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Original Research Article

A comparative study to determine the incidence of post-operative wound infection in primary orthopaedics surgery with betasaline and normal saline intraoperative wound irrigation

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ABSTRACT

Background: Orthopaedic surgeries are susceptible to surgical site infections (SSIs) that highly contribute to postoperative morbidity and cost of health care. The importance of wound irrigation is a preventive measure, which is critical, yet the relative effectiveness of antiseptic solutions and regular saline should be assessed further. This study aimed to compare the incidence of postoperative wound infection and the general tissue healing of intraoperative betasaline (diluted povidone-iodine) with normal saline irrigation during primary orthopaedic surgeries.
Methods: A comparative study was done over 21 months on 200 adult patients undergoing primary orthopaedic surgeries. Group A (betasaline, n=100) and group B (normal saline, n=100), were randomized equally. The Southampton wound grading system was used to assess postoperative wounds on day (POD) 2, 7, 14 and 30.
Results: Baseline demographics were similar. Grade 3 changes (serous discharge) occurred in 4% (n=4) of the normal saline cohort on POD 2 compared to 0% grade 3 or grade 4 changes in the betasaline cohort. More importantly, grade 4 SSIs (purulent discharge) were not developed by either group. At POD 7, 50 per cent (n=50) patients in the betasaline group had grade 1 healing, as compared to 46 per cent (n=46) patients in the normal saline group. By POD 30, 100% of participants in both groups had achieved complete wound healing (grade 0). There were only minor, localized skin reactions in 6% (n=6) of the betasaline group with no systemic adverse effects observed.
Conclusions: Betasaline and normal saline are good agents of ensuring satisfactory wound healing. Nonetheless, intraoperative irrigation with betasaline shows a very promising clinical pattern of reducing early postoperative infections and speeding up the healing of tissue inflammation with an acceptable safety profile.

Keywords: Betasaline, Normal saline, Orthopaedic surgery, Povidone-iodine, Surgical site infection, Wound irrigation

INTRODUCTION

Postoperative infections, especially surgical site infections (SSIs), is a serious and serious complication in contemporary healthcare. The consequences of SSIs after orthopaedic surgery are severe, often resulting in poor quality of life and increased hospital length of stay as well as significant additional healthcare expenses.[1] According to observational studies and reviews, the percentage of infections in certain local healthcare facilities can be much greater than the world average, and there is an absolute need to prevent them with aggressive and effective strategies.[2] These surgical complications place an overall economic burden on the economy which makes it necessary to follow the procedures of infection control to the letter to maximize patient outcomes.[3]

Both the World Health Organization and the Centers for Disease Control and Prevention have provided detailed guidance detailing preoperative, intraoperative and postoperative interventions aimed at reducing the risks of SSI.[4,5] The pathogens that cause these infections are

usually of exogenous environmental sources in the operating theater or endogenous flora of the patient.[6] In the list of preventive intraoperative procedures, careful wound irrigation is important physically to get rid of tissue debris and to minimize the microbial load at the surgical site.[7]

Normal saline is the most widely used irrigation solution worldwide because of its known safety history and isotonicity with tissues of the human body. Nevertheless, antiseptic agents like povidone-iodine have a wide-spectrum of antimicrobial effects that actively interfere with the fundamental bacterial cell structures.[8] Clinical effectiveness of intraoperative irrigation is also strongly dependent on delivery mechanisms and pressure dynamics, and moderate-pressure syringing is usually suggested, as it will not lead to deep tissue damage but will guarantee comprehensive cleansing.[9]

Although the antimicrobial effect of povidone-iodine is known and powerful, there is a dearth of comparative clinical evidence on the usage of this antimicrobial solution as a carefully diluted solution-betasaline versus normal saline during primary orthopaedic surgical procedures. The study determined the clinical incidence of post-operative wound infection and compare wound healing outcomes, tissue tolerance and local adverse reactions when switching to betasaline versus normal saline as the choice of intraoperative wound irrigation.

METHODS

Study design and setting

A randomized, comparative study was made, at the department of orthopaedics, Rama Medical College, Hospital and Research Centre, Hapur. The experiment was carried out on an ongoing basis of 21 months, that is, between March 2024 and December 2025.

Selection of study population

Two hundred adult patients (18 years and older) with primary orthopaedic procedures (joint replacements, fracture fixations and other major surgeries) were recruited. The 200 patient (100 in each arm) was determined based on an estimated event rate of 40 percent at a confidence level of 95 percent with a 5 percent desired level of error. The study excluded patients who had known allergies to iodine-based antiseptics or sodium chloride, had known skin infections or immunocompromised conditions (e.g. HIV/AIDS, chemotherapy) and patients undergoing revision surgeries. Women who were pregnant or lactating were also not allowed because it could be dangerous with antiseptic used during surgery.

Pre-operative preparation and intervention

There were two random groups of patients. In group A (betasaline), intraoperative wound irrigation was done (Figure 2) with a carefully prepared solution of betasaline, which was a solution of 95 ml of 0.9% normal saline and 5 ml of 5% povidone-iodine (Figure 1). In group B (normal saline), subcutaneous tissues were only sprayed using 0.9% normal saline (Figure 3) before skin closure. A standardized method of syringe was used to administer the irrigation so that there was adequate volume and pressure to carry out effective cleansing.

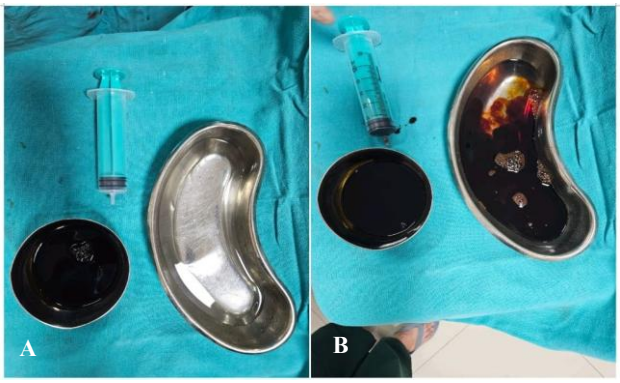

Figure 1 (A and B): Preparation of betasaline.

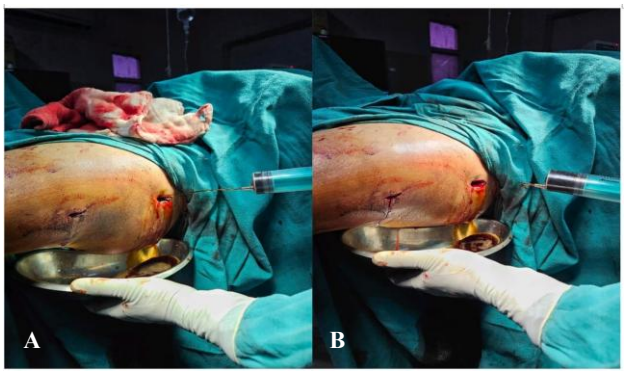

Figure 2 (A and B): Irrigation with betasaline.

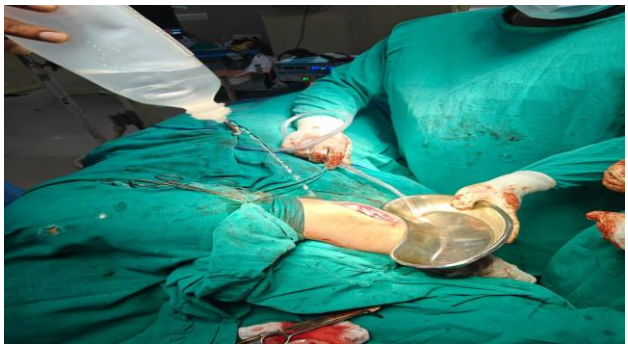

Figure 3: Irrigation with normal saline.

Evaluation

The Southampton wound grading method was used to standardize the postoperative wound assessment. Assessments were carefully documented at postoperative days (POD) 2, 7, 14 and 30. The following parameters were recorded: baseline demographic data, surgical records, progressive wound healing rates, specific

infection rates and the occurrence of any adverse localized or systemic reactions.

RESULTS

Demographic and clinical profile

Baseline variables of study participants (n=200) were found to be statistically similar. The mean age was 45.16±15.2 years for the betasaline group and 42.68±14.8 years for the normal saline group (p=0.41). The proportion of genders and proportion of surgery (e.g., ORIF with plating, arthroplasty, IM nailing) was balanced in both cohorts.

Postoperative wound grading (POD 2 to POD 30)

Early postoperative inflammatory responses, which were erythema (Southampton grade 2) were evenly distributed in the two groups on POD 2. Four patients (4%) in the normal saline group developed grade 3 changes (serous discharge) on POD 2. Conversely, none of the patients (0%) in the betasaline group acquired grade 3 or grade 4 complications. More importantly, grade 4 surgical site infections (purulent discharge) in neither group necessitated pus cultures. These findings have been organized in tabular form in (Table 1).

Table 1: Southampton wound grading on POD 2.

Southampton grade	Betasaline (n=100) (%)	Normal saline (n=100) (%)	P value
Grade 0 (normal healing)	0 (0)	0 (0)	—
Grade 1 (normal healing with mild bruising)	0 (0)	0 (0)	—
Grade 2 (erythema/inflammation)	100 (100)	96 (96)	0.12*
Grade 3 (serous discharge)	0 (0)	4 (4)	0.12*
Grade 4 (SSI- pus present)	0 (0)	0 (0)	—
Grade 5 (deep infection)	0 (0)	0 (0)	—

*Statistically significant.

Table 2: Southampton wound grading on POD 7.

Southampton grade	Betasaline (n=100) (%)	Normal saline (n=100) (%)	P value
Grade 0 (normal healing)	0 (0)	0 (0)	—
Grade 1 (normal healing with mild bruising)	50 (50)	46 (46)	0.69
Grade 2 (erythema/inflammation)	50 (50)	52 (52)	0.84
Grade 3 (serous discharge)	0 (0)	2 (2)	1.00*
Grade 4 (SSI pus present)	0 (0)	0 (0)	—
Grade 5 (deep infection)	0 (0)	0 (0)	—

*Statistically significant.

Table 3: Southampton wound grading on POD 14.

Southampton grade	Betasaline (n=100) (%)	Normal saline (n=100) (%)	P value
Grade 0 (normal healing)	0 (0)	0 (0)	—
Grade 1 (normal healing with mild bruising)	100 (100)	98 (98)	1.00
Grade 2 (erythema/inflammation)	0 (0)	2 (2)	1.00*
Grade 3 (serous discharge)	0 (0)	0 (0)	—
Grade 4 (SSI- pus present)	0 (0)	0 (0)	—
Grade 5 (deep infection)	0 (0)	0 (0)	—

*Statistically significant.

By POD 7, the early serous discharge in the normal saline group exhibited resolution. Overall, the betasaline group demonstrated a demonstrably cleaner wound profile, with 50% (n=50) of patients achieving grade 1 healing status (normal healing with mild bruising), compared to 46% (n=46) in the normal saline group. These findings have been organized in tabular form in (Table 2).

Assessments on POD 14 revealed that 100% of patients in the betasaline group attained grade 1 healing. Meanwhile, two patients (2%) in the normal saline group continued to present with grade 2 inflammatory erythema. These findings have been organized in tabular form in (Table 3).

By the conclusion of the monitoring period on POD 30, all patients (100%) in both experimental groups had achieved complete wound resolution (grade 0), with no residual clinical signs of inflammation or deep tissue infection. These findings have been organized in tabular form in (Table 4).

Table 4: Southampton wound grading on POD 30.

Southampton grade	Betasaline (n=100) (%)	Normal saline (n=100) (%)	P value
Grade 0 (normal healing)	100 (100)	100 (100)	1.00
Grade 1 (normal healing with mild bruising)	0 (0)	0 (0)	—
Grade 2 (erythema/inflammation)	0 (0)	0 (0)	—
Grade 3 (serous discharge)	0 (0)	0 (0)	—
Grade 4 (SSI- pus present)	0 (0)	0 (0)	—
Grade 5 (deep infection)	0 (0)	0 (0)	—

Table 5: Overall incidence of surgical site infection (grade ≥4).

Outcome	Betasaline (n=100) (%)	Normal saline (n=100) (%)	P value
Surgical site infection (grade ≥4)	0 (0)	0 (0)	—
No infection (grade <4)	100 (100)	100 (100)	—

Table 6: Comparison of adverse reactions between groups.

Adverse reaction	Betasaline (n=100) (%)	Normal saline (n=100) (%)
Local rash/redness	6 (6)	0 (0)
Allergic reaction	0 (0)	0 (0)
Systemic adverse effects	0 (0)	0 (0)

Incidence of surgical site infections and adverse reactions

The overall cumulative incidence of clinical surgical site infections (grade ≥4) over the 30-day period was 0% for both the betasaline and normal saline cohorts, though the normal saline cohort experienced a 4% incidence of grade 3 serous discharge. Regarding tissue tolerability, six patients (6%) receiving betasaline irrigation experienced mild, localized skin responses defined as superficial rash or redness. These minor reactions did not progress to surgical wound dehiscence or systemic allergy. No adverse reactions were recorded in the normal saline group. These findings have been organized in tabular form in (Tables 5 and 6).

DISCUSSION

The present study determined that targeted intraoperative wound irrigation with betasaline was clinically associated with a lower incidence of early postoperative serous discharge (grade 3) compared to standard normal saline (0% versus 4%), with no severe surgical site infections (grade ≥4) occurring in either group. Although such differences were not strictly statistically significant, which would likely be restricted by the total number of patients, it is clear from the data that povidone-iodine has a protective effect in preventing early postoperative infection. This clinical trend reinforces the general principles of comprehensive antiseptic wound management, which emphasize the need to take a proactive approach to reducing the amount of microbes that can contaminate a surgical site and cause overt infections.[10]

A progressive wound healing process was assessed using the Southampton wound grading system, which showed accelerated resolution of postoperative inflammation in the betasaline group. A greater percentage of betasaline patients achieved grade 1 healing without serous discharge by POD 7. Comparable accelerations in wound healing have been observed in larger studies comparing povidone-iodine to normal saline, and it was suggested that povidone-iodine was augmenting the natural wound healing process rather than just physically cleansing the wound.[11]

This increased physiological effect is in large part due to the broad antimicrobial spectrum of povidone-iodine, its ability to penetrate and actively destabilize bacterial biofilms, the main cause of recalcitrant postoperative infections.[12] In addition, specific studies of povidone-iodine review its unique anti-inflammatory and anti-edematous activity that also directly affects its suppression of localized erythema and promotion of early tissue regeneration.[13]

The lack of severe and deep incisional infections (grade 5) for both cohorts is a testament to the already good efficacy of modern sterile perioperative protocols. The specific decrease in early superficial infections in the betasaline group, however, parallels the large meta-analyses showing that there is a significant reduction in overall SSI risk with the routine use of aqueous povidone-iodine as a surgical wound irrigant.[15] Further, direct biocide action on microorganisms such as povidone-iodine offers an important strategic advantage in contemporary infection control in the face of the escalating problem of highly resistant nosocomial bacterial strains, which are frequently acquired as a result of systemic antibiotic use.[14]

Clinically, intraoperative betasaline was very well tolerated. In the betasaline group six patients (6%) experienced minor adverse reactions (mild rash) which did

not need complex intervention but were resolved with routine outpatient care only. This is in close agreement with the recent literature which stated the very low allergenicity and systemic safety of the povidone-iodine used in proper dilution.[12]

By POD 30, 100% of the wounds in both therapeutic groups had fully resolved, demonstrating that both solutions enable 100% complete wound resolution; however, betasaline provides an optimized early recovery pathway without significant localized toxicity.

CONCLUSION

Highly satisfactory long-term wound healing profiles are obtained with intraoperative wound irrigation by using betasaline and normal saline in primary orthopaedic surgeries. However, betasaline irrigation definitely shows a positive clinical trend which is proactive in terms of minimizing surgical site infections early after surgery and aiding faster healing of tissue inflammation. With good overall tissue tolerance and no systemic adverse effects, Betasaline is a safe, highly effective and strategically useful alternative to standard normal saline for intraoperative wound irrigation and complete infection prevention.

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