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QUESTION 7: What is the optimal duration of antibiotic treatment following spine infection in patients within whom hardware is retained? Is the antibiotic treatment different for those with spine infection without hardware?

RECOMMENDATION: There are no case-control studies allowing for an evidence-based recommendation on the optimal length of antibiotic treatment following spine infections in the presence of retained hardware. The most commonly implemented antibiotic regime is three months. However, duration of treatment was highly variable among all studies. Patients with non-instrumented surgeries did well with a shorter course of antibiotics.

LEVEL OF EVIDENCE: Consensus

DELEGATE VOTE: Agree: 93%, Disagree: 7%, Abstain: 0% (Super Majority, Strong Consensus)

RATIONALE

After searching PubMed, CINAHL and Embase (with MeSH terms "surgical site infection," "spine" and "antibiotic") and reviewing 381 abstracts, a final 14 studies included treatment of spinal surgical site infection (SSI) with retained implants (including data on antibiotic treatment regimens) [1–14]. There were no studies analyzing or comparing different antibiotic regimes. Most of these studies were retrospective in nature, however one study was a prospective observational study. There were no studies comparing different antibiotic treatment regimens. There was also a wide variation in the duration of treatment among the studies ranging from 42 to 597 days in 1 study, and ranging between 89 and 1,673 days in a separate study [9,11]. These variations were usually related to treatment failure or poor control of the infection. Of 14 studies, 7 reported mean antibiotic treatments of 12 weeks or 3 months [3–6,10,13,14]. All but three studies reported on time of intravenous (IV) and oral antibiotics. The most reported mean time for IV antibiotic administration was an average of four to eight weeks in eight studies. One study reported on 81 SSIs, of which 39 were treated with suppressive antimicrobial therapy [2]. At final two-year follow-up, seven patients were still under antibiotic treatment.

Three studies reported data on patients with early and late infection [2,5,10]. Also, there were significant variations regarding the onset of infection. Some studies only reported ranges and gave no mean or median values. Of the nine studies with available mean data, mean time to onset of infection was 103.2 days. Removing an outlier with 778 days for late infection, mean time to onset of infection was 18.98 days (range of mean values was 2.9 to 54)

There was only one retrospective study analyzing the antibiotic treatment regimen in a series of 74 patients, all with implant removal (IR) [15]. Patients had a median duration of IV antibiotics of four weeks and an additional five weeks of oral antibiotic treatment. There were no comparative studies regarding different antibiotic regimen.

Regarding IR, there were two very different settings in which implants had to be removed. Of 729 SSI cases recorded in the 15 studies, implants were removed in 195 patients (26.74%). In 114 cases (15.6%), IR was performed as part of SSI treatment during the first debridement procedure. In the remaining 81 cases (11.11%), IR was performed because of treatment failure after several debridement procedures. The fact that IR can be split into two differentiated groups makes it more difficult to compare treatment regimes. Usually, when IR was performed as the initial treatment, antibiotic regimens tended to be shorter [15]. On the other hand, when IR was performed because of treatment failure, antibiotic treatments were longer.

With regards to non-instrumented spine surgeries, Maruo et al. compared 59 non-instrumented infections with 166 instrumented cases [8]. They reported longer antibiotic treatment for instrumented cases (mean 40 days IV vs. 25.4 in non-instrumented and mean 255 days oral vs. 42). Only 10% of the non-instrumented cases needed more than one debridement compared to 28% for instrumented spine procedures. Of the non-instrumented spine surgeries, 20% were successfully treated without surgical debridement compared to only 6% of instrumented spine procedures.

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QUESTION 8: What tests should be used to monitor response to antibiotic treatment in patients with spine infection?

RECOMMENDATION: Serum C-reactive protein (CRP) levels are closely related to clinical response in spine infections and are therefore the preferred marker in monitoring the therapeutic course.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 93%, Disagree: 7%, Abstain: 0% (Super Majority, Strong Consensus)

RATIONALE

In two large retrospective studies including 363 patients, criteria for discontinuation of treatment included CRP normalization in addition to resolution of clinical symptoms [1,2]. A weekly decrease of CRP by 50% has been suggested as a therapeutic response in the retrospective study population [3].

Lack of normalization of serum CRP levels is a predictor of treatment failure and warrants additional evaluation, as demonstrated both by a retrospective cohort including 79 patients and a prospective study including 21 patients followed for postsurgical wound infections of the spine [4–5].

Moreover, in a retrospective analysis of 61 patients treated for bacterial spondylodiscitis, the only predictor for de-escalating intravenous therapy to highly bioavailable oral agents was a CRP decrease by week 2 of therapy [6].

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QUESTION 9: Which is the best alternative antimicrobial therapy for fluoroquinolone-resistant gram-negative acute post-surgical infection in spinal surgery?

RECOMMENDATION: The choice of antimicrobial therapy should be based on the pathogen and the susceptibility profile.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 93%, Disagree: 7%, Abstain: 0% (Super Majority, Strong Consensus)