

Comparative Evaluation of Operative Site Infection and Consequences in Clean and Clean-Contaminated Elective Hernia Operations with Single and Multi-Dose Antibiotics

Nitish Prabhakar¹, Ajit Kumar²

¹Senior Resident, Department of General Surgery, Government Medical College, Bettiah, Bihar, India.

²Senior Resident, Department of General Surgery, Government Medical College, Bettiah, Bihar, India

Received: 05-02-2023 / Revised: 24-02-2023 / Accepted: 16-03-2023

Corresponding author: Dr. Ajit Kumar

Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to assess the impact of single and multiple-dose antibiotics in clean and clean-contaminated elective hernia surgeries concerning surgical site infection and associated complications.

Methods: This prospective, longitudinal study was conducted for a period of 12 months at Department of General Surgery, Government Medical College, Bettiah, Bihar, India. 200 suitable patients who were admitted for elective groin surgery were included in this study were randomly assigned into two groups (n=100) single-dose pre-operative (SD) group and multiple-dose (MD) in each group.

Results: Data collected from both single antibiotic group I (n=100) and group II multidose group (n=100) who underwent elective hernia surgery. Out of 100 patients of group SD, only 15% of patients developed surgical site infection compared to none in group MD. Statistically, there was no appreciable difference in the incidence of SSI in both SD and MD groups with a p value of 0.310. Main complaints by many patients in the post-operative period were pain and headache managed well with intravenous fluids for spinal headache and analgesics. Seroma was found on the 3rd postoperative day in 5 patients in group I, fluid aspirated, and culture turned out to be negative.

Conclusion: This 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 its outcome on surgery related infections. It was 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.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Abdominal wall hernia is a prevalent disorder with an occurrence rate as high as 1.7% in all age groups and 4% in those aged above 45 years. Almost 75% cases of

abdominal wall hernias are accounted to Inguinal hernias which are potentially life staking in 27% of male patients and 3% female patients. [1] Inguinal hernias often appear as a protrusion in the inguinal

region that disappears when a little pressure is applied or when the patient reclines. The patient feels little to mild pain that may worsen due to increased activity. [2] Various surgeries can be opted to treat this condition such as laparoscopic repair, open mesh repair, nylon darn, Shouldice 4-layered and Lichtenstein mesh. Among them, mesh hernioplasty is the most preferred treatment as it has proved to be effective in reducing the relapse rates to only 1-2%.

Currently, the most famous surgical method used for open repair of inguinal hernia is Lichtenstein mesh hernioplasty. [3] Whereas, groin hernioplasty is done mostly to restrain peritoneal swelling through the myopectineal orifices. There are two ways to repair the hernias: either anteriorly by opening the groin such that appropriate division of the structures in and surrounding inguinal canal is done to reach the innermost layer of Apo neurotic fascia, or posteriorly through an Abdominal incision which directly exposes the hernia orifices on entry to the preperitoneal space. [4]

Surgical Site Infection (SSI) is a major post-operative complication linked with any surgery which will lead to increased hospital stay, loss of productive hours, increased hospital cost and subject morbidity and mortality. [5,6] While antimicrobial prophylaxis plays a significant role in dropping the rate of SSIs, other features such as interest in basic infection-control strategy, the surgeon's experience and method, the period of the process, hospital and operating-room environments, instrument sterilization issues, preoperative preparation and the underlying medical condition of the subject may have a strapping impact on SSI rates. [7,8]

Antibiotics play a particularly significant role in the postoperative care of subjects undergoing elective surgery since high occurrence of surgical site infection (SSI).

It has been reported that 30–40% of subjects experience post-operative SSI when a prophylactic antibiotic is not administered. while quite a few current researches have indicated that single-dose (SD) administration may be as successful as multiple-dose, argument still exists concerning the occurrence and suitable combination of antibiotics. [9,10] Inguinal hernia surgery is the most frequently performed surgery. Lichtenstein tension free repair utilizing poly propylene mesh is the gold standard process for inguinal hernioplasty. Surgical site infection is the most common complication in inguinal hernioplasty. Reported surgical Wound Infection rates in voluntary operations vary from 2% for inguinal hernia repair to 26% for colectomy, and still more for emergency surgery. [11-13]

The aim of the present study was to assess the impact of single and multiple-dose antibiotics in clean and clean-contaminated elective hernia surgeries concerning surgical site infection and associated complications.

Materials and Methods

This prospective, longitudinal study was conducted for a period of 12 months in the Department of General Surgery, Government Medical College, Bettiah, Bihar, India. 200 suitable patients who were admitted for elective groin surgery were included in this study were randomly assigned two groups (n=100) single-dose pre-operative (SD) group and multiple-dose (MD) in each group. Master chart for Protocol of the procedure was designed along with Proforma, patient identification details, and informed written consent form for all study. Both groups were homogenized in terms of age, type of hernia, and clinical findings. SD group was given amoxycillin-clavulanic acid (2 gm) intravenously at the time of induction of anesthesia. MD group was given amoxycillin-clavulanic acid (2 gm) parentally at the time of induction of

anesthesia and following it up with the same antibiotic (1 gm) intravenously twice a day for two days post-operatively. The Chi-square test was used to analyze the data. The difference in the rate of wound-related infection in both the groups was found to be statistically insignificant. Inclusion criteria included elective open hernioplasty, age group of 18-60 years of both sexes. Pediatric patients, hernia with complications, recurrent hernias, and patients with comorbidities were excluded from study.

Collection of data

Institutional ethical committee approval obtained for this study and written well-informed consent obtained from enrolled patients. The study population (n=200) was randomly divided into two groups of groups: group I (n=100) SD and group II (n=100) MD groups using computer-generated numbers.

Group I SD (100) received single-dose preoperative prophylaxis of injection amoxicillin and clavulanic acid 2 gm I/V half an hour before the scheduled procedure. Group II MD (n=100) cases were given single-dose preoperative antibiotic prophylaxis followed by multiple doses of the same antibiotic (injection I/V amoxicillin and clavulanic

acid 1.2 gm) BD for 3 days post-procedure followed by tablet amoxicillin and clavulanic acid 1.2 mg TDS for the next 2 days in addition. All the patients were operated on under regional anesthesia as per World Health Organization (WHO) safety guidelines and standard aseptic precautions. Monofilament polypropylene mesh was used for hernioplasty. Postoperative findings including wound site infections like seroma and wound infection documented serially till 12 post-operative day (POD) when patients got discharged and followed up in 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 of preoperative single-dose antibiotic, number of patients who got wound 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, it was analyzed by applying the Chi-square test and 'p' value less than 0.05 taken as statistically significant.

Results

Table 1: Incidence of surgery related infections in both groups

Study group	Group 1 (single dose) (n=100)	%	Group II (multiple dose) (n=100)	%	P value
No. of patients (N)	100		100		
Surgery related infections	15	15	0	0	0.310

Data collected from both single dose antibiotic group I (n=100) and group II multidose group (n=100) who underwent elective hernia surgery. Out of 100 patients of group SD, only 15% of patients

developed surgical site infection compared to none in group MD. Statistically, there was no appreciable difference in the incidence of SSI in both SD and MD groups with a p value of 0.310.

Table 2: SSI incidence in relation to various observations days in SD versus MD groups

Groups	Study population	Surgery related infections			
		Day 2	Day 4	Day 8	Day 12
Single dose (group I)	100	0	10	0	0
Multidose (group II)	100	0	0	0	0

Main complaints by many patients in the post-operative period were pain and headache managed well with intravenous fluids for spinal headache and analgesics. Seroma was found in the 3rd postoperative day in 5 patients in group I, fluid aspirated, and culture turned out to be negative.

Discussion

Post-operative surgical wound site-related infection (SSI) is an anticipated major complication associated with any surgery that may lead to a prolonged hospital stay, loss of work, and increased medicine expenditure especially among the rural population in addition to increased morbidity and mortality. [14] Antimicrobial prophylaxis plays an important role in reducing the rate of postoperative SSIs, in addition to operation theatre (OT) sterilization, autoclaving of instruments and linen, technical expertise of the operating surgeon, the duration of the procedure, hospital and operating-room environments, instrument sterilization issues, preoperative preparation of the patient and co morbid conditions all have a major role. [15] Traditionally, groin hernia repair is a clean wound operation for which antibiotic prophylaxis is not required, as there is little to no risk of occurrence of surgical site infection (SSI) (<1%). [16] It is presently the most preferred surgery for the plastic reconstruction of the inguinal region. Even though it is categorized as a clean surgery, there is a 0-9% risk of wound infection. [17]

Rate of surgical site infection (SSI) is fairly comparable in SD group (15%) as compare to MD group (0%). There was no significant dissimilarity in surgical site infection (SSI) among both groups (P

value =0.310). The insignificant rate of wound infections and the technically sound surgical management were all measured as factors alongside usual utilization of antibiotic prophylaxis in inguinal hernia repair. [18] Surgical site infection subsequent to hernia repair is linked with an elevated rate of recurrence of hernia. Platt et al randomized double-blind research which was aimed to throw light into the utilization of antibiotics in elective surgery. [19] The utilization of prophylactic antibiotic in all surgical cases is advocated ever since, the concept of utilization of antibiotic preoperatively to shutter and avoid wound infection was postulated by Bernard and Cole in 1964. On the whole understanding from around the world has obviously suggested utilization of the precise antibiotics in the preoperative era rather than conventional utilization of 5-7 days of antibiotics in the post-operative period. [20,21]

In this study, the percentage of infection was only 10% in SD group compared to the multi-dose antibiotics group and comparable with several studies. Several studies have been conducted on the choice of antibiotic and timing of use of antibiotics. Most of the studies have recommended the first dose to be given 30-60 minutes preoperatively, and long-acting antibiotics must be selected. [22] A Cochrane meta-analysis was conducted in 2004 about the prophylactic use of antibiotics but the study's result remained indecisive about its use. Inguinal hernia repair is one of the most frequently done operations all over the world; therefore, both misuse of antibiotics and a high rate of surgical site infection incur high medical and social expenses. So, it is important to have a piece of definite

evidence about the use of antibiotics. [23,24,25]

Conclusion

This study on antibiotic prophylaxis for hernia repair consisted of two groups with the 1st group receiving a single-dose antibiotic and the other group a multi-dose antibiotic course and the outcome on surgery related infections. It was 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 thus concluding that single-dose antibiotic prophylaxis is economical in uncomplicated elective surgery.

References

1. Shirah BH, Shirah HA. Lichtenstein mesh hernioplasty for inguinal hernias: simplicity is the ultimate sophistication. *International Surgery Journal*. 2016 Dec 13;3(1):230-6.
2. Öberg S, Andresen K, Rosenberg J. Etiology of inguinal hernias: a comprehensive review. *Frontiers in surgery*. 2017 Sep 22; 4:52.
3. Reistrup H, Fonnes S, Rosenberg J. Watchful waiting vs repair for asymptomatic or minimally symptomatic inguinal hernia in men: a systematic review. *Hernia*. 2021 Oct; 25:1121-8.
4. Dahlberg K, Philipsson A, Hagberg L, Jaensson M, Hälleberg-Nyman M, Nilsson U. Cost-effectiveness of a systematic e-assessed follow-up of postoperative recovery after day surgery: a multicentre randomized trial. *BJA: British Journal of Anaesthesia*. 2017 Nov 1;119(5):1039-46.
5. Bagnall NM, Vig S, Trivedi P: Surgical-site infection. *Surgery (Oxford)* 2009; 27:426-30.
6. Badia JM, Casey AL, Petrosillo N, Hudson PM, Mitchell SA, Crosby C. Impact of surgical site infection on healthcare costs and patient outcomes: a systematic review in six European countries. *Journal of Hospital Infection*. 2017 May 1;96(1):1-5.
7. Liu J, Li N, Hao J, Li Y, Liu A, Wu Y, Cai M. Impact of the antibiotic stewardship program on prevention and control of surgical site infection during peri-operative clean surgery. *Surgical Infections*. 2018 Apr 1;19(3): 326-33.
8. Bratzler DW, Dellinger EP, Olsen KM, Perl TM, Auwaerter PG, Bolon MK, Fish DN, Napolitano LM, Sawyer RG, Slain D, Steinberg JP. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Surgical infections*. 2013 Feb 1;14(1):73-156.
9. Liao KH, Aung KT, Chua N, Ho CK, Chan CY, Kow A, Earnest A, Chia SJ. Outcome of a strategy to reduce surgical site infection in a tertiary-care hospital. *Surgical infections*. 2010 Apr 1;11(2):151-9.
10. Uçkay I, Hoffmeyer P, Lew D, Pittet D. Prevention of surgical site infections in orthopaedic surgery and bone trauma: state-of-the-art update. *Journal of hospital infection*. 2013 May 1;84(1):5-12.
11. Sanabria A, Domínguez LC, Valdivieso E, Gómez G. Prophylactic antibiotics for mesh inguinal hernioplasty: a meta-analysis. *Annals of surgery*. 2007 Mar;245(3):392.
12. Arroyo Sebastian A, Perez F, Serrano P, Costa D, Oliver I, Ferrer R, Lacueva J, Calpena R. Is prosthetic umbilical hernia repair bound to replace primary herniorrhaphy in the adult patient? *Hernia*. 2002 Dec;6(4):175-7.
13. Moeen A, Niaz Z, Gardazi SJ. Comparison of Laparoscopic hernia repair (TEP) with Lichtenstein repair for inguinal hernias. *Annals of King Edward Medical University*. 2007;13 (1):29-31.
14. Isik O, Kaya E, Dundar HZ, Sarkut P. Surgical Site Infection: Re-assessment of the Risk Factors. *Chirurgia (Bucur)*. 2015;110(5):457-61.

15. Kirby JP, Mazuski JE. Prevention of surgical site infection. *Surg Clin North Am*. 2009;89(2):365-89.
16. Al Riyees L, Al Madani W, Firwana N, Balkhy HH, Ferwana M, Alkhudhayri A. Antibiotic prophylaxis against surgical site infection after open hernia surgery: a systematic review and meta-analysis. *European Surgical Research*. 2021;62(3):121-33.
17. Huerta S, Timmerman C, Argo M, Favela J, Pham T, Kukreja S, Yan J, Zhu H. Open, laparoscopic, and robotic inguinal hernia repair: outcomes and predictors of complications. *Journal of Surgical Research*. 2019 Sep 1;241: 119-27.
18. Roshan RK, Singh U: Prospective Comparative Study to Assess the Impact of Single Dose Versus Multidose Prophylactic Antibiotics in Elective Hernia Repair. *International journal of pharmaceutical and clinical research*, 2022; 14(1): 277-282.
19. Durai RM, Mohamed N. Impact of single dose versus multidose prophylactic antibiotics in elective hernia repair: an institutional study. *International Surgery Journal*. 2021 Sep 28;8(10):2998-3001.
20. Jayalal JA, Kumar SJ, Thambithurai D. Effect of single-dose antibiotic prophylaxis versus conventional antibiotic therapy in surgery: a randomized controlled trial in a public teaching hospital. *International Journal of Scientific Study*. 2015;3(8):109-13.
21. Bernard HR. The prophylaxis of surgical infection: the effect of prophylactic antimicrobial drugs on the incidence of infection following potentially contaminated operations. *Surgery*. 1964; 56:151-7.
22. Woods RK, Dellinger EP. Current guidelines for antibiotic prophylaxis of surgical wounds. *American family physician*. 1998 Jun 1;57(11):2731.
23. Sanchez-Manuel FJ, Lozano-García J, Seco-Gil JL. Antibiotic prophylaxis for hernia repair. *Cochrane Database of Systematic Reviews*. 2012(2).
24. Orelia CC, Hessen C, Sanchez-Manuel FJ, Aufenacker TJ, Scholten RJ. Antibiotic prophylaxis for prevention of postoperative wound infection in adults undergoing open elective inguinal or femoral hernia repair. *Cochrane Database Syst Rev*. 2020;4 (4):CD003769
25. Kenfuni M. M., Gallouo M., alafifi mahmoud, Tsikambu A. C. D., Alafifi R., Moataz A., Dakir M., Debbagh, A., & Aboutaieb, R. Pyonephrose: Risk factors, clinical, para-clinical and anatomopathological profile about 19 cases. *Journal of Medical Research and Health Sciences*, 2022; 5(2): 1770–1773.