



SURGICAL GOWN FABRIC; DETERMINATION OF RESISTANCE TO SURFACE WETTING OF EXISTING SURGICAL GOWN FABRIC.

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ABSTRACT... Objectives: 1. To find out the affect of surface wetting of existing surgical gown fabric before and after laundering (among three groups of hospitals). 2. To compare the results of surface wetting of existing surgical gowns among three groups of hospitals. **Study Design:** The study has Experimental design. **Period:** March, 2017- June, 2017. **Setting:** This fabric was collected from different govt. and private hospitals under study. **Materials and Methods:** The surgical gown fabric was used as sample for experiments. All the experimental work was done at PCSIR Labs. Lahore. **Result and Conclusion:** According to the above graph figure 04 the resistance of fabric to surface wetting (spray test) was absolutely same in Group B and C. However, in Group A, the values were slightly greater than other two groups from new gown to 10th laundering intervals and became null in further laundering, similar to group A and B. The resistance to surface wetting nullified in almost all groups after 5th laundry and no statistical difference was observed in resistance of fabric in all groups i.e. (p-value=0.423). These gowns did not match any international standard or parameter either. After repeated laundering most of the gowns were torn and became discolored. Among three groups under study group A showed highest ratings in ISO-Spray test where as for weft yarns group c failed the test.

Key words: Surgical Gowns, existing surgical gowns, Spray test, Surface Wetting, Parameters.

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INTRODUCTION

The surgical gowns and scrubs play pivotal role in barrier system against the prevention of wound infection. It is the duty of health care workers to provide infection free environment for the patient undergoing surgical procedure. In the perioperative setting, prevention of contamination for both patients to be operated and personnel is a prime objective. In contamination control plans the appropriate choice and use of operating attire is an indispensable element. So, perioperative staff and operating technicians need to be well-informed about the basic considerations in choosing and using surgical robes effectively in the operating preparation settings. Body fluids transmit bacteria, viruses and other particles. Operating robes should give a safe and effective protection to patients and medical personnel for the duration of their work. Patients are always vulnerable to infection from endogenous microorganisms and exogenous microorganisms

as well. Similarly medical personnel are at threat for infection from numerous blood borne microorganisms from patients' blood and body fluids. It is necessary for the patients' protection that operating gowns should also offer an effective defensive block against the transmission of pathogens, tiny particles, and body fluids in order to decrease strike-through and the prospective for health care workers infection. A good surgical gown should have some characteristics.¹⁹

At present, the biggest professional hazard faced by medical personnel is interaction with infectious fluids in usual patient care. This acquaintance to infections raises the possibility for severe contamination and might be fatal.¹²

The medical staff working in surgery and gynecology departments is more at risk than those working in medicine or other departments.

At present, surgical gowns and drapes are being used to defend healthcare professionals as well as the patients from microbes, transmitted by the medical staff and patient by themselves^{17,23} Rise in the occurrence of resistant microorganisms that can be easily transferred is alarming.¹ These problems are directing to the fabrication of advanced new products in the fabric manufacturing units. The surgical apparels and linen made of cotton fabric lose their barrier efficacy when damp, the assessment and improvement in materials with appropriate barrier efficacy for consumption in operation theatre, is still under investigation. Fabrics have the ability to be proper barrier still they need to stop the transference of microorganisms and liquids present in the operation theatre. Barrier operating clothing can play an important part in reducing infection spread in the operation theatres.^{2,3}

The potential of surgical gowns to prevent from contamination depends on the physical conditions i.e. their physical properties. Researchers found that there should be some specific characteristics in surgical gowns have capacity to resist against scratch, tear, flame, liquid strike, bacterial strike and any kind of discharge. Modern technology has successfully incorporated just some of these properties into surgical gowns (Disposable or Reusable). Therefore some characteristics have to be compromised upon to attain the more desirable ones but all is not done. Some properties did not incline to get along with each other whereas some of the features did so.¹³

Although it is known that laundering affects the shield properties of fabric material,¹⁵ Not many studies have published on barrier efficacy of surgical gowns.^{20,21} Studies have been conducted in the operation theatre rooms to assess the barrier efficiency to bacterial infection spread of different operating gowns.^{14,20,21}

Surgical gowns being used in hospitals are mainly of two types; disposable and reusable surgical gowns. Surgical gowns provide the resistance not only against environment but also microorganisms and impact forces etc.^{9,10,16}

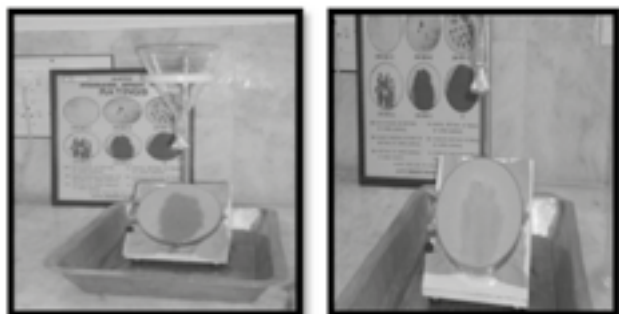
The current study is being conducted to study the current scenario of surface wetting of surgical gowns in private and Govt. hospitals of Lahore.

MATERIALS & METHODS

An experimental study was designed to evaluate the surface wetting of surgical gowns currently being used in various hospitals of Lahore. Fifteen hospitals were selected for study (both govt. and private sector hospitals). The sample was selected randomly and categorized into three groups A, B, & C on the bases of socio economic condition of the patients. The sample was tested before and after laundering and sterilization. Each sample was tested after completing five cycles of laundering and sterilization.

Determination of Resistance to Surface Wetting (Spray Test) of Fabrics:

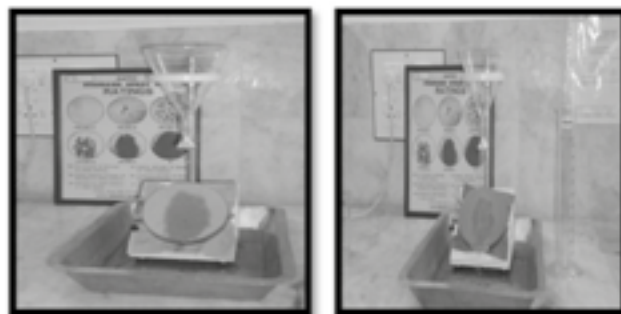
All the samples of surgical gowns were subjected to determination of resistance to surface wetting (spray test) of fabrics following.⁸ For this purpose, at least three test specimens were taken from each laboratory sample, 180 mm square, from different places in the fabric in order to represent the material as fully as possible. No specimen was taken from places with creases or fold marks. The test specimens were conditioned for 24 h in the standard atmosphere.¹¹ After conditioning, each test specimen was mounted securely on the specimen holder and placed it with the face of the fabric uppermost on the hoop support. The specimen was oriented so that the warp direction is parallel to the flow of the water down the specimen. 250 ml of water was poured into the funnel quickly, but steadily so that the spraying was continuous once it had commenced. Immediately the spray was ceased, removed the holder with its specimen and tapped smartly twice against a solid object (on diametrically opposite points of the frame). During this operation, the plane of the fabric was almost horizontal, with the fabric face down. After tapping, with the specimen still on the holder, the specimen was assigned a rating in the following descriptive scale or in the photographic scale which best describes the observed degree of wetting. No attempt was made to assign intermediate ratings.⁸



B-1

A-1

Figure-1. Resistance to Surface Wetting (ISO Spray Test)



B-2

C-1

Figure-2. Resistance to Surface Wetting (ISO Spray Test)



C-4

B-3

Figure-2. Resistance to Surface Wetting (ISO Spray Test)



A-2

Figure-4. Resistance to Surface Wetting (ISO Spray Test)

RATING OF ISO SPRAY TEST

Condition	Rating
Wetting of the whole of the sprayed surface.	01
Wetting of the half of the sprayed surface. This usually occurs through the merging of small discrete wetting areas	02
Wetting of the sprayed surface only at small discrete areas.	03
No wetting of, but adherence of small drops to, the sprayed surface.	04
No wetting of, and no adherence of small drops to, the sprayed surface.	05

RESULTS

Fifteen samples were mounted according to the test method and experiments were performed. Resistance to Surface Wetting (Spray Test).

Resistance to surface wetting is an important parameter for any surgical gown to be functional and effective. The material used the weight of the fabric, the surface treatment, the number of

laundering cycles and other factors affect the resistance to surface wetting and the barrier efficacy. The gowns, which were subjected for the spray test were tested before and after laundering and sterilization. They did not show much resistance to fluid penetration either in initial phase of analysis or in the end of the laundering cycle. All gowns were equally poor in resistance to surface wetting. ISO standard - 05 (Table-I).

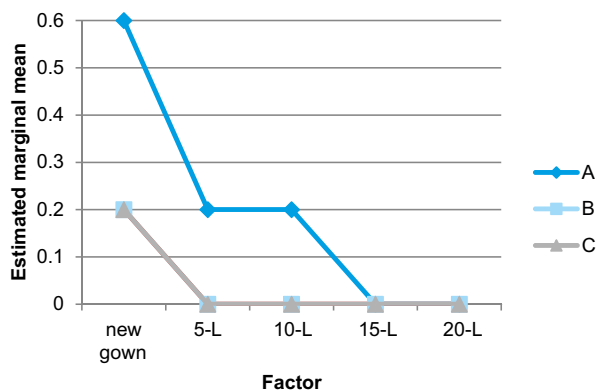
The above table describes the average statistics for resistance to surface wetting (Spray Test) of fabrics at various laundering intervals. In Group A, these mean numbers after spray test were reported as 0.60 ± 0.89 for new gown (before laundering), 0.20 ± 0.44 at 5th Laundering, 0.20 ± 0.44 at 10th Laundering and 0.00 ± 0.00 at 15th and 20th Laundering. However, in both Groups i.e. B and C, the average mean number for resistance to surface wetting was 0.20 ± 0.44 at 0 Laundering (new gown) and 0.00 at all other laundering from 5th to 20th laundering intervals. It

clearly shows that resistance of fabric to surface wetting diminished between 1-5 laundries in almost all study groups. Statistically, the average

resistance of fabric to surface wetting was same in all study groups. i.e. (p-value=0.06).

	Groups	N	Mean	SD
Resistance to Surface Wetting (Spray Test) of Fabrics (New Gown before washing)	Group-A	5	0.60	0.89
	Group-B	5	0.20	0.44
	Group-C	5	0.20	0.44
Total		15	0.33	0.61
Resistance to Surface Wetting (Spray Test) of Fabrics (After 05-laundering)	Group-A	5	0.20	0.44
	Group-B	5	0.00	0.00
	Group-C	5	0.00	0.00
Total		15	0.06	0.25
Resistance to Surface Wetting (Spray Test) of Fabrics (After 10-laundering)	Group-A	5	0.20	0.44
	Group-B	5	0.00	0.00
	Group-C	5	0.00	0.00
Total		15	0.06	0.25
Resistance to Surface Wetting (Spray Test) of Fabrics (15-laundering)	Group-A	5	0.00	0.00
	Group-B	5	0.00	0.00
	Group-C	5	0.00	0.00
Total		15	0.00	0.00
Resistance to Surface Wetting (Spray Test) of Fabrics (after 20-laundering)	Group-A	5	0.00	0.00
	Group-B	5	0.00	0.00
	Group-C	5	0.00	0.00
Total		15	0.00	0.00

Table-I. Descriptive Statistics for Resistance to surface Wetting (Spray Test) of Fabric at different Intervals Factor (p-value) = 0.056 (Insignificant: p-value>0.05)



Factor*Group (p-value) = 0.423(Insignificant: p-value>0.05)

Figure-5. Resistance to Surface Wetting (Spray Test) of Fabrics at different Laundry Intervals

According to the above graph figure 04 the resistance of fabric to surface wetting (spray test) was absolutely same in Group B and C. However, in Group A, the values were slightly greater than other two groups from new gown to 10th laundering intervals and became null in

further laundering, similar to group A and B. The resistance to surface wetting nullified in almost all groups after 5th laundry and no statistical difference was observed in resistance of fabric in all groups i.e. (p-value=0.423).

DISCUSSION

The liquid/water penetration on the fabric surface was increased over repeated laundering⁵ intervals and this increase in penetration was statistically same in all three groups.

i.e. (p-value=0.06). Overall a increasing trend was observed for surface wetting in all 3 groups of hospitals from 0 to 20th laundering. However, in both Groups i.e. B and C, the average mean number for resistance to surface wetting was 0.20±0.44 at 0 Laundering (new gown) and 0.00 at all other laundering from 5th to 20th laundering intervals. The increasing trend of liquid penetration indicates that fabric is losing its barrier/blockade quality and becoming weaker because during

wear and laundering abrasion removes the fur/lint from the surface layer of fabric and cause it weak and in some situations less dense.^{6&7} The cause is repeated washing, use of strong detergents/soaps/ and excessive use of bleaches and steam (sterilization).¹⁸

The gowns, which were subjected for the spray test, did not show much resistance to fluid penetration either in initial phase of analysis or in the end of the laundering cycle. This might be due to the reason that there were no finishes applied on the fabric surface. The gowns were not given any water repellent finish at all. All gowns were equally poor in resistance to surface wetting. This is an undesirable quality for surgical gowns. Cotton is hydrophilic in nature, which allows for seepage and penetrations when surgical gowns are splashed with water/simulated body fluids.²² This gives reason to all cotton made gowns to wet readily. Mostly cotton made gowns had an irregular (lint) surface. The irregular (lint) surface prevents the liquid from moving off the fabric, thus helping liquid penetration in the fabric. Previous researches have shown that wet fabrics are poorer barriers than are dry fabrics.⁴ According to Leonas study in 1998 repellency contributes to gown performance. Higher liquid repellency ratings generally relate with higher barrier properties.

CONCLUSION

The factor under consideration in this study was the resistance of existing surgical gown fabric to surface wetting. The surgical gowns were collected from fifteen different hospitals under study. These surgical gowns were subjected to ISO-Spray test to check the liquid barrier function of the fabric. The results proved that the fabric used for the surgical gowns was not up to the mark and did not show any resistance against fluid. The surgical gowns fabric disqualified the ISO-Spray test. Gowns rating were then checked against international standards. These gowns did not match any international standard or parameter either. After repeated launderings most of the gowns were torn and became discolored. Among three groups under study group A

showed highest ratings in ISO-Spray test where as for weft yarns group c failed the test.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Farzana Kishwar	Introduction, Research Methodology Experimentation Results Summary & Conclusion	
2	Fatima Ali	Discussion Statistical Analysis References Editing & Formatting	