



Original Article

# HAND-HYGIENE PRACTICES IN THE OPERATING THEATRE IN A TERTIARY CARE HOSPITAL IN A DEVELOPING COUNTRY: AN OBSERVATIONAL STUDY

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A variety of infection control measures are practiced to decrease the risk of transmission of pathogens in the hospital environment. Standard precautions are thought to be the most effective against healthcare-associated infections. However, compliance with standard precautions is not sufficiently high in healthcare setups in the third world countries. Frequent handwashing or use of alcohol based solutions is an important measure to reduce the risks of transmitting infectious organisms from one person to another, although it is not easy to maintain high compliance in healthcare settings.

Studies of surgical site infections (SSIs) in Western countries report a relative frequency of 15%-20% in prevalence studies and an incidence in general surgery that varies between 2%- 3% and 12%-15%, depending on the class of operation.

A recent overview of 30 studies published between 1990 and 2002 on the outcome of nosocomial infection prevention through intervention programs found that approximately 20% of all infections were avoidable.<sup>1</sup>

Two of the western studies conducted in general surgery departments showed a reduction in the number of the infections by 24%-25% after implementation of an infection surveillance and control program.<sup>2,3</sup>

In Italy, a nationwide study of nosocomial infection surveillance and control programs launched in early 2000 reported that only 31% of surgery departments had established protocols for infection prevention.<sup>4</sup>

“Standard precautions” require that health care

workers assume that the blood and body substances of all patients are potential sources of infection, regardless of the diagnosis, or presumed infectious status. Additional precautions are needed for diseases transmitted by air, droplets and contact. These are termed “additional (transmission-based) precautions”.<sup>5</sup>

Hand washing with soap (antimicrobial or non-antimicrobial) should be performed whenever there is visible contamination with blood or body fluids. Alcohol-based hand rubs are recommended for hand hygiene when there is no visible contamination. Spore-forming organisms such as *Clostridium difficile* and *Bacillus anthracis* are poorly inactivated by waterless hand hygiene products and require the physical action of washing and rinsing for removal.<sup>6,7</sup>

This study was carried out to assess the standard of applied infection control practices in terms of hand hygiene application in the operating rooms in a tertiary care hospital in a developing world country.

## Objective

To assess the the incidence of unscrubbed personnel coming in contact with the patient as well as the practice of hand hygiene in the operating room.

## Methods

A trained observer conducted a prospective series of covert observations. The hospital has generated several hand-hygiene protocols for implementation. Staff is required by hospital protocol to clean their hands before and after each patient contact. Alcohol-based hand rub is available inside and around the OT.

## Observation technique

The observer, a junior staff nurse, collected the required data. The nurse was trained to reliably observe hand-hygiene episodes. The observations were recorded on prepared performa. Members

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of staff were not informed about the nature of the study.

A 'hand-hygiene application' was defined as any usage of alcohol-based hand rub, irrespective of duration and amount of cleaning product used or taking off gloves after contact with a patient. A 'hand-hygiene opportunity' was defined as a situation requiring hand-hygiene application.

Staff under observation

OT staff were be categorized by profession as **anaesthesia consultants, anaesthesia residents , anaesthesia assistants, surgeons, surgical residents, surgical nurses, circulating nurses, operation theatre assistants and medical students.** Staff who performed a surgical scrub and donned sterile gown and gloves were excluded from observation. Surgeons were observed only before their surgical prep and after the surgical procedure was completed. The observational period for surgical nurses depended on their respective functions during the operation: scrub nurse (not observed while in sterile attire) or circulating nurse (non-sterile attire, continuously observed). Other staff members were observed continuously.

### Observations

1) **Application of hand hygiene** was recorded every time an individual performed this process.

2) We assessed the **frequency with which the patient was touched** by staff.

3) We monitored '**potential contamination**' defined as touching objects in the room after having been in contact with the patient or the patient's bodily fluids, without subsequent application of hand hygiene. *We did not differentiate between touching the patient with bare ungloved hands or with gloves if the gloves were not discarded after previous patient contact and hand hygiene was not applied.* After patient contact, hands need to be cleaned to prevent microbial contamination of OT implements. Since microbial contamination can also result from contact with patient body fluids (e.g. blood or saliva on dressing material). The various items touched by the OR staff by way of potential contamination were also noted.

4) **Total number of surgical procedures** were observed, for 60 h. Patients undergoing a variety of procedures, including general surgery, otolaryngology, urology, gynaecology, obstetrics, and orthopedic surgery.

5) **The average number of personnel**

**present in the OT** at the same time were recorded.

### Statistical analysis

We performed descriptive statistics using Microsoft spread sheet. Data analysis results in counts of the number of operations, observation times, number of staff members, and number of gloves used. The performance of hand hygiene is expressed as percentage (hand-hygiene applications/hand-hygiene opportunities) or as hand-hygiene applications per hour, per staff member. The categories used for analysis were 'before patient contact' and 'potential contamination'.

Results

A total of 40 surgical procedures were observed, totaling over 60 h of observations. Patients underwent a variety of procedures, including general surgery (12), otolaryngology (2), orthopedics (3) obstetrics (11) and gynaecology (7). The average number of personnel present in the OT at the same time was 8.025 (range: 5–12 people).

The team typically included two to three members of the anaesthesia team, four to five members of the surgical team, and one medical student. The number of people present in the operating room over 60.2 hours of observation were 321, a total of 238 applications of hand hygiene were observed during the entire study, an average of 0.12 hand-hygiene episodes per hour per individual were made. A total of 204 pairs of gloves were used. This constitutes 5.1 (range 2-7) pair of gloves on average per operation, excluding sterile gloves donned by the operating team for the operation.

The anaesthesia team used 145 of the 204 pairs of gloves. These were worn mainly during induction of anaesthesia (intubation, patient positioning), when touching objects visibly contaminated with body fluids and during emergence from anaesthesia (i.e. extubation, transporting patient into bed. Surgeons used non-sterile gloves for palpation and when positioning the patient (11 pairs). Surgical nurses and operation theatre assistants used gloves mainly for handling objects contaminated with blood or secretions (e.g. gauzes, tubing, or tissue samples for pathology) and when cleaning up after the operation was completed (49 pairs).

Hand hygiene expressed as percentage (hand-hygiene applications/hand-hygiene opportunities) and an indicator of the standard of practices in the operating room was on an average at 37% (range 11-50%)



### Discussion

Compared to our study where the hand hygiene application per staff was 0.12, Kradiet et al came up with a figure of 0.14 hand-hygiene applications per hour per staff member. <sup>8</sup>

We looked for hand hygiene application after contact with a patient and this amounted to 37% on the average. We did not count hand hygiene application at entering the operating room because of widely spaced locations of alcohol hand cleaning solution dispensers. In the study by Kradiet, upon entering or leaving the OT, hand hygiene was performed in 2% (7/363) and 8% (28/333) of opportunities respectively. A total of 69 applications of hand hygiene were observed during the entire study. Compliance to gloving guidelines varied from 0% to 87%.

The largest number of contacts with non-sterile parts of the patient were made by the anesthesia team in our study which amounted to 72% of all such contacts. This points to the importance of hand hygiene and other infection control practices amongst the anesthesia personnel. A similar percentage was observed in another study. <sup>8</sup>

We noted a use of an average of 5 gloves per procedure (range 2-7) by the teams. Smallest number of gloves being used by the surgical consultants (6 gloves), largest number being used by the anesthesia residents (73) which probably reflects the greater number of contacts, handling of airway and contact with secretions as well as greater awareness in anaesthetists, The ratio of potential contamination to patient contacts was 0.97 (range 0.6-1.44) reflecting the potential of the team to contaminate the OR environment. Compared to the study above in which a total of six to seven pairs of non-sterile gloves were used by the team per surgical procedure. Roughly three of four members of the surgical team touched the patient and OT implements repeatedly without intermittent application of hand hygiene. Almost invariably, members of the anaesthesia team came in contact with the patient or the patient's body fluids and objects in the OT without hand-hygiene application. Nine of ten OT staff wore non-sterile gloves when intubating the trachea or inserting a nasogastric tube. However, during insertion of peripheral venous catheters, less than one in four anaesthesia team members used gloves. <sup>8</sup>

We measured an average of 0.12 hand-hygiene applications per hour per staff member, which is similar but less frequent than most other studies where it ranged from 0.14–0.38 hand-

hygiene applications per hour per staff member that were measured. <sup>9</sup>

The practice of hand hygiene application can be increased by use of newer devices. Use of the Sprixx GJ device (Harbor Medical Inc., Santa Barbara, CA) increased hourly hand decontamination events by 27-fold as compared with baseline rates ( $P < 0.002$ ; 95% confidence interval, 3.3-13.4). <sup>9</sup>

Compliance of gloving guidelines is also reportedly low, with compliance rates never exceeding 50%. <sup>10,11</sup>

Studies mention a list of the different items or surfaces being contaminated especially by the anesthesia team which include the anesthesia machine surface, Oxygen flow control, Nitrous flow control, Halothane/isoflurane vaporizer, Laryngoscope handle, Anesthesia machine drawer handle, Monitor controls, Electrocardiogram cable, SaO<sub>2</sub> probe, Pop-off control, Anesthesia machine ventilator controls and Stethoscopes. Incidence of surface occult blood contamination of these sites was seen in 31.2%- 42.2% of times. <sup>12</sup> In our observation the items included the above as well as operating tables, drug trolleys, drip stands, infusion bags, pressure bags, drip sets, syringes, oxygen masks, face masks, their own face etc, OR kits, disposable caps, glasses, ball pens, books, cell phones, OR doors, door handles and OR walls. Most of these have been mentioned in different studies. Nearly all of an anesthesiologist's exposure to blood and saliva is preventable by proper mucocutaneous barrier protection. <sup>13</sup>

The largest contribution by the way of potential contamination was by the anesthesia team which were responsible for 63% of the total according to our observations. However the ratio for potential contamination to the opportunity for hand hygiene was the highest in the OT assistants (1.44) and the lowest in anesthesia consultants (0.6). Resident anesthesiologists were found to be more compliant with gloving policy than their attendings (61.8% vs. 33.7%,  $p < 0.0001$ ). However, the lower compliance among the attendings was entirely attributable to the most senior staff members (over age 55 years) whose compliance rate was 11.5% versus 55.6% for attending staff below age 55 years ( $p < 0.0001$ ). Departmental compliance as a whole was 49.6%. Compliance in pediatric cases averaged 10% and was equally poor among all department staff. <sup>14</sup> We did not note our observations with reference to age of the staff.

**Table-1: The average number of events occurring during the stay of a patient in the operating room for a surgical procedure**

	Oppurtunity for hand hygiene application per procedure	HH application	potential contamination	Average # gloves used
Anesthetist	1.925	0.925	1.15	0.825
Anesthesia resident	6.475	2.1	5.575	1.825
Anesthesia assistant	3.65	1.125	3.575	0.975
Surgeon	0.525	0.2	0.5	0.15
Surgery resident	0.625	0.275	0.525	0.125
Scrub Nurse	1.6	0.8	1.225	0.675
Circulating nurse	0.75	0.325	1	0.275
ODA	1.875	0.2	2.7	0.1
Medical student	0	0	0	0

Av # of gloves used/case =8.025 (Range 5-12)

Total observation time= 60.2 hours

**Table-2: he events and their ratios reflecting the standard of hand hygiene practice occurring during the stay of a patient in the operating room for a surgical procedure**

It is a part of our quality assurance program to upgrade the infection control awareness in the OR envirement and then would be in a position to compare this baseline data. The intervention programme in one study influenced positively the attitude of junior anaesthetists and nurses regarding the proper use of protective tools, anaesthetic equipments and hand hygiene. Senior

anaesthetists' compliance with hand hygiene, frequency use of gloves and anaesthetic filter did not change after intervention. But their attitude towards handling of laryngoscope, anaesthetic face mask and catheter for suction improved after intervention. The adherence of housekeepers to hand hygiene, frequency of gloves use and anaesthetic equipments' disinfection improved significantly after intervention. Ninety-two (63%) swabs were positive for bacteria at T0 before intervention. They reduced to 9 (6.3%) positive swabs after intervention. The number of positive swabs at T1 was 121 (82.9%) before intervention, reduced to 68 (47.2%) after intervention. One hundred and eight (74%) swabs from hands of anaesthetists were positive for bacteria before intervention. They lowered significantly to 55 (38.2%) after intervention. Bacterial cross infection between anaesthetic machine and anaesthetists' hands existed pre and post intervention.<sup>15</sup>

In a study by Kushimo et al, which considers the infection control practices in the OR environment with a background of HIV positive patients coming for surgery. One hundred (66.7%) out of 150 questionnaires distributed amongst members of the Nigerian Society of Anaesthetists were completed and returned. Fifty-five per cent (55%) of the respondents confirmed their willingness to be screened but only 45% had had a personal HIV screening test. Even though 23% of all the respondents will transfuse unscreened blood in an emergency, only 1(8.3%) of the consultants will do so. This trend was also reflected in gloving behaviour as 11(91.6%) of consultants will routinely wear gloves whilst only 12(70.5%) of the senior house officers will routinely glove for venepuncture despite the availability of gloves. Other precautionary facilities such as goggles, sharp disposal bins, routine screening of all surgical patients were more available in private than in government hospitals.<sup>16</sup>

Questionnaires were distributed to all 213 consultant anaesthetists in the North-West region of the UK with a response rate of 68%. These questionnaires were designed to assess the hygienic precautions taken to reduce the potential for transmission of infectious agents to and from the patients under their care. Face masks and gloves were always used by 35.2% and 14.5%, respectively, while only 36.4% washed their hands between cases. Most respondents have changed their practice since the recognition of HIV transmission (74.8%) and hepatitis B and C (69.8%).



A high proportion of anaesthetists continue to administer anaesthesia despite suffering from respiratory (94%), gastrointestinal (42.9%) or herpes simplex (32.6%) infections.<sup>17</sup>

### Conclusion

The importance of application of hand hygiene while handling the patients, and measures to reduce contamination of the operating room envi-

ronment are recognized measures in reducing the rate of infection in the surgical patient, cannot be over emphasized. This study gives us a good idea about the standard of practice and the areas where we need to put in effort in order to enhance patients' well being and minimizing the rate of infection in the operating room.

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