IP Journal of Surgery and Allied Sciences 2022;4(2):49–55

Content available at: https://www.ipinnovative.com/open-access-journals

IP Journal of Surgery and Allied Sciences

Journal homepage: https://www.jsas.co.in/

Original Research Article

Incidence and etiology of abdominal surgical site infections among emergency postoperative patients in a tertiary medical college hospital, Faridpur, Bangladesh

Saiful Islam Khan[1,*], Shifa Khan[2], Muhammad Mofazzal Hossain[1], Iqbal Hossain Talukder[3], Mohammad Ali[4], Swapan Kumar Biswas[1]

[1] *Dept. of Surgery, Bangabandhu Sheikh Mujib Medical College, Faridpur, Bangladesh*
[2] *Bangabandhu Sheikh Mujib Medical College, Faridpur, Bangladesh*
[3] *Dept. of Surgery, Sheikh Hasina Medical College, Tangail, Bangladesh*
[4] *Dept. of Haematology, National Institute of Cancer Research and Hospital, Mohakali, Dhaka, Bangladesh*

ARTICLE INFO

Article history:
Received 11-04-2022
Accepted 22-04-2022
Available online 31-05-2022

Keywords:
Surgical site infection
Appendectomy
E coli

ABSTRACT

Objective: This prospective study was conducted to provide data of the incidence, risk factors and microbiological pattern associated with SSIs among 112 patients who underwent emergency abdominal operations in Bangabandhu Sheikh Mujib Medical College Hospital, Faridpur in Surgery Unit: 2 between January 2020 and March 2021.

Materials and Methods: After fulfilling the recruitment criteria all patients were consecutively enrolled with their consent and their preoperative, intraoperative, and postoperative data were collected. Wound discharge/pus were collected and sent for culture and sensitivity testing. Follow-ups were done in the unit assistant register's room. Data were analyzed using IBM SPSS version 28.0.0.0.

Results: The overall incidence of SSI was 15.2%. Male (64.7%) are affected more than female (35.3%). Underweight patients (47.1%) and appendectomy related cases had most SSI (41.2%). All SSIs are detected between 2^{nd} and 7^{th} post-operative day. Most of the wounds are clean-contaminated, contaminated and dirty types. Chances of SSI increase when duration of surgery exceeds three hours. *E. Coli* was the most predominant organism (82.4%) followed by *Klebsiella pneumoniae* (11.8%) and *Staphylococcus aureus* (5.8%). Amikacin (100%), Levofloxacin (93.2%) and Moxifloxacin (92.3%) had maximum sensitivity patterns whereas commonly prescribed drugs like Ceftriaxone and Cefuroxime had high resistance (100%).

Conclusion: The incidence of SSI in this tertiary hospital is very high. *E. Coli* is the predominant organism responsible. Amikacin, levofloxacin and moxifloxacin are very potent antibiotics against organisms that cause SSI in our hospital.

For reprints contact: reprint@ipinnovative.com

1. Introduction

A surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place. Surgical site infections can sometimes be superficial infections involving the skin only. Other surgical site infections are more serious and can involve tissues under the skin, organs, or implanted material[1] It is also defined as an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision (superficial incisional) and/or the deep soft tissue (for example, fascia, muscle) of the incision (deep incisional) and/or any part of the anatomy (for example, organs and spaces) other than the incision that was opened or manipulated during an operation (organ/space).[2]

* *Corresponding author*.
E-mail address: ksaiful8@gmail.com (S. I. Khan).

https://doi.org/10.18231/j.jsas.2022.010

Patients undergoing clean–contaminated, contaminated, and dirty surgical procedures, have a 30-day SSI incidence ranging from 9·4% in high-income countries to 23·2% in low-income countries.[3] Incidence of deep tissue and organ space SSIs are less frequent than superficial SSIs.[4] SSI prevention is the highest priority worldwide.[5] SSIs can be avoided or minimized by the successful implementation of clinical practice guidelines using a multimodal improvement strategy.[6] In Faridpur, data about SSIs are still scarce and the true incidence, risk factors and microbiological involvement among the emergency abdominal cases are unknown.

No research has been done to determine the incidence of SSI among abdominal emergency postoperative patients. This study used standardized documentation to provide data of the incidence, risk factors and microbiological pattern associated with SSI among patients who underwent emergency abdominal operations in BSMMCH Surgery Unit - 2 and would be used to modify the risk factors and to establish the sensitivity patterns of organisms to commonly available antibiotics.

2. Materials and Methods

2.1. Study site

The study was conducted in surgery department, unit – 2 of Bangabandhu Sheikh Mujib Medical College Hospital, Faridpur, Bangladesh, a 500-bed capacity government hospital.

2.2. Study design and duration

It is a prospective study in which the participants who underwent emergency abdominal surgical operations were followed up for a maximum period of 30 days postoperatively between January 2020 and March 2021.

2.3. Study population

Study population was all patients of acute abdomen admitted through emergency under surgery unit-2 of Bangabandhu Sheikh Mujib Medical College Hospital who underwent laparotomy and those who had previous emergency laparotomy at BSMMCH for acute abdomen and were readmitted with wound sepsis within 30 days after operation.

2.4. Sample size

The sample size was calculated using open epi software (The Fleiss formula by John Wiley & Sons, 1981). Total sample size for this study was 112 patients.

2.5. Study procedures

Following resuscitation and stabilization, admitted patients who met the inclusion criteria were recruited into the study. Written consent to participate in the study was then obtained and a full history and physical examination done. Patient's data was collected using a pretested interviewer administered semi structured questionnaire.

2.6. Variables studied

Dependent variable: Abdominal surgical site infection (SSI).

Independent variables: Age, sex, BMI, ASA class, anemia, DM, cancer, smoking, wound class, surgeon category, type and duration of surgery & use of drain.

2.7. Laboratory procedures

The patients who developed SSI, exudates from their wounds were collected using sterile swabs which were transported at room temperatures to the laboratory within 30 minutes of collection. Conventional identification of bacteria was done by Gram staining followed by bacterial identification and antibiotic-susceptibility testing. Culture was done in chocolate agar or MacConkey agar medium. Plates were incubated at 37°C for 12–24 h in an aerobic atmosphere. After incubation for 48–72 h plates were examined for growth and biochemical tests were done to identify the genus and species of bacteria. After 24 h of observation, diagnosis of infection was made. Susceptibility testing was done by the disk diffusion or Kirby-Bauer method.

2.8. Statistical analysis

The analysis is done using IBM SPSS version 28.0.0.0. Multiple logistic regression of the independent variables has been done where the development of SSI (17 cases) was considered as dependent variable. Confidence interval was kept at 95 as% and sociated odds ratio (OR) was presented. Statistical significance was considered at p value <= 0.05.

3. Ethical Approval

The study was approved by the department of surgery, Faculty Research Committee and the Institutional Review Committee of Bangabandhu Sheikh Mujib Medical College Hospital. All participants were provided with a written informed consent.

4. Results

4.1. Patient information

Total 112 patients (85 male and 27 female) were recruited and among them 17 patients (11 male & 6 female) had developed SSI.

Table 1: Patient information

Characteristic		**SSIs**	
		No	**Yes**
Sex	Female	21	6 (35.3%)
	Male	74	11(64.7%)
	Total	95	17
Age group	13-35	59	5 (29.4%)
	36-75	36	12 (70.6%)

Table 2: SSI study patients (N = 17)

SSI study patients	n (%)
Types of SSI	
Superficial	7 (41.2)
Organ/Space	5 (29.4)
Deep	5 (29.4)
Symptoms on	
Day 2-7	17 (100.0)
Organism isolated	17 (100.0)
E. coli	14 (82.4)
S. Aureus	1 (5.9)
Klebsiella	2 (11.8)

Table 3: N: 112 Independent sample t test

General Characteristics of study patients; n (%)	**Without SSI 95 (84.8%)**	**SSI cases; n 17 (15.2%)**	**Total 112 (100%)**	**P-value**
Age				
Mean age in years; mean±SD	35±18	46±15	36±18	0.027^{s}
Median Age in years	32	50	33	
Gender				
Female	21 (18.8)	6 (5.4)	27 (24.1)	0.242^{ns}
Male	74 (66.1)	11 (9.8)	85 (75.9)	
BMI (Kg/m^2); mean±SD	21.93±3.70	24.03±3.87	22.25±3.78	0.034^{s}
Positive Smoking history;	36 (32.1)	7 (6.3)	43 (38.4)	0.798^{ns}
Co-morbidities				
Anaemia	32 (28.6)	6 (5.4)	38 (33.9)	0.897^{ns}
Diabetes	11 (9.8)	4 (3.6)	15 (13.4)	0.183^{ns}
Hypertension	13 (11.6)	44 (3.6)	17 (15.2)	0.297^{ns}
Tuberculosis	3 (2.7)	0 (0.0)	3 (2.7)	0.458^{ns}
Cancer	4 (3.6)	1 (0.9)	5 (4.5)	0.759^{ns}

4.2. Incidence of SSI

The overall incidence of surgical site infection was 15.2% (17/112). The SSI incidence was highest in the age group of 36 to 75 years (70.6%). The mean patient age was 36.84 years ± 17.97 (13–75) years, among 85 males, 11 (64.7%) had SSI and among 27 females, 6 (35.3%) had SSI. All of the 17 patients had developed SSI between 2^{nd} and 7^{th} post-operative days. Superficial SSI accounted for 41.2% (7 cases), deep and organ space SSI accounted for 29.4% (5 cases) each.

4.3. Etiology of SSIs

Three (3) organisms were responsible for causation of SSIs among this study. These are E. coli (14 cases) 82.4%, Klebsiella pneumoniae (2 cases) 11.8% and Staphylococcus aureus (1 case) 5.8%.

Table 4: Bivariate analysis of riskfactors for development of SSIs

Operative information	Without SSI 95 (84.8%)	SSI cases; n 17 (15.2%)	Total 112 (100%)	P-value
Type of Operation				
Emergency	37 (33.0)	7 (6.3)	44 (39.3)	0.862^{ns}
Urgent	58 (51.8)	10 (8.9)	68 (60.7)	
Done by_				
Senior Surgeon	53 (47.3)	8 (7.1)	61 (54.5)	0.506^{ns}
Trainee	42 (37.5)	9 (7.7)	51 (45.5)	
ASA class				
ASA class 1	71 (63.4)	9 (8.0)	80 (71.4)	
ASA class 2	22 (19.6)	7 (6.3)	29 (25.9)	0.171^{ns}
ASA class 3	2 (1.8)	1 (0.9)	3 (2.7)	
Operative duration				
<30 min	5 (4.5)	0 (0.0)	5 (4.5)	
30 min to <1hr	40 (35.7)	5 (4.5)	45 (40.2)	
1 hr to <2hr	27 (24.1)	4 (3.6)	31 (27.7)	0.001^{s}
2 hr to <3hr	19 (17.0)	2 (1.8)	21 (18.8)	
3 hr to <4hr	4 (3.6)	6 (5.4)	10 (8.9)	
Drain used	56 (50.0)	13 (11.6)	69 (61.6)	0.171^{ns}
Wound type				
Clean Wound	1 (0.9)	0 (0.0)	1 (0.9)	
Clean-contaminated	41 (36.6)	6 (5.4)	47 (24.1)	0.017^{ns}
Contaminated	21 (18.8)	6 (5.4)	27 (24.1)	
Dirty /Infected	32 (28.6)	5 (4.5)	37 (33.0)	
Post-operative information's				
Oxygen inhalation	55 (49.1)	14 (12.5)	69 (61.6)	0.056^{ns}

Table 5: Multiple logistic regression analysis

Parameter Estimates

SSI [a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
SSI Present	Intercept	-7.979	2.772	8.284	1	.004			
	Age	1.512	1.028	2.162	1	.141	4.537	.605	34.046
	Gender	-.327	.800	.167	1	.683	.721	.150	3.456
	BMI	.488	.583	.698	1	.403	1.628	.519	5.110
	ASA	-.171	.796	.046	1	.830	.843	.177	4.009
	Anemia	.017	.779	.000	1	.983	1.017	.221	4.685
	DM	-.132	.839	.025	1	.875	.876	.169	4.541
	Cancer	-1.749	1.616	1.171	1	.279	.174	.007	4.132
	Smoking	-.227	.831	.075	1	.784	.797	.156	4.063
	Wound class	-1.168	.617	3.577	1	.050	.311	.093	1.043
	Duration-of-OT	1.296	.521	6.202	1	.013	3.656	1.318	10.143
	Use of Drain	-.730	1.775	.169	1	.681	.482	.015	15.624
	Surgeon-category	.832	.678	1.504	1	.220	2.297	.608	8.675
	Type-of-OT	.101	.850	.014	1	.905	1.106	.209	5.853
	Post-op-Oxygen	1.102	1.651	.445	1	.504	3.009	.118	76.485

a. The reference category is: SSI Absent.

Table 6: N: 17: Fisher's exact test

Sensitivity pattern		E. coli	S. aureus	Klebsiella sp.	Total n (%)	P-value
Cefuroxime	Sensitive n (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	–
	Resistant n (%)	2 (100.0)	1 (100.0)	1 (100.0)	4 (100.0)	
Ceftazidime	Sensitive n (%)	1 (8.3)	0 (0.0)	0 (0.0)	1 (8.3)	–
	Resistant n (%)	10 (83.4)	0 (0.0)	0 (0.0)	10 (83.4)	
Ceftriaxone	Sensitive n (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	–
	Resistant n (%)	13 (100.0)	1 (100.0)	1 (100.0)	15 (100.0)	
Ciprofloxacin	Sensitive n (%)	4 (28.6)	1 (100.0)	0 (0.0)	5 (19.4)	0.357^{ns}
	Resistant n (%)	6 (42.9)	0 (0.0)	2 (100.0)	8 (47.1)	
Amikacin	Sensitive n (%)	1 (100.0)	2 (100.0)	1 (100.0)	4 (100.0)	–
	Resistant n (%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Gentamicin	Sensitive n (%)	8 (61.5)	2 (100.0)	1 (100.0)	11 (68.8)	0.432^{ns}
	Resistant n (%)	5 (38.5)	0 (0.0)	0 (0.0)	5 (31.3)	
Moxifloxacin	Sensitive n (%)	11 (78.6)	1 (100.0)	0 (0.0)	12 (80.0)	1.000^{ns}
	Resistant n (%)	1 (7.1)	0 (0.0)	0 (0.0)	1 (6.7)	
Azithromycin	Sensitive n (%)	12 (85.7)	1 (100.0)	0 (0.0)	13 (81.3)	0.350^{ns}
	Resistant n (%)	2 (14.3)	0 (0.0)	1 (100.0)	3 (18.8)	
Levofloxacin	Sensitive n (%)	11 (84.6)	1 (100.0)	2 (100.0)	14 (87.4)	1.000^{ns}
	Resistant n (%)	1 (7.7)	0 (0.0)	0 (0.0)	1 (6.3)	
Nitrofurantoin	Sensitive n (%)	9 (75.0)	1 (50.0)	1 (50.0)	11 (73.3)	0.637^{ns}
	Resistant n (%)	2 (16.7)	0 (0.0)	1 (50.0)	3 (20.0)	

4.4. Risk factors associated with SSI

At bivariate logistic regression and independent sample t test age (p = 0.027), BMI (p = 0.034), operative duration (p = 0.001), postoperative oxygen inhalation (p = 0.056) and wound class (p = 0.017) were associated with SSIs. Underweight participants (BMI <18.5) had most SSI (8/17) 47.1%. Majority of the SSI occurred in appendectomy related cases (7/17) 41.18% and laparotomy for traumatic small or large bowel perforation (3/17) 17.6%. Patients undergoing operations for duodenal ulcer perforation had less SSI than any other single procedure (1 out of 16 cases). Three cases had history of previous abdominal surgery and 2 (66.7%) of them developed SSI. Surgery performed within 12 - 24 hours of admission (urgent operations) had most SSI 58.8% (10/17)**.** Trainee surgeon performing alone had more SSI (9/17) 52.9%. Gender, comorbidities, smoking history, type of surgery, ASA class and use of drain were not associated with SSI (Tables 3 and 4).

The final model was composed of only wound class (p = 0.050) and duration of surgery (p = 0.013).

4.5. Sensitivity patterns of the causative organisms

Antibiotics that had maximum sensitivity patterns: amikacin (100%), levofloxacin (93.2%), moxifloxacin (92.3%), azithromycin (81.3%), nitrofurantoin (78.6%), gentamicin (68.8%). Antibiotics that had high resistance: Cefuroxime (100%), ceftriaxone (100%), ceftazidime (83.4%) and ciprofloxacin (47.1%). *E. coli* had highest resistance for Ceftriaxone, cefuroxime and ceftazidime, and had highest sensitivity for amikacin, azithromycin, levofloxacin, moxifloxacin, nitrofurantoin and gentamicin. *Klebsiella* had highest resistance for ceftriaxone, cefuroxime, ciprofloxacin, azithromycin and doxycycline, and had highest sensitivity for amikacin, gentamicin, and levofloxacin.

S Aureus had highest resistance for cefuroxime, and highest sensitivity for amikacin.

5. Discussion

Despite advances in sterilization methods, barriers, surgical technique, and availability of antimicrobial prophylaxis, SSIs remain a substantial cause of morbidity, prolonged hospitalization, unplanned readmissions and death all over the world.[7] Incidence of SSI differs widely from one hospital to another and from one geographic location to another.[8] Around 157,500 SSI cases (3.03%) occur in USA per year.[9] SSI rates assessed in a Canadian hospital over a period of 10 years showed a rate of only 4.7%.[10] SSI rates of 6.09% to 38.7% were observed in various Indian studies.[11] In China, the incidence of SSI in various hospitals varies from 13.0% to 18.0%.[12] In most studies in Africa the incidence of SSI was high, at around 16.4%.[13] The prevalence rate of SSI was 5.13% to 14.13% in two different studies conducted in Bangladesh.[14,15] In our study the overall prevalence of SSI was 15.2%. The incidence rate variations observed between other literature and our study may be related to the different surveillance systems, post-discharge surveillance and possible underreporting of SSI.[16] Advances in infection control like use of positive pressure, exchanges of filtered air per hour, air-conditioning systems with HEPA filters, etc. in theaters to reduce bacterial loads are still lacking in our country and this might contribute to the high incidence of SSI. The high standards of health care which were maintained in the developed countries made the difference in the rates of infection observed in developing countries.[16] SSI increases the cost of hospitalization and also led to development of antimicrobial resistance.[11]

The risk factors for SSI identified were: CDC wound class and duration of surgery. Duration of surgery has a statistically significant association with SSI. In this study, when duration of surgery exceeds three hours, it increase the chance of SSI development (p<0.001). This may be due to a greater exposure of the incision site to pathogens and/or a greater chance of breach of the aseptic technique.[16] CDC wound class was also statistically associated with SSI. Surgeries that are clean-contaminated, contaminated and dirty/infected showed an increase chance of developing SSI when compared to clean wounds.

Taking the patient factors into consideration, SSI incidence was most among patients of the age between 36 to 75 years (70.6%), whereas the lowest infection rate was in the age group of 13–35 years (29.4%) in our study**.** Various studies have reported that with increasing age, the incidence of SSI increases because of impairing immunity.[11] The ASA index for the patient's clinical status before surgery is a recognized risk factor for SSI[16] but in our series most of the patients belong to ASA class 1(71.4%), so this became insignificant. Microbiological profile found out *E. coli* as the main organism responsible for the development of SSI and identified in 82.4% of the cases. Identification of risk factors allows health care professionals to take actions that reduce complications resulting from infections and minimize SSI rates.

To overcome the high infection rate in developing countries, proper surveillance system is required for the use of antibiotics along with the implementation of infection control practices. To reduce the number of airborne particles in the operating theatre simple measures like limiting the number of personnel in the operating theatre with their restricted movements will decrease the dispersion of bacteria.[17] Approximately half of SSIs can be prevented using evidence-based strategies.[18] The most recent CDC 'Guideline for the Prevention of Surgical Site Infection' was published in 2017.[18] Prevention of SSI requires a multidisciplinary approach and also include personnel who are responsible for the design, layout and functioning of operating theatres.[17]

6. Conclusion

The incidence of SSI in this tertiary hospital is very high (15.2%). The risk factors related with SSI were: CDC wound class (clean- contaminated, contaminated or dirty/infected) and longer duration of surgery. Pus cultures found *E. Coli* as the predominant organism. Amikacin, levofloxacin and moxifloxacin are very potent antibiotics against organisms that cause SSI in our hospital. CDC guidelines for the prevention of surgical site infection should be followed strictly to decrease the incidence of SSI in our hospital.

7. Authors' Contributions

Dr. Saiful Islam Khan conceived and designed the research, was the principal investigator, and developed the manuscript as well as its review before submission. Dr. Shifa Khan collected the data. Dr. Muhammad Mofazzal Hossain and Dr. Iqbal Hossain Talukder contributed to the review of the manuscript. Dr. Mohammad Ali performed the data analysis. Dr. Swapan Kumar Biswas supervised the research.

8. Source of Funding

None.

9. Conflict of Interest

None.

References

1. Surgical Site Infection (SSI); 2010. Available from: https://www.cdc.gov/HAI/ssi/ssi.html.
2. Surveillance of surgical site infections in European hospitals – HAISSI protocol; 2012. Available from: http://ecdc.europa.eu/en/publications/Publications/120215_TED_SSI_protocol.pdf.
3. Sawyer RG, Evans HL. Surgical Site Infection-the next Frontier in Global Surgery. *Lancet Infect Dis*. 2018;18(5):477–8. doi:10.1016/S1473-3099(18)30118-X.
4. Segal CG, Waller DK, Tilley B, Piller L, Bilimoria K. An Evaluation of Differences in Risk Factors for Individual Types of Surgical Site Infections after Colon Surgery. *Surgery*. 2014;156(5):1253–60. doi:10.1016/j.surg.2014.05.010.
5. WHO. World Health Organization. Implementation Manual to Support the Prevention of Surgical Site Infections at the Facility Level: Turning Recommendations into Practice: Interim Version; World Health Organization; 2018. Available from: https://apps.who.int/iris/handle/10665/330071.
6. WHO. Preventing Surgical Site Infections: Implementation Approaches for Evidence-Based Recommendations; 2018. p. 59. Available from: https://apps.who.int/iris/handle/10665/273154.
7. Available from: https://www.cdc.gov/nhsn/pdfs/pscmanual/9pscssicurrent.pdf.
8. Estrada EOD, Duarte MR, Rodrigues DM, Raphael MD. Wound Infections in Pediatric Surgery: A Study of 575 Patients in a University Hospital. *Pediatr Surg Int*. 2003;19(6):436–8.
9. Magill SS, Edwards JR, Bamberg W, Beldavs ZG, Dumyati G, Kainer MA, et al. Emerging Infections Program Healthcare-Associated Infections and Antimicrobial Use Prevalence Survey Team. Multistate Point-Prevalence Survey of Health Care-Associated Infections. *N Engl J Med*. 2014;370(13):1198–1208. doi:10.1056/NEJMoa1306801.
10. Cruse PJ, Foord R. The Epidemiology of Wound Infection. A 10-Year Prospective Study of 62,939 Wounds. *Surg Clin North Am*. 1980;60(1):42031–2. doi:10.1016/s0039-6109(16)42031-1.
11. Narula H, Chikara G, Gupta P. A Prospective Study on Bacteriological Profile and Antibiogram of Postoperative Wound Infections in a Tertiary Care Hospital in Western Rajasthan. *J Family Med Prim Care*. 2020;2020(4):1927–34.
12. Kim BD, Hsu WK, De Oliveira GS, Saha S, Kim JY. Operative duration as an independent risk factor for postoperative complications

in single-level lumbar fusion: an analysis of 4588 surgical cases. *Spine*. 1976;39(6):510–20. doi:10.1097/BRS.0000000000000163.

13. Lubega A, Joel B, Lucy NJ. Incidence and Etiology of Surgical Site Infections among Emergency Postoperative Patients in Mbarara Regional Referral Hospital, South Western Uganda. *Surg Res Pract*. 2017;2017:6365172. doi:10.1155/2017/6365172.
14. Monjur F, Rizwan F, Ghosh NK. SURGICAL SITE INFECTION RELATED RISK FACTORS AND USAGE OF ANTIBIOTICS IN TWO DIFFERENT TERTIARY CARE HOSPITALS OF DHAKA CITY, BANGLADESH. *Asian J Pharm Clin Res*. 2018;11(7):184–8. doi:10.22159/ajpcr.2018.v11i8.25878.
15. Sickder HK, Lertwathanawilat W, Sethabouppha H, Viseskul N. Prevalence of Surgical Site Infection in a Tertiary Level Hospital in Bangladesh. *Int J Natural Soc Sci*. 2019;2017(3):63–8.
16. Carvalho RLR, Campos CC, Franco LM, De C, Rocha ADM, Ercole FF. Incidence and Risk Factors for Surgical Site Infection in General Surgeries. *Rev Lat Am Enfermagem*. 2017;4:2848. doi:10.1590/1518-8345.1502.2848.
17. Spagnolo AM, Ottria G, Amicizia D, Perdelli F, Cristina ML. Operating Theatre Quality and Prevention of Surgical Site Infections. *J Prev Med Hyg*. 2013;54(3):131–7.
18. Carvalho RLR, Campos CC, Franco LM, De C, Rocha ADM, Ercole FF. Incidence and Risk Factors for Surgical Site Infection in General Surgeries. *Rev Lat Am Enfermagem*. 2017;25(18):e2848. doi:10.1590/1518-8345.1502.2848.

Author biography

Saiful Islam Khan, Assistant Professor

Shifa Khan, Assistant Register

Muhammad Mofazzal Hossain, Assistant Professor

Iqbal Hossain Talukder, Assistant Professor

Mohammad Ali, Associate Professor & Head

Swapan Kumar Biswas, Associate Professor

Cite this article: Khan SI, Khan S, Hossain MM, Talukder IH, Ali M, Kumar Biswas S. Incidence and etiology of abdominal surgical site infections among emergency postoperative patients in a tertiary medical college hospital, Faridpur, Bangladesh. *IP J Surg Allied Sci* 2022;4(2):49-55.