E-ISSN: 2616-3470
P-ISSN: 2616-3462

www.surgeryscience.com
2019; 3(1): 69-72
Received: 16-11-2018
Accepted: 18-12-2018

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The effectiveness between two different antimicrobial prophylaxis regimen in abdominal surgeries: A comparative study

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DOI: https://doi.org/10.33545/surgery.2019.v3.i1b.13

Abstract
Wound infection is still the commonest complication seen in surgical practice, and the prevention of infection is still one of the most difficult problems faced by surgeons today. The development of a wound infection depends on the complex interplay of many factors the treatment of complicated Post-operative infections continues to challenge Surgeons, primarily because of the poly microbial nature of these infections coupled with the high risk of complications and even death. In this study altogether 100 cases were studied. Out of which, 62 cases received Type 1 regimen i.e. this group received only prophylactic antibiotic before surgery and did not receive any further antibiotic during per operative and post-operative and in this 8 cases (13 %) had post-operative infection and those cases were again given antibiotic based on their culture and sensitivity. In type 1 group (62 patients) were only prophylactic 12.9% had post-operative UTI, URTI, LRTI, i.e. and 19.35%, had fever 6.4% had erythema, 4.8% had pus discharge and 1.6%.had wound dehiscence.

Keywords: Antimicrobial prophylaxis regimen, abdominal surgeries, surgical site infections

Introduction

While introducing antibiotic therapy was a giant step in the treatment of non-surgical infections, it made much smaller impact in the treatment of surgical infections. The mortality rate of acute appendicitis was approximately 50% in the latter part of 19th century. Availability of intravenous fluid therapy and blood transfusion led to another decrease in mortality rate in the early part of 20th century. By the time penicillin became available, mortality rate of acute appendicitis was only 5%. Continuing improvement in the anesthesia, surgical technique and post-operative care have also contributed to the decline in mortality- as has antibiotic therapy [1].

Surgical site infections (SSI) are among the most common hospital-acquired infections, accounting for around 38%. Hospital-acquired infections increase morbidity and mortality, prolong hospital stay and increase the cost of medical care. The Surgical Wound Infection Task Force in 1992 published a new set of definitions for wound infections that included changing the term to SSI. Unlike surgical wound infections, SSIs include postoperative infections presenting at any level (incisional or deep) of a specific procedure. SSIs continue to be a significant problem for surgeons despite significant improvements in antibiotics, superior instruments and earlier diagnosis of surgical problems [2, 3].

Wound infection is still the commonest complication seen in surgical practice, and the prevention of infection is still one of the most difficult problems faced by surgeons today. The development of a wound infection depends on the complex interplay of many factors the treatment of complicated Post-operative infections continues to challenge Surgeons, primarily because of the poly microbial nature of these infections coupled with the high risk of complications and even death [4].

Surgical site infections (SSIs) are a major contributor to patient injury, mortality, and health care costs. Despite evidence of effectiveness of antimicrobials to prevent SSIs, previous studies have demonstrated effects inappropriate timing, selection, and excess duration of administration of antimicrobial prophylaxis.

Therefore to prevent infection, prophylactic antibiotic should be administered in such way that the maximum tissue concentration is during the most vulnerable period, so antibiotics should be administered pre operatively followed by post-operative antibiotics [5].

Whichever antibiotics are administered, the goal of therapy is to achieve antibiotic levels at the site of infection that exceed the minimum inhibitory concentration for the pathogens present. For mild infections, including most that can be handled on an outpatient basis, this concentration may be achievable with oral antibiotics when appropriate choices are available. For severe surgical infections, however, the systemic response to infection may make gastrointestinal absorption of antibiotics unpredictable and thus antibiotic levels unreliable. In addition, for intra-abdominal infections, gastrointestinal function is often directly impaired. For this reason, most initial antibiotic therapy for surgical infections is begun intravenously [6].

The choice of antibiotics is not the most common cause of failure unless the original choice was clearly inappropriate, such as failing to provide coverage for anaerobes with an intra-abdominal infection.

As the patient improves, one must decide when to stop antibiotic therapy. For most surgical infections there is no specific duration of antibiotics that is known to be ideal. Antibiotics generally support local host defenses until the local responses are sufficient to limit further infection. When an abscess is drained, the antibiotics prevent invasive bacterial infection in the fresh tissue planes opened in the course of drainage. After 3 to 5 days, the local responses of new capillary formation and inflammatory infiltrate provide a competent local defense. For deep-seated or poorly localized infections, longer treatment may be needed [7].

A reliable guideline is to continue antibiotics until the patient has shown obvious clinical improvement based on clinical examination and has had a normal temperature for 48 hours or longer. Signs of improvement include improved mental status, return of bowel function, resolution of tachycardia, and spontaneous diuresis. A shorter course of antibiotics may be sufficient, but data supporting a specific duration are not available [8].

The recent availability of potent systemic antibiotics that can be given orally has led to some studies demonstrating that patients with intra-abdominal and other serious infections can be treated initially with parenteral antibiotics and then switched to oral antibiotics to complete their antibiotic course. This practice has the potential to reduce overall costs of antibiotic treatment, but it also carries the risk of unnecessarily increasing the duration of antibiotic treatment. Some physicians have succumbed to the temptation to send patients home with oral antibiotics because it is easy, when previously, the same patient would have been sent home without any antibiotics at all. This temptation needs to be resisted [9].

The white blood cell count may not have returned to normal when antibiotic therapy is stopped. If the white blood cell count is normal, the likelihood of further infectious problems is small. If the white blood cell count is elevated, further infections may be detected, but in most cases they will not be prevented by continuing antibiotics. Rather, a new infection requires drainage or different antibiotics for a new, resistant pathogen in a different location. In this case, the best approach is to stop the existing drugs and observe the patient closely for subsequent developments [10].

Methodology

Study subjects: 100 Patients admitted for Elective and Emergency abdominal surgeries in Department of Surgery.

The method of study consists of

- Detail history taking & clinical examination
- Investigations after taking written informed consent
- Factors influencing Post-Operative Abdominal Wound Infection will be detailed.
- Patients who are undergoing elective and emergency abdominal surgeries are randomly divided into two groups.

First Group

- They will receive Antimicrobial Prophylaxis i,e administration of first antimicrobial dose IV cefazolin plus IV metronidazole within 60 min before the surgical incision.
- An additional antimicrobial dose will be provided Per-operatively if the operation is still continuing 2 half-lives after the initial dose.
- This group will not receive any further antibiotics and the patient will be watched for any signs of infection as mentioned in the proforma.
- If the patient develops any signs of infection, they will be given a broad spectrum antibiotic (Clindamycin plus Gentamicin) and after doing culture and sensitivity they will be assigned a new antibiotic basing on their Culture and Sensitivity report.

Second Group

- They will receive IV cefazolin plus IV metronidazole Pre-operative and Per-operative antibiotics followed by Post-operative Antimicrobial Therapy for 5-7 day.
- The drug in both the groups will be provided in an adequate dose on the basis of patient body weight, adjusted dosing weight, or body mass index.

Results

In this study altogether 100 cases were studied.

Out of which, 62 cases received Type 1 regimen i.e. this group received only prophylactic antibiotic before surgery and did not receive any further antibiotic during per operative and post-operative and in this 8 cases (13 %) had post-operative infection and those cases were again given antibiotic based on their culture and sensitivity.

Remaining 38 cases which were assigned randomly received antibiotic therapy i.e. this group received antibiotic during entire stay of operative period in this 17 cases (44%) had post-operative infection.

Table 1: Regime and Infection

		Infection At Wound Site		Total
		Not present	Present	
Type of Regimen	Type1	54	8	62
	Type2	21	17	38
Total		75	25	100

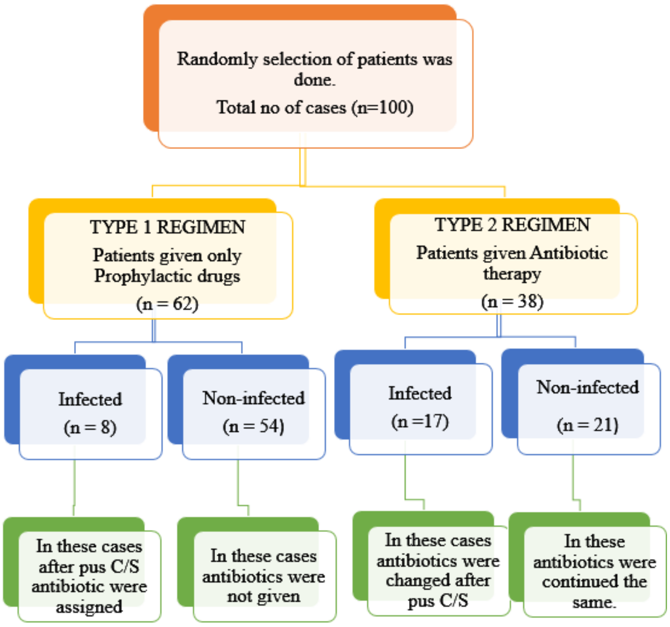

Fig 1: Flow chart regarding treatment.

After applying the Chi square the *P*<0.05, i.e. significant and rejects the null hypothesis and says that there is a significant difference in the post-operative wound infection and type of Regimen used. There is strong evidence that Type 1 regime is superior to type 2 regime and the difference observed is not due to chance.

Table 2: Type of case and incidence of infection.

	Infected	I %	Non Infected	NI %	Total no
Clean	7	17.9	32	82	39
Clean-contaminated	15	27.7	39	72.2	54
Contaminated	3	42.8	4	57.2	7
	25		75		100

Out of 100 cases, 39 were clean cases, 54 cases were Clean-contaminated cases and 7 cases were contaminated cases. Out of 39 Clean cases, 7 cases were infected that is 17.9%, Out of 54 Clean-contaminated cases 15 cases were infected that is 27.7%, Out of 7 Contaminated cases 3 cases were infected i,e 42.8%. and there is no statistical association between the infection outcome and the type of wound and majority had no infection at the wound site irrespective of type of case. (P value >0.05).

Table 3: Incidence of type of infection with type 1 and type 2 cases

	Type 1(62)	Percentage (%)	Type 2(38)	Percentage (%)
Post op Uti/urti/lrti	8	12.9	12	31.5
Fever	12	19.35	12	31.5
Erythema	4	6.4	3	7.8
Pus discharge	3	4.8	4	10.5
Wound dehiseence	1	1.6	6	15.7
Burst abdomen	0	0	3	7.8
	100		25	

In type 1 group (62 patients) were only prophylactic 12.9% had post-operative UTI, URTI, LRTI, i.e. and 19.35%, had fever 6.4% had erythema, 4.8% had pus discharge and 1.6%.had wound dehiscence.
In type 2 group, out of 38 patients where only antibiotic therapy was used 12 patients had post-operative UTI, URTI, LRTI, 31.5% had fever, 4 patients had pus discharge i.e. 10.5%, and 6 patients had wound dehiscence i.e. 15.75%, and 3 patients had burst abdomen i.e.7.8%.

Table 4: Incidence of infection with type of pathogen

	Infected	%	Non infected	%	Total no
Bacteriods	0	0	2	100	2
Coag –ve staph	9	18.75	39	81.25	48
Klebseiella	6	100	0	0	6
Peptostrep	0	0	4	100	4
Staph. aureus	10	43.47	13	56.53	23
No growth	0	0	17	100	17
	25		75		100

The incidence of infection is more with Klebsiella, Staph aureus, coag-ve staph.

Discussion

Sepsis is one of the most important postoperative morbidity. The complication includes wound sepsis intra-abdominal or pelvic abscess and septicemia. Consequences of these potentially preventable and sometimes fatal complications in the gastro intestinal surgery include thrombo-embolism, malnutrition, anastomotic dehiscence, wound disruption, disseminated intravascular coagulation and wound disruption, disseminated intravascular coagulation and death [6, 7].
The post-operative abdominal wound infection is status of preoperative status, preoperative diagnosis, type of surgery, technique of surgery, postoperative status of the patient etc. It is also influenced by method of preparation of the patient for surgery and post-operative care; Sterility of instruments, suture materials, masks, caps, gowns, and gloves are contributing factors [8, 9].
There are much variations in the overall infection rate in different hospitals and has only limited epidemiological value. Clean wound infection rate is a much more definitive value and therefore one of the most valuable factors of the quality of surgical care in hospital.
The endogenous contamination is at a minimum in clean wounds and other exogenous factors and general factors can be accurately assessed. Further it allows comparison between various surgical departments and surgeons. A clean infection rate less than 1% is exemplary, 1-2% acceptable and more than 2% is a cause for concern.
In type 1 group (62 patients) were only prophylactic 12.9% had post-operative UTI, URTI, LRTI, i.e. and 19.35%, had fever 6.4% had erythema, 4.8% had pus discharge and 1.6%.had wound dehiscence.
In type 2 group(38 patients) were only antibiotic therapy was used 31.5% had post-operative UTI, URTI, LRTI, and31.5%, had fever, 7.8%, had erythema, 10.5%, had pus discharge, 15.75%, had wound dehiscence, 7.8%.had burst abdomen.
28 patients stayed up to 8 days and among them 25%had infection.57% patients stayed up to 12 days and among them 32 %had infection. 15% patients stayed up to 18 days and among them54% had infection which is significantly high (P value is <0.05).
49 patients had the duration of surgery greater than 2hrs and incidence of infection was >50%and 51 patients had duration of surgery less than 2hrs incidence was <50%. The greater the duration of surgery, greater the chances of infection and it statistically significant as P value is <0.05
57 patients were placed drain and out of which 40.3% were infected and out of 43 patients were drain was not placed, only

4.6% were infected. Patients with drain had more chances of infection, which is significantly high. (P value is <0.05).
The percentage of recovery of organisms from infection site, as per studies of barlett and Lober.
In this study some of the cases had multiple organism in culture studies. Coag –Ve Staph 18.75 %, Klebseilla 100%, Staph aureus 43.7%.
Although penicillin was discovered years ago and antibiotics have been in widespread use over these years, many questions concerning the administration of antibiotics prophylactically in the past have been upturned by many studies. Some attempts have been made logically to arrive at a compromise which prohibit their use in clean surgeries. Many previous studies have shown that prophylactic antibiotic are successful in controlling post-operative infection.
In this study there were 12.9% infection in prophylactic antibiotic group and 44.7% infection in postoperative antibiotic group. There is difference in observation, which is statistically significant (P value is < 0.05). Studies conducted by M.R.B Kieghley, and Kaiser [11] showed perioperative antibiotic prophylaxis was successful in controlling infection. But similar study by Higgins and Lewis [12] shows that it is effective as post-operative antibiotic therapy.

Conclusion

- Infection rate is significantly high in patients with long duration of hospital stay up to 18 days (54%).
- Almost all organisms were sensitive to cefotaxime. These organisms were resistant to Ampicillin, cefazoline and erythromycin.
- Infection is more common with klebseilla i,e 100%., then followed by Staph aureus 43.7%. then by Coag -ve Staph 18.75 %,
- There were 12.9% of infection in patients with antibiotic prophylaxis and 44.7% infection in patients with postoperative antibiotics. Because P value is <0.05 this is significant. Hence it is assumed that Antibiotic prophylaxis is more effective than postoperative antibiotic therapy.
- Definitely antibiotic is an adjuvant to good surgical technique in reducing infection rate.

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