Does timing to operative debridement affect infectious complications in open long-bone fractures? A systematic review
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CRD summary
This review found no association between delayed debridement and infection in the treatment of open long-bone fractures, regardless of whether all infections, only deep infections or only more severe fractures were considered. The review was generally well conducted and included a large number of studies and fractures. Its conclusions are likely to be reliable.

Authors' objectives
To investigate the association between infection and time to operative debridement, in the treatment of open long-bone fractures.

Searching
MEDLINE, EMBASE and The Cochrane library were searched to December 2010, for publications in English. Some search terms were reported. Bibliographies of identified articles were searched, as were those of articles known to the reviewers.

Study selection
To be eligible for inclusion, studies had to include at least 26 patients, with open long-bone fractures, and all patients had to be over 18 years old. Studies had to report evidence of fracture union and of completeness of wound healing. They had to report infections as an outcome and give the time to debridement. Studies were excluded if they did not distinguish between open and closed fractures, if they included gunshot wounds, and if they did not involve long bones.

Included studies were prospective or retrospective. Eleven included only lower-extremity fractures, seven of which included only tibial fractures and one included only femoral fractures. Five studies included both lower and upper-extremity fractures. The threshold for distinguishing between early or late debridement, where reported, varied from five to 12 hours. Infection rates varied from 4% to 63%.

Three reviewers selected the studies, with disagreements resolved by consensus.

Assessment of study quality
Quality was assessed according to the criteria developed by Zaza, et al. This covered the descriptions of population, intervention, sampling, measurement, and data analysis, and the interpretation of results. Three reviewers assessed quality, with disagreements resolved by consensus.

Data extraction
Data were extracted from each study on the number of infections in early and late debridement groups. Data were collected on the type of infection (all infections or deep infections), severity of fracture (according to Gustilo-Anderson classification), and fracture location (upper extremity, lower extremity or tibial). Two reviewers independently extracted these data.

Methods of synthesis
Odds ratios, with 95% confidence intervals, for the incidence of infection, comparing early and late debridement, were calculated. These were combined in a meta-analysis, using a DerSimonian and Laird random-effects approach. Sensitivity analyses were performed to assess the effects of: including only deep infections; the level of evidence of the studies; the severity of the injury; the fracture location; and the time threshold for early to late debridement.

Publication bias was assessed using funnel plots and the Egger test.

Results of the review
Sixteen studies were included (six were prospective and 10 were retrospective), with a total of 3,539 fractures. The results of the quality assessment were reported.

There was no evidence of a difference in infections when comparing late with early debridement (OR 0.91, 95% CI 0.70 to 1.18; 13 studies). There was no evidence of a difference for any of the time cut-offs for early versus late debridement. There was no evidence of a difference when including only deep infections (OR 1.07, 95% CI 0.74 to 1.54; nine studies). The results were similar for prospective and retrospective studies, and for all fracture locations.

When including only Gustilo-Anderson type I or II fractures, infections were less common with late debridement, but the result was not statistically significant (OR 0.58, 95% CI 0.25 to 1.33; four studies). There was no difference in infection rates for Gustilo-Anderson type III fractures (OR 0.84, 95% CI 0.31 to 2.31; five studies).

There was no evidence of publication bias, and heterogeneity was not reported.

**Authors' conclusions**

There was no evidence of an association between delayed debridement and infection in the treatment of open long-bone fractures, regardless of whether all infections, only deep infections or only more severe fractures were considered.

**CRD commentary**

This was generally a well-conducted and well-reported review. Appropriate databases were searched, but only for publications in English and not for unpublished studies, so relevant studies may have been missed. Action was taken to minimise reviewer error and bias throughout the review. A quality assessment was performed. A meta-analysis was performed, with several appropriate sensitivity analyses. The authors recognised that most of the studies were retrospective, making them more prone to bias than prospective studies, but the sensitivity analyses found no evidence of a difference in results between prospective and retrospective studies.

The large number of included studies and the careful analysis suggest that the results are likely to be reliable.

**Implications of the review for practice and research**

**Practice**: The authors concluded that the six-hour rule for debridement was not supported, but choosing to delay treatment was not recommended.

**Research**: The authors suggested that further studies on the appropriate timing of debridement of open fractures, and assessing the relevant risk factors, were required.

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