IS A DROP OF WATER WORTH SAVING??

Anantha Krishna M. A[1], *K. Lakshman*[2], *Ajitha Pillai*[3]

[1]*Registrar, Department of General Surgery, Sagar Hospital, Bangalore.*
[2]*Consultant Surgeon, Sagar Hospital, Bangalore.*
[3]*Consultant Microbiologist, Sagar Hospital, Bangalore.*

ABSTRACT: BACKGROUND: In this era of progressive draught, a conscious effort needs to be made to conserve water. Routine scrubbing with soap and water prior to surgery is a standard for surgical disinfection. Recently waterless dry scrubbing technique using nonaqueous disinfectant, otherwise called Hand rub technique has been proposed to be an equally effective alternative. This study has attempted to find out if any differences exist between the two methods of surgical scrubbing with reference to surface flora on the surgeons hand and the rates of wound infection for the patient.

METHODS: A prospective randomised study was done using a non-inferiority hypothesis comparing the efficacy of the two scrub methods. Post procedure glove Juice was cultured to look for bacterial growth. Patients were also followed up to look for wound infection.

RESULTS: A total of 150 cases were included in the study conducted from October 2013 to February 2014. Ten cases were excluded as they satisfied the exclusion criteria. Among the cases studied, culture was positive in 1 of the 71 cases in the waterless dry scrub arm. No cultures were positive in the routine scrub arm. There were 3 cases of wound infection in the hand rub group and 5 cases of wound infection in the routine scrub group.

CONCLUSION: No statistically significant differences exist between routine scrub and the hand rub technique with regard to flora on surgeons hand and the wound infection rates. Hence hand rub can be recommended as an effective alternative to routine scrub and conserve water.

KEYWORDS: Water Conservation, Surgical Scrub, Surgical Site Infection, Wet Scrub, Dry Scrub, Hand Rub.

HOW TO CITE THIS ARTICLE: Anantha Krishna M. A, K. Lakshman, Ajitha Pillai. "Is a Drop of Water Worth Saving??" Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 94, November 23; Page: 15913-15917, DOI: 10.14260/jemds/2015/2316.

INTRODUCTION: Our world continues to move towards an era of severe water crisis and draught with the United Nations Environment Programme (UNEP) statistics placing India among countries utilising more than 40% of available water resources by 2025.[1] Surgical practice makes abundant use of this scarce resource and an average volume surgical centre uses up to 31,000 litres of water per month.[2] As responsible inhabitants, the surgical fraternity owes it to society to conserve as much of this scarce resource as it can.

Surgical site infections continue to be one of the leading causes of post-operative morbidity, prolonged post-operative stay and consequently contribute a major role in raising the costs.[3] Despite all the currently available sterilization techniques, disinfection of the hands of the operating team continues to be important to reduce surgical site infections. The world health organization has approved two different protocols for disinfection of the surgeons' hands. One is called the Hand scrub which comprises washing with an anti-septic based soap solution and water, hence also known as the 'Wet scrub.' the second method employs rubbing the hands with an alcohol-based antiseptic solution without using water, hence called the 'Dry Scrub.'

There are a few studies in literature which claim the supremacy of one technique over the other in providing effective disinfection. To confirm the validity of such recommendations, we conducted a study to analyse the differences in the two-stated disinfection protocols.

We analysed the difference between chemical disinfection without water (Dry Scrubbing) and standard surgical scrubbing (Wet Scrubbing) in terms of the (1) difference in surface flora on the hands of the operating team; this also serves as a surrogate marker of wound infection and (2) wound infection rates.

METHODS: A prospective randomised controlled trial was conducted at Sagar Hospital Jayanagar, Bangalore from October 2013 to February 2014 after ethical committee clearance with the non-inferiority hypothesis that 'Dry scrubbing' was not inferior to the 'Wet scrubbing.' All clean and clean contaminated cases of less than two hours duration performed in the general surgical department were included in the study. An informed consent was taken from the patients by the doctors of the operating team before being randomised and after explaining the study, its objectives and possibility of infection to the patient in brief. A standard pre-operative prophylactic antibiotic protocol was followed in all cases. Cases featuring needle stick injuries or glove punctures were excluded from the study as infection may enter the glove juice due to external contamination and confound the results of glove juice cultures. Patients who underwent repeat surgeries

Financial or Other, Competing Interest: None.
Submission 26-10-2015, Peer Review 27-10-2015,
Acceptance 13-11-2015, Published 20-11-2015.
Corresponding Author:
Dr. Anantha Krishna M. A,
No. 169, 37th Cross,
9th Main, 5th Block,
Jayanagar,
Bangalore–560041.
E-mail: drananthkrishna@gmail.com
DOI:10.14260/jemds/2015/2316.

in the study period were excluded as well, as it would be difficult to ascertain as to which particular instance the patient might have attained the infection.

Patients were also excluded if there was evidence of infection or open cut injuries on the hands of the operating team. Contaminated and dirty cases were also excluded from the study.

Sample size was calculated to be a minimum of 96 cases with a 95% Confidence level and Confidence interval of 90% and a standard deviation of 0.5. It was decided to conduct the study with a sample size of 150.

Minimum Sample size = $\{Z^2*(SD)*(1-SD)\}/CI^2$.

Where Z=z value which is 1.96 for Confidence level of 95%, SD is standard deviation and CI is Confidence interval. Substituting these values,

Minimum sample size=$(1.96)^2 * 0.5*0.5/(0.1)^2 = 96.04$.

Surgical procedures were randomised into the wet scrub and dry scrub protocols using computer generated random number table as mentioned in annexure II. Randomisation in the study was done using computer generated random number table. The patients were serially allotted, corresponding group derived from the random number table. Group 1 was the Dry scrub arm, and Group 2 was the Wet scrub arm. The techniques of the two scrub protocols are outlined below.

a. Wet Scrubbing: The traditional hand scrub protocol used towels, and 4% CHG in 70% isopropyl alcohol and 10% povidone-iodine. The 5-minute procedure was as follows:

Remove all jewellery (Rings, watches, and bracelets). Wash hands and arms to 2 inches above the elbow with the proper amount of povidone-iodine scrub solution. Scrub each side of the fingertips, each finger, the hand, and the arm. Repeat the process on the other hand and arm, keeping the hands above the elbows at all times. Rinse the hands and arms by passing them through the water in one direction only, from the fingertips to the elbow. Do not move the arm back and forth through the water. Repeat the same procedure for a second hand scrub, except scrub above the elbows. Then scrub the hands from the fingertips to the elbows. Rinse the hands and arms by passing them through the water in one direction only, from the fingertips to the elbow. If a hand touches anything at any time, the scrub must be redone. On entering the operating room suite, dry the hands and arms using a sterile towel and aseptic technique. Put on a gown and sterile gloves.

b. Waterless (Dry) Hand Scrub Protocol: A solution containing 80% ethyl alcohol was used, and following procedure was followed:

Remove all jewellery (Rings, watches, and bracelets). Apply the solution to clean, dry hands and nails using 3 pumps of solution in the following order: Dispense one pump (2mL) of waterless antiseptic into the palm of one hand. Dip the fingertips of the opposite hand into the hand prep and work it under the nails. Spread the remaining waterless antiseptic hand prep evenly over the hand and up to just above the elbow, covering all surfaces. Dispense another 2mL of waterless antiseptic, and repeat the foregoing procedure with the other hand. Dispense another 2mL of waterless antiseptic into each hand and reapply to all aspects of both hands up to the wrist. Do not touch any surfaces.

Allow the preparation to dry completely to air before donning sterile gown and gloves.

Disinfection efficacy was evaluated by the glove juice culture technique.[4] on a representative member of the surgical team as described further. At the end of the procedure, the glove from the surgeon's hand was removed carefully without inverting the glove; 50ml of sterile water was poured into the inner aspect of the glove, glove rinsed and sample collected in a sterile bottle. The specimen was immediately transported to the laboratory where it was first centrifuged and the resultant settlement taken for surface plating on tryptic soy agar medium. Culture plates were incubated for 48-72 hours at 30+/-2 degrees Celsius. Any growth was taken as culture positive and the growth further characterised to identify the organism.

Needle stick injuries were detected by assessing burning sensation on application of surgical spirit to the surgeon's hand. Glove punctures were detected by filling up the gloves with sterile water. Both laparoscopic and open procedures were included. Only procedures that took less than two hours were considered. A wide range of surgical procedures were performed and the details of procedures are provided in Table 2.

All patients were followed up till discharge, at one week and at one month by clinical examination to diagnose any evidence of surgical site infection using the criteria as provided by the Centre for Disease Control (CDC).[5] The differences in the rates of glove juice culture growth and the occurrence of surgical site infections were analysed. Statistical analysis was done using Chi-square test and a 'p' value of less than 0.05 was taken as significance level.

RESULTS: A total of 150 cases were included in the study; 75 cases were in the dry scrub category and 75 in the wet scrub category. Among the patients included in the study, 6 cases from the wet scrub technique and 4 cases from the dry scrub group were excluded as they came under the exclusion criteria. There were 85 males and 65 females. The mean age of the study population was 48.44 years. The demographic data of the patients were evenly distributed among the two study groups as outlined in Table 1. There was also a moderate distribution of clean and clean contaminated surgeries among both the groups as evidenced in Table no 3.

List of Excluded Cases:

1. Incisional hernia–Glove punctured.
2. Intestinal Obstruction–Re-operation in the study period.
3. Nodular goitre, left hemithyroidectomy done, completion thyroidectomy for papillary carcinoma thyroid.
4. Two patients of Cholelithiasis underwent Laparoscopic cholecystectomy, postoperatively lost follow up.
5. Acute cholecystitis, found to have empyema gall bladder.
6. Symptomatic cholelithiasis, found to have gangrenous gall bladder.
7. Acute appendicitis, found to have appendicular abscess.
8. Gastric outlet obstruction, underwent vagotomy with GJ, needed re-operation for efferent loop obstruction.

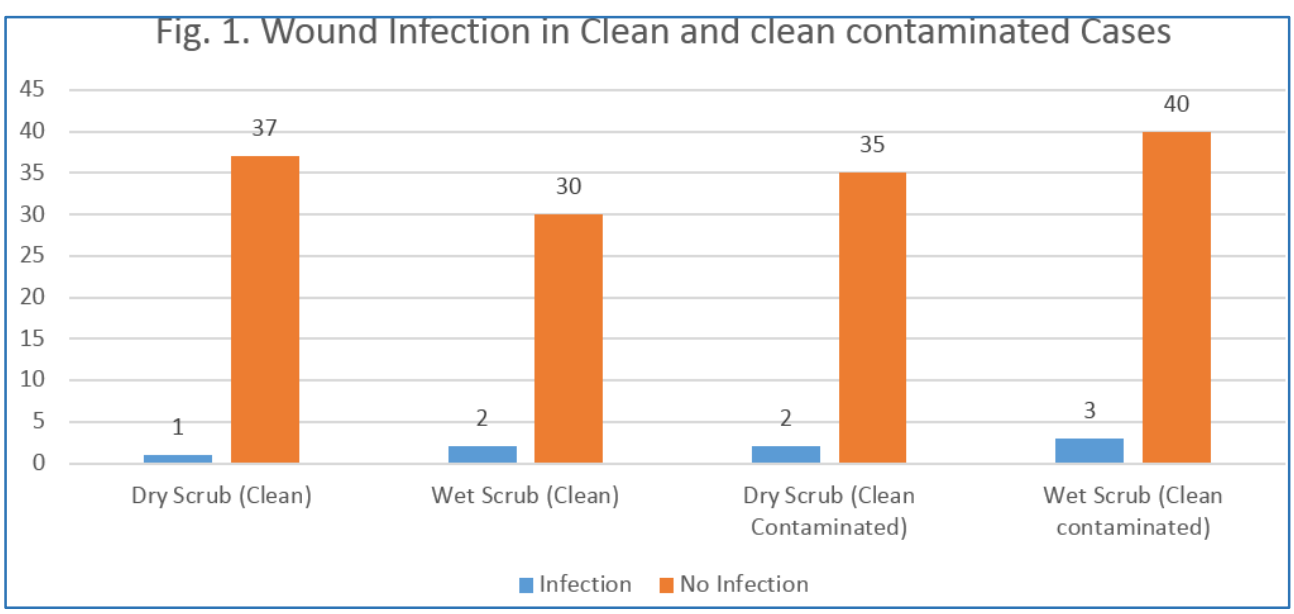
9. Adrenal tumor, underwent excision, needed re-operation for post-operative haemorrhage.

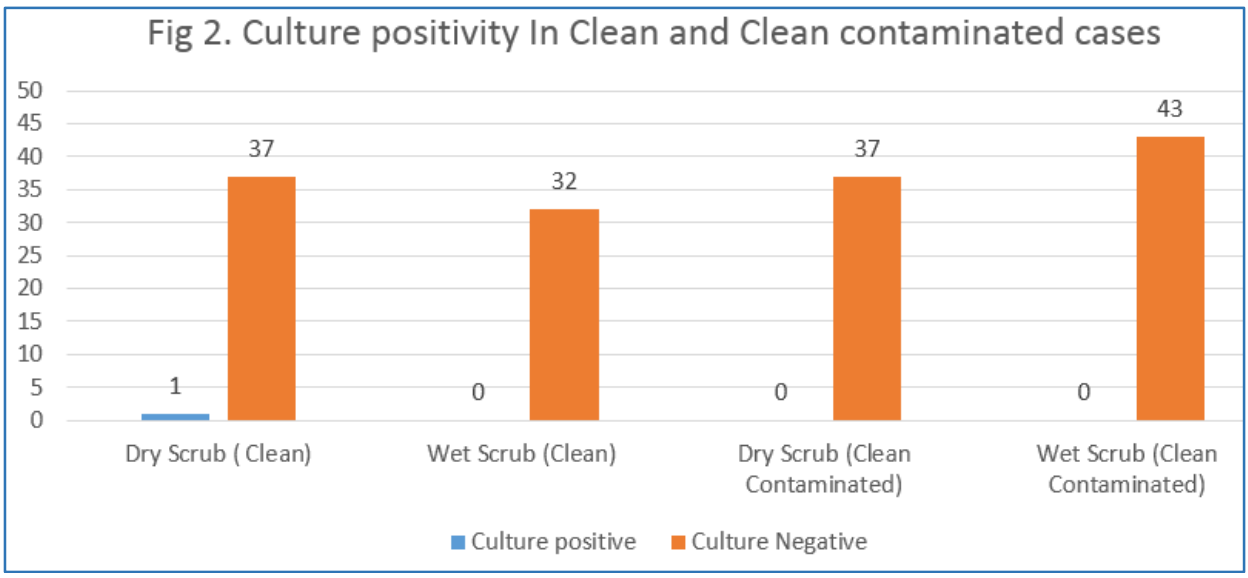
Parameters	Dry Scrub	Wet Scrub
Mean Age	48.78 yrs	48.08 yrs
Sex		
Males	45+(4)	34+(2)
Females	26+(0)	35+(4)
Clean Cases	36 + (2)	30 + (2)
Clean Contaminated cases	35 + (2)	39 + (4)
Procedures done		
Soft Tissue Mass Excision	6	2
Laparoscopic Appendicectomy	9	10
Laparoscopic Cholecystectomy	16	19
Laparoscopic Hernioplasty	12	17
Open Hernioplasty	6	5
Mastectomy/Lumpectomy	5	4
Thyroidectomy	2	3
Open Cholecystectomy	3	2
Laparoscopic Hellers myotomy	1	0
Laparoscopic Marsupialization	1	0
Laparoscopic Adhesiolysis	2	1
Laparotomy Omental Biopsy	1	0
Laparoscopic assisted hysterectomy	1	0
Stapled Rectopexy	1	0
Triple Bypass	1	1
Split skin grafting	1	0
Adrenalectomy	1	0
Laparoscopic Vagotomy	1	0
Hysterectomy/ Myomectomy	0	3
Parathyroidectomy	0	1
Puestow Procedure	0	1
Wound Infection	5	3
Glove Juice culture Positive	1	0

Table 1: Data of Patients Among the Two Scrub Groups

Note: Numbers indicated in parentheses are those cases that were excluded. Procedures done exclude the cases that were excluded and are enlisted below.

The overall wound infection rate in the study group was 5.7% and is similar to the statistics published in other studies.[5] The rates of wound infection in the two study groups are detailed in Fig 1 and Table 2.





	Clean Cases		Clean Contaminated Cases		Total	
	Infection	No Infection	Infection	No Infection	Infection	No Infection
Dry	1	35+2	2	33+2	3	72
Wet	2	28+2	3	36+4	5	70
Significance	n= 70 p=0.4565		n= 80 p=0.7722		n= 150 p=0.4674	

Table 2: Wound Infection Rates

Result: No statistically significant differences in wound infection rates among both scrub arms for either clean or clean contaminated cases.

	Clean Cases		Clean Contaminated Cases		Total	
	Positive	Negative	Positive	Negative	Positive	Negative
Dry Scrub	1	35+2	0	35+2	1	74
Wet Scrub	0	30+2	0	39+4	0	75
	n= 70 p=0.3553		n= 80 p=0.6533		n= 150 p=0.3157	

Table 3: Rates of Culture Positivity from Glove Juice

Result: No statistically significant differences in glove juice culture positivity rates among both scrub arms for either clean or clean contaminated cases.

The glove juice cultures in the study group yielded one culture positive for Group-B Beta haemolytic Streptococci in a case of open inguinal hernioplasty that was categorised in the dry scrub protocol group (Table. 3). However on follow-up, this patient did not develop any evidence of wound infection. In the wet scrub group, none of the cultures were positive.

There were total of 8 patients with evidence of wound infection of which 5 were in the wet scrub group and 3 in the dry group. These noted differences were statistically insignificant with respect to both glove juice culture as well as wound infection rates, with p values of 0.3157 and 0.4674 respectively. Hence the null hypothesis is rejected and alternate hypothesis that dry scrubbing is not inferior to the wet scrubbing is proved.

DISCUSSION: Ever since hand washing was introduced by Joseph Lister as a method of containing surgical site infections.[6] hand scrubbing has become a ritualistic practice amongst surgeons. Further, many practitioners adopt multiple methods of hand disinfection simultaneously without any demonstrable benefit of either method; but this adds to raising costs and loss of time. Many centres tend to waste a lot of water and time in the hand disinfection protocols. Since a long time, many attempts have been made at conserving water during surgical scrub.

These include switching over from regular soaps to antiseptic soaps and scrub solutions. The “Taps Off” method involves turning off the taps while scrubbing and allowing water flow only for washing. This can be done by using foot pedal operated taps or even by conscious effort. This “Taps Off” method has been independently demonstrated to prevent over than 60% of the total water used in the wet scrub technique as compared to the “Taps On” technique where water flow is continuously on throughout the period of scrubbing.[7] The technological advancement in saving water is by the usage of light sensor activated water taps where water flows only during the times of actual washing.[2] Further the recent hand rub technique or the dry scrub makes no use of water, thereby maximising the water conservation.

The major advantages of using an alcohol based non-aqueous hand rub include water conservation, reliable disinfection, improved compliance with the disinfection protocol, prevention of skin dryness and lastly, cost cutting.[8]

It has been demonstrated in some studies that the usage of non-aqueous alcohol-based hand rub solution helps in cutting costs by over 70%.[3,8]

Our study demonstrates that there is no significant difference between wet and dry scrub protocols with respect to the wound infections rates and the glove juice culture positivity rates. These results are echoed in other studies also.[3,9,10] A one-year randomised trial in France also states "Hand rubbing with alcohol-based solution before any procedure is as good as traditional hand scrubbing in preventing surgical site infections."[3]

The World Health Organisation guideline on hand hygiene in health care states–'In addition, the initial reduction of the resident skin flora is so rapid and effective that bacterial regrowth to baseline on the gloved hand takes more than six hours. This makes the demand for a sustained effect of a product superfluous. For this reason, preference should be given to alcohol-based products.'[10]

These evidences prove beyond doubt that non-aqueous alcohol-based hand rub solutions are at least, as effective as the wet scrub techniques and are accompanied with a variety of other benefits. Hence a clear case can be made to switch over to non-aqueous alcoholic rub solutions in preference to the traditional water based scrubs and make our small contribution towards conservation of water for the future.

In the same theme of conserving water future studies looking into different areas of water conservation in the scope of surgical practice such as cleaning of and sterilising the operation theatre, newer techniques in washing of surgical instruments, etc. can be undertaken.

CONCLUSION: Non-aqueous alcohol-based rub solutions are equally as effective as the traditional water based hand scrub techniques in terms of reliable disinfection and prevention of wound infection in addition to a host of other benefits. Hence it may be recommended that alcohol based rub solutions may be used in place of traditional scrubbing and hence conserve water for the future.

REFERENCES:

1. UNEP (2008), Vital Water Graphics-An Overview of the State of the World's Fresh and Marine Waters. 2nd Edition. UNEP, Nairobi, Kenya. ISBN: 92-807-2236-0.
2. A Al-Qahtani, F Messahel (2008) Water Wastage at the Scrub Sink: Critical evaluation and recommendations. The Internet J of Surgery. Volume 20 Number 1.
3. Parienti JJ, Thibon P, Heller R, Le Roux Y, von Theobald P, Bensadoun H, Bouvet A, Lemarchand F, Le Coutour X; Antisepsie Chirurgicale des mains Study Group. (2002) Hand-rubbing with an aqueous alcoholic solution vs traditional surgical hand-scrubbing and 30-day surgical site infection rates: a randomized equivalence study. JAMA. 2002 Aug 14;288(6):722-7.
4. Olson LK, Morse DJ, Duley C, Savell BK (2012) Prospective, randomized in vivo comparison of a dual-active waterless antiseptic versus two alcohol-only waterless antiseptics for surgical hand antisepsis.Am J Infect Control. 2012 Mar; 40(2):155-9. doi: 10.1016/j.ajic.2011.10.012.
5. Alicia J. Mangram, MD; Teresa C. Horan, MPH, CIC; Michele L. Pearson, MD; Leah Christine Silver, BS; William R. Jarvis, MD (1999) The Hospital Infection Control Practices Advisory Committee Infection Control and Hospital Epidemiology, Vol. 20, No. 4 (April 1999), pp. 250-280.
6. Worboys M (2013) Joseph Lister and the performance of antiseptic surgery. Notes Rec R Soc Lond. 2013 Sep 20;67(3):199-209.
7. Petterwood J, Shridhar V (2009) Water conservation in surgery: A comparison of two surgical scrub techniques demonstrating the amount of water saved using a 'Taps on/Taps off' technique. Aust J Rural Health. 2009 Aug; 17(4):214-7. doi: 10.1111/j.1440-1584.2009.01074.x.
8. Tavolacci MP, Pitrou I, Merle V, Haghighat S, Thillard D, Czernichow P (2006) Surgical hand rubbing compared with surgical hand scrubbing: Comparison of efficacy and costs. J Hosp Infect. 2006 May; 63(1):55-9. Epub 2006 Mar 3.
9. Chia-Feng Chen, RN, Chih-Lu Han, PhD, Chiou-Ping Kan, RN, Shyi-Gen Chen, MD, Ping Wei Hung (2012) Effect of surgical site infections with waterless and traditional hand scrubbing protocols on bacterial growth AJIC: American Journal of Infection Control Volume 40, Issue 4, Pages e15-e17, May 2012.
10. WHO Guidelines on Hand Hygiene in HealthCare, First Global Patient Safety Challenge, Clean Care is Safer Care, May 5, 2009.