Original Research Article

Comparison of surgical site infection using active and passive surveillance methods in two months

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ABSTRACT

The aim of this study was to compare active and passive surveillance methods. This descriptive cross-sectional study was conducted on 296 patients who were admitted to Shahid Sadoughi hospital in Yazd from 2018 to 2020. Surveillance for signs of Surgical Site Infection (SSI) was done using passive (via pamphlet) and active (by telephone) methods in two months. Among 296 patients, SSI was seen in 67 patients (22.6 %). The frequency of SSI in active and passive methods was 65 (24 %) and 2 patients (8 %), respectively. Significant difference was seen between two care methods ($p<0.05$). According to these findings, the active care method was superior to passive method in diagnosis of SSI. Therefore, this method can be used for early detection of infection to reduce complications.

Keywords**:** Surgery, wound infection, active and passive method

INTRODUCTION

Surgical Site Infection (SSI) or infection at near surgical incisions within 30 days after surgery contributes to surgical morbidity and mortality. It is a main public health problem [1] and accounts for approximately 15 % of all nosocomial infections. It is also the most common nosocomial infection among patients underwent surgery [2,3]. Postoperative infection leads to increased length of hospital stay, higher hospital readmission rate and compromised health outcomes [2]. On the other hand, the costs related to SSI are high due to additional diagnostic tests, prolonged hospitalization and rarely additional surgery [2,4]. The first step in SSI therapy is prevention encompassing meticulous operative procedure, timely administration of preoperative antibiotics and preventive measure types. These proceedings neutralize the threat of viral, bacterial and fungal contamination posed by operating room environment, operative staff, and patient's endogenous skin flora. Surveillance strategy decreases the burden of infection through identifying infection problems [5-9] and contributes to control of infection [10]. Various surveillance procedures have been developed for detecting hospital-acquired infection [10]. The choice of each procedure varies based on the accessible resources and the specific surveillance objectives [10].

Surveillance of patients with higher sensitivity can lead to earlier detection of infection at the surgical site and prevent more complications of infection and further use of antibiotics [10], increasing patient satisfaction [10]. Moreover, there are various post discharge surveillance methods for decreasing the incidence of SSI [11]. Curran et al., reported that preoperative training along timely telephone call after discharge decrease emergency department visits and improve satisfaction [12]. Belo-Blasco *et al.* reported that retrospective procedure of review of the medical record was the most effective surveillance procedure for detecting infection in these patients [10]. However, the use of these procedures is associated with methodological challenge because the patient is not under direct medical supervision and there is no consensus about the optimal post discharge surveillance procedure [2,13].

Given that awareness of postoperative infection rate was necessary to identify infections [10] and implement preventive measures and no study was conducted regarding comparison of SSI using active and passive surveillance in our region, the aim of current study was to assess the comparison of SSI using active and passive surveillance methods during a period of 2 months.

MATERIALS AND METHODS

Study design, sample selection and data extraction

This descriptive cross-sectional study was conducted on 296 patients admitted to the surgical ward of Shahid Sadoughi hospital**,** Yazd, Iran from 2018 to 2020. Data including age, gender, type of surgery, underlying disease and type of surgery were extracted from medical records.

Inclusion and exclusion criteria

All patients who underwent surgery at surgical ward of Shahid Sadoughi hospital during 2018-2020 were entered to the study. Patients with incomplete medical records were excluded from study.

Ethical consideration

After obtaining consent from patients, current study was approved by ethical committee of Shahid Sadoughi University of Medical Sciences (Number: IR.SSU.MEDICINE.REC.1398.346).

Assessment of symptoms of infection

Patients were monitored for signs of SSI during a period of 2 months after surgery. Symptoms of infection were evaluated in these patients (Table 1-3).

Surveillance of SSI in patients

Passive method

All patients were instructed to contact physician if they developed symptoms of infection through an educational pamphlet given to them prior to discharge.

Active method

30 days after discharge from hospital, patients informed physician about SSI using a standard interview program by telephone.

Statistical analysis

Data were entered to SPSS, version 19. Fisher exact test and Chi square test were used for analysis of data. $P<0.05$ was assumed significant.

RESULTS

In current study, the mean age of patients was 39.73 ± 22.15 years old. Moreover, no significant difference was seen between two groups, regarding age ($p > 0.05$). Among 296 patients, 67 patients (22.6 %) demonstrated SSI. Comparison of two care methods (active and passive methods) in terms of SSI is shown in Table 4. As shown in Table 4, significant difference was seen between two care methods (active and passive procedure) in terms of surgical site infection ($p<0.05$).

Table 1. Symptoms of SSI

SSI
Date of events happens within 30 days after any NHSN operative procedure (Day 1=the procedure date) Includes only skin and subcutaneous tissue of incision Patients has at least one of the followings **A**: purulent drainage from the superficial incision **B**: Organisms recognized from an aseptically obtained specimen from the superficial incision or subcutaneous tissue using a culture or non- culture based microbiologic tissue assays performed for clinical diagnosis or treatment. **C:** Superficial incision that is intentionally performed by a surgeon, physician or other specialist by culture or non-culture based testing of the superficial incision or subcutaneous incisions is not performed. Patient has at least one of the following symptoms and signs: localized swelling; localized pain or tenderness, erythema or heat. **D**. Diagnosis of a superficial incisional SSI by surgeon, infectious disease, other physician on the case, emergency physician**,** or physician's designee**.**

Table 2. Symptoms of deep incisional SSI

Deep incisional SSI **Must meet the following criteria**
This occurrence is seen within 30 or 90 days after the NHSN operative procedure. Day 1= the procedure date based on the list. Includes deep soft tissues of the incision Patients has at least one of the following: **A**: purulent drainage from the deep incision. **B**: a deep incision that dehisces spontaneously, or its intentionally opened or aspirated by a surgeon, physician or other specialist Organisms were recognized from the deep soft tissues of the incision by a culture or non **-**culture based microbiologic testing procedure which is done for purposes of clinical diagnosis or therapy. Patient has at least one of the following symptoms and signs such as fever >38^{o}C; localized tenderness or pain. **C**: An abscess or other evidence of infection includes a deep incision that is detected on an anatomical or histopathological examination or large imaging test.

Table 3. Symptoms of organ/ space SSI

Organ/ space SSI **Must meet the following criteria**
This occurrence is seen within 30 or 90 days after the NHSN operative procedure. Day 1= the procedure date based on list. Include any part of the body deeper than the fascial/muscle layer that is manipulated or opened during the operative procedure**.** Patients has at least one of the following: **A:** purulent drainage from a drain that is placed into the organ/ space. **B:** Organism identified from a drain that is placed by a culture or non-culture based microbiologic testing method for clinical or therapeutic purposes. **C:** Abscesses or other evidence of organ / space infection detected on anatomical or histopathological examination or large imaging test.

Table 4. Comparison of two care methods (active and passive method) on surgical site infection

Care Method	**Surgical site infection (SSI)**		**Total**	***p*-value***
	No	Yes		
Active	208 (76)	65 (24)	271 (100)	0.048
Passive	23 (92)	2 (8)	25 (100)	
Total	229 (77.4)	67 (22.6)	296 (100)	

*Fisher exact test

Comparison of patients with and without SSI in active care method in terms of variables including gender, type of surgery and history of diseases are shown in Table 5. As shown in Table 5, there was significant difference between two groups in terms of history of heart disease (p<0.05). In this regard, the risk of infection at the surgical site in patients with history of heart disease was significantly higher than other diseases. Moreover, significant difference was seen between two groups regarding the type of surgery (p<0.05). In this regard, the frequency of surgical site infection in surgeries including spleen, stomach and small intestine was significantly higher than other surgeries.

Table 6 demonstrates comparison of patients with and without SSI in passive care method in terms of variables including gender and type of surgery.

As shown in Table 4, significant difference was observed between two groups in terms of the type of surgery ($p<0.05$). In this regard, the frequency of SSI in surgeries including chest and breast was significantly higher than other surgeries.

DISCUSSION

Despite all the preventive measures and technical advances, SSIs are the second common nosocomial infections which increase morbidity and mortality of patients [14]. There are various surveillance strategies for reducing the incidence of SSI [10]. In current study, we compared active and passive surveillance methods regarding SSI after surgery and observed that the active care method was more effective than passive method in identifying SSI. Active surveillance of healthcare-associated infections provides the most accurate results and remains the gold standard, but can optimize the integration of active and passive surveillance data. [15] Brandt et al., assessed SSI rate via active surveillance procedure and reported that infection was decreased as result of the surveillance, indicating the usefulness of surveillance system [1] which was consistent with our study. It is believed that the reduction of SSI rate with surveillance reflects a real reduction of SSI [1]. Heipel *et al.* compared passive and active surveillance procedures for control of SSI neurosurgical procedures.

Table 5. Comparison of patients with and without SSI in terms of variables

Variables	Surgical site infection		Total	p-value
	No	Yes		
Gender				
Male	139 (76.8)	42 (23.2)	181(100)	0.699
Female	67 (74.4)	23 (25.6)	90 (100)	
Total	206 (76)	65 (24)	271(100)	
History of heart disease				
No	196 (79.7)	50 (20.3)	246 (100)	0.000
Yes	10 (40)	15 (60)	25 (100)	
Total	206 (76)	65 (24)	271 (100)	
History of hypertension				
No	182 (76.5)	56 (23.5)	238 (100)	0.637
Yes	24 (72.7)	9 (23.7)	33 (100)	
Total	206 (76)	65 (24)	271 (100)	
History of diabetes				
No	194 (76.7)	59 (23.3)	253 (100)	0.33
Yes	12 (66.7)	6 (33.3)	18 (100)	
Total	206 (76)	65 (24)	271 (100)	
History of hyperlipidemia				
No	189 (75.9)	60 (24.1)	249 (100)	0.885
Yes	17 (77.3)	5 (22.7)	22 (100)	
Total	206 (76)	65 (24)	271 (100)	
Type of Surgery				
Rectum	22 (78.6)	6 (21.4)	28 (100)	
Appendicitis	17 (63)	10 (37)	27 (100)	
Chest	7 (58.3)	5 (41.7)	12 (100)	
Neck	6 (100)	0 (0)	6 (100)	
Thyroid	2 (100)	0 (0)	2 (100)	
Prostate	5 (62.5)	3 (37.5)	8 (100)	0.000
Skin	22 (100)	0 (0)	22 (100)	
Spleen	0 (0)	1 (100)	1 (100)	
Hernia	58 (81.7)	13 (18.3)	71 (100)	
Gallbladder	25 (65.8)	13 (34.2)	38 (100)	
Insertion of shunt for dialysis	7 (100)	0(0)	7 (100)	
Diagnostic laparotomy	13 (76.5)	4 (23.5)	17 (100)	
Breast	12(75)	4 (25)	16 (100)	
Stomach	0 (0)	2 (100)	2 (100)	
Colon	6 (100)	0 (0)	6 (100)	
Amputation	3 (100)	0 (0)	3 (100)	
Small intestine	0 (0)	4 (100)	4 (100)	
Total	205 (75.9)	65 (24.1)	270 (100)	

*Chi Square test

Table 6. Comparison of patients with and without SSI in terms of variables

Variables	**Surgical site infection**		**Total**	***p*-value ***
	No	**Yes**		
Gender				
Male	11 (84.6)	2 (15.4)	13 (100)	
Female	12 (100)	0 (0)	12 (100)	0.157
Total	23 (92)	2 (8)	25 (100)	
Type of Surgery				
Rectum	4 (100)	0 (0)	4 (100)	
Appendicitis	5 (100)	0 (0)	5 (100)	
Chest	0 (0)	1(100)	1(100)	
Thyroid	1(100)	0 (0)	1(100)	
Skin	1(100)	0 (0)	1(100)	0.009
Hernia	5 (100)	0 (0)	5 (100)	
Gallbladder	3 (100)	0 (0)	3 (100)	
Insertion of shunt for dialysis	1 (00)	0 (0)	1(100)	
Breast	0 (0)	1 (100)	1(100)	
Stomach	1 (100)	0 (0)	1(100)	
Colon	1 (100)	0 (0)	1(100)	
Total	23 (92)	2 (8)	25 (100)	

*Chi Square test

In this regard, active surveillance by Infection Control Professionals (ICPs) and neurosurgeons was detected in 17 and 14 cases, respectively**.** According to these findings**,** an active surveillance procedure is essential for precise identification of SSIs. The primary problem in passive surveillance was failure to capture cases. Therefore, passive surveillance was associated with poor sensitivity for detecting SSIs in comparison of active surveillance by ICP [16]. Daniel J Borsuk *et al.* examined the role of active post-discharge surveillance program in decreasing readmissions of patients to hospital and observed that length of hospital stay in non-surveillance group (4.7 ± 2.6 days) was longer compared to active surveillance group (2.6 ± 2.8 days). Moreover, patients in active surveillance group had lower readmission compared to patients in non-surveillance group [17]. Therefore, according to findings of current study and other studies, it seems that active procedure was superior to passive procedure.

In active procedure, the frequency of SSI in surgeries including spleen, stomach and small intestine was significantly higher than other surgeries. Moreover in passive procedures, the frequency of SSI in surgeries including chest and breast was significantly higher than other surgeries. Barmparar *et al.* assessed postoperative infection rate after splenectomy and reported that splenectomy increases the risk of infection about 3 fold [4]. The early incidence of infectious complications in these patients is not well explained. It seems that the increased risk of infection in these patients may be due to splenectomy itself or underlying pathology. Other studies have shown that the risk of infection after splenectomy was 36 %–45 % [4,18]. Jeong *et al.* assessed incidence for surgical site infection after gastric surgery and reported that the incidence of SSI was 3.3 % [19]. Wang et al., assessed SSI after gastrointestinal surgery and observed SSI in 5.2 % of patients [20]. Therefore, the findings of studies in this regard were controversy and it further studies should be conducted in this regard.

In current study, although the SSI rate was higher in patients with history of heart disease, there was no significant difference between two groups (patients with and without SSI) regarding history of hypertension, hyperlipidemia and diabetes. Teo *et al.* assessed SSI after total knee arthroplasty and reported that no significant difference was seen between those who developed infection and those without infection regarding history of diabetes, hypertension, hyperlipidemia and ischemic heart disease [21]. Davis *et al.* assessed predictors of SSI after open lower extremity bypass and reported that there was significant difference between patients with and without SSI considering history of hypertension, diabetes, and congestive heart failure [22]. The findings of studies in this regard were controversy and it seems that the type of surgery is the reason of difference of the findings of studies. In addition, duration of these diseases may be another influential factor. Moreover, the mean age of patients was 39.73±22.15 years old. Megan Brenner *et al.* assessed long-term impact of damage laparotomy and reported that the mean age of patients was 34 years old [23].Other study also reported that the mean age of patients was 31.2 years old [24]. Therefore, it can be said that surgeries and their infections occur mostly after the third and fourth decades of life.

CONCLUSION

According to these findings, the active care procedure was superior to passive method in diagnosis of SSI. Therefore, this method can be used for early detection of infection to reduce complications of disease and increase the patient's chances of recovery. In addition, the type of surgery and the history of heart disease are influential factors on SSI. Therefore, it is recommended to pay more attention to patients with a history of heart disease and patients underwent surgery with a high risk of infection related wound.

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