



Surgical hand rubbing compared with surgical hand scrubbing: comparison of efficacy and costs

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Summary The aim of this study was to compare the efficacy of surgical hand rubbing (SHR) with the efficacy of surgical hand scrubbing (SHS), and to determine the costs of both techniques for surgical hand disinfection. A review of studies reported in the literature that compared the efficacy of SHS and SHR was performed using MEDLINE. The costs of SHR and SHS were estimated based on standard hospital costs. The literature showed that SHR had immediate efficacy that was similar to that of SHS, but SHR had a more lasting effect. SHR reduced costs by 67%. In conclusion, SHR is a cost-effective alternative to SHS.

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Introduction

The aim of surgical hand disinfection is the elimination of transient and the reduction of resident micro-organisms. This process is required for all surgical procedures and for some invasive medical procedures to prevent serious infections associated with mortality, morbidity and high costs.^{1–5}

Hand rubbing with alcohol-based hand rub (AHR) is recommended instead of handwashing with un-medicated soap or antiseptic soap⁶ based on several studies that have shown better compliance^{7–9} and dermal tolerance.^{10,11} For surgical hand disinfection, the use of antiseptic soap is the traditional technique. European recommendations for surgical hand disinfection conclude that 'there is no criterion to decide when surgical hand scrubbing is preferred as opposed to surgical hand rubbing'.¹² According to the French Society for Hospital Hygiene, 'surgical hand rubbing is preferable to surgical hand scrubbing'.¹³ In France, agents that have passed prEN 12054 (suspension tests) and prEN 12791 (in vivo test) are available for use.¹⁴

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However, studies have reported that lack of confidence about the efficacy of AHR is the main reason given for not adhering to hand rubbing.^{15,16} Confirmation of the efficacy of SHR compared with SHS may convince healthcare workers (HCWs) to use this technique. Cost could be another reason for non-use of AHR.

The aim of this study was to compare the efficacy of SHR and SHS, and to determine the costs of both techniques for surgical hand disinfection.

Methods

A review of published studies comparing the efficacy of surgical hand scrubbing (SHS) and surgical hand rubbing (SHR) was performed using PubMed and MEDLINE databases from 1992 to March 2005 by combining the following keywords: surgical hand disinfection and alcohol hand rubs, alcohol-based hand rub, or n-propanol or isopropanol, surgical hand rub, surgical hand scrub and surgical hand rubbing. The original articles compared the efficacy of SHS and SHR in practical conditions. Articles written in French or English were included, and articles regarding antiseptic disinfection were excluded.

The standard costs of surgical hand disinfection (SHR and SHS) were based on the hospital cost. The different products used for both techniques were established according to the recommendations for surgical hand disinfection of the French Society for Hospital Hygiene and the European recommendations as follows.¹²

SHS requires soaping hands and forearms for 1 min each side with antiseptic solution, brushing nails for 1 min, and rinsing with bacteriologically controlled water, sometimes using a filter depending on water quality, before soaping hands and forearms once again, then rinsing and drying them with sheets of sterile paper towel.¹⁷ Ten millilitres of 4% chlorhexidine gluconate (Hibiscrub, Regent Medical, Levallois Perret, France) or 6 mL of 4% povidone iodine (Betadine, Viatrix, Merignac, France) is required. Antiseptic soap is used in the authors' setting.

Before beginning SHR, if the hands are visibly soiled, a simple wash with an unmedicated soap (4 mL) is performed, nails are cleaned with a brush, following by rinsing with standard water and careful wiping with non-sterile paper. The user is then requested to perform SHR with an AHR that cover hands and forearms as well as the elbows (4.5 mL for each side) and to continue rubbing until the hands are dry. The procedure is repeated using a second AHR application excluding the elbows (4.5 mL)

(a total of 13.5 mL of AHR). The AHRs used were Sterillium Gel (ethanol) (Rivadis Laboratories, Thouard, France) and Manurub (phenoxyethanol, n-propanol, ethanol) (Anios Laboratories, Lille, France). AHR is used in the authors' setting.

The costs (tax exempt) of the various products were supplied by the economic department and the pharmacy of Rouen University Hospital, and the costs of sterile paper towels and water filters were also identified (Table I). Use of water filters depends on water quality, so the cost was calculated with or without filters. Simple washing before SHR is only necessary if hands are visibly soiled, so the cost of SHR was calculated with and without inclusion of the cost of simple handwashing.

Results

Six efficacy studies met the selection criteria. The criteria of efficacy used were bactericidal activity (quantitative colony counts with glove juice technique and fingertip impression) or the rate of surgical site infection (SSI) in accordance with the Centers for Disease Control and Prevention definitions for nosocomial infections.^{18,19} The results of these studies are given in Table II.^{20–26} Efficacy appears to be equivalent or superior for SHR.

The costs of SHS and SHR are given for each product in Table III. The global cost of each technique, taking into account whether or not simple washing was performed before SHR and the use or non-use of a water filter with SHS, is shown in Figure 1. The cost of a filter for each SHS

Table I Cost of the different products required for surgical hand scrubbing and surgical hand rubbing (in Euros, 2005)

Products	Cost (€, tax exempt)
Antiseptic soap	
Hibiscrub (500 mL)	3.40
Betadine scrub (500 mL)	3.15
Nail brush	0.28
Sterile towel (two sheets)	0.70
Antibacterial water filters	
Pall Aquasafe '7 jours'	27.00
Phagofiltre C500	54.00
Unmedicated soap	
Aniosoft (1 L)	3.20
Non-sterile towel (98 sheets)	0.52
Alcohol-based hand rubs	
Manurub (500 mL)	2.28
Sterillium Gel (475 mL)	2.90

Table II Methods and results of the six published studies on the efficacy of surgical hand scrubbing (SHS) and surgical hand rubbing (SHR)

Reference	Methods	SHS	SHR	Criteria of efficacy	Time of measure	Results
Hobson <i>et al.</i> ²⁰	90 healthy volunteers	Betadine or Hibiclens	Trispetin (total time of 3 min)	Bactericidal activity ^a	1 min, 3 h and 6 h after operation	SHR > SHS to 1 min, 3 h and 6 h
Larson <i>et al.</i> ²¹	20 healthy volunteers	Chlorhexidine 4%	61% ethyl alcohol, 1% chlorhexidine, 3*2 mL	Bactericidal activity ^a	Pre and post operative	SHR > SHS
Bryce <i>et al.</i> ²²	Observation	Betadine or Hibiscrub	Manorapid, 3*5 mL; total time of 3 min (prior to the first procedure: wash with unmedicated soap)	Bactericidal activity ^a	15 pre and post operative	Operation < 2 h: no difference, Operation > 3 h: SHR > SHS
Pietsch ²³	Randomized crossover trial; 60 volunteers	Hibiscrub	Sterillum	Bactericidal activity ^a	Before and after treatment and after operation	SHR > SHS after treatment and after intervention
Mulberry <i>et al.</i> ²⁵	Randomized trial; 137 volunteers	Chlorhexidine 4%	1% chlorhexidine/ alcohol, 3*2 mL	Bactericidal activity ^a	1 min, 3 h and 6 h after operation	SHR > SHS to 1 min, 3 h and 6 h
Marchetti <i>et al.</i> ²⁴	20 healthy volunteers	Derman plus, Hibiscrub, Betadine	Softa Man, Sterillum, (total time of 3 min)	Bactericidal activity ^a	Immediately and 3 h after operation	Sterillum > n-propanol 60%, antiseptic soap = n-propanol 60%
Parienti <i>et al.</i> ²⁶	Randomized crossover trial; 2252 SHR and 2135 SHS	Betadine or Hibiscrub	Sterillum, twice 5 mL (twice 2 min 30) (prior to the first procedure: wash with unmedicated soap)	Rate of surgical site infections		2.44% (SHR) vs 2.48% (SHS) ($P < 0.01$; test of equivalence)

Betadine: povidone iodine 4%.

Derman Plus: 1% triclosan.

Hibiscrub, Hibiclens: chlorhexidine 4%.

Triseptin: 70% ethanol.

Manorapid: 54% ethanol, 10% 1-propanol.

Softa Man: 45% ethanol, 18% 1-propanol.

Sterillum: 45% 2-propanol, 30% 1-propanol, 0.2% mecetronium etilsulphate.

^a Bactericidal activity: quantitative colony counts with fingertip impression cultures and/or glove juice culture.¹⁸

Table III Cost of surgical hand scrubbing and surgical hand rubbing (in Euros, tax exempt)

Products	Surgical hand rubbing (€, tax free)		Surgical hand scrubbing (€, tax exempt)			
Unmedicated soap	0.013	0.013				
Non-sterile towel	0.011	0.011				
Alcohol-based hand rubs or antiseptic soap	Manurub	Sterilium Gel	Hibiscrub		Betadine	
	0.062	0.082	0.067		0.038	
Sterile towel			0.700		0.700	
Nail brush	0.280	0.280	0.280		0.280	
Water filter			Single use	Multipurpose	Single use	Multipurpose
			0.077	0.027	0.077	0.027
Total (€)	0.366	0.386	1.124	1.074	1.095	1.045

procedure was assessed and the result of the sensitivity analysis with a single-use filter is shown in Figure 2. The cost only varied slightly beyond 35 SHS procedures per day.

Discussion

This literature review indicated that SHR has an immediate bactericidal efficacy, similar to that of SHS, but with a more lasting effect. SHR was equivalent to SHS in preventing SSI after clean and clean-contaminated surgery. SHR was found to reduce the cost of hand disinfection by 67%. The sensitivity analysis showed that the cost of SHS is only slightly modified beyond 35 SHS procedures per day and per water tap. The cost of SHR can also be lower for short and repeated operations, where washing with unmedicated soap is not always necessary, or for invasive

procedures requiring surgical hand disinfection if hands are not visibly soiled.^{12,13} The savings generated using SHR are not restricted to the cost of the procedure. The cost of HCWs' time was not estimated but SHR saves 1–2 min (SHS takes 5 min whereas SHR generally takes 3 min).¹³ Similarly, the use of SHR for surgical hand disinfection avoids the need for bacteriological control of water or use of a filter. The cost savings generated by reducing water samples can therefore add to the overall economy.

In conclusion, the use of SHR should be considered by HCWs as an attractive alternative to SHS, with a similar efficacy and a lower cost. SHR is also a cost-effective alternative to SHS outside the operating theatre (i.e. intensive care units, interventional radiology) where water is not systematically bacteriologically controlled and could be a source of nosocomial infection.^{27,28} This approach could contribute to improved quality of

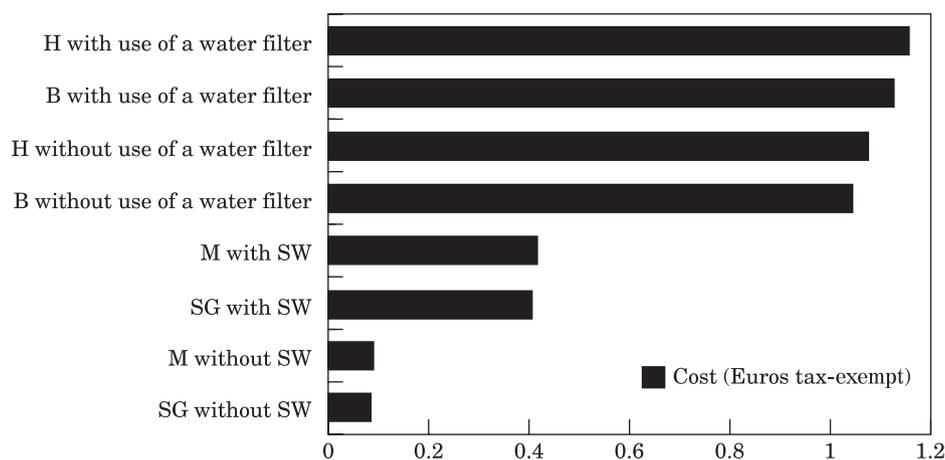


Figure 1 Global cost of a surgical disinfection according to the techniques, products and washing with unmedicated soap and use of a water filter. SG, Sterilium Gel; SW, simple washing with unmedicated soap; M, Manurub; B, Betadine; H, Hibitane.

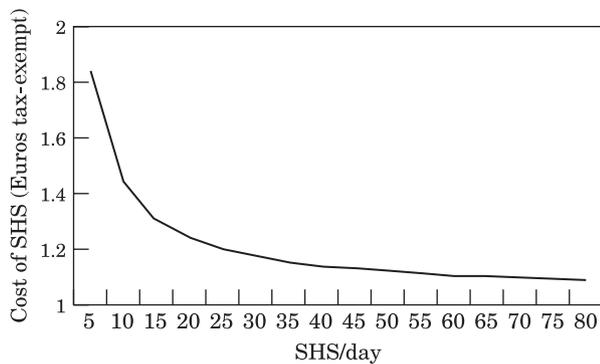


Figure 2 Sensitivity analysis of surgical hand scrubbing (SHS) according to the number of disinfections per day with a single-use water filter.

surgical hand decontamination outside the operating theatre.

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