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Original Research Article

Cost analysis of reprocessing of gloves

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ABSTRACT

Background: Gloves are an integral component of standard precautions. Reprocessing and reuse of gloves are undertaken in hospitals in resource- limited settings to reduce the cost incurred in the procurement of single use disposable gloves. There is no standardized procedure to ascertain the integrity of gloves after reprocessing. The aim of the study was to calculate the cost of reprocessing gloves vis a vis use of disposable gloves.
Methods: A prospective observational study was conducted in the CSSD. The cost incurred in all the steps of reprocessing of gloves in terms of manpower involved, consumables used and the cost of operating the equipment was determined. The overall cost was then divided by the number of total pairs of gloves reprocessed during the study period to arrive at the cost of reprocessing per pair of gloves.
Results: Total cost incurred for running the machinery, manpower involved and consumables used was calculated to be Rs. 716,649. Number of pairs of gloves reprocessed was 42900. The total cost incurred in reprocessing one pair of glove in this setting was calculated to be Rs. 16.7 per glove, whereas the cost of sterile disposable surgical gloves was Rs. 11.50 during the study period.
Conclusions: The results of the present study show that the reprocessing of gloves is not cheaper than using disposable gloves. The healthcare institutions should carefully look into the sterilisation techniques vis a vis the cost of using the disposable gloves.

Keywords: Reprocessing, Resource limited setting, Cost analysis, Reuse

INTRODUCTION

Gloves are an important part of personal protective equipment (PPE) and, along with hand hygiene are an integral component of standard precautions.[1] Intact surgical gloves are an important barrier to transmission of infections during procedures.[2-7] Reprocessing and reuse of gloves are undertaken in hospitals in resource- limited settings to reduce the cost incurred in the procurement of single use disposable gloves and also ensure the continuous supply of gloves.[8-10] There is no standardized procedure to ascertain the integrity of gloves after reprocessing and visual detection or any other method routinely used is not reliable.[11,12] WHO guidelines suggests that in absence of any standardized validated procedure and evidence based guidelines for reprocessing of gloves, it should be avoided.[13] Therefore it can be assumed that while using a reprocessed glove, the possibility of micro perforations or damage to the integrity of the glove cannot be ruled out, thus putting the health care worker at risk.

Given the recent pandemic, hospital management is expected to find a balance between infection control, continuous supplies, and the justification of costs. With a variety of types of disposable gloves available in the market and at competitive rates especially on online portal for public sector hospitals, it is prudent to calculate the cost incurred in reprocessing of gloves to justify the assumption that reprocessing is cheaper or otherwise. The aim of the

study was to calculate the cost of reprocessing gloves in the central sterile supply department vis a vis use of disposable gloves in a tertiary care hospital of North India.

METHODS

A prospective observational study was conducted in the CSSD of a 900 bedded tertiary care hospital and data was collected for 6 months. The gloves that were procured were first sterilized before circulation and then reprocessed by washing and sterilization till it was damaged and discarded. The steps involved in the washing and sterilization are given in Table 1.

The steps from washing gloves to issuing gloves are carried out in CSSD by dedicated staff for the purpose. The cost involved in these steps in terms of manpower involved, consumables used and the cost of operating the equipment was determined to arrive at the cumulative cost. The cost of manpower was calculated based on the salary and was calculated for the study period on a cost to company basis. The cost of materials, i.e. gloves, cleaning agent, powder, and packing envelope, was recorded in CSSD to know the spending on the procurement of raw materials. The expenditure incurred on electricity was calculated from the wattage/hour of the equipment and the time the equipment was operational was noted every day. Similarly, water consumed by each machine per cycle was estimated based on the specifications provided by the vendors of the machinery used. The prevalent rates (per unit) as paid by the institution for electricity and water during the study period were taken for arriving at the final charges for the same. The overall cost was calculated and then divided by the number of total pairs of gloves reprocessed during the study period to arrive at the cost of reprocessing per pair of gloves. The collected data was analyzed using Microsoft excel.

RESULTS

A total of 14,300 pairs of gloves were subjected to reprocessing during the study period. It was observed that on average one pair of gloves was reprocessed three times before it was discarded. Therefore, for the study it was assumed that a single glove was used three times.

Costs involved in the various processes of reprocessing a pair of glove were calculated (Table 2-4).

Total cost incurred for running the machinery, manpower involved and consumables used was calculated to be Rs. 716,649. Number of pairs of gloves reprocessed was 42900 (14300×3 i.e.; assuming one pair is reprocessed 3 times). Thus the total cost incurred in reprocessing one pair of glove in this setting was calculated to be Rs. 16.7 per glove.

It is pertinent to mention here that the cost of the equipment and maintenance of the equipment have not been apportioned, since these machines are also used for sterilization of other items side by side. The cost of manpower included only the manpower directly involved in only glove reprocessing. The hospital was also procuring sterile disposable surgical gloves through central stores at an approximate cost of Rs. 11.50 during the study period.

Table 1: Steps involved in the reprocessing of the gloves in CSSD.

S. no.	Steps involved
1.	Procurement of unsterile gloves, consumables like cleaning agent, glove powder, and envelopes used for packing
2.	Receipt of unsterile gloves in CSSD
3.	Washing of gloves
4.	Checking for any defect
5.	Packing of gloves
6.	Sterilization of gloves
7.	Issue and usage of gloves in patient care areas
8.	Return of used gloves to CSSD for reprocessing

Table 2: Cost of material [all costs in Indian Rupee (INR)].

S. no.	Items	No./unit used during the study period	Cost/unit	Total cost (INR) during the study period
1.	Non-sterile gloves	14300	7.73	110539
2.	Glove powder	80	36.75	2940
3.	Outer envelope	12250	1.95	23887.5
4.	Cleaning agent (Ezee)	6	165	990
Total cost of consumables used			Rs.138356.5	

Table 3: Cost of manpower (all costs in INR).

S. no.	Activity	No./ unit used during the study period	Cost/unit	Total cost (INR) during the study period
1.	Receiving and distribution	Hospital attendant (1)	20830	124,980
2.	Washing and Sterilization	Hospital attendant (1)	20830	124,980
3.	Checking for defects and packing, including powdering	Hospital attendant (1)	20830	124,980
4.		Hospital attendant (1)	20830	124,980
Total cost of manpower		Rs.499,920		

Table 4: Cost of water and electricity (all costs in INR).

S. no.	Item	Activity	Total consumption in six months in units	Cost per unit	Costing for the study period
1	Water	Washing	54	25	1350
2	Water	Sterilization	126	25	3150
3	Electricity	Washing	1350	4.8	6480
4	Electricity	Sterilization	14040	4.8	67392
Total cost incurred for machinery			Rs.78372		

DISCUSSION

Single use or disposable supplies offer better patient safety by reducing risks of cross infection. On the other hand, the reuse of supplies is assumed to be an economically viable option in resource limited settings like public hospitals in developing countries or in crisis like pandemic or disaster. But, the necessity to assess the pros and cons in monetary terms vis a vis in terms of patient and occupational safety cannot be underestimated.[9]

Gloves are widely used throughout the healthcare setting as a mainstay of barrier and universal precautions.[1,14] Gloves are one of the most commonly used consumables in a hospital and also contribute to a considerable amount of spending from the hospital budget. Despite this, shortage of gloves in public sector hospitals where the consumption is too high is commonplace. The reprocessing and use of surgical gloves is one such measure to overcome the shortage of gloves.[9,13] It is assumed that the cost of reprocessing gloves is less than the cost of procuring disposable gloves. However, the literature suggests that single use of gloves leads to wear and tear and the incidence of micro perforations during surgeries is well documented.[4-6,8,10,15] In a setting where the gloves are reprocessed, the techniques used to detect such perforations in healthcare settings are not validated.[13] During this present study it was observed that the gloves before sterilisation were thoroughly inspected and air insufflations technique was used to detect tears or holes in the gloves. Damage to the physical integrity of gloves prepared for reuse was also noticed in similar studies.[8,10]

Reuse has been documented as a factor contributing to glove fragility. Physical integrity in reprocessed gloves have failed sterility tests in significant number of cases.[16] While reprocessing gloves, it is powdered and repacked before sterilisation. It is also pertinent to mention that use of powdered gloves are also not recommended due to inherent disadvantages to the user as well the patient.[17] In view the facts related to disadvantages associated with the reprocessing of gloves and possibility of a gap in infection control practices, the only reason of reprocessing and reusing gloves could be a financial one.

However, during the study it was seen while the cost of reprocessing a pair of glove was more than cost of a pair of surgical disposable glove being purchased by the stores in the same organization. The costing exercise and the comparison of the cost of reprocessed gloves with disposable surgical gloves have shown that the reprocessing is not economical which is the only reason the process is undertaken as shown in the results are comparable to a similar study conducted by Arora et al.[8]

CONCLUSION

The results of the present study show that the reprocessing of gloves is not cheaper than using disposable gloves. The methods used while checking the integrity of the gloves in such settings are not ideal and at present there is lack of evidence based data to justify the same. Keeping in view the infection control practices the healthcare institutions should carefully look into the sterilisation techniques vis a vis the cost of using the disposable gloves.

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