Preoperative hair removal: a systematic literature review
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Authors' objectives
To assess pre-operative hair removal and the subsequent incidence of surgical site infections (SSIs) in order to determine future policy respecting whether, how and when to perform pre-operative hair removal.

Searching
The following sources were searched: the Cochrane Controlled Trials Register (Issue 3, 1999); MEDLINE from 1966 to 1999; EMBASE from 1974 to 1999, CINAHL from 1982 to 1999; and the DARE, NHS EED and HTA databases. The search terms included 'surgical site infection/s' or 'surgical wound infection' and 'depilation' or 'hair' or 'shaving'. The reference lists of relevant articles published in the 1990s were also searched manually. References cited in the Centers for Disease Control and Prevention guideline on pre-operative hair removal were also retrieved.

Study selection
Study designs of evaluations included in the review
Both randomised and observational studies were eligible for inclusion in the review.

Specific interventions included in the review
Interventions (safety razor, depilatory cream, or electric or manual clippers) to remove body hair from on and around the site of proposed surgical incision, in order to prevent subsequent surgical wound infection, were included in the review. These included: shaving compared with no hair removal; shaving compared with clipping; shaving compared with depilation; timing of pre-operative hair removal with razor or clippers; and wet and dry shaving. All endoscopic, transurethral, catheterisation and interventional radiology procedures were excluded, together with studies concerning pilonidal cysts.

Participants included in the review
The participants were patients undergoing conventional surgical procedures in operating rooms.

Outcomes assessed in the review
The outcome assessed in the review was the percentage of wounds with infection.

How were decisions on the relevance of primary studies made?
Two team members independently read and evaluated all the titles and summaries retrieved electronically for inclusion in the review. Potentially relevant references identified from the manual searches were also retrieved, and these articles were also read independently for inclusion. All ten members of the team assessed all of the included articles and decided in plenary the relevance of each article (based on study design only).

Assessment of study quality
Each article was assessed and graded based upon modified recommendations provided by the U.S. Agency for Healthcare Research and Quality (see Other Publications of Related Interest). This grades documentation into 7 levels based on study design: Ia for meta-analyses; Ib for randomised controlled trials; IIA for controlled studies; IIb for quasi-experimental studies; III for non-experimental observational studies; IV for documentation from expert groups or review articles; and 0 for irrelevant studies. No detailed validity assessment was performed. All ten members of the team assessed all of the included articles and decided in plenary the quality of each article.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.
Data were extracted on study scope, authors' conclusions and outcomes (percentage of wounds with infection). Data on study scope included the type and time of the intervention and comparison(s), the outcomes measured, the participants and/or number of wounds included, and the documentation level (i.e. study design).

Methods of synthesis
How were the studies combined?
No statistical pooling of the data was performed. The studies were combined narratively within the following groups: shaving compared with no hair removal; shaving compared with clipping; shaving compared with depilation; timing of pre-operative hair removal with razor or clippers; and wet and dry shaving.

How were differences between studies investigated?
No formal test of heterogeneity was undertaken.

Results of the review
Twenty-one clinical studies (minimum of 11,196 participants) were included in the review. There were 9 randomised trials, one prospective non-randomised study, 9 prospective observational studies (including 2 studies with historical controls), one observational study with sequential switchover, and one observational study designed only to find general trends.

Shaving compared with no hair removal (9 studies): the data gave some support to the claim that not shaving patients undergoing surgical procedures was preferable to pre-operative shaving. The disadvantages of shaving compared with no hair removal was demonstrated in 3 observational studies (P<0.05) and as tendencies in one of 2 randomised trials. Shaving compared with clipping (6 studies): 2 better RCTs (out of 3) and 2 observational studies showed that clipping was associated with fewer SSIs compared with shaving (2 RCTs: P=0.024 and P<0.01).

Shaving compared with depilation (6 studies): the data suggested that depilation may be preferable to shaving in the removal of hair pre-operatively. Two RCTs failed to demonstrate significant differences between shaving and depilation, although both studies had more wound infections in the shaved groups. Two observational studies demonstrated that depilation was better than shaving in preventing SSIs. Timing of pre-operative hair removal with razor or clippers (4 studies): there was moderate evidence to recommend the removal of hair as close as possible to the time of the surgical procedure. One RCT favoured this for clipping, while one observational study found significantly in favour of it for shaving (P<0.01). Another study also indicated a similar association, but the results were not significant.

Wet and dry shaving: one study demonstrated a non significant doubling of the infection rates after wet shaving when compared with two other interventions. However, the study was only designed to give indications, not firm answers.

Authors' conclusions
It is not strongly documented whether hair removal results in a higher frequency of SSIs than no hair removal. Several randomised and observational studies with controls showed that either wet or dry shaving the evening before the surgical procedure results in a significantly higher infection rate than depilation or electric clipping. There were no convincing differences in the incidence of post-operative SSIs between electric clipping, depilation or no hair removal. Hair removal with clippers should be performed as close as possible to the time of the procedure.

CRD commentary
The review question and the study selection criteria were stated clearly. The literature search seemed reasonably comprehensive, although it was unclear whether any language restrictions were applied. There are some discrepancies within the text, e.g. in the review abstract the authors refer to 20 clinical studies included, although 21 are actually listed in the tabulated data. In fact, there is no clear statement of the final number of included studies anywhere in the text of the review.
The authors provided appropriate information on the study selection and validation processes, but not on the data extraction. The decision not to undertake an overall statistical meta-analysis seems appropriate given the heterogeneity of the studies and their data, although some statistical pooling of the studies may have been attempted within the different subgroups described. The tabulated data are rather unclear; it may have been better to have presented the study design, the number of participants and/or wounds or procedures being included, and the type of intervention being assessed separately, rather than to include them all under 'study scope' and then to repeat information respecting study design and participants again under 'comments'. Other discrepancies include the summary observation in the 'Results' section that two observational studies found significantly in favour of shaving immediately prior to the operation, when in fact only one of the findings was statistically significant.

The authors' conclusions seem mostly appropriate, although the comment that 'several randomised and observational studies with controls show that either wet or dry shaving the evening before the surgical procedure results in a significantly higher infection rate than depilation or electric clipping' is rather stronger than the actual evidence presented in the 'Results' section, wherein no study demonstrated findings in favour of depilation that were statistically significant, although significant differences that favoured electrical clipping to shaving were demonstrated.

Implications of the review for practice and research
Practice: The authors state that either wet or dry shaving the evening before the surgical procedure results in a significantly higher infection rate than depilation or electric clipping. The authors further state that there are no convincing differences in the incidence of post-operative SSIs between electric clipping, depilation or no hair removal. In addition, hair removal with clippers should be performed as close as possible to the time of the procedure.

Research: The authors state that future research should be directed toward randomised trials of clipping or depilation versus no hair removal. Observational studies could also be used, contingent upon proper accounting for confounding factors, e.g. age, gender, co-morbidity, antibiotic prophylaxis and type of surgery. An observational design would, however, require proper data analysis, primarily with logistic regression or proportional hazard (i.e. Cox) regression.

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**Record Status**
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.