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**‘AN OBSERVATIONAL STUDY OF SURGICAL SITE INFECTION PREVENTION PRACTICES BY SURGICAL STAFF AMONG THE PRIVATE SECTOR TERTIARY CARE HOSPITALS OF PESHAWAR’.**

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**ABSTRACT:**

**Objective:**

To observe intraoperative practices adopted by the Surgical Staff regarding Surgical Site Infection Prevention as per WHO guidelines in Private Sector Tertiary Care Hospitals of Peshawar.

**Methodology:**

This was an observational study which included surgical staff of Peshawar, conducted from May 2022 to July 2022. Participants were selected by purposive serial technique and their surgical infection prevention control practices were observed by investigators in operation theatre. The data was analysed using SPSS version-25. The categorical variables like frequency and percentages were calculated.

**Results:**

Surgical staff members were assessed for their compliance to WHO guidelines regarding surgical site infection prevention control. The frequency of guidelines practiced/adopted by participants was not satisfactory.

**Conclusion:**

According to observational analysis of our study, the surgical site infection prevention practices adopted by the surgical staff of private sector tertiary care hospitals of Peshawar were not according to the WHO guidelines. As health care professionals they should not only primarily know about the updated guidelines issued by WHO, but also effective workshops should have to be carried out to acknowledge them about the national recommendations regarding surgical site

infection prevention control. The national economic burden of nosocomial infections resulting after surgeries should also be highlighted accordingly.

**Keywords:** Surgical staff, surgical site infections, surgical site infection prevention control.

## **BACKGROUND:**

### **Introduction:**

Infection of a wound after a surgical operation is called post-operative surgical wound infection<sup>1</sup>. The term “surgical wound infection” was replaced by “surgical-site infection” by the Surgical Wound Infection Task Force in 1992 to include infections of organs or spaces deep in the skin and soft tissues<sup>2</sup>. Surgical-site infections (SSIs) are classified by The Centre for Disease Control (CDC), USA into (a) superficial incisional SSI, (b) deep incisional SSI, and (c) organ/space SSI<sup>3</sup>. According to a study conducted in China in 2010, *E. coli* (25.9%), *S. Aureus* (14.3%) and *P. aeruginosa* (11.9%) were the three most common pathogens associated with surgical site infections<sup>4</sup>.

Surgical site infections remain a major problem faced by health care facilities and are associated with significant morbidity and mortality and continues to be a major problem worldwide. The risk of surgical site infections is higher in developing countries relative to developed nations. Surgical site infections account for over 20% of all health care associated infections in surgical patients<sup>4</sup>. Surgical site infections have been reported to be one of the most common causes of nosocomial infection accounting for 20-25% of all nosocomial infections worldwide<sup>5, 6</sup>. Wound sepsis due to health care associated transmission of bacteria is a major global issue amounting to an annual economy of approximately \$3.3 billion in the United States and £700 million in the UK.<sup>1</sup> About 15.5% of the population of developing countries suffers from healthcare-associated infections each year and an estimated 700,000 lives are lost due to antimicrobial resistance<sup>7</sup>.

Despite modern surgical techniques and the use of antibiotic prophylaxis, surgical site infection is the most common complications encountered in surgery<sup>8</sup>. Globally, surgical site infection rates have been found to be from 2.5% to 41.9%.in western countries, 2 – 5 % of patients undergoing clean surgery and up to 20 % patients undergoing intra-abdominal surgery develop surgical site infection<sup>9</sup>. A pilot study in Pakistan shows that 13% of patients who underwent elective surgery and had surgical site infection<sup>10</sup>.

Surgical site infection imposes a substantial clinical burden with socioeconomic that lead to frequent hospital re-admissions, prolong treatment, disability, patient morbidity and mortality. The surgical site infection incidence is four times higher in lower- and middle-income countries. The surgical site infection accounts for approximately 31% of all higher income countries and up to 20% of post-surgical readmissions. Mostly patients recover from a surgical site infection without having long term adverse sequel. The mortality associated as per researches, with surgical site infection itself is 77%<sup>11</sup>.

Important patient-related factors increasing the risk of an SSI include pre-existing infection, malnutrition, obesity, low serum albumin, elderly, smoking, and immunosuppression (diabetes mellitus, irradiation). Surgery-related factors include contaminated surgeries, emergency

surgeries, prolonged procedures, substandard sterilization, inadequate handling of instruments, and inadequate antiseptic surgical site preparation. Physiological conditions that predispose to an increased incidence of SSI include multi-trauma, hemodynamic instability, shock, massive blood transfusions during the procedure, and postoperative hypothermia, hypoxia, and hyper-glycaemia. Other independent predictors of SSI include abdominal surgeries, contaminated or dirty procedures, and three or more diagnoses upon hospital discharge 12.

Various factors affecting the infection rate include skin preparation, wound contamination, the length of pre-operative hospital stay, drainage of wounds, the age of the patient, duration of surgery, and skill and technique of the surgeon. There is higher infection rate involving senior surgeons which can be attributed to the fact that they perform more difficult and lengthy surgeries, while the low rate of infections in surgeries performed by medical officers can be attributed to the fact that they perform simpler and uncomplicated surgeries 13.

Recently a study reported from Pakistan showed that in older patients, 4 out of 9 developed surgical site infections and those who underwent emergency surgery were the most affected 14. Pakistan established its first national infection guidelines in 2006 15. WHO has developed evidence-based guidelines and recommendations for the prevention of surgical site infection 16. Implementation of these guidelines and further modification is a challenge in Pakistan.

Burden of surgical site wound infections is high and can be highlighted by knowing the magnitude of its outcome in our region. A study concluded in Abbottabad that the percentage of SSIs in the Ayub Teaching Hospital was 33.68%, i.e., 32 out of 95 patients developed SSIs.

Likewise, a prospective study aimed to determine the surgical site infection (SSI) rate and associated risk factors was carried in a general surgical ward at Liaquat University Hospital Jamshoro. A total of 460 patients requiring elective general surgery from July 2005 to June 2006 were included in that study. All four surgical wound categories were included. The overall cumulative rate of SSI was 13.0%.

The SSI rates in Surgical 'C' ward of KTH, Peshawar were higher than International SSI rates. The overall SSI rate (9.294%) was found to be higher than the rates obtained by large international multicenter studies.

The human and financial consequences of surgical site infections are substantial. Surgical site infection is a complex problem influenced by numerous factors, only some of which are under surgeon's control. Ensuring high compliance with risk reduction strategies is crucial to the success of surgical site infection reduction efforts. Tremendous international researches are available on this topic, however, limited Pakistani studies on surgeon's compliance to WHO/National guidelines. So, there is a need of further research in this regard. As per researcher's browsing and knowledge, this effort is first of its kind in Peshawar.

To observe intraoperative practices adopted by the Surgical Staff regarding Surgical Site Infection Prevention as per WHO guidelines in Private Sector Tertiary Care Hospitals of Peshawar.

**Techniques:**

The data was collected from selected private hospitals (i-e Kuwait Teaching Hospital, Prime Teaching Hospital and Mercy Teaching Hospital) of district Peshawar. Surgical staff's compliance towards WHO guidelines regarding surgical site infection prevention was assessed using standardized structured check-list as per WHO after permission from hospital's HR department and Medical Superintendent and HOD of surgical unit.

A total of 123 Procedures were recorded by observers. Sample size was calculated online by Raosoft17 by keeping a margin error of 5%, confidence level of 95%, population size of 200 and response distribution of 50%.

A purposive serial sampling technique was used to assess the surgical staff of hospitals concerning their adherence to the techniques for surgical site infection. prevention. The surgical staff included male and female surgeons, anesthesiologist, a certified registered nurse anesthetist, and an operating room nurse.

Study duration was two months (from 13-05-2022 to 13-07-2022) after IRB approval on 10-05-2022 (Prime/ERC/2022 - 28).

The surgical staff members who were willing to participate were included in the study whereas, surgeries other than abdominal wall (including pelvis related procedures) were excluded from the criteria.

**The data collection tool was Standardized self-structured pro-forma by WHO.**

The data was collected by research observers from surgical staff of hospitals after permission from the HR department, Medical Superintendent and HODs of surgical units; using Standardized Self-Structured Pro-forma extracted from WHO guidelines. It began after entry into OT. A set of 14 observations to assess the compliance related to the surgical site prevention practices were formulated. The Check-list collected information about the infection safety protocols practiced by surgical staff in OT.

**Operational Definitions:**

**Surgical site preparation:** the pre-operative treatment of the intact skin of the patient within the operating room18.

**Surgical site infection:** an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue and/or the deep soft tissue of the incision and/or any part of the anatomy19.

**Surgical staff:** The surgical team is made up of a surgeon, an anesthesiologist, a certified registered nurse anesthetist, and an operating room nurse 20.

**Ethical considerations were as followed;**

- Anonymity to the surgical staff was maintained.
- The collected data will be kept in one computer with password protection.
- No third party will have access to collected data.

After successful collection of data, data was entered and analyzed using SPSS software version-25. The categorical variables like Frequencies, Percentages were calculated.

**RESULTS:**

A total of 123 surgical procedures were monitored. Skin around incision site was cleaned and washed among 87 (70.2%) of procedures in operating room by surgical staff. Use of surgical antibiotic prophylaxis was done in 102 (82.3%) of operations and administered up to 120 min before surgical incision in 65 (52.4%) of the procedures. Alcohol based antiseptic was used in 101 (81.5%) of procedures among which chlorhexidine and povidine solution was used for 114 (91.9%) of surgeries. The solution was applied by sterile gauze and instruments in 119 (96%) of procedures. Proper scrubbing method was applied in 98 (79%) of procedures. The incision area after applying the solution was allowed to dry in 92 (74.2%) of procedures. It was ensured among 91 (73.4%) of procedures by surgical staff that alcohol-based solution has not formed a pool underneath the patient before operation. It was ensured among 68 (54.8%) of procedures by surgical staff that any adverse events associated with solution are investigated and recorded. The information on surgical site skin preparation on surveillance forms and in patient records was recorded in 64 (51.6%) of procedure. Number of people limited in OR during surgery among 81 (65.3%) of procedures. Staff was supporting colleagues to adhere to above recommendations in 101 (81.5%) of procedures. The Surgical site skin preparation performed prior to surgery within the OR, immediately before draping and incision for the surgical procedure was performed in 110 (88.7%) of procedures.

**Table 1.1 Descriptive Statistics by check-list**

S.no	Check-list	Total observations	Frequency	%
1	Incision site cleaned or washed	132	87	70.2
2	Antibiotic prophylaxis	132	102	82.3
3	Administration of antibiotic before 120 mins of surgery	132	65	52.4
4	Use of alcohol-based antiseptic	132	101	81.5
5	Use of chlorhexidine and Povidone solution	132	114	91.9
6	Use of solution by sterile gauze/instruments	132	119	96
7	Proper scrubbing method	132	98	79
8	Incision area allowed to dry	132	92	74.2
9	No pooling of solution underneath patient	132	91	73.4

<b>10</b>	Adverse events by solution investigated and recorded by SS	132	68	54.8
<b>11</b>	Recording of SS preparation on patient record	132	64	51.6
<b>12</b>	Limited people in OR during surgery	132	81	65.3
<b>13</b>	Whether staff was supporting colleagues to adhere to recommendations	132	101	81.5
<b>14</b>	SSP prior to surgery in OR immediately and incision for surgery	132	110	88.5

**Table 1.2 Descriptive Statistics of Practices adopted by SS regarding SSI prevention control guidelines**

<b>S. no</b>	<b>Check-list</b>	<b>Yes</b>	<b>No</b>
<b>1</b>	Incision site cleaned or washed	87	45
<b>2</b>	Antibiotic prophylaxis	102	30
<b>3</b>	Administration of antibiotic before 120mins of surgery	65	67
<b>4</b>	Use of alcohol-based antiseptic	101	31
<b>5</b>	Use of chlorhexidine and povidine solution	114	18
<b>6</b>	Use of solution by sterile gauze/instruments	119	13
<b>7</b>	Proper scrubbing method	98	34
<b>8</b>	Incision area allowed to dry	92	40
<b>9</b>	No pooling of solution underneath patient	91	41
<b>10</b>	Adverse events by solution investigated and recorded by SS	68	64
<b>11</b>	Recording of SS preparation on patient record	64	68
<b>12</b>	Limited people in OR during surgery	81	51
<b>13</b>	Whether staff was supporting colleagues to adhere to recommendations	101	31

14	SSP prior to surgery in OR immediately and incision for surgery	110	22
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## DISCUSSION:

As surgical site infection causes considerable morbidity and economic burden. The results of this study were significantly higher as compared with studies measuring the SSIs in developing countries and consistent with many studies in under developing countries.

Paolo Durando and his colleagues actively monitored total of 717 elective interventions in Surgical Audit Team of the San Martino University Hospital of Genoa, in which all of the patients showered, either with a common detergent (87%) or with an antiseptic solution (13%) whereas our study concluded that among 132 patients only 72(80.2%) patients had washed their surgical site before being operated. It either was demarked by non-compliance of patients themselves or improper counselling techniques by surgical staff prior to surgical day.

Our study showed that Alcohol based antiseptic was used in 81.5% of procedures, among which chlorhexidine and povidine solution was used for 91.9% of surgeries. According to concluded antimicrobial testing of Karan Goswami and Mathew S.Austin , povidone-iodine has been shown to kill methicillin-resistant *Staphylococcus aureus* and other antibiotic-resistant strains within 20-30 seconds of exposure and also highlighted the in vitro polymicrobial efficacy of povidone-iodine against *Staphylococcus epidermidis*, *Haemophilus influenzae*, *Pseudomonas aeruginosa*, *Burkholderia cepacia*, and *Escherichia coli*.

Also, the use of surgical antibiotic prophylaxis (SAP) among 132 procedures was done in 82.3% of operations and administered up to 120 min before surgical incision in 52.4% under researcher's observation. A study by Adriana Cristina de Oliveira and Camila Sarmento Gama showed that among 100 of their conducted procedures the agent of choice that was appropriate/satisfactory in only 62% of their operations and administered up to 60 min before surgical incision in 90.3% of the cases. In a study conducted by Gabriel Kambale Bunduki and his colleagues, the compliance rate of SAP among patients undergoing surgery was 18.1%. Emergency surgery increased the risk of SAP non-compliance by three folds. The most frequent antibiotics used in SAP were ampicillin, cloxacillin, gentamicin and ceftriaxone, alone or in combination. Categories of non-compliance included; inappropriate initial dose of antibiotic (compliance rate of 23.8%) and incorrect duration of antibiotic use (compliance rate of 30.9%). Among the included patients, 22 (8.3%) presented with a surgical site infection, of those 20 (90.9%) had received non-compliant SAP. A national study in two teaching hospitals (PIMS and SIH) of Islamabad conducted by Zakir Khan and his colleagues concluded that the appropriate choice of SAP in 860 abdominal surgeries was about half (49%). The appropriate choice/selection of SAP according to the guidelines was lower in abdominal surgeries and compliance with respect to timing was significantly lower.

Another study by Adriana Cristina de Oliveira and Camila Sarmento Gama concluded that an average of nine professionals were present during surgery and the surgery room door remained open in 94.4% of the procedures. Our study stated that in 65.3% procedures the people in OT were limited.

The barriers that influenced our study results significantly are depicted in the below fig.1.1, which is completely based on authors observation.

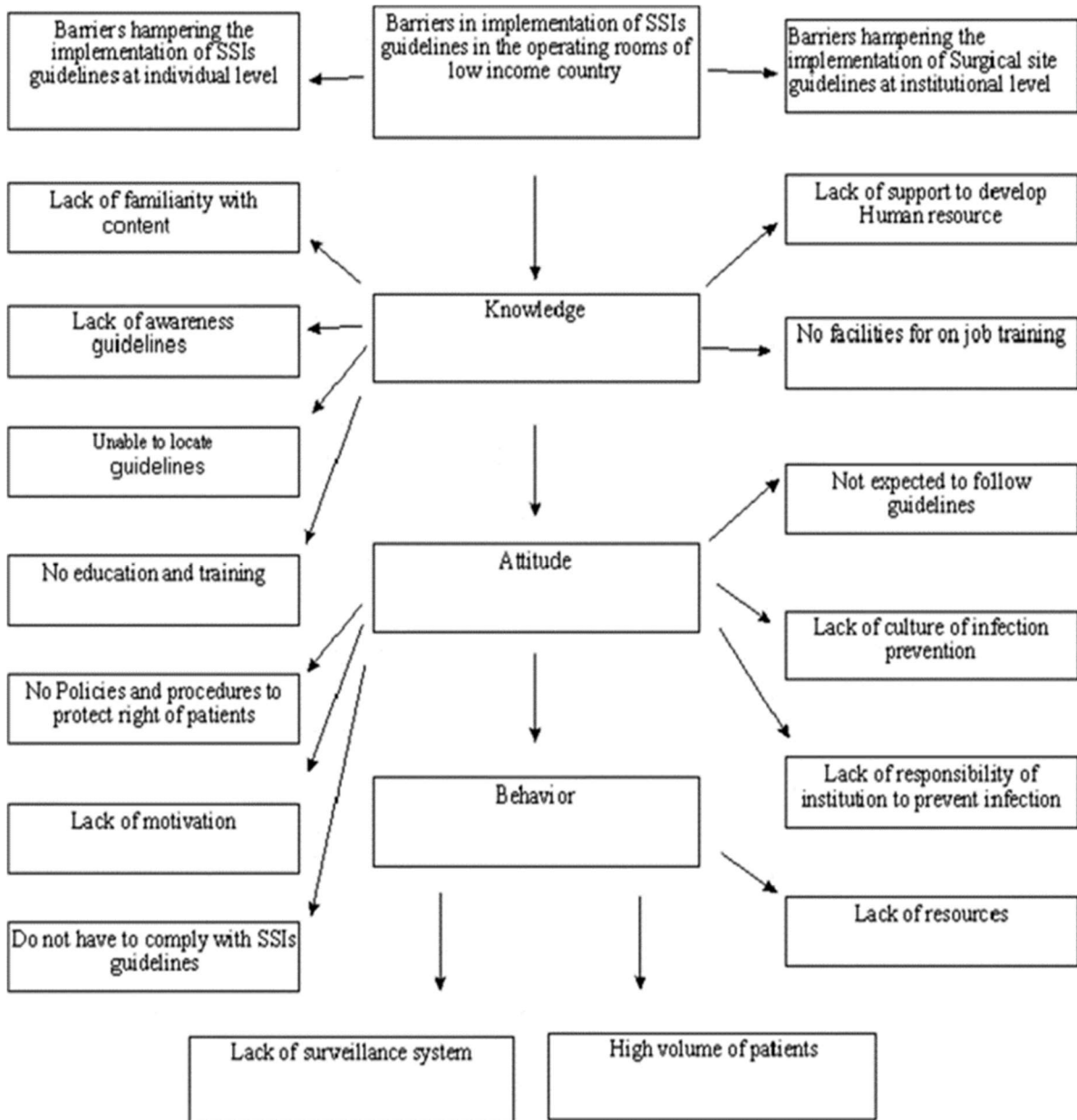


Figure 1.1; Barriers Hampering the implementation of SSIs Guidelines

Infection of wounds after surgical operations is a real risk associated with any surgical procedure and represents a significant burden in terms of patient morbidity and mortality. The routine reporting of SSI rates stratified by potential factors associated with increased risk of infection is highly recommended. Our findings indicate a need to improve surveillance and infection-control practices because it can be a benchmark for national incidence data.



**CONFLICT OF INTERESTS:**

None declared.

**LIMITATIONS OF STUDY:**

Inability to conduct research on wide scale because limited number of operating rooms were observed alternately among three tertiary care hospitals with same rotating surgical staff.

**CONCLUSIONS:**

According to observational analysis of our study, the surgical site infection prevention practices adopted by the surgical staff of private sector tertiary care hospitals of Peshawar were not according to the WHO guidelines.

As health care professionals, they should not only primarily know about the updated guidelines issued by WHO; but effective workshops should have to be carried out to acknowledge them about the national recommendations regarding surgical site infection prevention control. The national economic burden of nosocomial infections resulting after surgeries should also be highlighted accordingly.

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**APPENDIX****Appendix A;**

**CRP 03. AN OBSERVATIONAL STUDY OF SURGICAL SITE INFECTION  
PREVENTION PRACTICES BY SURGICAL STAFF AMONG  
PRIVATE SECTOR TERTIARY CARE HOSPITALS OF PESHAWAR**

**Demographics:**

Surgical Unit	
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**WHAT should be done ? (according to WHO guidelines)**

<b>Sr. No</b>	<b>CHECK LIST</b>	<b>REMARKS</b>
1.	Was the skin around incision site cleaned and washed?	YES / NO
2.	Use of SAP? (Surgical antibiotic prophylaxis)	YES / NO
3.	If yes, was SAP administered before 120min of incision?	YES / NO
4.	Use of alcohol based antiseptic?	YES / NO
5.	If yes, either 2% chlorhexidine with 70% isopropyl alcohol or povidine iodine with 70% isopropyl alcohol?	YES / NO
6.	Was the solution applied using sterile gauze and instruments?	YES / NO
7.	Proper scrubbing method?	YES / NO
8.	Was the incision area after applying solution allowed to dry?	YES / NO
9.	Was it ensured that the alcohol based solution has not formed a pool underneath the patient before operation?	YES / NO
10.	Was it ensured that any adverse events associated with solution are investigated and recorded?	YES / NO
11.	Was the information on surgical site skin preparation on surveillance forms and in patient records recorded?	YES / NO
12.	Are number of people limited in OR during surgery?	YES / NO
13.	Is the staff supporting colleagues to adhere to these recommendations?	YES / NO
14.	Was the Surgical site skin preparation performed prior to surgery within the OR, immediately before draping and incision for the surgical procedure?	YES / NO