

The Effect Subcutaneous Wound Irrigation with Betadine Versus Normal Saline in Preventing Surgical Site Infections in Elective Surgeries: A Cross-Sectional Comparative Study

Abstract

Background Surgical site infection (SSI) describes an infectious complication of surgical wounds. Although SSI is thought to be preventable, it still represents a major cause of morbidity and substantial economic burden on the health system. Wound irrigation (WI) might reduce the level of bacterial contamination, but current data on its role in reducing or preventing SSI is conflicting. Selection of the ideal antiseptic in real-world practice should therefore be based on evidence-based guidelines.

Aim The present study was aimed to investigate the effectiveness of Betadine solution versus normal saline prior to wound closure for the reduction of SSI in patients undergoing elective abdominal surgeries.

Material and Methods: The hospital-based prospective comparative study was conducted in the Department of Obstetrics and Gynecology, Jawaharlal Nehru Medical College, Aligarh Muslim University of Aligarh after approval from Institutional Ethics Committee, Faculty of Medicine. The study population were divided into two groups based on odd and even number and subjected to betadine and normal saline irrigation simultaneously. The women detailed history and examination and outcomes of study were recorded as per study Performa . Primary outcome was the rate of SSI while allergy, postoperative fever, obstetric hemorrhages, need for antibiotic therapy, repeat surgical interventions and duration of hospital stay were included in secondary outcome measures. All data were entered in the MS excel sheet and were analysed by using SPSS latest version.

Results: Total of 200 women were included for analysis. The incidence of superficial and deep SSIs were lower in betadine group compared to normal saline group . Similarly, significant

differences in postoperative fever, antibiotic therapy requirements, mean hospital stay between the two groups.

Conclusion: The use of Betadine solution for subcutaneous surgical wound irrigation prior to skin closure is a feasible and inexpensive approach for preventing surgical site infections.

Keywords: Normal Saline irrigation, povidone-iodine, Subcutaneous tissue, Wound infection, elective surgeries , surgical site infections

Introduction

Surgical site infections (SSIs) occur after an operative procedure and can range from superficial to deep wound infections. Global estimates of SSIs have ranged from 0.5% to 15%, whereas studies in India have consistently shown higher rates from 23% to 38%^[1]. SSIs are a substantial cause of morbidity, prolonged hospitalization, hospital readmissions, and death and pose a considerable financial burden on healthcare systems^[2-4]. Thus, prevention and minimization of SSIs improve patient outcomes and reduce resource consumption^[4,5]. Intraoperative measures primarily focus on decontamination of the skin and intraoperative wound irrigation using soap and antiseptics and are a simple, efficient, and cost-effective measure to reduce SSIs^[6]. The most frequently used antiseptic is povidone-iodine (PVI), commonly applied as irrigation or a spray. PVI is an iodophor in which iodine is complexed with the polymer povidone. The microbicidal activity of iodine involves inhibition of vital bacterial cellular mechanisms and structures^[7]. Povidone-iodine irrigation is a simple and inexpensive solution with the potential to prevent surgical site infection. Multiple studies investigated the use of povidone-iodine and normal saline irrigation in multiple types of surgery. However, despite the potential usefulness of topical antiseptics, current clinical practice is variable and largely dependent on surgeon preference. Furthermore, the routine use of topical antibiotics and antiseptics has been associated with adverse effects such as tissue toxicity and interference with wound healing^[8,9]. Although systematic reviews and meta-analyses on the benefits of PVI in reducing the incidence of SSIs have been published, there has been no definite conclusion on the effectiveness of PVI and normal saline in different surgical categories^[10,11]. and its use as a prophylactic irrigation solution against surgical site infection has been examined to a lesser degree. Thus, the present study was conducted to compare the efficacy and safety of subcutaneous wound irrigation with

betadine versus normal saline in preventing postoperative surgical site wound infections in elective obstetrical and gynecological surgeries.

Material and Methods

The hospital-based cross-sectional comparative study was conducted in the Department of Obstetrics and Gynecology, Jawaharlal Nehru Medical College, Aligarh Muslim University

Material and Methods

This hospital-based cross-sectional comparative study was conducted in the Department of Obstetrics and Gynecology, Jawaharlal Nehru Medical College, Aligarh Muslim University of Aligarh, during 2022-2024. The study protocol was approved by the Institutional Ethics Committee, Faculty of Medicine, AMU. 200 women meeting the inclusion criteria were enrolled and an informed written consent was obtained.

Women were equally divided into two different groups.

- **Group A (study group)** → subcutaneous wound irrigation with 50ml 10% aqueous povidine iodine solution (betadine) before skin closure.
- **Group B (study group)** → subcutaneous wound irrigation with 100ml normal saline before skin closure.

After detailed history and examination, information such as surgical indication, age, parity, body mass index (BMI), preoperative hemoglobin (Hb%) value, diabetes, history of smoking, length of hospitalization and the wound infection status of the women during hospitalization were recorded.

Inclusion Criteria

- Elective obstetrical and gynecological surgeries.
- Women with known cases of sepsis
 - Patients with postoperative purulent discharge
 - Antibiotic therapy
 - Daily dressing of wound
- Septicaemic cases

- Patients with subcutaneous hematoma, seroma and wound dehiscence

Methodology

Exclusion Criteria

- History of Allergy to iodine
- History of immune suppressive drugs.
- Diabetes mellitus.
- Anemia.
- Rupture of membrane

Methodology

All elective surgeries were performed on the women in accordance with the standardized surgical procedure. After elective surgery parietal peritoneum and the rectus sheath was closed. In Group A subcutaneous wound irrigation was done with 50ml 10% aqueous povidine iodine solution (betadine) before skin closure and in Group B (study group) subcutaneous wound irrigation was done with 100ml normal saline before skin closure. With the help of a sterile syringe, the subcutaneous space was thoroughly irrigated with saline and cleaned. At the end of the surgery, the wound surface was wiped with a betadine antiseptic solution and sterile dressing was applied.. Postoperatively, wound dressings were changed after 72 hrs. The women were hospitalized for 7 to 10 days depending upon the nature of surgery and was given antibiotic and postoperative standard care. According to our hospital protocol single dose of cephazolin 2 g was given prior to skin incision and dressings of the patients were opened on 3rd postoperative day and wounds were examined for subcutaneous hematoma, seroma, dehiscence, and skin hyperemia, postoperative purulent discharge and any side effects of the betadine was also included. Women were allowed to take a bath after discharge and were called for stitch removal on 7- 8 postoperatively.

The primary study outcome measures included incidence of wound infection (wound cellulitis, wound abscess, post-operative fever, pus discharge from wound, wound dehiscence) while allergy ,wound healing time , postoperative fever, obstetric Hemorrhages ,wound healing, time needed for antibiotic therapy, other surgical interventions and duration of hospital stay were included in secondary outcome measures.

Results

In the present study, total of 200 women were evaluated. The study involved two groups Betadine (Group A) and a Normal Saline (Group B) each consisting of 100 women. The demographic profile was same among two groups.

Table 1- Distribution According to Surgical Procedures

Surgical Procedure	Group A (n=100)	Group B (n=100)	p-value
Laparotomy	22 (22.0%)	18 (18.0%)	p=0.767 Non-significant
Cystectomy	11 (11.0%)	12 (12.0%)	
Myomectomy	15 (15.0%)	14 (14.0%)	
Total Abdominal Hysterectomy	25 (25.0%)	26 (26.0%)	
Caesarean Section	27 (27.0%)	30 (30.0%)	

Out of 200 surgical procedures, the most common surgical procedure was caesarean section followed by TAH, laparotomy for adnexal masses, myomectomy and ovarian cystectomy. The differences in surgical procedure distribution across the two groups was not statistically significant ($p=0.53$).

Group B shows a significantly higher occurrence (20%) of SSI compared to the Betadine group (7%). The differences were statistically significant.

Table 2- Distribution of cases according to SSI and Hospital Stay

Type of Discharge	Group A (n=100)	Group B (n=100)	Total (n=200)	p-value
No Discharge or no pus	85	58	143	<i>X²=8.53, p=0.014, Significant</i>
Mild Discharge or Pus Present	5	14	19	
Pus Culture Growth Present	0	10	10	
Hospital Stay >10 days	85	62	147	
6 to 10 days	10	28	38	0.0001 <i>Significant</i>
>10 days	5	10	15	
<i>Mean ± SD</i>	9.54 ± 4.06	15.60 ± 6.6	13.54 ± 7.0	

There is a significant association between the type of discharge and the group type (p=0.014) and the differences in the mean hospital stay across the groups was statistically significant (p-value = 0.0001)

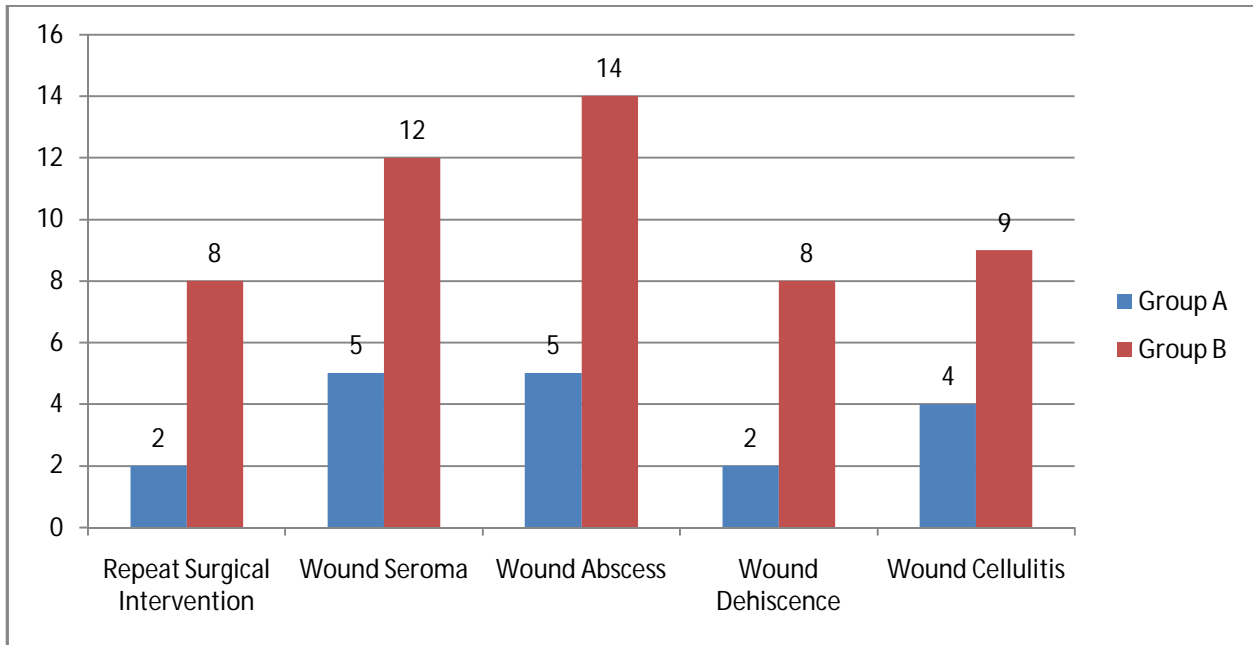


Figure 1: Association of Post Operative Infection Among Groups

The differences in the need for relaparotomy due to wound dehiscence and other complications of SSI across The groups were statistically significant (p-value =0.0001)

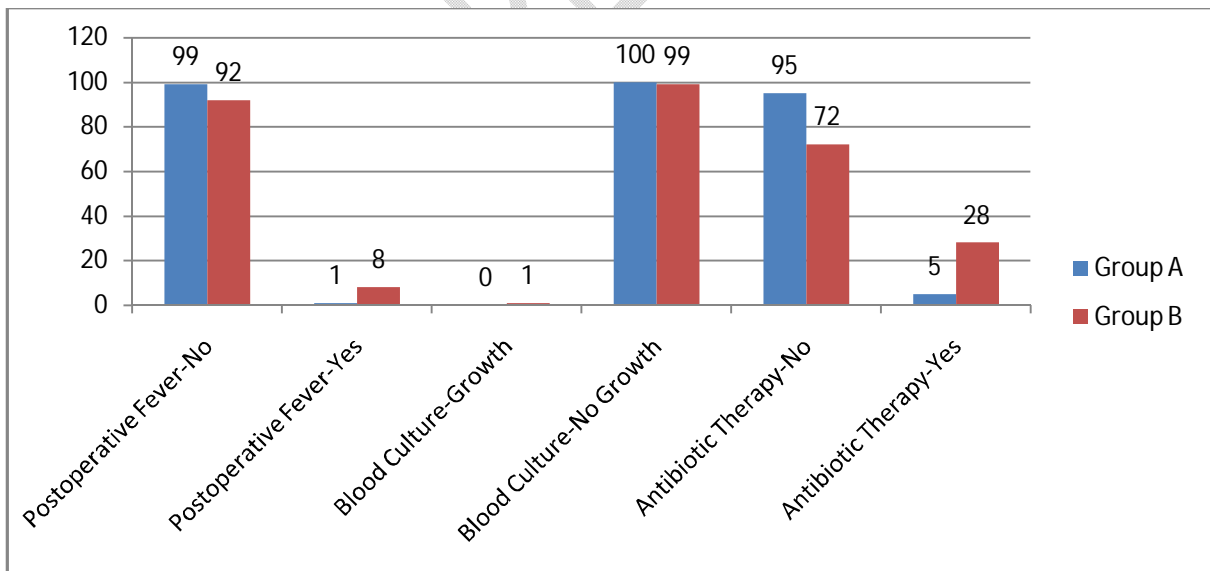


Fig 2: Association of Postoperative Fever and Antibiotic Therapy in Groups

The incidence of postoperative fever and antibiotic therapy varies significantly among the groups.

Discussion

Irrigation's aim is to clean wound whereas minimizing trauma to wound bed and risk of introducing bacteria into wound bed. Protocol for systemic review and meta-analysis on impacts of saline irrigation before wound closure in reducing surgical place infection was published in 2018^[12] The NS is used as an intravenous isotonic solution and for cleaning wounds. It is a mild but effective disinfection agent and will not harm normal tissue, unlike many stronger antiseptics^[13]. It is available and less expensive in compared to PVI.

The WHO, CDC, and Infectious Diseases Society of America (IDSA) recommend irrigation of the incisional wound with an aqueous PVI solution before closure to prevent SSIs^[14,15,16]. Few studies explored irrigation in abdominal operations while reporting contradictory results. Thus, the prospective randomized control research was conducted on 200 women planned for elective surgeries using subcutaneous wound irrigation with betadine (Grp A) and normal saline (Grp B) prior to skin closure. **Sindelar et al.** showed that the effectiveness in decreasing the rate of infection of 10% povidone-iodine is more than normal saline^[17]. **Al-Ramahi et al.**^[18] reported NS irrigation did not reduce the SSI rate during gynaecological surgery (10.6% irrigation vs. 9.8% control). **Gungorduk et al.**^[19] concluded NS irrigation was not associated with SSI rates for caesarean section (6.5% irrigation vs. 7.3% control, $p = 0.86$).

Aslan et al.^[20] also revealed the limited effect of NS irrigation on SSI reduction for cesarean section (14.3% irrigation vs. 12.8% control). A decrease in SSIs has been reported when diluted aqueous PVP-I is used for wound irrigation in a range of surgical settings, including craniotomy, cesarean delivery, breast surgery, and intraperitoneal irrigation during laparotomy and spinal surgery^[21, 22-24].

During surgery, intraoperative irrigation is an effective way to stop biofilms from forming. ^[25] **De Jonge et al.** focuses on prophylactic irrigation and supports the World Health Organization's recent recommendations on SSI prevention, which suggest that antibiotic irrigation should not be considered in favor of povidone iodine irrigation ^[26]

Our results are contrary to the study of **Amstey et al** ^[27] who evidenced that NS solution can have the same efficacy as PI in the prevention of postoperative infections after vaginal surgery the reason could be they have used different surgical route.

Müller et al. ^[06] and **Ambe PC** ^[28] showed a noteworthy decrease in SSI after WI. the rate of SSI was considerably lower when WI was combined with antibiotics, but there was no benefit when WI was combined with saline.

Aslan et al. found no significant difference between the groups in terms of SSI rates (14.3% in the saline group, 12.8% in the control group, $p=0.76$). However, they reported that the presence of hematoma and seroma in the saline irrigation group was significantly lower than the control group ^[29] **Edmiston and Leaper** found the incision saline irrigation favorable.

Ambe PC et al found that saline irrigation has no beneficial effect in prevention of SSI ^[30]

In a prospective randomized study, **Çetin et al** ^[20] found no important variation among categories in terms of SSI rates .Nonetheless, the saline irrigation group showed a significant decrease in the presence of hematoma and seroma as compared to the control group. Also, present research was supported by **Gül Dk et al** ^[31] who revealed that Seroma , hematoma and superficial surgical place infection were significantly lower in saline irrigation group, whereas wound dehiscence was similar.

Ashraf Hamday et al ^[32] concluded that irrigation of subcutaneous tissue with saline throughout caesarean section significantly reduced rates of seroma, hematoma, and superficial surgical place of infections

Ambe et al. ^[28] found there was no variation in hospital stay length and no benefit to routine irrigation of abdominal wounds with normal saline over no irrigation prior to wound closure in terms of avoiding or decreasing rate of SSI which is in disharmony with our results.

Swaminathan C et al ^[33] in a meta-analysis of 24 studies on 4967 subjects evaluating antibiotic solution irrigation, aqueous PVI, and saline irrigation. Thus the supported reviews that the use of PVI wound irrigation to reduce SSI incidence in concordance with our findings.

Conclusion

The use of a Betadine for antiseptics for subcutaneous surgical wound irrigation prior to skin closure is a feasible and inexpensive approach for preventing surgical site infections as compared to normal saline

Limitations

1. Long-term patient follow-up was not conducted.
2. Future research should consider increased standardization of the groups in terms of procedure types, co-morbid variables, to improve the collection of additional data on the effects of this technique.
3. Additionally, this study emphasizes the need of conducting well designed randomized controlled trials (RCTs) with a larger number of patients to investigate the impact of wound irrigation before skin closure.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name,

version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

- 1.
- 2.
- 3.

Conflict of Interest

No

Funding sources

None- Funded

Ethics approval

Ethics approval was taken from our institutional ethics committee for doing this study.

Acknowledgements

All women who participated in conducting this research. All Authors who contributed in helping to publish this manuscript.

References

1. Arora A, Bharadwaj P, Chaturvedi H, et al. A review of prevention of surgical site infections in Indian hospitals based on global guidelines for the prevention of surgical site infection. JPSIC 2018; 6: 1-12. Surgical Site Infection (SSI), National Healthcare Safety Network, January 2021.

2. Norman G, Atkinson RA, Smith TA, et al. Intracavity lavage and wound irrigation for prevention of surgical site infection. *Cochrane Database Syst Rev* 2017; 10: CD012234.
3. Dimick JB, Chen SL, Taheri PA, et al. Hospital costs associated with surgical complications: a report from the private-sector national surgical quality improvement program. *J Am Coll Surg* 2004; 19: 531-7.
4. Astagneau P, Rioux C, Golliot F, Brücker G; INCISO Network Study Group. Morbidity and mortality associated with surgical site infections: results from the 1997-1999 INCISO surveillance. *J Hosp Infect* 2001; 48: 267-74.
5. 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* 2016; 16: e276-87.
6. Mueller TC, Loos M, Haller B, et al. Intra-operative wound irrigation to reduce surgical site infections after abdominal surgery: a systematic review and meta-analysis. *Lang Arch Surg* 2015; 400: 167-81.
7. Bigliardi PL, Alsagroff SA, El-Kafrawi HY, et al. Povidone-iodine in wound healing: a review of current concepts and practices. *Int J Surg* 2017; 44: 260-8
8. Surgical site infections: prevention and treatment. National Institute for Health and Care Excellence (NICE) 2019. www.nice.org.uk/guidance/ng125.
9. Alexander JW, Solomkin JS, Edwards MJ. Updated recommendations for control of surgical site infections. *Ann Surg* 2011; 253: 1082-93.
10. Fournel I, Tiv M, Soulias M, et al. Meta-analysis of intraoperative povidone-iodine application to prevent surgical-site infection. *Br J Surg* 2010; 97: 1603-13.
11. López-Cano M, Kraft M, Curell A, et al. A meta-analysis of prophylaxis of surgical site infections with topical application of povidone-iodine before primary closure. *World J Surg* 2018; 43: 374
12. Magill SS, Edwards JR, State M et al., Multistate point-prevalence survey of health care-associated infections. *N Engl J Med*. March 27, 2014; 370(13):1198-1208
13. CDC National and State Healthcare-Associated Infections Progress Report, published November 2021
14. WHO global guidelines for the prevention of surgical site infection (2016).

15. Martin JA, Hamilton BE, Ventura SJ (2012): Births: final data for 2010. *Natl Vital Stat Rep.*, 61 (1):1.
16. Lake AG, McPencow AM, Dick-Biascoches MA et al. Surgical site infection after hysterectomy. *Am J Obstet Gynecol.* November 12, 2013;209(5).
17. Dimick JB, Chen SL, Taheri PA, et al. Hospital costs associated with surgical complications: a report from the private-sector national surgical quality improvement program. *J Am Coll Surg* 2004; 19: 531-7.
18. Al-Ramahi M, Bata M, Sumreen I, Amr M. Saline irrigation and wound infection in abdominal gynecologic surgery. *Int J Gynaecol Obstet.* (2006) 94
19. Gungorduk K, Ascioglu O, Celikkol O, Ark C, Tekirdag AI. Does saline irrigation reduce the wound infection in caesarean delivery? *J Obstet Gynaecol.* (2010) 30(7):662–6.
20. Aslan Çetin B, Aydogan Mathyk B, Barut S, Koroglu N, Zin- dar Y, Konal M, et al. The impact of subcutaneous irrigation on wound complications after cesarean sections: A prospec- tive randomised study. *Eur J Obstet Gynecol Reprod Biol* 2018;227:67–70
21. Patel KS, Goldenberg B, Schwartz TH. Betadine irrigation and post-craniotomy wound infection. *Clin Neurol Neurosurg.* 2014;118:49–52.
22. Meza BC, Talwar D, Flynn JM. Measures to reduce end-of-case wound contamina- tion: the impact of intra-wound vancomycin powder and betadine irrigation on surgical site infections in posterior spinal fusion. *Spine Deform.* 2020;8(1):45–50.
23. Van Herwijnen B, Evans NR, Dare CJ, Davies EM. An intraoperative irrigation regi- men to reduce the surgical site infection rate following adolescent idiopathic scoli- osis surgery. *Ann R Coll Surg Engl.* 2016;98(5):320–3.
24. Marino R, Capriglione S, Morosetti G, Di Angelo Antonio S, Miranda A, Pazzola M, et al. May intraperitoneal irrigation with betadine improve cesarean delivery out- comes? Results of a 6 years' single Centre experience. *J Matern Fetal Neonatal Med.* 2018;31(5):670–6.
25. Thorn RM, Austin AJ, Greenman J, Wilkins JP, Davis PJ. In vitro comparison of anti- microbial activity of iodine and silver dressings against biofilms. *J Wound Care.* 2009;18(8):343–6.

26. De Jonge SW, Boldingh QJJ, Solomkin JS, et al. Systematic review and meta-analysis of randomized controlled trials evaluating prophylactic intra-operative wound irrigation for the prevention of surgical site infections. *Surg Infect* 2017; 18:508–519.
27. Eming SA, Smola-Hess S, Kurschat P, Hirche D, Krieg T, Smola H. A novel property of povidon-iodine: inhibition of excessive protease levels in chronic non-healing wounds. *J Invest Dermatol.* 2006;126(12):2731–3.
28. Ambe PC, Rombey T, Rembe JD, Dörner J, Zirngibl H, Pieper D. The role of saline irrigation prior to wound closure in the reduction of surgical site infection: A systematic review and meta-analysis. *Patient Saf Surg* 2020;14:47
29. Aslan Çetin B, Aydoğan Mathyk B, Barut S, Koroglu N, Zin- dar Y, Konal M, et al. The impact of subcutaneous irrigation on wound complications after cesarean sections: A prospec- tive randomised study. *Eur J Obstet Gynecol Reprod Biol* 2018;227:67–70
30. Ambe PC, Rombey T, Rembe JD, Dörner J, Zirngibl H, Pieper D. The role of saline irrigation prior to wound closure in the reduction of surgical site infection: A systematic review and meta-analysis. *Patient Saf Surg* 2020;14:47
31. Gul Dk Et Al Gül The role of saline irrigation of subcutaneous tissue in preventing surgical site complications during cesarean section: a prospective randomized controlled trial. *J Surg Med.* 2021;5:8e11.
32. Mohamed, Ashraf Hamdy; El-fatah, Ahmed Taha Abd; and Kasem, Mohamed Sayed Ahmed "Role of saline irrigation of subcutaneous tissue to reduce wound infection in cesarean section in obese women," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 3, 2023.
33. Swaminathan C, Toh WH, Mohamed A, M Nour H, Baig M, Sajid M. Comparing the Efficacy of Povidone-Iodine Versus Normal Saline in Laparotomy Wound Irrigation to Prevent Surgical Site Infections: A Meta-Analysis. *Cureus.* 2023 Dec 2;15(12)

UNDER PEER REVIEW

UNDER PEER REVIEW

UNDER PEER REVIEW