature has associated two-stage revisions as having a higher success rate when compared with one-stage [4-6]. As one would expect, amputation has been shown to carry the highest rate of infection eradication. The risk of amputation due to an infected endoprosthesis has been reported to be between 23.5% and 87% [4,7,8].

Periprosthetic infection can lead to a poor functional outcome as well as an increased morbidity and mortality. Management of infections after reconstructive surgery for bone tumors is a challenge, requiring careful planning, consideration of the patient's prognosis and a potentially aggressive surgical approach.

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