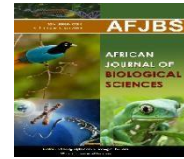


<https://doi.org/10.48047/AFJBS.6.8.2024.2848-2855>



African Journal of Biological Sciences



Research Paper

Open Access

Assessment of the efficacy of alcoholic hand rubs on examination gloves for continued use between patients

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Article History

Volume 6, Issue 8, 2024

Received: 09 May 2024

Accepted: 10 Jun 2024

doi: 10.48047/AFJBS.6.8.2024.2848-2855

Abstract:

Purpose: Nosocomial infections are a significant cause of morbidity and mortality and are associated with costs and resource economization. The transmission of organisms through the hands of HCWs is a commonly known phenomenon. Changing gloves frequently is not practical and a frequently flouted procedure during the hospital rounds. Using gloves is not a substitute for hand hygiene. The aim of this study is to assess the efficacy of hand sanitizers to disinfect gloves between patients and to assess if this method has potential for further elaborate studies.

Methods: 100 impression cultures and 300 swabs were collected from HCWs including Doctors and Nurses for culture and sensitivity attending OPD patients. Impression prints of the gloved hands were collected. Three swabs from each glove were obtained the study.

Results: On sampling, 66% of the gloves used by the doctor's showed presence of organisms, compared to only 52% donned by the nurses. And no growth was seen after using hand rub over the gloves.

Conclusion: The principal enquiry was to know, how effective alcoholic hand rub in disinfecting gloves was after clinical examination. Using hand rub over the gloves is an effective way to disinfect and to prevent cross infections between the patients. This approach is user-friendly, reliable and safe.

Key words: Gloves, Healthcare workers, Alcoholic Hand rub, Hand hygiene

Introduction:

Nosocomial infections are a significant cause of morbidity and mortality in healthcare setups. They put a burden on finances and resources [1]. The current COVID-19 pandemic has remarkably changed the practice and perspective of barrier protection. Hands of the HCWs are commonest vehicles transmitting organisms from patient to patient making doctors and HCWs to follow strict hand hygiene practices [2,3]. It is necessary to perform hand hygiene before and after using gloves [4]. Commonly new, disposable, non-sterile latex or PVC examination gloves are used as barrier protection.

The routine gloving practice is shown to decrease the rate of horizontal infection transmission. However, frequently changing gloves and performing hand hygiene between patients is very difficult to comply with. Many clinicians and HCWs feel this etiquette to be impractical and is a frequently flouted procedure especially during the hospital rounds [5]. **70% alcohol-based hand rubs** are effective and are recommended for hand hygiene during patient care. There is no enough literature available on using alcoholic hand rubs to disinfect the gloves between patients to enable continued use of the same pair of gloves without changing between patients. This study, therefore, was aimed to assess the efficacy of **alcohol-based hand rubs** to disinfect gloves between patients and to assess if this modification could be used as a practical and acceptable solution to the problem of non-compliance of the HCWs with the recommendation of changing gloves between patients.

Materials and Methods:

The term health care worker (HCW) is used here for the subjects included in the study. A written consent was obtained from all the participants.

Inclusion & Exclusion criteria:

- Inclusion - Doctors and Nurses attending OPD patients with gloved hands.
- Exclusion - Doctors and Nurses attending patients in the IPD and OT.

Table No. 1: List of OPDs for sample collection

Departments	Nurses	Doctors
Dermatology	2	1
Diabetic foot care	2	0
ENT	2	5
General Medicine	7	6
General Surgery	5	9
Obstetrics and Gynecology	7	2
Ophthalmology	1	1
Orthopedics	2	5

Pediatrics	3	7
Psychiatry	2	3
Pulmonology	2	1
Nephrology	5	0
Neurology	1	0
Plastic Surgery	3	0
Special Clinic	6	0
Naturopathy	0	4
Physiotherapy	0	6

A protocol for collection of samples from the HCWs was followed as below.

1. A swab was collected from the examination gloves immediately doing them from both the hands.
2. After the HCW completed the examination of the patient, impression cultures were obtained from fingers of both the hands on sterile BHI agar plates.
3. Swabs were collected from both the hands. Sterile cotton swabs were kept in freshly prepared sterile BHI broth tubes. A single swab was used for each hand. The swab was rolled against the wall of the tube to drain excess broth and rubbed over the gloved hand. The swab was rubbed on the palm, back of the palm and the portion covering the finger web and tips. Both the swabs were immediately placed in one BHI broth tube.
4. The HCW was requested to apply 70% alcohol-based hand rub carefully on both the gloved hands. A minimum contact time of 60 seconds was observed, the alcohol was allowed to dry and swabs were collected from the gloved hands of HCWs as explained at No. 3 above.

Thus from 100 HCWs,

- a. A total of 100 swabs were collected after donning the gloves
- b. 200 impression cultures were obtained on BHI plates form after examination of the patient.
- c. 100 swabs were collected after examination of the patient.
- d. 100 swabs were collected after disinfection with 70% alcohol before discarding the gloves.

The BHI plates having impression cultures were incubated for 48 hours at 37°C. The swabs collected in the BHI broth were incubated at 37°C for 24. If there was no growth in the tubes the tubes were incubated for an additional period of 24 hours. Subcultures from the turbid BHI broths were done on sterile BHI agar plates and MacConkey's agar plate. The plates were incubated at 37°C for 48 hours. Identification of bacteria was done as per standard protocols [6]. No antibiotic sensitivity of the isolates was done except for identification of MRSA using

cefotixin disk (30 µg). The results were tabulated in excel sheet. Ethical clearance was obtained from Institutional Ethics Committee.

Results:

A total of 100 personnel that included 50 doctors and 50 nurses formed the study group. The protocol used for the collection of samples has been explained in the materials and methods. Briefly, we collected samples from gloves immediately after donning, after examination of patients and after using alcohol-based hand rubs on the gloves before disposal.

The gloves were discarded after sample collection and not used further. Table No. 1 shows different OPDs visited for sample collection.

Table No. 2: Swab cultures: Before exam / after exam / after hand-rub

	Nurses					Doctors				
	Total	Sterile	%	Growth	%	Total	Sterile	%	Growth	%
Before exam*	50	24	48	26	52	50	17	34	33	66
After exam*	50	2	4	48	96	50	0	0	50	100
After hand rub	50	50	100	0	0	50	50	100	0	0
Total	150	76	50.7	74	49.3	150	67	44.7	83	55.3

Total swabs processed 300 (150 from nurses & 150 from doctors)

*Clinical examination

Table No. 3: Impression Cultures from HCWs

	Nurses					Doctors				
	Sample Number	Sterile	%	Growth	%	Sample Number	Sterile	%	Growth	%
Left Hand	50	2	4.0	48	96.0	50	1	2.0	49	98.0
Right Hand	50	2	4.0	48	96.0	50	0	0.0	50	100.0
Total	100	4	4.0	96	96.0	100	1	1.0	99	99.0

Table No. 4: Organisms from gloves before clinical examination

Organisms	Nurses	Doctors
CONS	0	7

MRCONS	1	1
MRSA	1	1
MSSA	4	3
GPB	12	16
Micrococcus	11	5
	29	33

CONS: Coagulase negative staphylococci, MRCONS: Methicillin resistant Coagulase negative staphylococci, MRSA: Methicillin resistant Staphylococcus aureus, MSSA: Methicillin sensitive Staphylococcus aureus, GPB: Gram positive bacilli

Table No. 5: Impression cultures and swabs after clinical examination

Pathogens	Impression culture				Swab		Total	
	Right		Left		D*	N*	D*	N*
	D*	N*	D*	N*				
CONS	13	10	11	5	9	5	33	20
MRCONS	7	4	7	4	6	5	20	13
MRSA	4	7	4	7	5	6	13	20
MSSA	8	3	6	4	6	5	20	12
Micrococcus	21	18	22	19	15	23	58	60
GPB	14	27	12	27	11	12	37	66
STERILE	0	2	1	2	0	2	1	6
Total	67	69	66	52	52	56	181	191

D: Doctors N*: Nurses*

CONS: Coagulase negative staphylococci, MRCONS: Methicillin resistant Coagulase negative staphylococci, MRSA: Methicillin resistant Staphylococcus aureus, MSSA: Methicillin sensitive Staphylococcus aureus, GPB: Gram positive bacilli

Discussion

Hand hygiene has been the most important single measure to prevent hospital infections [2]. Pathogens from patients and any other surfaces we touch are carried on the hands of healthcare workers and transmitted to other patients. The WHO and other infection control guidelines followed all over the globe stress upon the importance of hand hygiene [7].

Recommendations based on careful and meticulous studies on techniques of hand-washing, its steps, the recommended disinfectants etc. have been described in details in literature [3,4]. In spite of the unquestionable importance of hand hygiene, it is a procedure commonly practiced

without a serious approach. A number of healthcare workers find it difficult to practice the hand hygiene in letter and spirit.

For the personal protection hand gloves are recommended as barrier protection. Gloves are not the substitute for hand hygiene. Donning gloves is mandatory especially while expecting contact with blood and body fluids or the MDR pathogens [3]. This, in reality, has added to the practical difficulties in compliance by the healthcare workers. One must accept that it is very cumbersome to keep changing gloves between patients every now and then. It also adds to the healthcare cost which ultimately is levied on to the patients and is also wasteful of the resources.

COVID-19 has strongly underlined the importance of barrier protection. There is a deeply rooted fear of transmitting SARS-CoV-2 easily by fomites and objects, including gloves in the minds of healthcare workers. Ironically, the laypeople have a pseudo sense of protection when they put on gloves for their own protection.

We, therefore, thought over an idea of using alcohol-based hand sanitizers to disinfect gloves between patients. A search made in the literature using combinations of the following terms, hand rub, 70% alcohol, latex gloves, disinfection, reuse of gloves in PubMed, Google Scholar, Medline and Web of Science Articles. We did not come across any article close to our study aimed at using 70% alcohol on gloves between patients for extended use or in place of changing the gloves. Alcohol based hand rubs are preferred because of their availability at point of care, greater antimicrobial efficacy, better tolerability by the skin and faster action. The study began in August 2020 after obtaining permission from Institutional Ethics Committee.

Table No 2 shows the observations in all the three settings namely before examination, after examination and after hand rub. The disposable PVC examination gloves are being used in our hospital for clinical examination of the patients. These gloves are expected to be clean but not sterile. On sampling, 66% of the gloves used by the doctors showed presence of organisms, compared to only 52% donned by the nurses.

The examination gloves were from the same pack. The difference is statistically significant; it is likely that the technique of wearing gloves by nurses is better than the technique of doctors. Performing hand hygiene before donning gloves is mandatory. Both the nursing staff and doctors were using hand rubs to perform hand hygiene before donning gloves. It was observed that CONS were found on the gloves of seven doctors compared to no CONS found on the gloves of nurses before clinical examination. The doctors might have carried their hand flora onto the gloves during donning. A total of 24 samples obtained from nurses were sterile compared to 17 samples obtained from doctors.

Table No 4 shows species and types of organisms recovered from gloves of doctors and nurses after clinical examination. The species recovered before and after clinical examination remained the same. However, the organism load increased after the clinical examination which was expected (Table No 5).

Table No. 5 shows the species recovered from the gloves after clinical use. A total of 181 isolates from doctors and 191 isolates from nurses were cultured from 200 gloves after clinical use. The isolates could be broadly categorized as non-pathogens (*Micrococcus* and GPBs) and pathogens (MRSA, MSSA, CONS, MR-CONS). The doctors' gloves carried 86 pathogens while the nurses' gloves had 65 pathogens.

A total of 9 isolates including MSSA and MRSA were recovered from the donned gloves before use. The observation endorses the tenet that hands serve as a vehicle to transfer organisms from patient to patient. The gloves might have been contaminated from hand flora while donning or the gloves were contaminated during manufacturing or packing. This emphasizes the need for careful hand hygiene before donning the gloves.

We had an interesting finding in the study that we did not recover any gram-negative organism in the entire work from the gloves either before or after clinical use.

The principal enquiry was to know, how effective alcoholic hand rub in disinfecting gloves was after clinical examination. A total of 200 gloves were used by 50 doctors and 50 nurses for clinical examination and all of them did not yield any organism after using hand rub over the gloves. This provides dependable evidence that use of alcoholic hand rubs is effective and would prevent transfer of organisms from patient to patient.

There are reports suggesting damage to latex by alcohol. It is likely that the other ingredients used in the hand rub to potentiate the disinfectant action may be detrimental to the integrity of latex gloves [8]. We however did not come across any reference suggesting bad effect of alcoholic hand rubs on PVC gloves. The bad effect of alcohol on the gloves will depend on the duration of contact. A brief repeated exposure, maybe, for 10 to 12 times is not likely to cause serious or unacceptable damage to the gloves [9].

Many healthcare workers do not like to use alcoholic hand rubs directly on hands again and again as there is a concern raised about possible carcinogenicity of the ingredients in the preparations [10]. Using alcoholic hand rub to disinfect gloved hands is a suitable, reliable and user-friendly alternative during the clinical examination of the patients in the OPDs as well as during the clinical rounds in the wards. Such gloves may be disposed-off after 8-10 uses. This will effectively escalate the compliance to observe the hand hygiene and help in reducing the spread of bacteria from patient to patient. It needs to be emphasized that hand hygiene is not optional, it is obligatory and the health care givers must avidly adhered to it.

Conclusion:

Changing gloves frequently is not practical and a frequently flouted procedure during the hospital rounds. Using gloves is not a substitute for hand hygiene. In fact, it is necessary to perform hand hygiene before and after using gloves. Using hand rub over the gloves is an effective way to disinfect gloves and to prevent cross infections between the patients. This approach is user-friendly, reliable and safe. It will improve the compliance of the HCWs to follow hand hygiene norms while imparting healthcare.

ACKNOWLEDGMENTS

The authors would like to thank all the doctors and nursing staff for their participation and support throughout the study.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTION

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

FUNDING

None.

DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript.

ETHICS STATEMENT

This study was approved by Institutional Ethics Committee, SDM College of Medical Sciences and Hospital, SDM University, Dharwad, Karnataka, India.

INFORMED CONSENT

Written informed consent was obtained from the participants before enrolling in the study.

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