Surgical hand scrubs in relation to microbial counts: systematic literature review

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CRD summary
The authors concluded that an alcohol rub is more effective in reducing microbial counts than a traditional surgical hand scrub with chlorhexidine gluconate (CHG), and that there is no evidence that a 2-minute CHG hand scrub is more effective than a 3-minute scrub. The use of inappropriate statistical methods means that the authors' conclusions are not reliable.

Authors' objectives
To evaluate the effectiveness of surgical hand scrubs in reducing bacterial growth on the hands of operating room staff.

Searching
PubMed, EMBASE, CINAHL, Current Contents, Clinical Evidence, the Cochrane Library and Dissertation Abstracts were searched from 1990 to December 2004; the search terms were reported. The reference lists of retrieved articles and relevant journals were also searched. The search was restricted to English language articles.

Study selection
Studies of surgical hand scrubs were eligible if they compared different durations of scrubbing, different antiseptic agents and/or the use or non-use of brushes. The interventions in the included studies comprised alcohol hand rub compared with 6-minute surgical scrub using a brush and 4% chlorhexidine gluconate (CHG); and a 2-minute versus a 3-minute surgical scrub using a brush and 4% CHG. The participants in eligible studies were operating theatre staff who scrub for invasive procedures (e.g. surgeons, anaesthetists, scrub nurses and operating department practitioners). The primary outcome in eligible studies was the microbial count found on participants' hands, measured using the 'glove juice' technique. Studies using other techniques were excluded. The outcomes in the included studies were measured at various time points: immediately after scrubbing (all studies), at 2 and 3 hours (one study), and on two further occasions over the following 2 weeks (one study). Study designs eligible for inclusion were randomised controlled trials (RCTs) and quasi-experimental trials.

The three authors independently selected studies for inclusion, with any disagreements resolved by discussion.

Assessment of study quality
The authors used the following list of criteria (which they apparently compiled themselves) to evaluate study validity: random assignment, allocation concealment, clearly described inclusion and exclusion criteria, sample size calculation, description of outcome measures, and baseline comparability.

Two authors jointly applied the quality criteria, with any disagreements resolved by discussion with the third author and an independent person.

Data extraction
The mean difference between the groups in post-intervention microbial counts was calculated for each study, along with a 95% confidence interval (CI).

One author extracted the data, which the other two authors checked.

Methods of synthesis
The data were meta-analysed to obtain weighted mean differences (WMDs) with 95% CIs using a fixed-effect model (in the absence of significant statistical heterogeneity). Statistical heterogeneity was evaluated using a $\chi^2$ test (level of significance $p<0.10$).
**Results of the review**

Three studies (n=82) were included: one parallel design RCT (n=27), one crossover RCT (n=25) and one quasi-randomised parallel study (n=30).

The methodological quality of the studies was rated as adequate, although none clearly described allocation concealment or utilised blinding. The drop-out rate was low and baseline values were similar in the parallel-group studies, but not measured in the crossover study.

Alcohol hand-rub versus 6 minute CHG scrub (two parallel-group RCTs, n=57): there was a statistically significant difference between the groups in microbial count (measured in \( \log_{10} \) colony forming units), favouring the alcohol rub group (WMD -0.83, 95% CI: 0.99, 0.27, p=0.0006). No statistically significant heterogeneity was found.

Two-minute versus 3-minute CHG scrub (one crossover RCT, n=25): there was no statistically significant difference between the groups in microbial count (WMD 0.29, 95% CI: -0.13, 0.71, p=0.18).

**Authors’ conclusions**

An alcohol rub is more effective in reducing microbial counts than traditional surgical hand scrub using 4% CHG. There is no evidence that a 2-minute CHG hand scrub is more effective than a 3-minute scrub.

**CRD commentary**

The objective and inclusion criteria of the review were clear and relevant sources were searched, though the restriction to English language articles may have meant that some studies were missed. Appropriate quality criteria were applied and the study selection, quality assessment and data extraction processes were undertaken by multiple reviewers independently, thereby reducing the risk of reviewer error and bias. However, the methods used for the meta-analysis were not appropriate. The data from repeated measures from two studies were pooled with the result that each participant contributed more than once to the data, which artificially inflates the statistical power of the meta-analysis. Inappropriate statistical methods were also applied to the crossover data, which were analysed as if they were parallel data. Although the authors highlighted potential confounding factors that might create bias and in most respects the review was well-conducted, the use of inappropriate statistical methods means that their conclusions are not reliable.

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

Practice: The authors stated that their results validate brushless scrubbing with an alcohol-based agent for surgical hand antisepsis.

Research: The authors stated that well-designed RCTs are needed to evaluate the optimum duration of surgical scrubbing methods, the best antiseptic product to use, and whether a brush is beneficial. Baseline, immediate, persistent and residual microbial counts should be measured.

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