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Impact of Surgical Site Infection at Obstetric Department on Healthcare Costs and Patient Outcomes: Retrospective Review

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Abstract **Introduction**: Morbidity and mortality were associated with increased surgical site infections (SSIs). Besides, it is a financial problem and has a negative impact on patient quality of life (QoL). **Aim of study**: It was to evaluate the impact of surgical site infection at Obstetric Department on healthcare costs and patient outcomes. **Methods:** Retrospective descriptive design was used for nine months survey, from October 2018 to Jun 2019. It included all the infected cases at a certain period, conducted through patient's files and infection control surveillance at Kasr Al Ainy Obstetric Emergency Hospital. **Results:** SSI rate was around 0.7% per month, with an average length of stay (LOS) of 21 days which affected the patient outcomes. Total cost for antibiotics ranged from 400 to 7800 Egyptian Pounds per patient. Most common pathogens were *Acinetobacter baumannii* and Escherichia coli (E. coli) found in the environment and food. The most antibiotics used were Flagyl (metronidazole), Rocephin (ceftriaxone) and Unasyn (Ampicillin/Sulbactam). **Conclusions:** Surgical site infections have bad health and economic impacts. Environmental sanitation, safety measures for intravenous (IV) solutions, corrective department design, implementation of policies and procedures for infection control are highly recommended.

Keywords: *surgical site, health, infection control, quality of life*

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1. Introduction

A surgical site infection (SSI) is an infection that occurs after surgery in the part of the body. It sometimes is superficial infections involving the skin only and other surgical site infections can involve tissues under the skin organs or implanted material [1].

Morbidity and Mortality were associated with increase of surgical site infections (SSIs).Besides; it was a financial burden and negatively impact of SSIs on patient quality of life (QoL). [2]; Moreover it represents 77% of hospital mortality, as attributed to the infection itself [3].

Surgical site infections (SSI) were the second cause of adverse events, and 30% of all hospital-acquired (HAI) [4].

There is no firm evidence that one type of hand antisepsis is better than another in reducing SSIs [5]. Antibiotic prophylaxis, showering and skin preparation weren't proved that reduce the risk of infection yet [6].

The criteria for surgical site infection based on wound type, superficial includes only skin or deep includes tissue or organ with at least one of the following signs Purulent drainage, pain, tenderness, redness, swelling, heat [7].

At developing countries, study results had reported a very high incidence of surgical site infections were common in elderly patients, patients undergoing emergency surgeries, and patient's with longer preoperative hospital stay and longer surgical duration. [8]

Outbreak of SSI could be having different reasons. Previous study founded wound contamination from the thumbnail of Scrub nurse, doesn't use appropriate surgical gloves led to many infected surgical wound by P. *aeruginosa.* [9].

The Institute for Healthcare Improvement (IHI) recommends four evidence-based strategies for reducing SSIs: Administer the right perioperative antibiotics, removing hair from surgical site, Control blood glucose and warmth of patient postoperative. [10]

The approaches of Management strategies should be including, strong leadership, Education strategies (present evidence based practices to clinicians and patients), Implementation strategies and Evaluation strategies for feedback and corrections. [11]

1.1. Significant of the Study

Hospital acquired infection one of the important health care problems, were Ministry of Health and Population (MOHP) have been supported. Prevention of transmitted disease should be priority of patient safety, to improve patient health care services. Staff nurses performance affected by Social, Culture, management of senior's staff regarding the competencies skills and guidelines of universal precautions so it is vary according to setting of health care organization. Furthermore it has been observed that nursing performance in Obstetric department regarding SSI care depend on staff experience.

1.2. Aim of Study

The aim of this study was to evaluate the impact of surgical site infection at Obstetric department on healthcare costs and patient outcomes.

1.3. Research Questions

- What is the effect of surgical site infection on health care cost?
- What is the effect of surgical site infection on patient outcome?

2. Methodology

2.1. Study Design

Retrospective descriptive study about Surgical Site Infection (SSI), using infection control surveillance report and patient files (Hard Copies) for last nine months which has all details about each infected case through the admission at Obstetric Emergency hospital seeking for medical treatment.

2.2. Study Sample

It included all the infected cases at a certain period, using the hospital surveillance files, for all patients admitted to Obstetric hospital, regarding age or another diseases, in a daily bases for nine months from October 2018 to Jun 2019. Most of cases admitted for delivery or abdominal exploration, and lately admitted to critical care unit for management plan. As observed no cases come back for follow up or readmission has been reported. It was Found 31 cases infected out of 4439 patients; Most of the Cases commuting from ruler and urban cities of Cairo.

2.3. Setting

It conducted at Teaching Obstetric Emergency Hospital of Kasr AlAiny, Cairo University. Consist of ground floor including (Reception, Triage, and labor room for normal vaginal delivery). 2nd floor for Critical care unit and Operation room. It works for nonprofit, Governmental sector. There are NICU for caring the neonates as well.

2.4. Tool

Evaluation sheet: was established by the researcher and divided to two parts:

Part I:

Including personnel data which contain (age, chief complain, type of operation, a dress….etc.) and date of admission and readmission.

Part II: It was including:

1. Patient medical history, investigation, and medical treatments.
2. The surgical site infection, its culture, drugs prescription, length of stay, hospital department.
3. Flow up and patient condition (includes progress or\ and prognosis)

2.5. Procedure

- After the approval from a head department, for conducting the research study, the, researcher collect the data for one month
- Review patient files
- Review the infection surveillance for last nine months.
- Review Blood \ Site-Wound Culture
- Review administer Antibiotics
- Calculate the length of stay.
- Calculate the antibiotic Cost.
- Calculate the rate of infection per month.

2.6. Ethical Consideration

Formal Latter was sent to head department, for approval which explained the aim of study. Sharing and Participating of infection control nurse was a must. No name was included in the questionnaire sheets, and confidentiality of each case. Confidentiality was assured and the content of the tools only used for the research purpose.

2.7. Statistical Design

All collected data were organized, categorized, tabulated, entered, and analyzed by using SPSS (Statistical Package for Social Sciences); a software program version 14, which was applied to frequency tables. The statistical significance and associations were assessed using, the arithmetic mean, and the standard deviation (SD).

3. Results

The following results represent the total cases admitted during the study period at Obstetrics Emergency Department Kasr AlAiny Hospital, SSI rate, cost, LOS, and others aspect.

Figure 1 illustrates that the number of infected cases was gradually decreasing; October 2018 was the highest number of infected cases while May and June 2019 had dropped to one case per month.

Figure 2 shows gradual decreases of the curve of the infected cases at the Obstetric Department; the rate of infection ranged from 1.2 to 0.2% /month.

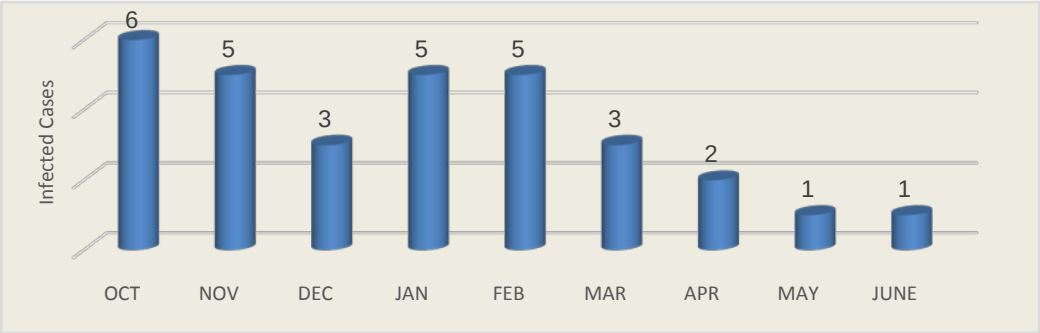

Figure 1. Number of SSI Cases per month

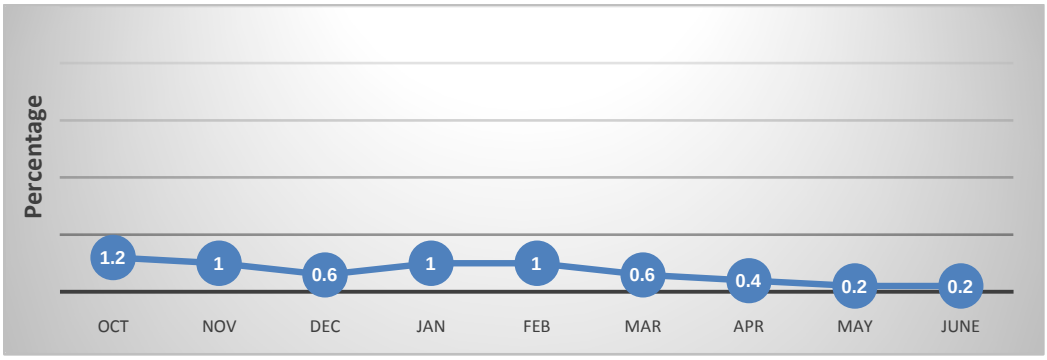

Figure 2. Percentage of SSI/month

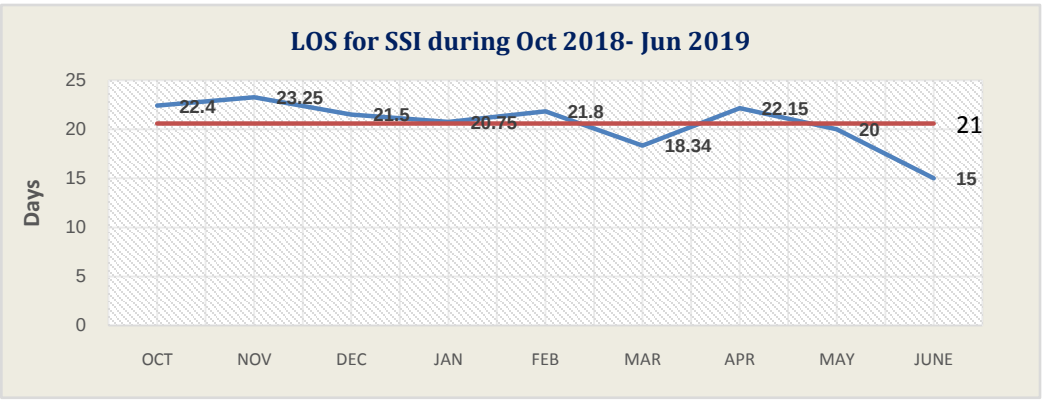

Figure 3. LOS for SSI

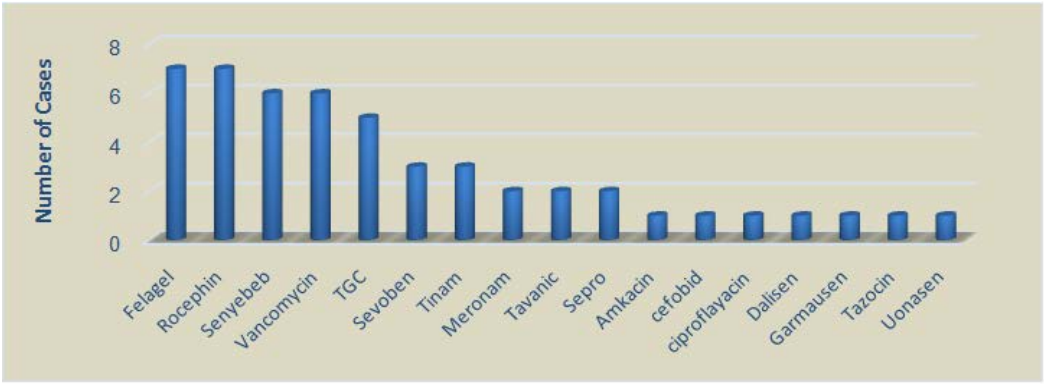

Figure 4. Types of used antibiotics

Figure 3 illustrates that the average range of length of stay was 21 day this dropped at last month.

Figure 4 show that the Flagyl (metronidazole) and Rocephin (ceftriaxone sodium) is the highest consuming antibiotic and Unasyn (ampicillin sodium) is the lowest demand.

Figure 5 show that LOS affects the cost of antibiotics, which fluctuating based on price and patient condition. Maximum Cost was 7600 LE and Minimum was 400 LE during the Nine Months.

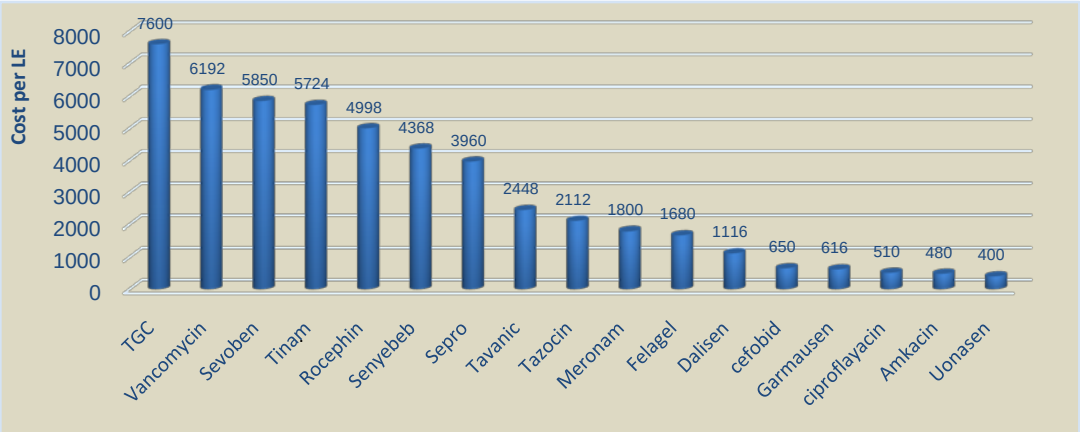

Figure 5. Costs of used antibiotics

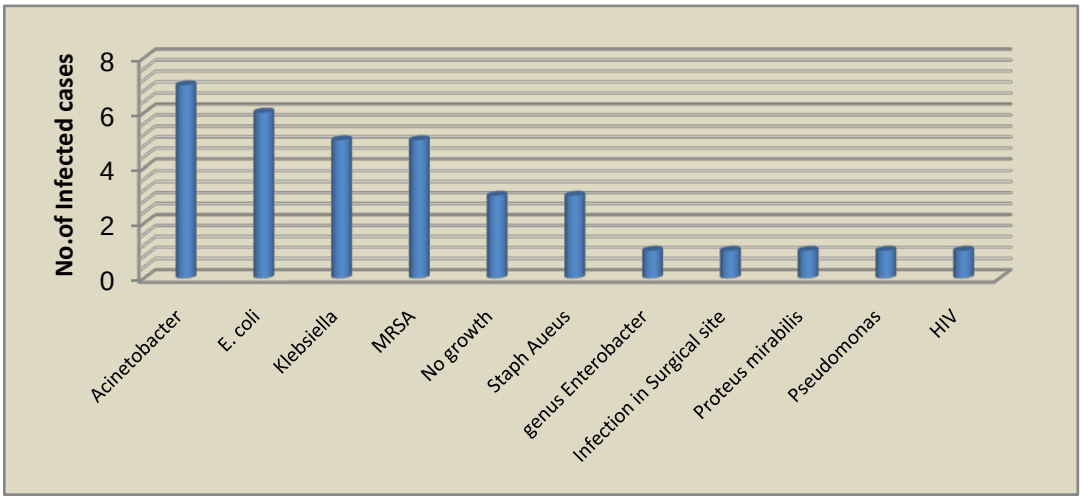

Figure 6. Germs Types

Figure 6 illustrates that most common infection caused by ***Acinetobacter baumannii*** which is a pleomorphic aerobic gram-negative bacillus (7) cases; Followed by **Escherichia coli** (abbreviated as E. coli) are bacteria found in the environment, foods, and intestines of people and animals; ***Klebsiella*** They often live in body intestines without giving any problem But can be dangerous if they get into other parts of your body; and ***Methicillin-resistant Staphylococcus aureus (MRSA)*** is a bacterium that causes infections in different parts of the body. It shown also HIV was presented in one case through this nine month.

4. Discussion

Surgical site infections (SSIs) are wound infections that occur after invasive surgical procedures, it is less clear whether reducing skin microflora leads to a lower incidence of surgical site infection [12].

No clear evidence were suggest that one dressing type was better than any other at reducing the risk of surgical site infection, nor that covering wounds with any dressing at all reduced the risk of surgical site infection [13]. Decision makers nowadays select a dress wound based on patient and clinician preferences and dressing costs, Moreover, there was no clear evidence that any dressing type improves scarring, pain control, and patient acceptability or ease of removal [13].

The current study reported that SSI average rate 0.7% per month as average patient admission was around 500 patients at Kaser AlAiny, Obstetric department using retrospective review while, 12% was the average rate of surgical patients operated in the Medical Research Institute hospital in Egypt [14].

Centers of Disease Control and Prevention (CDC), reported that SSI rate 1.7 % in the period between 2006 and 2008 in inpatient setting to all surgical procedure [14].

Moreover, Surgical Site Infections one of the main cause had been reported of morbidity, prolonged hospitalization, and death. SSI is related with a mortality rate of 3%, and 75% of SSI associated with deaths [7]. This study reveal that SSI effects the length of stay for average 21 days, while at this period of hospitalization patients are liable to many problems, and cost effect.

Others study reported that infection rate was 3.7%, and mean of LOS 7.25 days with total mean cost $13.746/patient but all those variables vary of score and increasing with disease acuity [15]. As observed that Kaser AlAiny hospital was fall in the average range of international rate of infection.

There are also drop have been noted at results last two months in LOS and cases as well, it might be due to others factors (type of operation surgery, age of patients, or\ and

disease severity). Some of others studies discuss the relationship between antibiotics and LOS, so might be LOS affected by the type of Antibiotic administered or used as prophylaxis [15].

Present study results disclose that Antibiotics Cost associated with patient LOS. The total costs were 50,504 LE during the nine months. 7,600 Egyptian pound for maximum LOS of one patient during hospitalization , although others study were estimated median total cost of treating them would be around 66,700 Egyptian Pounds from the hospital perspective including hospital services, 76,800 Egyptian Pounds from the patient perspective including others patient care [16].

According to WHO Unit costs are evident to public hospitals, including the hotel element of hospital costs, i.e., excluding drugs and diagnostic tests and including other costs such as personnel, capital and food costs. The results are presented in International dollars and local currency units of 2005 around 62.99 $ per bed per day In Egypt [17].

Surgical Site Infection is the most costly HAI type with an estimated annual cost of $3.3 billion, and is associated with nearly 1 million additional inpatient-days annually [7].

The present study show that most common infection caused by *Acinetobacter baumannii* which is a pleomorphic aerobic gram-negative bacillus. It is a water organism and specially colonizes water environments, irrigating solutions and intravenous solutions. This organism is often cultured from hospitalized patients' sputum or respiratory secretions, wounds, and urine [18].

While Escherichia coli (abbreviated as E. coli) are bacteria found in the environment, foods, and intestines of people and animals. E. coli are a large and varied group of bacteria, Might be spread during catering and preparing patient foods [19].

Followed by *Klebsiella* these common bacteria are usually harmless and often live in patients intestines without giving you any problem, but it can be dangerous if they get into other parts of body. They can turn into “superbugs” that are almost impossible to fight with common antibiotics. The germs can give you pneumonia, wound infection or blood, and cause other serious problems [20]. Easily spread among the patients, which patient beds very close to each other’s and the ventilation very poor.

Methicillin-resistant Staphylococcus aureus (MRSA) is a bacterium, gram-positive, which affect different parts of the body. It’s resistant to some commonly used antibiotics. Often cause skin infections, pneumonia, heart valve infections, and bone infections. Very threatening infection, need routine Surveillance for early detection.

Enterobacter, (genus Enterobacter), are gram-negative bacteria that are classified as facultative anaerobes, which means that they are able to thrive in both aerobic and anaerobic environments. Followed by *Pseudomonas* infections are illnesses that occur due to the bacteria Pseudomonas. Mostly cause mild symptoms.

Others study reported that methicillin-resistant *Staphylococcus aureus* (MRSA) (29.7%), Followed by *methicillin-susceptible S. aureus* (16.2%), Bacillus cereus (2.7%), and *Enterococcus faecalis* (7.4%). The earliest diagnosis of SSI was on postoperative day 1, and the latest was on postoperative day 76, with a median time from surgery to SSI diagnosis of 4.5 days [21].

Current study reveal that Flagyl (Metronidazole) was widely antibiotics used for most of infected patient, it works for stopping variety of bacterial growth and parasites infection but not viral. Additionally treat some certain problems such as stomach and intestinal ulcers caused by *H.pylori* infection. Rocephine was the second antibiotic Consumption as broad-spectrum, that should be administer after growth culture, to reduce the development of drug-resistant bacteria and treat or prevent infections that are proven or strongly suspected to be caused by susceptible bacteria.

5. Recommendation

Through the study results, some issue has been arisen as the following: the water sanitation and environmental cleaning, Controlling I.V solution, Reviewing Catering policies and Procedures, redesigning the beds distribution at the department, good ventilation and early detection of cases are the must.

Further studies needed for more investigation of the causes of infection at ER, and the infection control polices. Additionally, Staff adherence one of the most important issues at organization health should be evaluated, to solve the barriers and discuss the problem related.

6. Conclusion

The study results indicate that SSI rate around 0.7% per month, with average LOS 21 days which affect the patient outcomes and patient Cost. Total Cost for Antibiotic range from 7800 – to 400 Egyptian Pounds. Additionally the most Common cause of HAI were *Acinetobacter baumannii* which is a pleomorphic aerobic gram-negative followed by A *baumannii* which a water organism and specially colonizes aquatic environments and *Acinetobacter* commonly colonizes at irrigating solutions and intravenous solutions. The most usage of antibiotic were Flagyl (metronidazole), Rocephin (ceftriaxone sodium) while Unasyn (ampicillin sodium) is the lowest demand.

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