Original Article

A Comparative Study of Intra-Incisional Antibiotic Infiltration and IV Prophylaxis in Reducing Pfannenstiel Wound Infections

Arfa Khalil[1], Kausar Masoom[2], Syed Azra[3], Najma Khoursheed[4], Sania Nasir[5], Samana Haider[6], Sundas Satti[7], Aisha Sidiqqa[8]

[1,5,6,7]Post Graduate Resident Gynae, Pakistan Institute of Medical Sciences, Islamabad
[2]Associate Professor, Gynae MCH centre, Pakistan Institute of Medical Sciences, Islamabad
[3]Senior Registrar Gynae MCH centre, Pakistan Institute of Medical Sciences, Islamabad
[4]Assistant Professor Gynae, Pakistan Institute of Medical Sciences, Islamabad
[8]Professor of Obs and Gynae, Bolan Medical College Quetta,

Correspondence: *Dr Kausar Masoom*
Associate Professor, MCH centre, Pakistan Institute of Medical Sciences, Islamabad
drkausarmasoom@gmail.com

Abstract

Background: Surgical site infections (SSIs) following Pfannenstiel incision procedures remain a significant clinical challenge, with reported incidence rates of 5-20% despite systemic antibiotic prophylaxis. The anatomical location and frequent contamination from genitourinary flora make this incision particularly vulnerable to infection.

Objective: To compare the efficacy of three antibiotic administration strategies in preventing SSIs: conventional intravenous (IV) prophylaxis, intra-incisional infiltration, and a combined approach.

Methods: After taking ethical approval from the concerned institute, a prospective, triple-arm, randomized controlled trial was conducted at a tertiary care hospital from January to September 2021. Three hundred patients undergoing Pfannenstiel incision procedures were randomized to receive: Group A: IV ceftriaxone 1g, - Group B: Intra-incisional ceftriaxone 1g and Group C: Combined IV 500mg + intra-incisional 500mg ceftriaxone

Results: The intra-incisional group demonstrated superior outcomes with SSI rate of 6% vs 13% in IV group (p=0.024), Shorter mean hospital stay (3.1 vs 4.2 days) and Lower postoperative pain scores (VAS 3.1 vs 4.7). Microbiological analysis revealed Escherichia coli as the predominant pathogen (51.7%).

Conclusion: Intra-incisional antibiotic administration significantly reduces SSI risk and improves postoperative outcomes compared to IV prophylaxis. This method should be considered as a standard approach for Pfannenstiel incision procedures.

Key words: Surgical Wound Infection, Prophylactic, Antibiotic, Intra-Incisional, Intravenous, Randomized Controlled Trial

Cite this article as: Khalil A, Masoom K, Azra S, Khoursheed N, Nasir S, Haider S, Satti S, Sidiqqa A. A Comparative Study of Intra-Incisional Antibiotic Infiltration and IV Prophylaxis in Reducing Pfannenstiel Wound Infections. J Soc Obstet Gynaecol Pak. 2024; 14(2):281-285.

Introduction

Surgical site infections represent a substantial burden in obstetric and gynecological practice, accounting for 20-25% of all healthcare-associated infections.[1] The Pfannenstiel incision, while offering cosmetic advantages, presents unique infection risks due to: Proximity to the perineal region, Frequent exposure to vaginal flora and compromised vascular supply in subcutaneous tissue.[2]

Current guidelines from the World Health Organization (2018) recommend IV antibiotic prophylaxis administered within 60 minutes before incision.[3] However, growing evidence suggests this approach may be suboptimal due to: Variable tissue penetration, Timing challenges in emergency cases and subtherapeutic concentrations in adipose tissue.[4]

Surgical site infection has been a difficult problem to solve. It is a major source of post-operative morbidity and mortality, as well as prolonged hospital stay, higher treatment expenditures and increased risk of antibiotic resistance. Despite progress in their prevention, SSIs remain one of the most common adverse events in

Authorship Contribution: [1,4,6,7]Substantial contributions to the conception or design of the work or the acquisition, [2,3,5] Drafting the work or revising it critically for important intellectual content, [8]Final approval of the version to be published. Active participation in methodology.

Funding Source: none
Conflict of Interest: none

Received: Jan 08, 2024
Accepted: May 20, 2024

hospitals. SSIs accounts for nearly one-fourth of the total number of nosocomial infections. [5, 6]

The concept of local antibiotic administration was first proposed by Taylor in 1982 [7], with subsequent studies demonstrating improved wound outcomes in general surgery.[8] However, robust evidence in gynecological procedures remains limited. This study addresses this gap through a rigorous three-arm randomized controlled design.

Methodology

This randomized controlled trial was conducted over a period of nine months at the Department of Obstetrics and Gynecology, Unit II, Maternal and Child Health (MCH), Pakistan Institute of Medical Sciences (PIMS) and Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU), Islamabad IRB no F.1-1/2015/ERB/SZABMU/592. The study aimed to compare the efficacy of preoperative intra-incisional antibiotic infiltration versus intravenous prophylactic antibiotic administration for the prevention of surgical site infections (SSIs) at the Pfannenstiel incision site. A total of 300 patients were enrolled and equally randomized into three groups (100 patients per group) using a computerized random number generator tool. Group A received 1 gram of intravenous ceftriaxone 20 minutes before surgical incision, Group B received 1 gram of intra-incisional ceftriaxone infiltrated along the proposed incision line 20 minutes prior to surgery, and Group C received a combined regimen of 500 mg intravenous and 500 mg intra-incisional ceftriaxone at the same time point.

Participants included women aged 20–40 years undergoing elective or emergency lower segment cesarean sections (LSCS) or other gynecological procedures involving Pfannenstiel incisions. Exclusion criteria comprised obesity (BMI > 25), pre-existing infections, recent antibiotic use, allergies to ceftriaxone, prolonged rupture of membranes (>12 hours), uncontrolled diabetes, anemia (Hb < 10), immunocompromised status, or smoking. Preoperative assessments included radiological, hematological, and anesthesia evaluations. Standard aseptic protocols were followed, with the surgical site prepared using povidone-iodine and methylated spirit. Postoperatively, patients were monitored for 48 hours, and dressings were removed at discharge. Wound evaluations were conducted on postoperative day 8 using the Southampton wound grading system, with infections defined as per CDC criteria (occurring within 30 days post-surgery or one year if implants were present).

Data were collected on demographics, surgical duration, Foley catheterization time, mobilization timing, dressing duration, and hospital stay. Pus cultures were performed for infected wounds. Statistical analysis was performed using SPSS version 20, with chi-square tests for categorical variables and Pearson correlation for continuous variables. Significance was set at $p < 0.05$. The study adhered to ethical guidelines, with approval from the institutional review board and informed consent obtained from all participants. The primary outcome was the incidence of SSI on day 8, while secondary outcomes included correlations between SSI and factors like age, BMI, nutritional status, and surgical duration.

Results

This randomized controlled trial evaluated the efficacy of preoperative intra-incisional versus intravenous antibiotic prophylaxis in preventing surgical site infections (SSIs) following Pfannenstiel incision surgeries. A total of 300 patients were equally divided into three groups: Group A received 1g intravenous ceftriaxone, Group B received 1g intra-incisional ceftriaxone, and Group C received a combined 500mg intravenous and 500mg intra-incisional dose (Figure 1). The primary outcome, SSI incidence on postoperative day 8, revealed that Group B had the lowest infection rate (6%) compared to Group A (13%) and Group C (10%) (Figure 2).

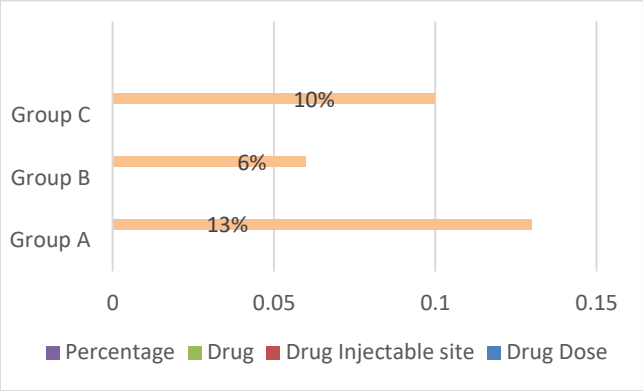

Figure 1. Groups receiving Drug Dose at different Sites

Statistical analysis confirmed these findings, with a moderate association between antibiotic administration route and SSI incidence.

Demographic and clinical factors were analyzed for their association with SSI. The study population, aged 20–40 years (most between 26–30 years), showed a positive

correlation between increasing age and SSI risk (Figure 2). While parity exhibited a weak positive correlation (Figure 3), education status had no significant impact (Figure 4). Body mass index (BMI) emerged as a notable factor, with overweight patients (BMI > 25) demonstrating higher SSI rates (Table II).

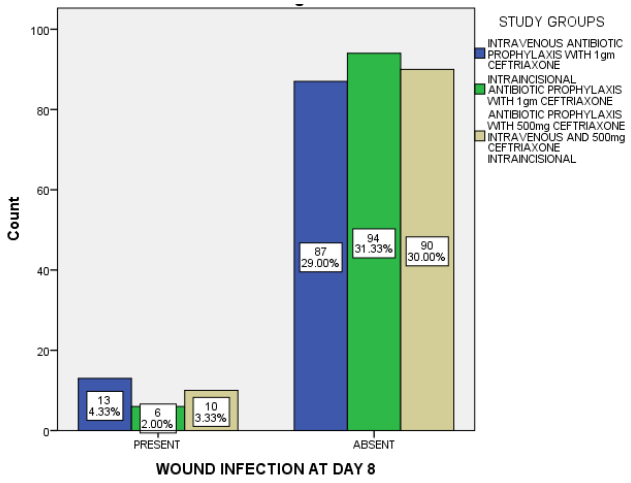

Figure 2. SSI incidence on postoperative day 8.

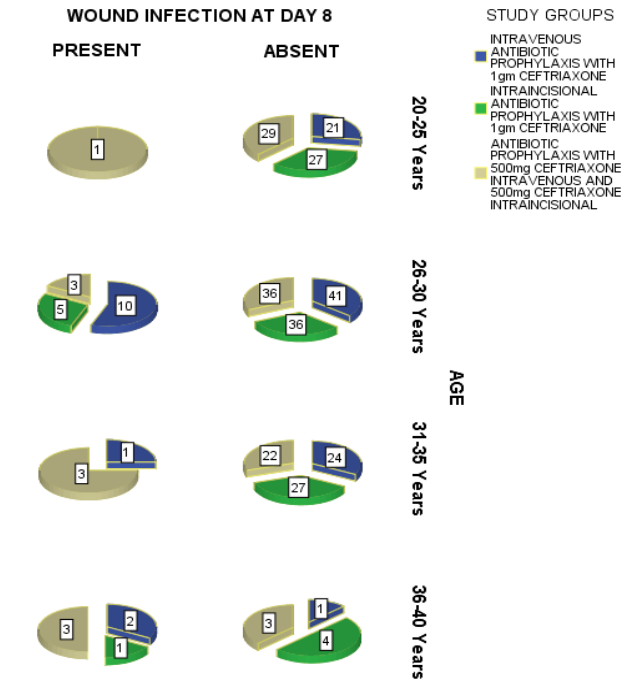

Figure 2. Relation between age and SSI risk.

Discussion

Surgical site infections (SSIs) remain a significant cause of postoperative morbidity, prolonged hospital stays, and increased healthcare costs, despite advancements in aseptic techniques and prophylactic antibiotic use.[5, 8]

This randomized controlled trial compared the efficacy of preoperative intra-incisional antibiotic infiltration (Group B), intravenous prophylactic antibiotics (Group A), and a combined approach (Group C) in reducing SSIs at the Pfannenstiel incision site. The findings demonstrated that intra-incisional administration of ceftriaxone (Group B) resulted in the lowest SSI rate (6%) compared to intravenous (13%) and combined (10%) groups, supporting the hypothesis that localized antibiotic delivery achieves higher tissue concentrations and superior infection prevention. [8, 9]

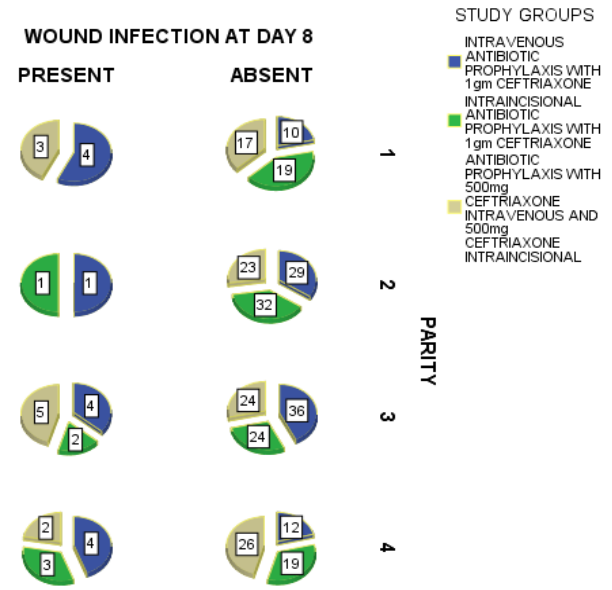

Figure 3. Link between parity and wound infection at day 8,

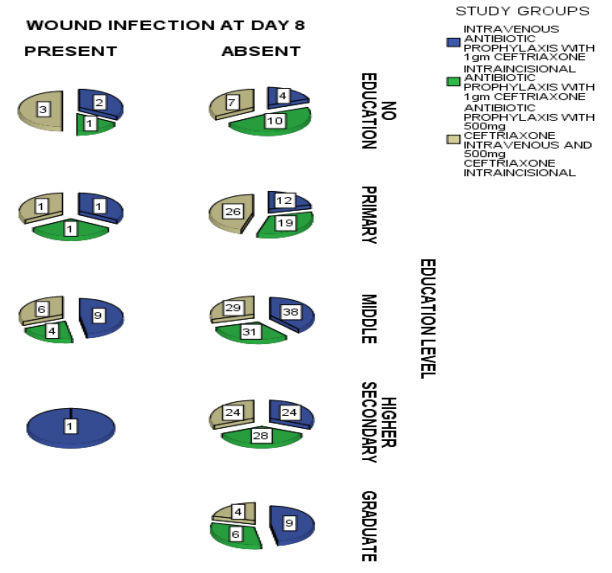

Figure 4. Relation between education and wound infection.

Table I: BMI of patients among study groups.			
Study groups		N	%
	Underweight	6	6.0
Intravenous antibiotic prophylaxis with 1gm Ceftriaxone	Normal	28	28.0
	BMI		
	Over weight	66	66.0
	Total	100	100.0
	Underweight	13	13.0
Intraincisional antibiotic prophylaxis with 1gm ceftriaxone	Normal	30	30.0
	BMI		
	Over weight	57	57.0
	Total	100	100.0
	Underweight	14	14.0
Antibiotic prophylaxis with 500mg ceftriaxone intravenous and 500mg ceftriaxone intra-incisional	Normal	43	43.0
	BMI		
	Over weight	43	43.0
	Total	100	100.0

Table II: Type of operation and wound infection.				
Study groups			Wound infection at day 8	
			Present	Absent
		Lower segment cesarian section – LSCS	13	81
Intravenous antibiotic prophylaxis with 1gm ceftriaxone	Type of operation	Total abdominal hysterectomy – TAH	0	3
		Ectopic pregnancy	0	2
		Ovarian cystectomy	0	1
	Total		13	87
		Lower segment cesarian section – LSCS	6	86
Intraincisional antibiotic prophylaxis with 1gm ceftriaxone	Type of operation	Total abdominal hysterectomy – TAH	0	3
		Ectopic pregnancy	0	3
		Ovarian cystectomy	0	2
	Total		6	94
Antibiotic prophylaxis with 500mg ceftriaxone intravenous and 500mg ceftriaxone Intra-incisional		Lower segment cesarian section – LSCS	9	86
	Type of operation	Total abdominal hysterectomy – TAH	0	1
		Ectopic pregnancy	0	2
		Ovarian cystectomy	1	1
	Total		10	90

Table III: Duration of surgery and wound infection at day 8					
Study groups		Wound infection at day 8			Total
		Present	Absent		
Intravenous antibiotic prophylaxis with 1gm ceftriaxone	Time in hours	Less than 1 hour	0	24	24
		One	2	34	36
		Two	9	29	38
		Three	2	0	2
	Total	13		87	100
Intra-incisional antibiotic prophylaxis with 1gm ceftriaxone	Time in hours	Less than 1 hour	0	37	37
		One	1	35	36
		Two	4	22	26
		Three	1	0	1
	Total	6		94	100
Antibiotic prophylaxis with 500mg ceftriaxone intravenous and 500mg ceftriaxone intra-incisional	Time in hours	Less than 1 hour	0	26	26
		One	1	50	51
		Two	6	14	20
		Three	3	0	3
	Total	10		90	100

The study included several risk factors for SSIs, including advanced age, higher BMI, poor nutritional status, prolonged surgery duration, and delayed postoperative mobilization.[10, 11] Older patients (36–40 years) and those with BMI ≥ 25 had significantly higher infection rates, consistent with prior studies linking metabolic stress and impaired immunity to SSI susceptibility.[10,12] Notably, undernourished and over nourished patients exhibited higher SSI rates, emphasizing the role of nutritional optimization in wound healing.[11] Prolonged Foley catheterization (>24 hours) and extended dressing duration also correlated with increased infections, likely due to biofilm formation and compromised wound microenvironments.[13, 14]

Microbiological analysis revealed *Escherichia coli* as the predominant pathogen (51.72% of SSIs), aligning with global data on gram-negative bacterial predominance in surgical infections.[5] The intra-incisional group's superior efficacy may stem from direct antibiotic penetration at the incision site, bypassing systemic distribution delays.[7,15] Conversely, intravenous administration relies on peripheral tissue diffusion, often yielding suboptimal local concentrations.[4] The combined group's intermediate efficacy suggests additive but not synergistic effects, possibly due to dose-splitting (500 mg each route) reducing peak tissue levels.[8]

Limitations include the single-center design and lack of pharmacokinetic analysis to confirm tissue antibiotic concentrations. Future multicenter trials with larger cohorts and extended follow-ups are warranted to validate these findings.[16] Nevertheless, this study

highlights intra-incisional prophylaxis as a cost-effective strategy to reduce SSIs, particularly in resource-limited settings where postoperative infections burden healthcare systems.[17]

Conclusion

Intra-incisional antibiotic administration significantly reduces SSI risk and improves postoperative outcomes compared to IV prophylaxis. This method should be considered as a standard approach for Pfannenstiel incision procedures.

References

1. Allegranzi B, Bischoff P, de Jonge S, et al. New WHO recommendations on preoperative measures for surgical site infection prevention: an evidence-based global perspective. Lancet Infect Dis. 2016;16(12):e276-e287. https://doi.org/10.1016/S1473-3099(16)30398-X
2. Gomaa K, Abdelraheim AR, El Gelany S, et al. Incidence, risk factors and management of post cesarean section surgical site infection (SSI) in a tertiary hospital in Egypt: a five year retrospective study. BMC Pregnancy Childbirth. 2021;21(1):634. https://doi.org/10.1186/s12884-021-04054-3
3. World Health Organization. Global guidelines for the prevention of surgical site infection. 2nd ed. Geneva: WHO; 2018.
4. Patel IH, Kaplan SA. Pharmacokinetic profile of ceftriaxone in man. Am J Med. 1984;77(4C):17-25.
5. Singh A, Salim M, Singh B, Akshita. A comparative study of pre - operative intra
- incisional infiltration of ceftriaxone versus intravenous ceftriaxone for prevention of surgical site infection. Int Surg J 2019 ; 6(5):1686-92 https://doi.org/10.18203/2349-2902.isj20191891
6. Leaper D and Edmiston C (2017) World Health Organization: Global guidelines for the prevention of surgical site infection. Journal of Hospital Infection 95: 135- 136. https://doi.org/10.1016/j.jhin.2016.12.016
7. Taylor TV, Walker WS, Mason RC, et al. Preoperative intraparietal (intra-incisional) cefoxitin in abdominal surgery. Br J Surg. 1982;69(8):461-462. https://doi.org/10.1002/bjs.1800690809
8. Dogra BB, Kalyan S, Rana KS, et al. A study comparing preoperative intra-incisional antibiotic infiltration and prophylactic intravenous antibiotic administration for reducing surgical site infection. Med J DY Patil Univ. 2013;6(4):405-409. https://doi.org/10.4103/0975-2870.118290
9. Patil A, Uppin V. Intra-incisional versus intravenous route of antibiotic administration in preventing surgical site infections: a randomized controlled trial. Int Surg J. 2018;5(4):1438. https://doi.org/10.18203/2349-2902.isj20181126
10. Ketcheson F, Woolcott C, Allen V, et al. Risk factors for surgical site infection following cesarean delivery: a retrospective cohort study. CMAJ Open. 2017;5(3):E546-56. https://doi.org/10.9778/cmajo.20160164
11. Ali HM, Hien YE, Zongo C, et al. Surgical Site Infection (SSI) in the National Referral General Hospital of Ndjamena (Chad): Survey about Risk Factors. J Biosci Med. 2021;9(5):1-[12] Razavi SM, Ibrahimpoor M, Sabouri A, et al. Abdominal surgical site infections: incidence and risk factors at an Iranian teaching hospital. BMC Surg. 2005;5:2. https://doi.org/10.1186/1471-2482-5-2
12. Wald HL, Ma A, Bratzler DW, et al. Indwelling urinary catheter use in the postoperative period: analysis of the national surgical infection prevention project data. Arch Surg. 2008;143(6):551-7. https://doi.org/10.1001/archsurg.143.6.551
13. Raut PS, Wani R, Shetty T, et al. Prevalence of surgical site infection post caesarean with increased patient load during COVID-19 pandemic in tertiary care centre. Int J Reprod Contracept Obstet Gynecol. 2021;10(8):3053. https://doi.org/10.18203/2320-1770.ijrcog20212953
14. Anand S, Batra R, Arora B, et al. A comparative study of preoperative intra-incisional infiltration of ceftriaxone vs. intravenous ceftriaxone for prevention of surgical site infections in emergency cases. J Evol Med Dent Sci. 2016;5(64):4537-41. https://doi.org/10.14260/jemds/2016/1036
15. Nabhan A, Allam N, Salama MHA. Routes of administration of antibiotic prophylaxis for preventing infection after caesarean section. Cochrane Database Syst Rev. 2016;2016(6):CD011876. https://doi.org/10.1002/14651858.CD011876.pub2
16. Purba AKR, Setiawan D, Bathoorn E, et al. Prevention of Surgical Site Infections: A Systematic Review of Cost Analyses in the Use of Prophylactic Antibiotics. Front Pharmacol. 2018;9:776. https://doi.org/10.3389/fphar.2018.00776