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INCIDENCE OF SURGICAL SITES INFECTION AFTER ABDOMINAL SURGERIES

By

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ABSTRACT

Background: Surgical site infections (SSIs) are one of the most frequent complications in abdominal surgery. It is associated with prolonged hospital stay, a compromised quality of life and an increase in mortality and in costs.

Objective: To assess the prevalence, risk factors and causative organism of surgical sites infection after abdominal surgeries.

Patients and methods: Five hundred patients who underwent an abdominal surgery were included in this prospective observational comparative study. The study population was divided into two equal groups: Group (A): Non- comorbidities group and Group (B): Comorbidities group. Patients underwent abdominal surgeries in Ismailia general Hospital and Al-Zahra'a University Hospital. The study was conducted at Ismailia General Hospital from November 2020 to June 2021. All patients who were subjected to full medical history, general and systemic examination and laboratory investigation

Results: There was an insignificant difference between the groups according to the demographic data. The results showed significant difference between the groups according to the frequency of surgical wound classification, and according to total leukocitic count, C. reactive protein and the fasting blood sugar results (P value >0.001) after the surgery. The result of the treatment followed with the infected site among the study groups after the abdominal procedure showed significant difference between the groups according to the treatment (P value = 0.001).

Conclusion: Although surgical site infections cannot be completely eliminated, a reduction in the infection rate to a minimal level could have significant benefits, by reducing postoperative morbidity and mortality, and wastage of health care resources. A pre-existing medical illness, the wound class, and wound contamination strongly predisposed to wound infection.

Keywords: Inflammation, Infection, Abdominal surgeries.

INTRODUCTION

Infections that occur in the wound created by an invasive surgical procedure are generally referred to as surgical site infections (SSIs). SSIs are one of the most important causes of healthcare-associated infections (HCAIs). Surgical site infections and its management are costly to both patients and the health facilities. Surgical site infections definitions can vary because they range from a relatively trivial wound discharge without complications to serious conditions that are fatal. Therefore, to encourage a uniform and standard approach among data collectors, the Center for Disease Control and Prevention (CDC) brought out definitions for each category *(Merollini et al., 2013).*

Surgical site infections (SSIs) are one of the most frequent complications in

abdominal surgery. It is associated with prolonged hospital stay, a compromised quality of life and an increase in mortality and in costs *(Lyden and Dellinger, 2016).*

The SSIs appears when the bacterial inoculum exceeds the immune system's ability to control it. Contamination in abdominal surgery originates from the skin or organs that have been targeted during surgery *(Tovar and Josep, 2014).*

Additional costs attributable to SSI have been reported depending on the type of surgery and the severity of the infection. The main additional costs are related to re-operation, extra nursing care and interventions, and drug treatment costs. The indirect costs, due to loss of productivity, patient dissatisfaction and litigation, and reduced quality of life, have been studied less extensively *(Umscheid et al., 2011).*

The present work aimed to assess the prevalence, risk factors and causative organism of surgical sites infection after abdominal surgeries.

PATIENTS AND METHODS

Between November 2020 and June 2021, a prospective study was performed on 500 patients at Al-Zahra'a University hospital and Ismailia General Hospital. All patients underwent different abdominal surgeries with and without comorbidities. The study aimed to assess the prevalence, risk factors and causative organism of surgical sites infection after abdominal surgeries.

All patients who included in the study were subjected to full medical history, general and systemic examination and laboratory investigations. The study population was divided into two equal groups: Group (A): Non- comorbidities group, and Group (B): Comorbidities group, who underwent an abdominal surgery.

All patients' undergone different abdominal surgery with and without comorbidities will be underwent the following:

1. Full history taking (before surgery):
    - Personal history.
    - Complaint.
    - History of presenting illness.
    - Past history.
    - Family history.
    - Socio-economic history.
2. General and systematic examination:
    - Preoperative examination: General Examination.
    - Postoperative examination (every week): Wound assessment early and late.
3. Laboratory investigations:
    - Complete blood count (CBC).
    - Kidney function tests.
    - Liver function tests.
    - Coagulation profile.
    - Fasting blood glucose.
    - Electrolytes.
4. Swab from surgical site postoperative if there is signs of infection (redness, hotness, swelling, discharge).
5. Culture and sensitivity of the collected swabs.

Statistical analysis:

Collected data was coded, entered and analyzed using Microsoft Office Excel (2007) software. Data was then imported into Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM SPSS Ver. 20.0) and MedCalc version 12.1.3.0 software for (SPSS INC. CHICAGO IL USA) analysis. Baseline characteristics of the study population were presented as frequencies and percentages (%) in qualitative data or mean values and standard deviations (SD) in quantitative data. Differences between frequencies were compared by Chi-square or Fisher exact tests. Differences between means were compared by t-test. Pearson correlation coefficient test was used to evaluate the inter-correlations between the studied variables. Analysis of variance (ANOVA) test followed by logistic regression analysis model of the dependent variable and other studied variables (independent predictors) were performed. P value of < 0.05 was considered significant.

RESULTS

Our study showed that the mean of age of the study population was 40.45 ± 10.42 years with range of 18 to 89 years old. Most of our study populations (51.4%) were females **(Table 1)**.

Table (1): Demographic characteristics of the study groups

Variables \ Groups		Group (A)	Group (B)	P value
Age (year)		40.05 ± 11.99	40.69 ± 9.76	0.47
Sex	Males	120 (48%)	128 (51.2%)	0.55
	Females	130 (52%)	122 (48.8%)	

Inguinal hernia was the most frequent procedure among the study population (21.4%). The results showed no significant difference between the groups according to the frequency of surgical procedures **(Table 2)**.

Table (2): Frequency of the surgical abdominal procedure among the study group.

Surgical abdominal procedure \ Groups	Group (A)	Group (B)	P value
Lipoma	25 (7.1%)	12 (4.8%)	<0.001
Appendectomy	62 (17.7%)	13 (5.2%)	
Cancer colon	20 (5.7%)	14 (5.6%)	
Desmoid tumor	21 (6%)	5 (2%)	
Hysterectomy	23 (6.6%)	7 (2.8%)	
Incisional hernia	10 (2.9%)	5 (2%)	
Inguinal hernia	70 (20%)	57 (22.8%)	
Laparoscopic cholecystectomy	26 (7.4%)	50 (20%)	
Open cholecystectomy	12 (3.4%)	40 (16%)	
Splenectomy	30 (8.6%)	12 (4.8%)	
Umbilical hernia	16 (4.6%)	25 (10%)	
Varicocele	35 (10%)	10 (4%)	

No significant difference between the groups according to the frequency of surgical procedures. Clean wound (Class I) was the most frequent in both groups. The results showed significant difference (P value <0.001) between the groups according to the frequency of surgical wound classification **(Table 3)**.

Table (3): Frequency of the surgical abdominal procedure according to the surgical wound classification among the study group

Groups / Surgical Wound Classification	Group (B)	Group (A)	P value
Class I: Clean	215 (86%)	170 (68%)	<0.001
Class II: Clean-contaminated	21 (8.4%)	52 (20.8%)	
Class III: Contaminated	10 (4%)	18 (7.2%)	
Class IV: Dirty-infected	4 (1.6%)	10 (4%)	

There was a significant difference between the groups according to the fasting blood sugar results before the surgery (P value <0.001). The results showed significant difference between the groups after the surgery according to total leukocitic count, C. reactive protein and the fasting blood sugar results (P value >0.001). The results showed significant difference between the groups according to the grade and the frequency of inflammation (P value >0.001) **(Table 4)**.

Table (4): Frequency and the grade of the inflammation among the study groups

Groups / Inflammation	Group(A)	Group (B)	Total (N=500)	P value
Superficial incisional surgical site infection	17 (6.8%)	44 (17.6%)	61 (12.2%)	<0.001
Deep incisional surgical site infection	12 (4.8%)	21 (8.4%)	33 (6.6%)	
Organ/space surgical site infection	6 (2.4%)	15 (6%)	21 (4.2%)	
Total	35 (14%)	80 (32%)	115 (23%)	

There was insignificant difference between the groups according to the demographic data. (P value = 0.066) and significant difference in the frequency of surgical site infections in patient underwent urgent surgery (p value <0.001), open surgery (P value = 0.012), and patients with comorbidities (P value < 0.001) specially, malignancy and diabetic patient (39% and 29% respectively). There was no significant difference in the frequency of surgical site infection according to sex **(Table 5)**.

Table (5): Frequency of SSI among the study groups

Variables \ Surgical site infection		Yes	No	P value
Sex	Male (n=248)	55 (22%)	193 (78%)	0.66
	Female (n=252)	60 (24%)	192 (76%)	
Surgical procedure	Elective (n=404)	75 (19%)	329 (81%)	<0.001
	Urgent (n=96)	40 (42%)	56 (58%)	
Type of procedure	Open (n=334)	88 (25%)	246 (75%)	0.012
	Laparoscopic (n=166)	27 (16%)	139 (84%)	
Comorbidities	DM (n=156)	46 (29%)	110 (71%)	<0.001
	HTN (n=120)	11 (9%)	109 (91%)	
	CHD (n=114)	12 (11%)	102 (89%)	
	Malignancy (n=77)	30 (39%)	47 (61%)	
	Obesity (n=128)	16 (13%)	112 (87%)	

The result of the treatment followed with the infected site among the study groups after the abdominal procedure showed significant difference between the groups according to the treatment (P value = 0.001) **(Table 6)**.

Table (6): Treatment followed with the infected site among the study groups after the abdominal procedure

Treatments \ Groups	Group(A)	Group (B)	P value
Dressing and antibiotics	18 (5.1%)	12 (4.8%)	0.001
Debridement and antibiotics	0 (0%)	10 (4%)	

The results showed that DM was the most frequent comorbidity (62.4%) in the comorbidity group **(Figure 1)**.

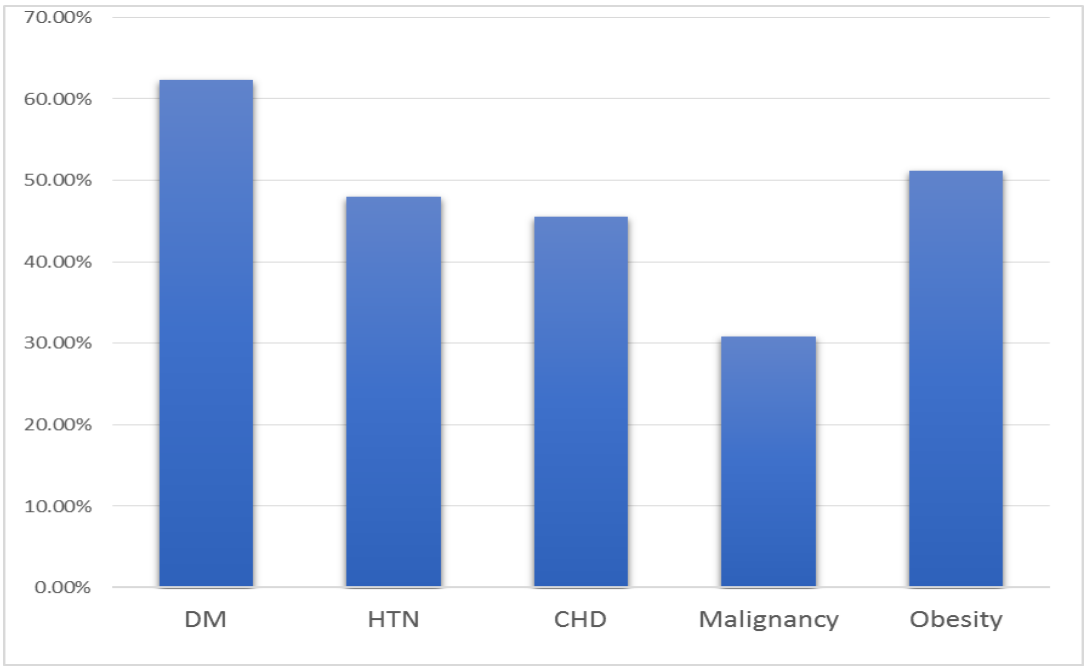

Figure (1): Frequency of Comorbidites in comorbidities group

The results showed significant difference between the groups according to the culture results of the infected site swap among the study groups after the abdominal procedure (P value >0.001) **(Figure 2)**.

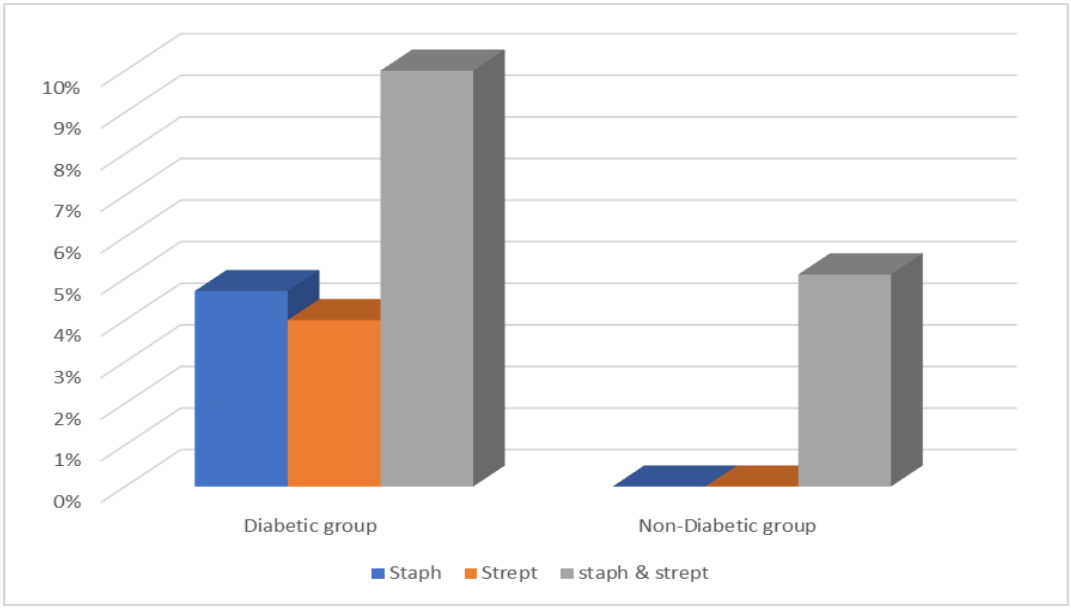

Figure (2): Distribution of culture results.

DISCUSSION

Our study demonstrated that the surgical wounds according to the degree of contamination showed significant difference between the comorbidities group and the non-comorbidities group. Even higher rates are reported by prospective studies in developing countries. A longer duration, even of a clean operation, represents increased time at risk for contamination *(Isik et al., 2015).*

Regarding the prevalence of SSI, the present study showed that SSI has higher significant prevalence in comorbidities group comparing to the non-comorbidities group. Our study showed that SSI occurred in 32% of comorbidities group with only 14% of non-comorbidities group. The rate of SSI varies greatly worldwide and from hospital to hospital. The present study found that the overall rate of SSI was 23%. This was similar with study conducted by *Hafez et al. (2012)* made in Egypt, in Alexandria, and reported that SSIs occurred in 17% of patients, while other study which took place at Cairo University found an SSI incidence to be 9% *(Labib et al., 2012).* Another international study took place in India found an SSI incidence of 12.6% *(Goyal et al., 2015).*

Regarding age, the mean age in comorbidities group was 40.7+ 9.76 years in comparison to non-comorbidities group which was 40.1+ 11.99 years with no statistically significant difference in age between two groups. Regarding age the mean age in comorbidities group was 40.7+ 9.76 years in comparison to non-comorbidities group which was 40.1+ 11.99 years with no statistically significant difference in age between two groups. This finding was similar to that from a study conducted in Duke University by *Khairy et al. (2011)* stating that increasing age independently predicted an increased risk of SSI until age 65 years. At ages >65 years, increasing age independently predicted a decreased risk of SSI.

Our study showed that the superficial SSI was the highest prevalence in both groups with significant difference between the comorbidities and non-comorbidities groups. *Labib et al. (2012)* study showed that the entire infected group (100%) complained of redness, 68% complained of pain, meanwhile, 30% suffered from fever and 20% had discharge.

Regarding laboratory finding there was a statistically significant difference in Laboratory finding post operation between both groups regarding TLC, CRP and FBs.

Regarding the causative organism; Staph and stept was the most isolated micro-organisms which present in 10% of the comorbidities group and 5.1% of the non-comorbidities group.

Labib et al. (2012) found that the most frequent SSI isolates detected were E. coli (29.8%), followed by Staph. aureus (17.1%). while the study done by *Hemant et al. (2016)* found that Pseudomonas infection was more prevalent followed by Klebsiella, then coagulase positive staphylococci, after that Escherichia coli, and diphtheroid infection.

Isgren et al. (2017) reported that common bacterial isolates were Escherichia coli (59.5%), Enterococcus spp. (42.4%) and Staphylococcus spp.

(25.4%). Penicillin resistant isolates accounted for 92% of isolates while 18% of isolates were gentamicin resistant.

Alkaaki et al. (2019) stated that, the commonest organisms isolated from patients with SSI were gram-negative bacteria, namely extended-spectrum β-lactamase-producing E. coli. This finding is contrary to those in studies that revealed more gram-positive bacteria such as Staphylococcus aureus and coagulase-negative staphylococci *(Sugiura et al., 2012* and *Azoury et al., 2015).*

CONCLUSION

Surgical site infection is an important measure of the quality of patient care by surgeons, infection control practitioners, health planners and public. Although surgical site infections cannot be completely eliminated, a reduction in the infection rate to a minimal level could have significant benefits, by reducing postoperative morbidity and mortality, and wastage of health care resources. A pre-existing medical illness, the wound class, and wound contamination strongly predisposed to wound infection.

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معدل حدوث عدوى فى مواقع الجراحة بعد العمليات الجراحية فى البطن

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خلفيـــة البحـــث: تعـــد التهابـــات المواقـــع الجراحيـــة واحـــدة مـــن أكثـــر المضـــاعفات شـــيوعًا فـــي جراحـــة الـــبطن. وهـــو يـــرتبط بإقامـــة طويلـــة فـــي المستشـــفى، وتـــدهور نوعيـــة الحيـــاة وزيـــادة فـــي معـــدل الوفيـــات والتكـــاليف. تعـــد التهابـــات المواقـــع الجراحيـــة وإدارتهـــا مكلفـــة لكـــل مـــن المرضـــى والمرافـــق الصـــحية. يمكـــن أن تختلـــف تعريفـــات عـــدوى المواقـــع الجراحيـــة لأنهـــا تتـــراوح مـــن إفـــرازات بســـيطة نســـبيًا بـــالجرح بـــدون مضـــاعفات إلـــى حالات خطيرة مميتة.

الهـــدف مـــن البحـــث: تقيـــيم نســـبة الاصـــابة وعوامـــل الخطـــر والكائنـــات المسببة للعدوى الجراحية بعد العمليات الجراحية فى البطن.

المرضـــى وطـــرق البحـــث: أجريـــت دراســـة مقارنـــة قائمـــة علـــى الملاحظـــة بـــين المرضـــى الـــذين يعـــانون مـــن أمـــراض مزمنـــة والمرضـــى الـــذين لا يعـــانون مـــن أمـــراض مزمنـــة لتقيـــيم انتشـــار وعوامـــل الخطـــر والكائنـــات المســـببة لعـــدوى المواقـــع الجراحيـــة بعـــد العمليـــات الجراحيـــة فـــي الـــبطن فـــي مستشـــفى الزهـــراء الجـــامعي ومستشـــفى الإســـماعيلية العـــام. ضـــمت الدراســـة قرابـــة الخمســـمائة مـــريض خضـــعوا لعمليـــات جراحيـــة فـــي الـــبطن. تـــم تقســـيم المرضـــى إلـــى مجمـــوعتين، مجموعـــة مصـــابة بـــأمرا ض مزمنـــة، ومجموعة غير مصابه بامراض مزمنة.

نتـــائج البحـــث: لـــم يكـــن هنـــاك فرقـــا معنويـــا بـــين المجموعـــات حســـب البيانـــات الديموغرافيـــة. ولكـــن أظهـــرت النتـــائج فرقـــاً معنويـــاً بـــين المجموعـــات حســـب نســـبة العـــدوى ووتيـــرة الالتهابـــات حيـــث كانـــت نســـبة تكـــرار العـــدوى فـــي مجموعـــة المرضـــى الـــذين يعـــانون مـــن الأمـــراض المزمنـــة 32٪ مقارنـــة بـــ 14٪ فقـــط فـــي مجموعـــة المرضـــي الـــذين لا يعـــانون مـــن أمـــراض مزمنـــة. أظهـــرت النتـــائج فرقـــاً معنويـــاً بـــين المجموعـــات تبعـــاً لتكـــرار تصـــنيف الجـــرح الجراحـــي ، ووفقـــاً لعـــدد الكريـــات البـــيض الكلـــي ، بـــروتين ســـي. التفـــاعلي ونتـــائج ســـكر الـــدم الصـــائم (قيمـــة الاحتمـــال > 0.001) بعـــد الجراحـــة. أظهـــرت نتيجـــة عـــلاج الجـــروح المصـــابة بالعـــدوى فرقـــا معنويـــا بـــين المجموعات حسب المعاملة (قيمة الاحتمال = 0.001).

الاســـتنتاج: عـــدوى الموقـــع الجراحـــي هـــي مقيـــاس مهـــم لجـــودة رعايـــة المرضـــى مـــن قبـــل الجـــراحين وممارســـي مكافحـــة العـــدوى والمخططـــين الصـــحيين والجمهـــور. علـــى الـــرغم مـــن أنـــه لا يمكـــن القضـــاء تمامًـــا علـــى التهابـــات الامـــاكن الجراحيـــة، فـــإن خفـــض معـــدل العـــدوى إلـــى الحـــد الأدنـــى يمكـــن أن يكـــون لـــه فوائـــد كبيـــرة، مـــن خـــلال تقليـــل الفتـــره المرضـــيه والوفيـــات بعد الجراحة، وإهدار موارد الرعاية الصحية.

الكلمات الدالة: الالتهابات، العدوى، جراحات البطن.