

Retrospective Analysis of Bacterial Spectrum and Associated Risk Factors in Post-Operative Wound Infection

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ABSTRACT

Introduction: Post-Operative wound infection is very interesting for the surgeons since it is considered inevitable in some cases and also very unfortunate. In spite of great sophistication in surgical techniques and recent advances in the microbial studies, the post-Operative wound infection remains to be ever challenging in the daily practice of the surgeon. It is utmost discomfort to the patient, causes delay in resuming work due to disability, decreases the quality of life of the patient and increases financial burden to the patient especially in a resource limited country like ours. This retrospective study conducted in Sharda Hospital, briefly discusses the history and the relevant definition necessary for the discussion of surgical site wound infection, the known postulated risk factors and the profile of causative micro-organisms. **Material and Method:** Hundred cases of laparotomies (emergency and elective) carried out in Sharda Hospital in August 2015 and November 2017 were included in the study and studied retrospectively. Study is based on the clinical observation of the patient. All the patients irrespective of age were included in the study. For the convenience, laparotomy wounds are graded as Grade0-No infection, Grade1-Surgical site erythema, Grade2-Subcutaneous collection, Grade3-Partial burst, Grade4-Complete Burst. **Result:** The incidence of post-operative wound infection was 26%. The percentage of post-operative wound infection increases with the poor nutrition, increasing age, hypo-proteinemia, anaemia, contaminated peritoneum of abdomen, poor chest compliance. The rate of post-operative wound infection is directly proportional to the duration of surgery, longer stay in the hospital. Deranged liver function and kidney function lead to increase incidence of post-operative wound infection. The rate of post-operative wound infection is less in cases where the gastrointestinal tract was not opened. The most common Infecting organism found was Escheria coli.

Keywords: Post-Operative wound, Infection, Infective organisms, seroma.

INTRODUCTION

The post-operative surgical infections are interesting but are also inevitable. In spite of tremendous advancement in surgical techniques and treatment of infections the post-operative infections continue to be a disturbing event in the treatment of surgical patients⁹ (Khyati Jain et al).

Surgical site infection is a big trouble to the patient which may end up in disastrous consequences. The post-operative wound infection may manifest as collection of pus at the site of operation before the sutures are removed or stitch abscess leading to tissue necrosis terminating in septicaemia shock and death to the patient. It causes delay and discomfort in resuming in work because of disability. The quality of life of the patient also deteriorates and it also causes financial loss to the patient¹⁰ (Narsinga Rao Bandaru et al).

So far, it has not been feasible to eliminate the post-operative wound infection completely¹¹ (Guliani et al.). So, it keeps on consuming the considerable finance of the patient and of the state. It also reduces the comfort and wellbeing of the patient. The reduction in

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the rate of post-operative wound infection could have considerable benefit in terms of resources available to the patient and the state and the wellbeing of the patients. MRSA infections are generally multidrug resistant and their therapy entails a huge drain on financial resources⁶ (Divya p.j at el). Presently the problem of post-operative wound infection appears to be stupendous and terrible.

Even though enough newer antibiotics are developed; they are not capable of containing the infections present in the wards⁸ (Malhotra R et al). The nosocomial infections, the development of resistance to the new antibiotics by the bacteria make it very difficult to cure the post –operative wound infections.

This study will discuss and establish various risk factors for development of post-operative wound infection and also the profile of causative bacteria's.

The study includes the 100 cases of laparotomy (elective as well as emergency) which were performed during the period of August 2014-June 2018.

AIMS AND OBJECTIVES

To calculate the incidence of post –operative wound infections after emergency and elective laparotomies.

To find out the type of pathogenic organisms causing laparotomy wound infections.

To co-relate the relationship of post-operative wound infections with the possible pre-disposing factors.

Material and methods

Hundred cases of laparotomies (Emergency and Elective) carried out from Aug2014 to June 2018 are studied retrospectively.

Study is based on clinical observation of patient.

All patients irrespective of age included in the study.

The patients on chemotherapy, steroid therapy, HIV, DM, TB, Cancer are excluded from the study.

Cases were studied under following headings:

1. Personal details of the patients
2. Pre-operative assessment of the patients
3. Pre-Operative investigations of the patients

4. Pre-operative skin preparations of the patients
5. Post-Operative antibiotics given to the patients
6. Operative details of the patients
7. Result-

The laparotomy wound infections were graded as follows:

- 0-No infection
- 1-surgical site erythema
- 2-Subcutaneous collection
- 3-Partial burst
- 4-complete burst

Additionally:

Pre –Operative skin preparations were done for all patients

Peri-Operative antibiotics were given to all patients

Nutritional assessment has been done for all patients with mid arm circumference

Broca,s Index calculated for all patients

Serum proteins done for all patients

Skin fold thickness done for all patients

For patients with peritonitis and peritoneal contamination ascitic fluid sent for routine, microscopic examination. Pus Culture and sensitivity done for all surgical site wound infections.

OBSERVATIONS AND RESULTS

Infection Rate

Out of the hundred total cases 26% indicated post-Operative wound infection. So the percentage of wound infection was 26%.

Sex Ratio

Sex distribution of post-Operative wound infection in males and females showed that 33.33% of female patients and 20.70% of male patients were infected.

Age distribution

Post-operative wound infection is commoner in old age groups. It was found to be 40% in >50 years of Age and it was 20-33% in the younger age group.

Post-Operative wound infection in differing nutritional status

The incidence of Post-operative wound infection was found to be highest in cases with poor nutritional status. It was found least in well-nourished groups. In nutritionally well group, it was 13.92 percent and in nutritionally poor group it was 33.33 percent. Broca's index was taken as to determine the nutritional status of the patients along with mid arm circumference, skin fold thickness, serum proteins and Hb concentration.

Table-1: Respiratory complication status

Status	No.	Infected	percentage
Clear	68	17	25%
Pleural Effusion	13	5	38.46%
Consolidation	09	3	33.33%
Atelectasis	04	1	25%
COPD	06	0	0%
Total	100	26	

This shows the post-operative wound infection rates in cases with compromised pulmonary functions and in cases with normal chest functions. In cases having clear chest, the wound infection rate was 25%. It increased with reduced compliance of the lung up to 40%.

Post-Operative wound infections in differing Hb concentrations

The study of Hb concentration signifies the nutritional status of the patients. Hb concentration less than 10 gm % is taken as Anaemia. So, here is comparison of incidence of post-operative wound infection with varying levels of Haemoglobin. The incidence of post-operative wound infection is 50% if the Hb is less than 10 gm% and it is 21% if the Hb is above 10 gm %. So, as the Hb concentration increases rate of post-operative wound infection decreases. That is the reason, why anaemia and hypoproteinaemia is associated with high incidence of laparotomy wound infection.

Table-2: Post-operative wound infection in varying serum bilirubin concentration

Serum Bilirubin (mg %)	No. of cases	Infected cases	Percentage
0.5-1.0	46	10	21.73
1.1-1.5	34	08	23.52
1.6-2.0	10	04	40
2.1-2.5	10	04	40

The incidence of post-operative wound infection rises to 40% in cases of serum bilirubin increasing to more than 1.6 gm%. So, a jaundiced patient has more chances of getting post-operative wound infection.

Table-3: Post-operative wound infection in differing serum creatinine concentrations.

Serum Creatinine (mg %)	No. of Cases	Infected Cases	Percentage
0.5-1.0	48	6	12.5%
1.1-1.5	34	11	32.35%
1.6-2.0	10	5	50%
2.1-2.5	3	0	0
2.6-3.0	3	2	66.66
3.1-3.5	2	2	100

The rate of infection increases with increasing serum creatinine value. Normal level of serum creatinine is taken as 1 mg%. The study shows that the rate of infection is 32.35% if the creatinine level is up to 1.5 mg%, 66.66 % if the creatinine level is up to 3.0mg% and 100% at level above 3.1 mg. Therefore, diminished kidney function is associated with increased incidences of post-operative wound infection.

Post-operative wound infection in different serum proteins concentrations

Hypoproteinaemia is related to increased rates of post-operative wound infection. Serum proteins level show nutritional status of the patient. Low levels of serum proteins is associated with high incidence of post-operative wound infection. Serum proteins below 6 gm% have rate of infection of 53.84% whereas above 7 gm % it is 13.95%.

Post –Operative wound infection in different type of laparotomy

The incidence of laparotomy wound infection increases with emergency.in emergency laparotomy the rate of infection is 28.76% while in the laparotomies done electively rate of infection decreases to 18.51%.

Table-4: Post-operative wound infection in relation to blood loss.

Amount Of blood loss(ml)	No.of cases	Infected cases	Percentage
<100	32	6	18.75%
101-200	40	10	25%
201-300	9	1	11.11%
301-400	5	1	20%
401-500	3	2	66.66%
>501	11	6	54.54%

The intra-operative blood loss is harmful for the patient in many ways. If the blood loss is 100 ml the post-operative wound infection is 18.75% in our study.it rises to 54.54 % if the intra –operative blood loss is more than 500ml.hence, the post-operative wound infection increases with increase in intra-operative blood loss.

Post-operative wound infection in relation of the condition of peritoneum

The contaminated peritoneum is more likely to get post-operative wound infection as compared to the clean peritoneum. In our study the clean peritoneum developed only 10.71% post- operative wound infection as compared to 31.94% infection in cases of contaminated peritoneum .Therefore, the healthy peritoneum during laparotomy is associated with less infected cases whereas contaminated peritoneum during laparotomy is having more infected cases.

Post-operative wound infection in relation to peritoneal drains

In our study 27.47% of case with drains kept post-operatively developed wound infection and 11.11% without drain developed post-operative wound infection.

Table-5: Post-operative wound infection in relation to Time taken for surgery

Surgery Time(Hrs)	No.Of cases	Infected cases	percentage
<1	16	3	18.75%
1-2	54	8	14.81%
2-3	27	13	48.14%
>3	3	2	66.66

It was observed that more time taken during surgery would have derogatory effect on the patient that the rate of infection increases with the time taken during surgery. If the time taken during surgery was less than I hour the rate of infection was 18.75% .the rate of infection observed was 66.66% if the time taken during surgery was more than 3 hours.

Post-operative wound infection in relation to duration of stay in wards

The rate of post-operative wound infection is 100% if the duration of stay in the ward is more than 21 days It decreased to 16.66% if the duration of stay is less than 15 days. hence, the rate of laparotomy wound infection increases as the post-operative stay in the ward increases.

Post-operative wound infection in relation to suturing technique.

The interrupted suturing technique seems better over the continuous suturing technique. The post-operative wound infection rate was 22.44% in cases of interrupted technique while it was 29.41% in cases of continuous technique.

Table-6: Post –operative wound infection with profile of micro-organisms

Organism isolated	No. Of Patients
Pseudomonas Aeruginosa	3
Staphylococcus Aureus	4
E.coli	10
Klebsiella pneumoniae	3
Proteus mirabilis	3
Anaerobes	3

We isolated causative organisms from 26 patients. Some of the patients had infection with only one micro-organism and the others were infected with multiple micro-organisms. E.coli was the most frequent organism found to infect the post-operative wounds.

DISCUSSION

Being a major inconvenience to the patient, the expenses of the patient also rises considerably as these patients wounds require prolonged stay in hospital .multiple dressings and repeated surgical interventions in the form of debridement and secondary suturings. Surgical site infection is the most common post-operative complication. Post-Operative wound infection have deleterious effects on the final result of operation and patient's full recovery.

This study of Post-operative wound infection has been done in Sharda Hospital in the year 2014-15. Hundred cases has been taken from the surgical ward and studied retrospectively. The Study includes both elective and emergency patients.

This study is undertaken to find out the likelihood of post-operative infection in cases of Post-operative laparotomy wound and to find out association between certain possible predisposing risk factors & wound infection with profile of causative organisms.

Howes said that wound infection is the septic breakdown of the devitalized tissue, blood clot or serum. Boyd said that the time required for complete repair of the wound depends on the number of factors of which amount of tissue destruction and the degree of sepsis are most important. However, direct bacterial inoculum is necessary. From the hundred cases 26% showed post-operative wound infection.

Out of the 26% infected cases 23 were males and 3 were females. There was greater number of men infected than the women.

Advancing age has definite effect on wound healing. In our study, the percentage of post-operative wound infection was highest in older age group (51-57) is 40%. malnutrition is linked with high probability of post-operative wound infection. Diabetes Mellitus has been thought to decrease host resistance to infection but in this study we have excluded diabetes mellitus.

In post-operative wound infection, condition of the chest of the patient is also an important deciding factor. The decreased compliance of the chest associated with pleural effusion, consolidation of lung, atelectasis of lung and COPD is associated with high incidence of post-operative wound infection.

Anaemia is an important factor in determining the post-operative wound infection. In this study 50% of the cases were infected if the Hb level was less than 10 gm%.

In case of contaminated peritoneum, the post-operative wound infection was 31.94% and 10.71 in case of healthy peritoneum.so, it should be important to keep the peritoneum clean and healthy and avoid spillage during surgery if one wishes to avoid post-operative wound infection.

Wound healing will critically depend on an intact inflammatory response for initial formation of wound matrix and subsequent maintenance of sterile environment. Increased level of serum creatinine is linked with impaired immune function leading to laparotomy wound infection and increasing risk of wound dehiscence. Jaundice is also associated with post-operative wound infection. Acute blood loss during surgery leads to poor oxygenation of the tissue which leads to good and fertile media for certain bacterial growth.

Longer stay of the patient in the ward will lead to higher rate of post-operative wound infection due to infection by the spectrum of bacteria that resides in the ward and colonizes the site of surgery.

Closure of the abdomen after surgery can be done either by continuous or interrupted suture technique. In this study interrupted technique was favourable with 22.44% infection and continuous with 29.41% of infection.

Factors influencing surgical site infection

There are many factors which influence surgical wound healing and determine the influence for, and the incidence of infection. The level of bacterial burden is the most significant risk factor, but modern surgical techniques and the use of prophylactic antibiotic have reduced the risk.

The operative wounds classification is based on the degree of microbial contamination was developed by US national research council in 1964. Three wound classes with an increasing risk of ssi_s were described :clean, clean-contaminated and dirty. The simplicity of this system of classification has resulted in it being widely used to predict the rate of infection after surgery.

CONCLUSION

The incidence of post-operative wound infection was 26%.

The percentage of post-operative wound infection increased with the:-

- *Poor nutrition
- *Increasing age
- *Anaemia
- *hypoproteinaemia
- *Contaminated peritoneum of abdomen
- *with poor chest compliance

3. The rate of post-operative wound infection is directly proportional to the duration of surgery and hospital stay.

4. Deranged renal function and liver function leads to increased incidence of post-operative wound infection.

5. The rate of Post-operative wound infection is less in cases where gastrointestinal tract was not opened.

6. The most common organism found in infected cases was Escherichia coli.

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