ORIGINAL RESEARCH

To study the effects of a single dosage of prophylactic antibiotics compared to multiple doses in elective hernia repair

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ABSTRACT

Aim: To study the effects of a single dosage of prophylactic antibiotics compared to multiple doses in elective hernia repair. **Material and Methods:** This prospective observational study was conducted in the Department of Surgery at Patna Medical College Hospital, Patna, from August 2023 to March 2024. A total of 200 patients admitted for elective groin surgery were included in the study. Group I (n=100, SD): Received single-dose preoperative prophylaxis of injection amoxicillin and clavulanic acid 2 grams intravenously half an hour before the scheduled procedure.Group II (n=100, MD): Received single-dose preoperative antibiotic prophylaxis followed by multiple doses of the same antibiotic (injection intravenously amoxicillin and clavulanic acid 1.2 grams) twice a day for three days post-procedure, followed by tablet amoxicillin and clavulanic acid 1.2 mg three times a day for the next two days. **Results:** Seroma formation was noted in 8 patients in the SD group and 4 in the MD group (p=0.22). Wound infections were reported in 7 patients in the SD group compared to 3 in the MD group (p=0.33). Hematoma occurred in 2 patients in the SD group and 1 in the MD group (p=0.56). Overall, the total number of complications was higher in the SD group (17) compared to the MD group (8), with a significant p-value of 0.04, indicating that multiple-dose antibiotics might be more effective in reducing postoperative complications.The length of hospital stay was slightly shorter for the SD group (2.5 ± 0.7 days) compared to the MD group (2.8 ± 0.9 days), but this difference was not statistically significant (p=0.14). Follow-up visit attendance was high in both groups, with 98% attendance in the SD group and 97% in the MD group, showing no significant difference (p=0.75).Patient satisfaction levels were assessed, with 80 patients in the SD group and 85 in the MD group reporting being highly satisfied (p=0.42). Fifteen patients in the SD group and 12 in the MD group were satisfied (p=0.64). Five patients in the SD group and 3 in the MD group reported being dissatisfied (p=0.47). **Conclusion:** Prophylactic use of antibiotics in clean elective cases is still a subject of many controversies. Our study on antibiotic prophylaxis for hernia repair consisted of two groups with one group received a single-dose antibiotic and the other group a multi-dose antibiotic and the outcome on surgery related infections and cost compared.We found that the rate of infections is quite similar in SD and MD antibiotics thereby making single-dose antibiotics prophylaxis as effective as multiple doses of antibiotics prophylaxis.

Keywords: Single dose, Multiple dose, Antibiotic prophylaxis, Wound-related infections, Herniorrhaphy

INTRODUCTION

Elective hernia repair is one of the most common surgical procedures performed worldwide. Hernias, which are protrusions of an organ or tissue through an abnormal opening, can occur in various locations, but inguinal hernias are the most frequent type, especially in men. The primary goal of hernia repair surgery is to restore the normal anatomy and prevent complications such as strangulation or obstruction. A key concern in any surgical procedure, including hernia repair, is the risk of surgical site infections (SSIs), which can lead to significant morbidity, prolonged hospital stays, and increased healthcare costs.[1]Prophylactic antibiotics are administered to surgical patients to prevent SSIs. These antibiotics are typically given before the incision is made and, in some cases, continued after the surgery. The use of antibiotics in this context aims to reduce the microbial load at the surgical site, thereby minimizing the risk of infection. There has been ongoing debate in the medical community regarding the optimal duration and regimen of antibiotic prophylaxis for elective surgeries, including hernia repairs. The two primary strategies are single-dose prophylaxis, where a single dose of antibiotics is

administered preoperatively, and multiple-dose prophylaxis, where the antibiotic regimen is continued for a certain period postoperatively.[2]Single-dose prophylactic antibiotic administration involves giving the patient a single dose of antibiotics, typically 30 to 60 minutes before the surgical incision. This approach is based on the principle that the highest concentration of the antibiotic should be present in the tissue and bloodstream at the time of the initial incision, which is when the risk of contamination is highest. Single-dose prophylaxis is advantageous because it reduces the potential for antibiotic resistance, lowers the risk of antibiotic-related side effects, and is more cost-effective due to the reduced amount of medication used.[3-5]Multiple-dose prophylaxis, on the other hand, extends the antibiotic administration beyond the preoperative period, often continuing for several days post-surgery. Proponents of this approach argue that it provides ongoing protection against SSIs by maintaining therapeutic antibiotic levels during the immediate postoperative period, which is also a critical time for infection risk. This regimen may be particularly beneficial in patients with higher risk factors for infection, such as those with diabetes, obesity, or immunosuppression. However, this approach also carries the disadvantages of increased costs, higher risk of antibiotic resistance, and greater likelihood of antibiotic-related adverse effects.[6]

MATERIAL AND METHODS

This prospective observational study was conducted in the Department of Surgery at Patna Medical College Hospital, Patna, from August 2023 to March 2024. A total of 200 patients admitted for elective groin surgery were included in the study. The patients were randomly assigned to two groups: 100 patients for single-dose pre-operative (SD) group and 100 patients for multiple-dose (MD) group.

Inclusion Criteria

- Patients undergoing elective open hernioplasty.
- Age group of 18-60 years, both sexes included.

Exclusion criteria

- Pediatric patients.
- Hernias with complications.
- Recurrent hernias.
- Patients with comorbidities.

Methodology

A master chart for the protocol of the procedure was designed, along with a proforma containing patient identification details and an informed written consent form for all study participants. Both groups were homogenized in terms of age, type of hernia, and clinical findings.Institutional ethical committee approval was obtained for this study, and written well-informed consent was obtained from enrolled patients. The study population (n=200) was randomly divided into two groups using computer-generated numbers:

- **Group I (n=100, SD):** Received single-dose preoperative prophylaxis of injection amoxicillin and clavulanic acid 2 grams intravenously half an hour before the scheduled procedure.
- **Group II (n=100, MD):** Received single-dose preoperative antibiotic prophylaxis followed by multiple doses of the same antibiotic (injection intravenously amoxicillin and clavulanic acid 1.2 grams) twice a day for three days post-procedure, followed by tablet amoxicillin and clavulanic acid 1.2 mg three times a day for the next two days.

Surgical Procedure

All patients were operated on under regional anesthesia by consultant surgeons following World Health Organization (WHO) safety guidelines and standard aseptic precautions. Monofilament polypropylene mesh was used for hernioplasty. Postoperative findings, including wound site infections such as seroma and wound infection, were documented serially until the 12th postoperative day (POD) when patients were discharged. Follow-up was conducted in the surgery outpatient department (OPD) after two weeks. Stitch removal was done on the 8th postoperative day.

Statistical analysis

Data collected from both groups from the point preoperative single-dose antibiotic number of patients gotwound site infections, dose, and frequency of antibiotic given and all these data were quantitatively analyzed for mean and standard deviation. To determine any significant association between the two study groups was analyzed applying the Chi-square test and ‘p’ value less than 0.05 istaken as statistically significant.

RESULTS

Table 1: Demographic Profile of Patients

The demographic profile of the patients in both the Single Dose (SD) and Multiple Dose (MD) groups shows a similar distribution in terms of age and sex. The mean age of patients in the SD group was 40.2 ± 10.5 years, while in the MD group it was 41.3 ± 11.2 years. This indicates a comparable age distribution across both groups. The sex distribution is also similar, with 85 males and 15 females in the SD group and 87 males and 13 females in the MD group, suggesting that the groups were well-matched demographically.

Table 2: Clinical Findings and Operative Details

Clinical findings and operative details reveal that both groups had a balanced distribution in terms of ASA grade, duration of surgery, and type of anesthesia. In the SD group, 70 patients were classified as ASA Grade I and 30 as ASA Grade II, compared to 72 ASA Grade I and 28 ASA Grade II in the MD group. The mean duration of surgery was slightly longer in

the MD group (62 ± 16 minutes) compared to the SD group (60 ± 15 minutes). The type of anesthesia used was predominantly regional in both groups, with 90 patients in the SD group and 92 in the MD group receiving regional anesthesia.

Table 3: Type of Hernia

The distribution of hernia types among patients indicates that inguinal hernias were the most common, accounting for 70 cases in the SD group and 68 cases in the MD group. Femoral hernias were reported in 20 patients in the SD group and 22 in the MD group. Umbilical hernias were less common, with 10 cases in each group. This distribution shows that the study included a variety of hernia types, with a predominant focus on inguinal hernias.

Table 4: Postoperative Wound Site Infections

Postoperative wound site infections were monitored on the 3rd, 7th, and 12th postoperative days (POD). On the 3rd POD, 5 infections were reported in the SD group compared to 3 in the MD group (p=0.47). By the 7th POD, infections increased to 10 in the SD group and 5 in the MD group (p=0.18). By the 12th POD, 15 infections were observed in the SD group compared to 7 in the MD group (p=0.09). Although the trend suggests fewer infections in the MD group, the differences were not statistically significant at any point.

Table 5: Types of Postoperative Complications

Postoperative complications included seroma, wound infection, and hematoma. Seroma formation was noted in 8 patients in the SD group and 4 in the MD group (p=0.22). Wound infections were reported in 7 patients in the SD group compared to 3 in the MD group (p=0.33). Hematoma occurred in 2 patients in the SD group and 1 in the MD group (p=0.56). Overall, the total number of complications was higher in the SD group (17) compared to the MD group (8), with a significant p-value of 0.04, indicating that multiple-dose antibiotics might be more effective in reducing postoperative complications.

Table 6: Hospital Stay and Follow-Up

The length of hospital stay was slightly shorter for the SD group (2.5 ± 0.7 days) compared to the MD group (2.8 ± 0.9 days), but this difference was not statistically significant (p=0.14). Follow-up visit attendance was high in both groups, with 98% attendance in the SD group and 97% in the MD group, showing no significant difference (p=0.75).

Table 7: Cost of Antibiotic Therapy

The cost of antibiotic therapy was significantly higher in the MD group, with a total cost of 2000 INR compared to 500 INR in the SD group. This significant cost difference highlights the economic impact of multiple-dose prophylactic antibiotic regimens.

Table 8: Patient Satisfaction

Patient satisfaction levels were assessed, with 80 patients in the SD group and 85 in the MD group reporting being highly satisfied (p=0.42). Fifteen patients in the SD group and 12 in the MD group were satisfied (p=0.64). Five patients in the SD group and 3 in the MD group reported being dissatisfied (p=0.47). These results suggest a high level of patient satisfaction in both groups, with no significant difference between them.

Table 1: Demographic Profile of Patients

Characteristic	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	Total (n=200)
Age (years), mean ± SD	40.2 ± 10.5	41.3 ± 11.2	40.75 ± 10.85
Sex			
Male	85	87	172
Female	15	13	28

Table 2: Clinical Findings and Operative Details

Characteristic	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	Total (n=200)
ASA Grade (I/II)	70/30	72/28	142/58
Duration of Surgery (minutes), mean ± SD	60 ± 15	62 ± 16	61 ± 15.5
Type of Anesthesia (Regional/General)	90/10	92/8	182/18

Table 3: Type of Hernia

Type of Hernia	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	Total (n=200)
Inguinal Hernia	70	68	138
Femoral Hernia	20	22	42
Umbilical Hernia	10	10	20

Table 4: Postoperative Wound Site Infections

Postoperative Day (POD)	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	p-value
3rd POD	5	3	0.47
7th POD	10	5	0.18
12th POD	15	7	0.09
Total Infections	15	7	0.09

Table 5: Types of Postoperative Complications

Complication	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	p-value
Seroma	8	4	0.22
Wound Infection	7	3	0.33
Hematoma	2	1	0.56
Total	17	8	0.04

Table 6: Hospital Stay and Follow-Up

Characteristic	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	p-value
Length of Hospital Stay (days), mean ± SD	2.5 ± 0.7	2.8 ± 0.9	0.14
Follow-Up Visit Attendance	98 (98%)	97 (97%)	0.75

Table 7: Cost of Antibiotic Therapy

Cost	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	p-value
Total Cost (INR)	500	2000	-

Table 8: Patient Satisfaction

Satisfaction Level	Single Dose (SD) Group (n=100)	Multiple Dose (MD) Group (n=100)	p-value
Highly Satisfied	80	85	0.42
Satisfied	15	12	0.64
Dissatisfied	5	3	0.47

DISCUSSION

Antibiotic prophylaxis is still indicated in elective surgicalprocedures where the prosthesis is implanted, anticipatingchances of infection can be at times fatal. On the other hand, the benefit of antibiotic prophylaxis in elective surgical procedures, such asinguinal hernia surgery repair, the prophylactic antibiotic is considered debatable. The negligible rate of wound infections and the technically sound surgical management are all considered as factors against routine use of antibiotic prophylaxis in inguinal hernia repair. Our studywhich was done to compare the effectiveness of a single multidose antibiotics.7 With the advantage of state of the art sterilization, aseptic precaution, technical advancementthe need for multidose antibiotics has come down for cleanand clean-contaminated surgical cases. In 2001, Naz et al in a comparative study between single-dose prophylactic antibiotics versus conventional dose of antibiotics in majorgynecological procedures have documented that prophylactic antibiotic use is sufficient provided standard principles of operative surgery have adhered.8 Postoperative wound site infections were monitored on the 3rd, 7th, and 12th postoperative days (POD). The infection rates were consistently higher in the SD group compared to the MD group at each time point, though the differences were not statistically significant. By the 12th POD, the SD group had 15 infections compared to 7 in the MD group (p=0.09). These findings suggest a trend towards fewer infections with multiple-dose antibiotic regimens, corroborating studies by Itani et al. and Anthony et al., which also reported reduced infection rates with extended antibiotic prophylaxis.9,10 The total number of postoperative complications, including seroma, wound infection, and hematoma, was higher in the SD group (17) compared to the MD group (8), with a significant p-value of 0.04. Seroma formation and wound infections were more common in the SD group, although these differences were not statistically significant individually. These results support the hypothesis that multiple-dose antibiotic regimens may be more effective in reducing overall postoperative complications, consistent with findings from Bratzler et al. and Anderson et al.[11,12]The average length of hospital stay was slightly shorter in the SD group (2.5 ± 0.7 days) compared to the MD group (2.8 ± 0.9 days), but this difference was not statistically significant (p=0.14). High follow-up attendance rates (98% in the SD group and 97% in the

MD group) indicate good patient compliance and effective postoperative care management. Similar studies have shown that the duration of hospital stay is more influenced by the type and severity of the hernia and postoperative complications rather than the antibiotic regimen alone.[13]The cost of antibiotic therapy was significantly higher in the MD group, with a total cost of 2000 INR compared to 500 INR in the SD group. This significant cost difference highlights the economic impact of multiple-dose regimens, which is an important consideration for healthcare systems, particularly in resource-limited settings. Previous cost-analysis studies, such as those by Leaper et al., have emphasized balancing clinical benefits with economic feasibility when selecting antibiotic prophylaxis strategies.[13]Patient satisfaction levels were high in both groups, with no significant differences. Eighty percent of patients in the SD group and 85% in the MD group reported being highly satisfied. This high level of satisfaction underscores the effectiveness of both antibiotic regimens in providing quality care and good surgical outcomes. Studies by Young et al. and Liddle et al. have also reported high patient satisfaction rates with both single-dose and multiple-dose antibiotic regimens, further validating these findings.[14,15]

CONCLUSION

Prophylactic use of antibiotics in clean elective cases is still a subject of many controversies. Our study on antibiotic prophylaxis for hernia repair consisted of two groups with one group received a single-dose antibiotic and the other group a multi-dose antibiotic and the outcome on surgery related infections and cost compared.We found that the rate of infections is quite similar in SD and MD antibiotics thereby making single-dose antibiotics prophylaxis as effective as multiple doses of antibiotics prophylaxis. We also conclude that single-dose antibiotic prophylaxis is economical in uncomplicated elective surgery.

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