Journal of SURGICAL ARTS
CERRAHİ SANATLAR DERGİSİ
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jsurgarts.com
1308-0709

Clinical Practice Study

Pattern of surgical site infection in contaminated and infected wounds and corelation with introperative bacterial growth

Kontamine ve enfekte yaralarda cerrahi alan enfeksiyonu paterni ve intraoperatif bakteri üremesi ile korelasyonu

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J Surg Arts: 2021;14(1):17-21. DOI: https://doi.org/10.14717/jsurgarts-210104

ABSTRACT

Surgical Site Infections (SSIs), previously called post operative wound infections, result from bacterial contamination during or after a surgical procedure.Surgical site infections are the third most common hospital associated infection, accounting for 14-16% of all infections in hospitalized patients.

Aims and objectives are to establish the pattern of wound infection in terms of aerobic organisms after contaminated and infected surgical procedures. 50 patients having emergency or elective traumatic or non-traumatic abdominal operations who fulfil the criteria of infected and contaminated wounds are included in the study. Patients to be studied were selected in random basis.

The incidence of wound infection is 31.57% in contaminated surgical procedures and 29.03% in infected surgical procedure. Operation in emergency set up results in an increased risk of wound infection. Patients with positive intra operative bacteriology runs a higher risk of developing wound infection. The commonest organism isolated from intra operative swab cultures were E. coli followed by Klebsiella in both infected and contaminated procedures. Presence of polymicrobial flora in intraoperative swab culture is associated with higher rate of wound infection.

Keywords: Surgical site infection; contamination; infection; antibiotic; treatment; wound.

ÖZET

Daha önce ameliyat sonrası yara enfeksiyonları olarak adlandırılan Cerrahi Alan Enfeksiyonları (SSI), bir cerrahi prosedür sırasında veya sonrasında bakteriyel kontaminasyondan kaynaklanır. Cerrahi bölge enfeksiyonları, hastanede yatan hastalarda tüm enfeksiyonların %14-16'sını oluşturan üçüncü en yaygın hastane enfeksiyonudur.

Amaçlar ve hedefler, kontamine ve enfekte cerrahi prosedürlerden sonra aerobik organizmalar açısından yara enfeksiyonunun modelini belirlemektir. Çalışmaya acil veya elektif travmatik veya travmatik olmayan karın ameliyatı geçiren, enfekte ve kontamine yaralar kriterlerini karşılayan 50 hasta alındı. İncelenecek hastalar rastgele seçildi.

Yara enfeksiyonu insidansı kontamine cerrahi işlemlerde %31.57 ve enfekte cerrahi işlemde %29.03'tür. Acil operasyonlar yara enfeksiyonu riskinin artmasına neden olduğu saptanmıştır. Pozitif intraoperatif bakteriyolojisi olan hastalarda yara enfeksiyonu gelişme riski daha yüksektir. İntraoperatif sürüntü kültürlerinden izole edilen en yaygın organizma E. coli idi ve ardından hem enfekte hem de kontamine prosedürlerde Klebsiella izledi. İntraoperatif sürüntü kültüründe polimikrobiyal flora varlığı, daha yüksek yara enfeksiyonu oranı ile ilişkilidir.

Anahtar kelimeler: Cerrahi yara enfeksiyonu; kontaminasyon; enfeksiyon; antibiyotik; tedavi; yara.

INTRODUCTION

Surgical site infection (SSI) has always been a major complication of surgery and trauma and has been documented for 4000-5000 years (1). SSIs, previously called post operative wound infections, result from bacterial contamination during or after a surgical procedure. Surgical site infections are the third most common hospital associated infection, accounting for 14-16% of all infections in hospitalized patients (2).

The criteria used to define surgical site infections have been standardized and described three different anatomic levels of infection: superficial incisional surgical site infection, deep incisional surgical site infection and organ/space surgical site infection (2). According to the degree of contamination wounds may be classified as clean, potentially contaminated, contaminated, and dirty (3).

One study among 322 children surgical patients in Nigeria reported high SSI rate of 25.8% in emergency procedures in contrast to 20.8% in elective procedures, although the association was not statistically significant (4). Also a similar study documented high rate of SSI in dirty surgery (60%) compared with contaminated (27.3%), clean contaminated (19.3%) and clean surgery (14.3%), the association being statistically significant (4). Studies have shown that introduction of minimal invasive surgery like laparoscopic surgery has resulted in decrease in incidence of SSI (2). Surgical antibiotic prophylaxis was appropriately provided in 93% of procedures likely contributing to low SSI rate (5).

MATERIAL and METHOD

Aims and objectives are to establish the pattern of wound infection in terms of aerobic organisms after contaminated and infected surgical procedures. 50 patients having emergency or elective traumatic or non-traumatic abdominal operations who fulfil the criteria of infected and contaminated wounds are included in the study. Selection of patients;

Inclusion criteria

The patients having emergency or elective traumatic or non-traumatic abdominal operations who fulfil the criteria of infected and contaminated wounds. Operation carried out at Tertiary care Medical school.

Exclusion criteria

Class 1 and class 2 wounds are excluded.

Study procedure

After admission short history was taken and physical examination was conducted on patient with acute abdomen. Informed written consent was taken from the patients or their guardian willing to participate in the study.

Study population

A. Category-1; (Contaminated: Class III of Altemeier): The group included patients of contaminated surgical procedures like when a hollow muscular organ was opened with gross spillage or acute inflammation without pus formation was encountered. A traumatic wound less than 4 hour old also fall in this group.

B. Category-2; (Infected/dirty), In this group appendicular perforation, primary peritonitis; drainage of intra-abdominal abscess were studied. Traumatic wounds more than 4 hours duration was also included in this group. “Patients to be studied were selected in random basis”

A-Per operative- Swab culture, peritoneal fluid culture in syringe, tissue, and pus.

B-Post operative- On 3rd/4thpost-operative day wound exudate{if present} Wound swabs (2 in nos.)/Pus in syringe/Tissue

Sample are processed for Aerobic culture and antibiotic sensitivity (Figure 1-3).

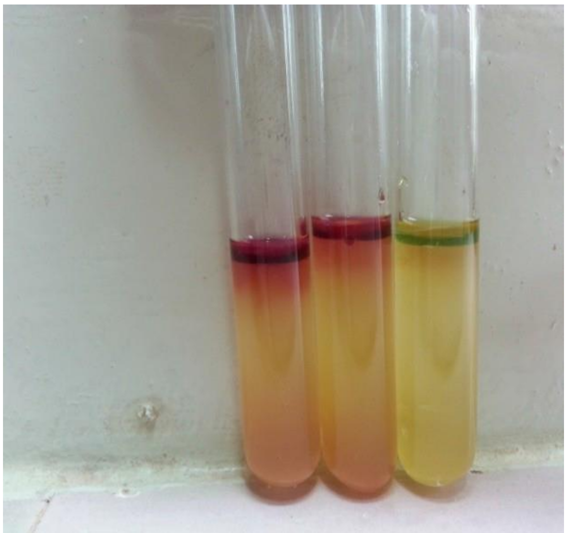

Figure 1: Indole test.

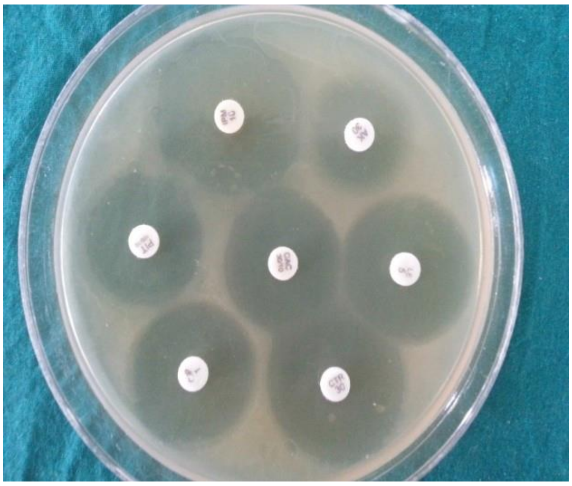

Figure 2: Antibiotic sensitivity test by Kirby Bauer disc diffusion test on 100mm plate.

Figure 3: Lactose fermenting mucoid colonies of Klebsiella pneumoniae on Macconkey agar.

RESULTS

The study consists of 50 cases who were operated at a tertiary school, either as an emergency or elective case during the period of April 2011 to April 2013. All cases are investigated and observed under material and methods. Out of the 50 patients studied 19 are from contaminated group and 31 are from infected group. Amongst the contaminated group, only 8 had surgical site infection whereas in infected group 13 had surgical site infection (Table 1-5).

Table 1: Overall incidence of wound infections.

No of cases	Contaminated (n =19)	Infected n=31	Total 50
With wound infection	6	9	15

Table 2: Distribution of patients in infected group (n=31).

Nature of illness	**Number**	**Intraoperative bacteriology**	**Incidence of SSI**	**Bacterial growth in wound**
Duodenal ulcer perforation	09	E. coli-5, Klebsiella-2 BH Streptococci-1, Staph. aureus-1 No growth-1	02	E. coli-1 Stap. aureus-1 No growth-07
Enteric perforation	09	E. coli-4, Klebsiella-4 BH Streptococci-1 No growth-3	03	E. coli-1, Klebsiella-1 Staph. aureus-1 No growth-06
Intra-abdominal abscess	03	E. coli-0, Klebsiella-2 No growth-1	02	Staph. aureus-01 No growth-01
Gallbladder perforation	01	E. coli-1, Klebsiella-0 No growth-0	--	No growth-01
Kochs	03	E. coli-3 No growth-0	2	Staph. aureus-2 No growth-01
Appendicular perforation	05	E. coli-3, Klebsiella-1 No growth-1	--	No growth-05
Large bowel surgery	01	Klebsiella-1	1	No growth-01

Table 3: Distribution of patients in contaminated group (n = 19).

Nature of illness	**Patients (n)**	**Intraoperative bacteriology**	**Incidence of SSI**	**Bacterial growth in wound**
Colonic surgery	2	E. coli-1, Klebsiella-1 No growth-0	2	E. coli-2 No growth-0
Fresh traumatic wound	2	E.coli-0, BH Streptococci-0 No growth-2	--	No growth-2
Small bowel surgery	9	E. coli-6, Klebsiella-3 No growth-0	3	E. coli-01, Klebsiella-02 No growth-06
Appendicectomy for Acute Appendicitis	6	E. coli-2, Klebsiella-1 Streptococcus fecalis-1 No growth-2	2	E. coli-01 Staph. aureus-01 No growth -04

Table 4: Relationship between intra-operative bacteriology of the wound to that of wound infection.

Intraoperative bacteriology	Patients (n)	Wound infection (n)
Contaminated		
+	15	5
-	4	1
Infected		
+	25	7
-	6	2

The following results could be drawn from the study on 50 patients, from both contaminated and infected group who underwent operations either on emergency basis or on routine basis;

1. The incidence of wound infection is 31.57% in contaminated surgical procedures and 29.03% in infected surgical procedure.
2. The variation of wound infection was not significant.
3. Operation in emergency set up results in an increased risk of wound infection.
4. Patients with positive intra operative bacteriology runs a higher risk of developing wound infection.
5. The commonest organism isolated from intra operative swab cultures were E. coli followed by Klebsiella in both infected and contaminated procedures.
6. Presence of polymicrobial flora in intraoperative swab culture is associated with higher rate of wound infection.
7. Patients of infected group are more likely to have wound infection with the same organism present in the wound per operatively.
8. Septic complication like wound site infection was the most common pattern seen in patients.
9. Staph Aureus was found to sensitive to Vancomycin, Tiecoplanin, Linezolid whereas Streptococcus was sensitive to Levoflox, Ampicillin and Vancomycin.
10. E. coli, Klebsiella were found to hav sensitivity towards Amikacin, Levofloxacin.

DISCUSSION

In spite of the development of latest techniques in surgery and recent advancements in antimicrobial therapy. Surgical sepsis remains the most frequent single cause of death after surgery(Wilson 1985).The overall incidence of wound infection has been variously quoted from 4 to 40 %(31.5 % and 29.03 % incidence amongst contaminated and infected groups respectively.

Table 5: Sensitivity of gram (+) cocci - (%)

Antibiotics (S. aureus)	
Vancomycin	91.5
Teicoplanin	91.1
Linezolid	90
Levofloxacin	87.5
Netilmycin	81.8
Antibiotics (Streptococcus)	
Levofloxacin	100
Ampicillin	100
Vancomycin	100
Piperacillin tazobactam	87
Azithromycin	75
Antibiotics (E. coli)	
Imipenem	100
Amikacin	84.6
Piperacillin tazobactam	84.6
Gentamicin	69.2
Antibiotics (Klebsiella)	
Levofloxacin	100
Imipenem	90.9
Amikacin	83.3
Piperacillin tazobactam	75
Antibiotics (Enterococcus)	
Imipenem	100
Amikacin	63.6
Levofloxacin	63.6
Ceftazidime clavulanic acid	63.6
Piperacillin tazobactam	54.5

Our study shows that the incidence of wound infection in two groups, contaminated and infected .Apparently, The maximum incidence of wound infection was noted in patients with enteric perforation. No wound infection was seen after appendicular perforation. This finding may probably was related to bacterial load and extent of the peritoneal soiling as well as the duration of illness.

Our study showed a definite increase in wound infection amongst patients of infected category (1in3), where the intraoperative bacteriology was positive

While in the contaminated group, half of the patients with negative bacteriology at operation developed wound infection.

In our study, the source of infection in 50 % cases was endogenous and 50 % exogenous. Thereby indicating intraoperative bacteriological environment of the wound is not a singular determinant of wound infection.

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