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Original Research Article

A Comparative Study Between Single Dose Versus Multiple Dose Antibiotic Therapy After Elective Ent Surgery

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Abstract:

Background: Surgical site infections are one of the most common healthcare associated infections (HAI) observed in health care setting in developing countries. Appropriate antibiotic therapy must be initiated in appropriate dose against pathogens most likely to contaminate the surgical site depending upon site of surgery. This study was conducted to compare the single dose versus multidose antibiotic therapy on the outcome of clean elective surgery.

Methodology: The present study was conducted as a randomized controlled study on patients undergoing clean elective surgeries at Department of Otolaryngology, L.N. Medical College Hospital. A total of 108 patients were enrolled and divided into two groups of 54 patients each using simple random sampling as single dose and multiple dose group.

Results: None of the patients had fever during the pre-operative period in either group. However, on postoperative day 2, 5.6% and 3.7% patients in single dose and multidose group respectively with no statistically significant difference between the groups ($p>0.05$). Postoperative discharge and SSI were noted in 5.6% cases in single dose group and 3.7% in multidose group. We documented no significant difference in complications between two groups ($p>0.05$).

Conclusion: Single dose regimen for prevention of surgical site infection following clean elective surgeries is as effective as multiple dose antibiotic prophylaxis. The use of single dose regimen is a cost effective method as the length of hospital stay is similar to multidose regimen. Long term antibiotic prophylaxis not only increase the cost of treatment but also increase the risk of antibiotic resistance.

Keywords: Surgical Site Infections, Single Dose, Multiple Dose, Antimicrobial Agent, Fever.

Introduction

Surgical site infections are one of the most common health care associated infections (HAI) observed in health care setting in developing countries. SSI has been defined as "an infection occurring within the 30 days of the operative procedure when no implant is in place or within a year of procedure if there is an implant in-situ. The infection may occur at the site of operation or any part of the anatomy that was manipulated during an operation. SSI are associated with increased morbidity as well as mortality due to high risk of complications including need for revision surgery, prolonged hospitalization, reduced work capacity and productivity, poor quality of life and need for antibiotic therapy; sequelae include revision surgeries, poor quality of life, prolonged antibiotic treatment etc. The incidence of SSIs has been documented to range from 0.5% to 15% Worldwide.

To reduce the risk of surgical site infections, adequate sterilization of operation theatre (OT), use of autoclave sterilized instruments and linen, short duration of procedure, decolonization, carrier screening, and maintaining thorough asepsis throughout the procedure has been recommended.[6] Apart from this, prophylactic antibiotic therapy plays an important role in reducing the risk of surgical site infections or postoperative wound infections. However, the use of antimicrobials as prophylaxis against surgical site infections have been associated with emergence of antimicrobial resistance. The antibiotic prophylaxis for surgical wounds has been defined as the use of antimicrobial agents' post-surgery to prevent the risk of infection at the site of surgery.

To prevent the surgical site infection, clinical practice guidelines have been developed jointly by the Infectious Diseases Society of America (IDSA),

the Infectious American Society of Health-System Pharmacists (ASHP), the Society for Healthcare Epidemiology of America (SHEA) and the Surgical Infection Society (SIS). These guidelines are intended to provide the standard uniform approach for the surgeon to promote safe, rational and effective use of antibiotics to prevent the surgical site infections depending upon the current emerging issues and reliable clinical evidence.[12] As per these guidelines, appropriate antibiotic therapy must be initiated in appropriate dose against pathogens most likely to contaminate the surgical site depending upon site of surgery. These antimicrobial agents must be initiated at appropriate time i.e. atleast an hour prior to skin incision and must be continued for shortest effective period.

The choice of appropriate antimicrobial therapy depends upon certain factors which include safety profile of the drug, allergic status of the patients, site of surgery, possible contaminating microbial agent, susceptibility of the pathogen etc. However, the fear of infection following surgery has led to the practice of administration of antibiotics for 7 to 10 days even in presence of clean wound.[13] Few studies conducted in Western countries suggest a single dose of prophylactic antibiotic therapy given preoperatively reduce the risk of surgical site infection. Such studies are lacking in Indian scenario. This study was therefore conducted to compare the single dose versus multidose antibiotic therapy on the outcome of clean elective ENT surgery.

Methodology

The present study was conducted as a randomized controlled study on patients undergoing clean elective surgeries at Department of Otolaryngology, L.N. Medical College Hospital (MP) during study period between May 2024 and December 2024. All the patients of age >18years to <60 years and patients undergoing clean elective surgery. All patients not willing to participate in the study; undergoing emergency surgeries; having comorbid conditions for e.g. diabetes, immunocompromised states etc. were excluded from the study.

Sample Size: A total of 108 patients undergoing clean elective surgery admitted at study area during the study period. After obtaining ethical clearance from Institute's ethical committee, all the patients willing to participate in the study were included and randomized into two group using simple random sampling. Using a proforma, detailed data regarding the sociodemographic variables, clinical history, complaints, diagnosis history of comorbid conditions etc. were obtained and documented. All the patients were then subjected to detailed clinical examination and laboratory workup was done. Based upon the clinical findings and investigation, diagnosis was made and patients were scheduled for elective surgery.

Randomization

Patients were divided into two groups of 54 patients each using simple random sampling

Group A: Single dose group - single dose of antimicrobial agent Inj. Amoxycillin plus Clavulanic acid intravenously in the operating room at the time of the induction of anaesthesia.

Group B: Multiple dose group - Inj. Amoxycillin plus Clavulanic acid intravenously in the operating room at the time of the induction of anaesthesia and Tab. Amoxycillin plus Clavulanic acid for 5 days postoperatively.

All the patients were followed up at postoperative day 2 and day 7 and vitals, were recorded. WBC counts, Differential Leukocyte Count, Post-operative fever, Surgical site infection, Post-operative Wound discharge, Wound culture report and Duration of Hospital Stay were observed postoperatively-

Statistical Analysis:

Data was compiled using MS Excel and analysis was performed with the help of SPSS software version 20. Quantitative continuous data was presented as Mean and SD. Two groups were compared using Unpaired Student T test. Categorical data was expressed as frequency and proportion and two groups were compared using Chi-Square test. P value < 0.05 was considered statistically significant.

Results

This study was conducted on a total of 108 patients who underwent clean elective surgery, of them, 54 patients were given single dose antibiotic whereas remaining 54 patients were given multidose regimen.

Table 1: Comparison Of Age Between Two Groups

Baseline variables		**Single dose (n=54)**		Multi-dose (n=54)		P value
		n	**%**	**n**	**%**	
Age (years)	1-20	7	13.0	4	7.4	0.478
	21-30	15	27.8	19	35.2	
	31-40	16	29.6	12	22.2	
	41-50	13	24.1	12	22.2	
	>50	3	5.6	7	13	
	Mean±SD	35.13±11.26		36.28±12.79		

Sex	Male	32	59.3	36	66.7	0.425
	Female	22	40.7	18	33.3	

Mean age of patients who received single dose and multiple dose antibiotic was 35.13±11.26 years and 36.28±12.79 years respectively. We documented no significant difference in age and sex between two groups (p>0.05). None of the patients in either group had diabetes or were immunocompromised.

Table 2: Comparison of Diagnosis and Surgeries Between the Groups

Diagnosis			Single dose (n=54)		Multidose (n=54)	
			n	%	n	%
Nasal polyp			12	22.2	7	13.0
Dermoid cyst	Excision		1	1.9	1	1.9
Epidermoid cyst			2	3.7	0	0.0
Lipoma	Excision		4	7.4	2	3.7
Neurofibroma	Excision		1	1.9	0	0.0
Sebaceous cyst			3	5.6	4	7.4
DNS	Septoplasty		1	1.9		1.9
Colloid cyst of thyroid	Left hyoid lobectomy		1	1.9	0	0.0
Colloid goiter	Total thyroidectomy		0	0.0	1	1.9
Multinodular goiter			0	0.0	1	1.9
Thyroid nodule	Hemithyroidectomy		0	0.0	1	1.9
Thyroglossal cyst	Sistrunck procedure		1	1.9	0	0.0
P value			0.798			

We observed no significant difference in diagnosis as well as surgeries between single dose and multidose groups (p>0.05).Mean duration of surgery was 41.9±16.7 minutes in single dose group whereas that in multidose group was 42.6±11.4 minutes and the observed difference was statistically insignificant (p>0.05).

Table 3: Comparison of Investigations Between the Groups

Investigations	Time	Single dose (n=54)		Multidose (n=54)		P value
		Mean	SD	Mean	SD	
WBC	Pre-operative	6711.1	1373.1	6868.5	1270.7	0.538
	Post op day 2	6581.5	1438.4	6609.3	1249.9	0.915
	Post op day 7	6464.8	1111.4	6646.3	953.2	0.364
Neutrophils	Pre-operative	58.7	8.0	59.9	5.7	0.08
	Post op day 2	63.7	6.2	64.4	6.1	0.546
	Post op day 7	61.5	5.0	63.7	6.4	0.046
Lymphocytes	Pre-operative	31.5	5.3	30.4	7.1	0.349
	Post op day 2	29.2	5.6	28.1	6.1	0.348
	Post op day 7	30.3	4.7	29.1	4.3	0.174

We documented no significant difference in CBC findings between two groups preoperatively as well as postoperatively (p>0.05).

Table 4: Comparison of post-operative complications between the groups

Complications		Single dose (n=54)		Multidose (n=54)		P value
		n	%	n	%	
Fever		3	5.6	2	3.7	0.547
Post operative discharge		3	5.6	2	3.7	0.647
Surgical site infection		3	5.6	2	3.7	0.647
Culture	*Pseudomonas*	1	1.9	0	0.0	0.504
	Staphylococcus aureus	2	3.7	2	3.7	

None of the patients had fever during the pre-operative period in either group. However, on postoperative day 2, 5.6% and 3.7% patients in single dose and multidose group respectively with no statistically significant difference between the groups (p>0.05). Postoperative discharge and SSI were noted in 5.6% cases in single dose group and 3.7% in multidose group. We documented no

significant difference in complications between two groups (p>0.05).

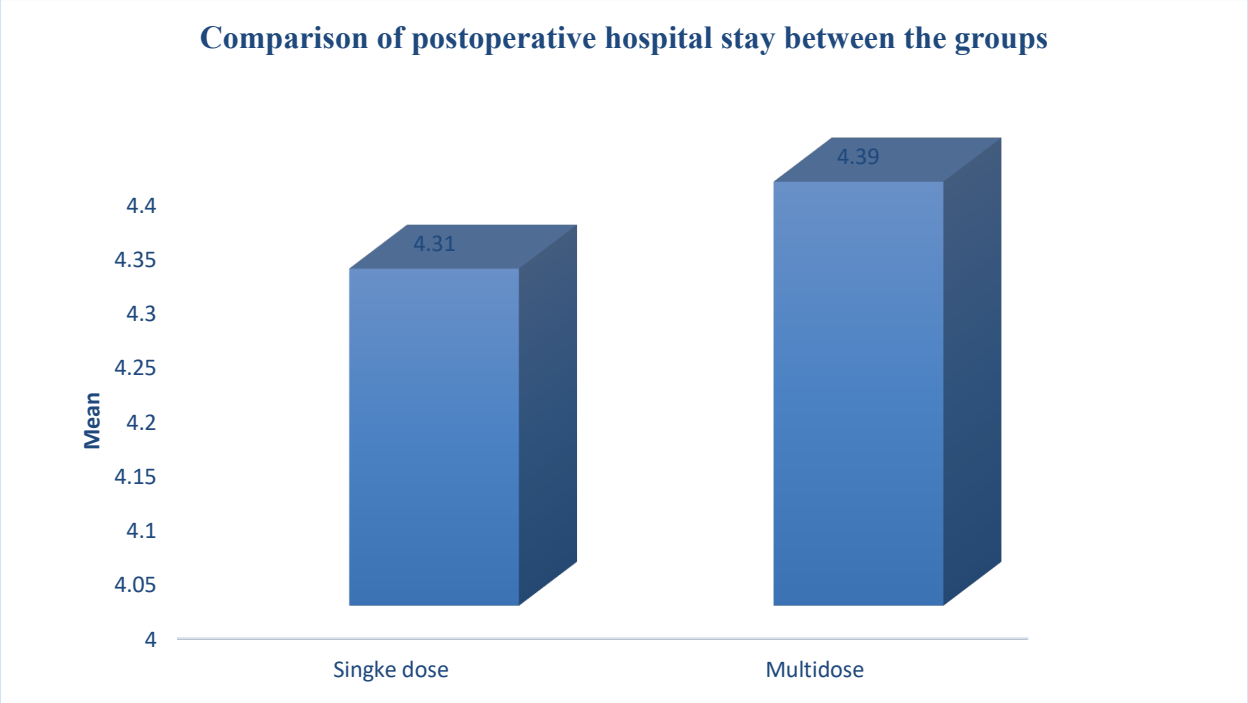

Figure 1: Comparison of postoperative hospital stay between the groups

Mean duration of hospital stay in single dose group was 4.31±0.9 days whereas that in multidose group was 4.39±0.92 and the observed difference in mean duration of postoperative hospital stay was statistically insignificant (p>0.05).

Discussions

Postoperative surgical site infection is one of the most commonly encountered problem following any surgical procedure as any breach in the skin or mucosa following a surgery may allow the invasion of bacteria into the sterile wound site. To prevent such infection, prescription of antibiotics in postoperative period is a common practice. However, there is a controversy regarding the use of single dose or multiple dose following surgery to prevent the risk of surgical site infections. This study aimed to compare the rate of SSI and duration of hospital stay in single dose versus multi dose antibiotic therapy in clean elective surgery between the groups. In our study, SSI was noted in 5.6% cases in single dose group and 3.7% cases in multidose group with no significant difference between the two groups (p>0.05) indicating the single dose antibiotic is as effective as multiple doses of antibiotics in prevention of wound site infections following clean surgeries. All these cases presented with high grade fever on post operative second day along with discharge from the wound site. We observed no significant difference in the findings of complete blood picture between two groups pre-operatively as well as at any postoperative day (p>0.05).

The findings of present study were concordant with the findings of Shakya et al, in which the authors observed febrile illness following cesarean section in 4% cases receiving single dose and 6% cases receiving multiple dose of antibiotics with no statistically significant difference between the two groups (p>0.05). Similarly, Shaheen et al reported febrile morbidity in 20% cases in both the groups with surgical site infection in 5% cases in single dose and group and 6% cases in multidose group (p>0.05). Dutt et al also reported single dose antibiotic in clean wound post-surgery to be as efficacious to multidose antibiotic in preventing surgical site infections Sutariya et al reported the postoperative infection rate of 4.4% and 3.3% in single dose and multi dose group respectively with no significant difference between the groups following elective laparoscopic cholecystectomy.

Similarly, Madhu et al also reported no significant difference in the infection rate following lichtenstein tension free mesh repair between single dose and multidose group (p>0.05). Koirala et al also documented no significant difference in surgical site infection in patients receiving single dose and multidose of antibiotic (p=0.500).Basant et al also concluded single dose antibiotic prophylaxis to be as sufficient as multiple dose antibiotics for clean as well as clean contaminated surgeries. In our study, the discharge obtained from the wound site was subjected to culture sensitivity and we reported staphylococcus aureus in 3.7% cases each in both the groups and 1 culture yielded pseudomonas in

single dose group (p>0.05). Tamayo et al reported identical isolation of micro-organisms from the wound site in both the groups and in approximately 86% cases, gram-positive cocci were isolated from the wound site. Dutt et al also found Staphylococcus, Klebsiella and E Coli in patients developing surgical site infections following clean elective surgery.

Mean duration of hospital stay was statistically similar in both the groups with mean length of hospital stay of 4.31±0.9 days 4.39±0.92 in single and multidose group respectively (p>0.05) in present study. The length of hospital stay was less than 6 days in majority of patients receiving single dose and multidose antibiotic prophylaxis with no significant difference between the two groups (p>0.05) in a study of Shaheen et al. Our study findings were also supported by findings of Naser et al, in which the duration of hospital stay was comparable between patients allocated to single dose and multidose antibiotic groups in patients undergoing laparoscopic cholecystectomy (p>0.05).

Yetzke M studied are perioperative antibiotics necessary during direct microlaryngoscopy. Procedures with significant cartilage destruction, concurrent open surgery, or esophageal surgery were excluded. Overall, 58% of surgeries involved use of carbon dioxide or potassium-titanyl-phosphate laser. Only one SSI was reported on follow-up in a patient who did receive PAs. Conclusions of study was that SSIs are exceedingly rare following DML. PA use is not indicated for routine DML

Patel PN et al studied evidence-based use of perioperative antibiotics in otolaryngology. Current evidence does not support routine antibiotic prophylaxis for tonsillectomy, simple septorhinoplasty, endoscopic sinus surgery, clean otologic surgery (tympanostomy with tube placement, tympanoplasty, stapedectomy, and mastoidectomy), and clean head and neck surgeries (eg, thyroidectomy, parathyroidectomy, salivary gland excisions). Antibiotic prophylaxis is recommended for complex septorhinoplasty, skull base surgery (anterior and lateral), clean-contaminated otologic surgery (cholesteatoma, purulent otorrhea), and clean-contaminated head and neck surgery (violation of aerodigestive tract, free flaps). In these cases, antibiotic use for 24 to 48 hours postoperatively has shown equal benefit to longer duration of prophylaxis. Despite lack of high-quality evidence, the US Food and Drug Administration suggests antibiotic prophylaxis for cochlear implantation due to the devastating consequence of infection.

Ottoline AC et al studied antibiotic prophylaxis in otolaryngologic surgery. Prolonged antibiotic prophylaxis does not enhance the prevention of surgical infection and is associated with higher rates of antibiotic-resistant microorganisms. This review of the literature concerning antibiotic prophylaxis, with an emphasis on otolaryngologic surgery, aims to develop a guide for the use of antibiotic prophylaxis in otolaryngologic surgery in order to reduce the numbers of complications stemming from the indiscriminate use of antibiotics.

The present study had certain limitations. First, the study was conducted on a sample of 54 patients in each groups, however, the higher sample size could have yielded more accurate results. Second, the patients with clean elective surgeries included irrespective of the site of the surgery. As the rate of SSI depend upon multiple factors such as type of surgery, site of incision, the surgical techniques, these factors were comparable between the groups, but effect of these factors on rate of SSI could not be observed.

Conclusion

Single dose regimen for prevention of surgical site infection following clean elective surgeries is as effective as multiple dose antibiotic prophylaxis. The use of single dose regimen is a cost-effective method as the length of hospital stay is like multidose regimen. Long term antibiotic prophylaxis not only increase the cost of treatment but also increase the risk of antibiotic resistance. The single dose regimen must be incorporated in routine practice to reduce the risk of surgical site infection, reduce the unnecessary financial burden on the individual.

References

1. Allegranzi B, Nejad SB, Combescure C, Graafmans W, Attar H, Donaldson L, Pittet D. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. The Lancet. 2011 Jan 15;377(9761):228-41.
2. European Centre for Disease Prevention and Control. Antimicrobial resistance surveillance in Europe 2014. Annual report of the European antimicrobial resistance surveillance network (EARS-net). ECDC. 2015.
3. Ganguly PS, Khan MY, Malik A. Nosocomial infections and hospital procedures. Indian Journal of Community Medicine. 2000 Jan 1;25(1):39.
4. Vatavati SR, Kampli MS. Surgeries and surgical site infection in India: a analysis of Health Management Information System 2019-2020. J Surg Surg Res. 2020;6:146-8.
5. Basant RK, Kumar R, Pandey VK, Saxena A, Singh V, Madeshiyaa S. A comparative study of single dose preoperative antibiotic prophylaxis versus five-day conventional postoperative antibiotic therapy in patient undergoing elective surgical procedure. International Surgery Journal. 2019 Jan 28;6(2):409-15.

6. Dellinger EP, Gross PA, Barrett TL, Krause PJ, Martone WJ, McGowan JE, Sweet RL, Wenzel RP. Quality standard for antimicrobial prophylaxis in surgical procedures. Infection Control & Hospital Epidemiology. 1994 Mar;15(3):182-8.
7. Page CP, Bohnen JM, Fletcher JR, McManus AT, Solomkin JS, Wittmann DH. Antimicrobial prophylaxis for surgical wounds: guidelines for clinical care. Archives of Surgery. 1993 Jan 1;128(1):79-88.
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. Leuva HL, Khambholja JR, Nayak KK, Shah RC. Role of antibiotics in clean surgeries: Prophylaxis v/s. conventional. Gujarat Med J. 2014;69:96-8.
10. Koirala A, Thakur D, Agrawal S, Chaudhary BL. Single dose versus multiple dose antibiotics in laparoscopic cholecystectomy: A prospective comparative single blind study. Journal of Society of Anesthesiologists of Nepal. 2018;5(1):11-5.
11. Shakya A, Sharma J. Comparison of single versus multiple doses of antibiotic prophylaxis in reducing post-elective Caesarean section infectious morbidity. Kathmandu University Medical Journal. 2010;8(2):179-84.
12. Dutt CK, Shukla A, Dutt RD. Single dose antibiotic prophylaxis in planned surgical procedures in Gwalior. Int J Med Res Rev 2015;3(8):877-83.
13. Madhu BS, HB SK, Reddy AV, Kalabhairav S. Effect of single dose pre-operative antibiotic prophylaxis versus conventional antibiotic therapy in patients undergoing lichtenstein tension free mesh repair. International Surgery Journal. 2017 Jan 25;4(2):738-42.
14. Garg S, Garg S, Shoaib M. Efficacy of single dose versus multiple dose antibiotic prophylaxisin clean and clean-contaminated herniorrhaphy surgery. J. Evid. Based Med. Healthc. 2018; 5(39), 2786-9.
15. Naser SM, Banerjee A, De U, Mandal S, Mandal A. Single Dose vs Multiple Dose Prophylactic Antibiotic to Prevent Early Port-Site Infection in Elective Laparoscopic Cholecystectomy.Int. J Cont. Med Res. 2019 Jun: 6 (6); F28-34.
16. Yetzke M, Heyes R, Nakra N, Merea VS, Lott D, Clary MS, Bryson P, Verma SP. Are perioperative antibiotics necessary during direct microlaryngoscopy? The Laryngoscope. 2018 Dec;128(12):2838-43.
17. Patel PN, Jayawardena AD, Walden RL, Penn EB, Francis DO. Evidence-based use of perioperative antibiotics in otolaryngology. Otolaryngology–Head and Neck Surgery. 2018 May;158(5):783-800.
18. Ottoline AC, Tomita S, Marques MD, Felix F, Ferraiolo PN, Laurindo RS. Antibiotic prophylaxis in otolaryngologic surgery. International archives of otorhinolaryngology. 2013 Jan;17(01):085-91.