

## HEALTH-CARE ASSOCIATED INFECTIONS AND INFECTION CONTROL PRACTICES IN INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL

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### ABSTRACT

**Objectives:** The risk of acquiring health-care associated infections (HCAIs) is significant in intensive care units (ICU). It increases the morbidity and mortality of hospitalized patients as well as hospital staff.

**Methods:** This cross-sectional prospective study was conducted among 60 health-care professionals in ICU which included 20 nurses, 20 interns, and 20 consultants. A preformed questionnaire was used to collect details from those who were posted in ICU.

**Results:** All the staff working in ICU units have satisfactory performance level regarding infection control (IC) standard precautions. Hand hygiene topped the priority among IC procedures. The most common HCAIs in this study was catheter-associated urinary tract infection and surgical site infections. Awareness about safe injection practices and needle prick infections were satisfactory. A proper disposal of waste was done by nurses in ICU's.

**Conclusion:** The most of the existing measures to prevent and control nosocomial infections in the ICU are largely effective, modifications and refinements to these existing measures may only help in further improving the patient care.

**Keywords:** Catheter associated urinary Tract infections, Ventilator associated pneumonia.

### INTRODUCTION

Health-care associated infections (HCAIs) are a major global safety concern for both patients as well as health-care professionals. Many factors promote infection among hospitalized patients, which includes decreased immunity among patients; increasing the variety of medical procedures and invasive techniques creating potential routes of infection; and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control (IC) practices may facilitate transmission.

The risk of acquiring HCAI is significant in intensive care units (ICU), where the World Health Organization (WHO) estimates that approximately 30% of patients are affected by one or more episodes of HCAI with associated morbidity and mortality [1]. The burden of HCAI is substantial in developed countries, where it affects from 5% to 15% of hospitalized patients and nearly half of the patients in ICU. In developing countries, the magnitude of the problem remains underestimated, because the diagnosis of hospital-acquired infection is complex and surveillance activities to guide interventions require expertise and resources [2]. Thus, this study was designed to determine the awareness levels of IC practices among health-care professionals in a tertiary care teaching hospital.

### METHODS

#### Setting of the study and study design

This study was conducted in the tertiary care hospital among 60 health-care professionals in ICU which included 20 nurses, 20 interns, and 20 consultants. The study duration was 3 months (June to August 2015). This is a cross-sectional prospective study.

#### Procurement of permission

Institutional Ethical Committee approval was obtained before the study. The purpose of the study was explained to each health-care worker and informed written consent was obtained from them before getting enrolled in this study.

#### Selection criteria

A preformed questionnaire was used to collect details from those who were posted in ICU during the above period. Those health-care workers who have not worked in ICU were excluded from the study.

#### Methodology

Questions were prepared based on the hospital-acquired infection guidelines provided by the WHO and Centre for Disease Control. A self-administered questionnaire was given to all participants who included testing their knowledge and practice regarding IC practices in ICU, type of infections, hand hygiene, vaccination status for hepatitis B, etc.

#### Statistics

A simple descriptive statistics was used in this study.

### RESULTS

Among the IC practices in ICU - hand hygiene topped with 85%, 95%, and 90% of the nurses, interns, and consultants, respectively, as they believed that this strategy alone can prevent HCAI. Among the nursing professionals, 10% responded that cleaning and disinfection of the equipment would reduce disease transmission which was their second priority while the doctors gave much importance to personal protective measures. Patient's oral care, catheter care tops the priority among nurses (55%), interns (45%), and consultants (65%) to prevent HCAIs.

Sterilization of instruments was given the next priority by the participants. None had commented about head end elevation of the patients. Nurses differ from doctors in environmental cleaning where they paid much attention to cleaning of equipment (65%). The management of blood spills and replacement of intravenous (IV) set was given priority by interns with the response of 45% and 45%, respectively, whereas consultants showed 50% and 35% of response, respectively. The detailed description related to the IC practices in ICU was depicted in Table 1.

Table 1: Infection control practices in ICU (n=60)

S. No	Infection control practices in ICU (on priority basis)	Nurses	n=20 (%)	
			Interns	Consultants
1	Practices in ICU			
1a	Hand hygiene	17 (85)	19 (95)	18 (90)
1b	Cleaning and disinfection	2 (10)	Nil	1 (5)
1c	Personal protective measures	1 (5)	1 (5)	1 (5)
1d	Biomedical waste management	Nil	Nil	Nil
2	Precautions to be taken in patient care in ICU			
2a	Patients' oral health care	11 (55)	9 (45)	13 (65)
2b	Good catheter care	7 (35)	8 (40)	4 (20)
2c	Sterilization of equipment's	2 (10)	3 (15)	3 (15)
2d	Head end elevation	Nil	Nil	Nil
3	Environmental cleaning in ICU			
3a	Cleaning of medical equipment's	13 (65)	Nil	1 (5)
3b	Waste management and disposal of sharps	4 (20)	2 (10)	2 (10)
3c	Management of blood spills	3 (15)	9 (45)	10 (50)
3d	Replacement of IV set	Nil	9 (45)	7 (35)

ICU: Intensive care units, IV: Intravenous

Table 2 impregnated the average incidence of catheter-associated urinary tract infections (CAUTI) in this hospital is 20%. Common bacteria isolated are *Escherichia coli*, *Klebsiella*, *Pseudomonas*, etc. Among them, 30% of strains are multi-drug resistant in CAUTI.

Table 3 showed that nurses, interns, and consultants are well aware about surgical site infections (SSIs), of which they have responded that 25% is the average incidence of SSIs in this hospital. Of them, 30% of strains are multi-drug resistant.

Table 4 highlighted ventilator-associated pneumonia (VAP) is diagnosed by clinical criteria by most of the respondents (nurses, interns, and consultants). Common organisms isolated are *E. coli*, *Pseudomonas*, and *Acinetobacter* spp. Of the total organisms isolated 10% are resistant strains.

The majority of the respondents were aware about safe injection practices that are 1 needle and 1 syringe, to be used once for the patients. Very few (5%) of nurses and interns were not aware about it. Regarding infections transmitted by needle prick, interns, and consultants had a good knowledge, whereas the few of the nurses (30%) were unaware of it. Almost 100%, 90% of the interns and consultants had completed vaccination against hepatitis B, respectively. Only 20% of the nurses have not been vaccinated against hepatitis B (Table 5).

Table 6 highlighted the awareness about biomedical waste management was high among interns (100%) than nurses (90%). Only 85% of consultants were aware about proper biomedical waste management.

## DISCUSSION

The risk of acquiring HCAI is significant in ICU. Although ICU has fewer than 10% of beds in hospitals, more than 20% of nosocomial infections are acquired in ICU [3]. IC prevention is the responsibility of critical care nurses, and practitioners. It represents an integral element of patients' safety programs. It includes the processes and activities which identify and reduce the risks of acquiring and transmitting endemic or epidemic infections among individuals. IC and prevention refer to the clinical application of microbiology in practice. It is also a quality standard which is essential for the well-being and safety of patients, staff, and visitors in hospitals environment.

In this study, among the IC practices in ICU - hand hygiene topped the priority among nurses, interns, and consultants. All health-care workers were well aware of the fact that hands are the most common vehicle for transmission of organisms and "hand hygiene" is the single most effective means of preventing the horizontal transmission of infections among hospital patients and health-care personnel. Only

Table 2: Awareness about CAUTI (n=60)

S. No	CAUTI infections	Descriptions
1	Number of urinary catheters inserted in hospital/day	10%
2	Average incidence of CAUTI in the hospital	20%
3	Common organisms isolated	<i>E. coli</i> , <i>Klebsiella</i> , <i>Pseudomonas</i> and <i>Candida</i> spp.
4	Incidence of resistance strains isolated in CAUTI	30%

CAUTI: Catheter associated urinary tract infections, *Escherichia coli*: *Escherichia coli*

Table 3: Awareness about SSI (n=60)

S. No	SSI infections	Descriptions
1	Average incidence of SSI in the hospital	25%
2	Common presenting feature of SSI in this hospital	1. Drainage of cloudy pus from wound site 2. Fever
3	Common organisms isolated	<i>E. coli</i> , <i>Acinetobacter</i> spp. and <i>S. aureus</i>
4	Incidence of resistance strains isolated in SSI	30%

SSI: Surgical site infections, *S. aureus*: *Staphylococcus aureus*

Table 4: Awareness about VAP (n=60)

S. No	VAP infections	Descriptions
1	VAP is diagnosed in this hospital mainly by	Clinical criteria
2	Awareness about VAP care bundle and its practice in ICU	Yes
3	Common organisms isolated	<i>E. coli</i> , <i>Pseudomonas</i> , <i>Acinetobacter</i> spp.
4	Incidence of resistance strains isolated in VAP	10%

VAP: Ventilator associated pneumonia

consultants were able to recollect the five moments of hand washing when compared to nurses. Hand hygiene compliance was nearly 90% in this study, whereas a study was done in Ghana in the year 2013 [4]. Hand hygiene compliance among doctors ranged from 9.2% to 57%

Table 5: Awareness about safe injection practices in ICU (n=60)

S. No	Injection practices and needle prick infections	Nurses	n=20 (%)	
			Interns	Consultants
1	Safe injection practices (1 needle, 1 syringe for 1 time)			
1a	Aware	19 (95)	19 (95)	20 (100)
1b	Unaware	1 (5)	1 (5)	Nil
2	Infections transmitted by needle prick			
2a	Aware	14 (70)	18 (90)	20 (100)
2b	Unaware	6 (30)	2 (20)	Nil
3	Vaccinated against hepatitis B			
3a	Yes (completed vaccination)	16 (80)	20 (100)	18 (90)
3b	No (incomplete/not vaccinated)	4 (20)	Nil	2 (10)

ICU: Intensive care units

Table 6: Practice of proper disposal of biomedical waste (n=60)

Response	Nurses	n=20 (%)	
		Interns	Consultants
Correct method	18 (90)	20 (100)	17 (85)
Incorrect method	2 (10)	-	3 (15)

and 9.6% to 54% among nurses. Both interns and nurses preferred hand washing with soap and water when compared to alcohol rub. In a study done in the pediatric ICU of Turkey [5], the respondents (health care workers) preferred to use soap and water (63.6%) compared to waterless-alcohol-based hand hygiene (36.3%). However, the current WHO recommendation says to use an alcohol-based hand rub (IA), e.g., 0.5% chlorhexidine with 70% w/v ethanol, if hands are not visibly dirty. A combination of chlorhexidine and alcohol is ideal as they cover Gram-positive and Gram-negative organisms, viruses, mycobacteria, and fungi [6].

Regarding patient care in ICU, most of the participants have answered that patient's oral care, catheter care, sterilization of equipment's play pivotal role in nursing care of patients and much attention to be paid to it. Failure of these will lead to nosocomial infections. Cleaning of medical equipment and disposal of waste and sharps was given priority by nurses. 70% ethanol is used to disinfect medical equipment, which has to be done daily. Nurses admitted the fact that they clean the equipment once in 3 days. Biomedical waste management practices are well established among nurses, where they segregate them and use needle destroyer for sharps. The knowledge regarding this was very poor among doctors.

The doctors (interns and consultants) gave priority to the management of blood spills and replacement of IV sets. In the health-care setting, blood-borne pathogen transmission occurs predominantly by percutaneous or mucosal exposure of workers to the blood or body fluids of infected patients. A study highlighted the risk of occupationally acquired disease ranges from 10% to 73% [7]. Prompt removal and surface disinfection of an area contaminated by either blood or body substances are sound IC practices and OSHA requirements [8].

Periodical changing of IV set is necessary for patients in ICU because they are almost moribund, and thrombophlebitis due to IV line may lead to sepsis. Although the overall incidence of IV line infections is low, approximately 1% of incidence occurs in patients with multiple IV lines and prolonged IV cannulations [9]. The infections common in our ICU set-up are SSIs and CAUTI as given by nurses, interns, and consultant. A study was done in North India in the year 2014, reported that CAUTI and catheter-related bloodstream infection (CRBSI) are more common [10].

UTIs are tied with pneumonia as the second most common type of healthcare-associated infection, second only to SSIs and account for more than 15% of infections reported by acute care hospitals [1].

Virtually all healthcare-associated UTIs are caused by instrumentation of the urinary tract [11]. The knowledge regarding risk factors for CAUTI were correctly identified by interns and consultants, when compared to nurses. This implies that nurses do not update their knowledge regarding HCAI. An effort must be taken to educate the nurses and other technical staff so that they adhere to strict IC policies.

SSIs account between 10% and 30% of all HCAI. They are associated with substantial economic costs. In our ICU set-up, orthopedic surgery, gastrointestinal surgeries, and hysterectomy accounts for the majority of SSI. A study was done by Jonathan *et al.* in India gastrointestinal and cardiothoracic surgery topped priority [12]. VAP, CRBSI are very rare in our ICU set up. This is contrary to the studies done by Lee *et al.*, Richards *et al.* where CAUTI followed by VAP [13,14].

Safe injection practices awareness was high among nurses and to a lesser extent by interns. This is because the consultant rarely gives injections to the patient, but they were aware regarding the diseases transmitted by needle prick. Unsafe injection practices put patients and health-care providers at risk of infectious and non-infectious adverse events. Safe injection practices are part of standard precautions and are aimed at maintaining basic levels of patient safety and provider protections [15].

Most participants of the study have been vaccinated against hepatitis B, only 20% are left with incomplete vaccination. This was in concordance with other studies [16]. The waste produced in the course of health-care activities carries a higher potential for infection and injury than any other type of waste. Inadequate and inappropriate knowledge of handling of healthcare waste may have serious health consequences and a significant impact on the environment as well. In this study, nurses had adequate knowledge regarding the color coding and waste segregation at source when compared to doctors. Under reporting of needle stick injuries is common among both nurses and doctors. This was due to the fact that most of the doctors and other technical and non-technical staff were unaware about a formal system of injury reporting [17].

## CONCLUSION

Based on the findings of this study, it can be concluded that all the staff's working in ICU units in the current study have satisfactory performance level regarding IC standard precautions. While most of the existing measures to prevent and control nosocomial infections in the ICU are largely effective, modifications and refinements to these existing measures may only help in further improving the patient care. Moreover, these IC measure guidelines must be updated frequently as an essential procedure. The current study recommends the following:

- HCAIs need to be notified and records should be maintained for SSIs, CAUTI, VAP, and blood stream infections
- Infection-control guidelines should include standard operating procedures for management of common HCAI
- There should also be posters, charts, handouts, and snippets of these guidelines displayed on strategic places/points of the hospital for ready reference in every department and ward

- Updating knowledge and performance of ICU nurses through continuing in-service educational programs
- Strict observation of nurses' performance/utilization of IC standard precautions and correction of poor practices by the IC team are required
- It is mandatory to train newly joined ICU nurses and Interns about IC standard precautions
- Availability of all facilities and equipment required for applying IC standard precautions.

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