VOLUME - 10, ISSUE - 12, DECEMBER - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Surgery

ROLE OF ANTIBIOTIC PROPHYLAXIS ON SURGICAL SITE INFECTION IN ELECTIVE ABDOMINAL SURGERY

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ABSTRACT Surgical site infection (SSI) are healthcare-associated infections(HAIs) with significant source of preventable morbidity and mortality. Prophylactic antibiotics are used most often to prevent infection of a surgical incision. *S. aureus*, *coagulase-negative Staphylococci* and *Enterococci* are the three organisms most commonly isolated from SSI.

KEYWORDS :

INTRODUCTION:

Before the antisepsis era risk of surgery was exceedingly high due to the enormous rates of surgical infection. Introduction of sulphonamides in 1936, penicillin in 1941 and numerous antibiotics in 1950 lulled many surgeons that wound infection was a vanishing problem. Although antibiotic resistant strains of pathogenic bacteria were recognized early in the antibiotic era, it was not until the mid 1950s that problem received wide spread recognition.

For most SSI, the sources of pathogens are endogenous flora of the patient's skin, mucous membrane or hollow viscus{1}. When mucous membrane is incised, the exposed tissues are at risk for contamination with endogenous flora {2}. These organisms are usually aerobic gram-positive cocci (e.g. *staphylococci*), but may include faecal flora (e.g. anaerobic bacteria and gram-negative aerobes) when incisions are made near the perineum or groin. When a gastro-intestinal tract (GIT) organ is opened during an operation and becomes the source of pathogens, gram-negative bacilli (e.g. *E. Coli*), gram-positive organisms and sometimes anaerobes (e.g. *Bacillus fragillis*) are the typical SSI isolates.

In the recently published 2010 NHSN data, *S aureus* accounted for 30.4% of SSI, up from 20 in the early 1990s. In the 2010 NHSN update, the proportion of SSI due to MRSA was 43.7%{3 }. Increases in MRSA prevalence internationally show similar temporal trends.

Antibiotic prophylaxis :

Selection of antibiotics for prophylaxis should be made with primary consideration of the spectrum of coverage required. This consideration should be made because of the wound classification and the overall risk of infection. Appropriately selected antibiotic prophylaxis can protect the patient from postoperative infection by reducing the bacterial load present within the surgical site at the time of operation{4}.

In clean surgical procedures, risk of SSI is low &, in several cases AMP is not indicated. Consideration of intrinsic patient related factors associated with increased risk of SSI (e.g., age, malnutrition, immunosuppression. In clean procedures, the primary coverage is for the likely Staphylococcus sp. that will be predominant cause.

For clean contaminated procedures additional coverage is needed depending upon site of surgery, so first and second generation cephalosporins remain the recommended antibiotics for large number of surgical procedures. The recommendations for antibiotic prophylaxis for procedures of the biliary tract is specific risk factors, high risk is conferred by age older than 70 years, diabetes mellitus, or a recently instrumented biliary tract (e.g biliary stent).

General principles of AMP are consistent although there have been continued updates to clinical practice guidelines. First AMA should be safe. Second, an AMA should be selected that has narrow spectrum of coverage for the expected relevant pathogens. Third, AMP should be administered in the perioperative period to allow serum and tissue concentration to reach appropriate level at the time of incision. Lastly, the AMA should be administered for the shortest effect period, with appropriate discontinuation of the agent.

The routine use of postoperative antibiotics for infection prophylaxis beyond 24 hours has not been shown to decrease SSI rates in general surgery {5}. Postoperative antibiotic prophylaxis should not be used in patients without evidence of infection or significant contamination intra operatively.

For contaminated and dirty wound classes, prophylaxis is typically not indicated, because therapeutic antibiotic management is required. Obviously, prophylaxis merges into empiric therapy in situations in which the risk of infection increases markedly because of intraoperative findings.

MATERIALS AND METHODS

This prospective study was carried out in the department of General Surgery after getting clearance from Institutional Ethics Committee at Dr. RPGMC Tanda. 300 consecutive cases of elective abdominal surgeries hospitalized during study period i.e December 2014 to March 2016 under Surgery were included in the study.

Inclusion Criteria:

1. All consecutive patients admitted under surgery department of Dr. RPGMC Tanda for elective abdominal surgery.

Exclusion Criteria:

1. Patients undergoing reoperation.
2. Patients where implants in the form of mesh were used.
3. Patients operated for emergency surgical conditions.

(i) Antibiotic prophylaxis was given in clean and clean contaminated elective surgery.

a) In biliary surgery intravenous cefuroxime was given as prophylactic antibiotic.

b) In colonic surgery intravenous cefuroxime and metronidazole was used in prophylaxis.

One dose of prophylactic antibiotic was given within 1 hour of surgery. In cases where surgery, lasted longer than four hours or with major blood loss then additional intra-operative doses of antibiotic were given. In contaminated and dirty wounds therapeutic antibiotics were used for 3-5 days after the prophylactic dose.

iii) In colorectal surgery bowel preparation was done by starting patient on low or no residue clear liquid diet 48 hours before surgery, polyethylene glycol solution night before surgery and systemic antibiotic prophylaxis day before surgery.

iv) In obstructive jaundice patients, coagulation profile study was done. These patients were given injection vitamin K, 10 milligram, intramuscularly once daily for three days. Proper hydration of the patients was done with intravenous fluids i.e. 5% dextrose and ringer lactate. Prophylactic antibiotics were also given.

Type of surgery and class of surgical wounds were recorded. Center for disease control and prevention criteria was used for wound classification[6].

Surgical Wound Classification

Class	Criteria
Class 1: Clean wounds	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered. In addition clean wounds are primarily closed and, if necessary, drained with closed drainage.
Class 2: Clean Contaminated wounds	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination. Operations involving biliary tract and appendix are included in this category, provided no evidence of infection or major break in technique is encountered.
Class 3: Contaminated wounds	Open, fresh, accidental wounds. In addition, operations with major break in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, non purulent inflammation is encountered are included in this category.
Class 4: Dirty wounds	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organism causing postoperative infection were present in the operative field before the operation.

SSI was recorded as per the Centers for disease control criteria for defining surgical site infection as mentioned below:

Superficial incisional SSI: Infection occurs within 30 days after the operation and infection involves only skin and subcutaneous tissue of the incision and at least one of the following:

1. Purulent drainage, with or without laboratory confirmation, from the superficial incision.
2. Organism isolated from an aseptically obtained culture of fluid or tissue from the superficial incision.
3. At least one of the following sign or symptoms of infection: pain or tenderness, localized swelling, redness, or heat and superficial incision is deliberately opened by surgeon, unless incision is culture negative.
4. Diagnosis of superficial incisional SSI by the surgeon or attending physician.

Deep incisional SSI :

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and infection involves deep soft tissues (e.g fascial and muscle layers) of the incision and at least one of the following:

1. Purulent drainage from the deep incision but not from the organ/space component of the surgical site.
2. A deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms: fever (>38 degree), localized pain, or tenderness, unless site is culture negative.
3. An abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of a deep incisional SSI by surgeon or attending physician.

Organ/Space SSI:

Infection occurs within 30 days after the operation if no implant is left in place or within one year if implant is in place and the infection appears to be related to the operation and infection involves any part of the anatomy (e.g. organ or spaces), other than the incision, which was opened or manipulated during an operation and at least one of the following:

1. Purulent drainage from a drain that is placed through a stab wound into the organ/ space.
2. Organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space.
3. An abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination.
4. Diagnosis of an organ/space SSI by a surgeon or attending physician.

The data was analyzed using simple statistical tests such as averages and percentages

OBSERVATIONS

The age of the patients in our study ranged from 1 to 82 years with a mean age of 42.7 years.

Table 1: Age wise distribution of patients

Age	Number	Percentage
0-10	12	4
11-20	10	3.3
21-30	37	12.4
31-40	78	26
41-50	84	28
51-60	47	15.6
61-70	21	7
>70	11	3.7
Total	300	100

The sex distribution of the study showed that out of 300 patients, 74(24.7%) were males and 226 (75.3%) were females (Table 2).

Table 2: Sex distribution

Sex	No of Patients	Percentage
Male	74	24.7
Female	226	75.3

Out of 300 elective surgical patients, 24 (8%) were clean surgical wounds, 274 (91.4%) clean-contaminated surgical wounds, 1 (0.3%) contaminated surgical wounds and 1 (0.3%) dirty surgical wounds(Table 3).

Table 3: Class wise distribution of operative wounds

Class of wound	No. of operations	Percentage
I: Clean	24	8

II: Clean-contaminated	274	91.4
III: Contaminated	1	0.3
IV: Dirty	1	0.3
Total	300	100

SSI rate was 100% in dirty surgical wound, 100 % in contaminated wounds, 5.1% in clean-contaminated wounds and 4.1% in clean wounds(**Table 5).**

Table 5: Correlation of class of wound with SSI

Class of wound	No. of operations	No of SSI	SSI rate
I: Clean	24	1	4.1
II: Clean contaminated	274	14	5.1
III: Contaminated	1	1	100
IV: Dirty	1	1	100

Pus discharge from wound was the commonest (47%) clinical feature of SSI in our study followed by pain incision site (29.4%), fever (23.5%), wound dehiscence (17.6%), tenderness (17.6%), redness (11.6%), pus discharge drain (11.6%) and swelling (5.8%)(**Table 6).**

Table 6: Clinical features of SSI

	Pus discharge	Pain	Fever	Wound dehiscence	Redness	Swelling	Tenderness	Pus discharge from drain
Superficial (n=10)	5	3	1	-	2	1	1	-
Deep (n=3)	3	2	1	3	-	-	2	-
Organ space (n=4)	-	-	2	-	-	-	-	2
Total N=(17)	8	5	4	3	2	1	3	2
Percentage	47	29.4	23.5	17.6	11.6	5.8	17.6	11.6

Standard mechanical bowel preparation & prophylactic systemic antibiotics was used in all 9 patients of colorectal carcinoma. Out of these 9 cases 3(33.3%) developed SSI.Antibiotic prophylaxis was given within 1 hour of incision as per protocol in 300 patients and 17 patients (5.6%) developed SSI.In obstructive jaundice patients Out of 4 patients, 2(50%) developed SSI.

Table7: Preoperative preparation and SSI

Type of preparation	Patients with preoperative preparation			Patients without preoperative preparation		
	No of patients	No of SSI	%	No of patients	No of SSI	%
Mechanical bowel preparation	9	3	33.3	0	0	0
Antibiotic prophylaxis	300	17	5.6	0	0	0
Obstructive jaundice	4	2	50	0	0	0

Out of 17 samples subjected to culture, 10 (58.8%) turned out to be positive. **Table 8**

Table 8: Profile of aerobic microorganism isolated

Microorganism isolated	No of cases	Percentage
Staphylococcus aureus	4	23.4
Coagulase negative staphylococci	1	5.8
Escherichia coli	3	17.6
Escherichia coli, Klebsiella pneumonia	1	5.8
Pseudomonas aeruginosa	1	5.8
Pus /drain culture sterile	7	41
Total	17	100

DISCUSSION

In this study we observed the rate of SSI with AMP in different elective abdominal surgery. The overall SSI rate with Antibiotic prophylaxis was 5.66% (17/300) consistent with the 5% SSI rate observed by Pathak et al{7 }and Sahu et al{8 }. In our study we SSI rate was 4.1% in clean wounds, 5.1% in clean contaminated wounds, 100% in contaminated wound and 100% in dirty wound which shows that SSI increases with the increase in the degree of contamination of the wound. Lul Raka et al{9 }, have also reported similar findings.

In our study, mechanical bowel preparation was done in all 9 patients of colorectal surgery along with systemic preoperative antibiotics and we observed 33.3% SSI rate. A recent multivariate analysis of colon resection databases have demonstrated reduced SSI rates in patients receiving the oral antibiotic bowel preparation and systemic antibiotics together compared to patients receiving only systemic antibiotics{10 }.

Out of ten positive culture results, *Staphylococcus aureus* was isolated in 4 (40%), *E.coli* in 4(40%), *Coagulase negative Staphylococci* in 1(10%), *Pseudomonas* in 1(10%). In one patient two pathogens *E.coli and Klebsiella* were isolated. Afifi et al {11} also observed *Staphylococcus aureus* as most frequent single pathogen followed by *E. coli*, *Klebsiella pneumoniae*, *Proteus* and *Pseudomonas*.

CONCLUSION

ABP guidelines should be used in elective surgery and rational drug use ensured based on wound class, risk factors and type of specific operative procedure. ABP is not required in clean and clean contaminated laproscopic surgery except in patients with risk factors. Single dose prophylactic antibiotic is justified in clean–contaminated open surgery.

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