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RESEARCH ARTICLE
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EFFICACY OF ADRENALINE SPRAY IN REDUCING SEROMA FORMATION FOLLOWING HERNIOPLASTY: A RANDOMIZED CLINICAL TRIAL

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Abstract

Objective: To evaluate the efficacy of adrenaline spray in reducing seroma formation in hernioplasty cases.

Methods: This randomized controlled trial evaluated the efficacy of adrenaline spray in reducing seroma formation. Conducted over six months at Ayub Teaching Hospital, 152 participants undergoing elective hernioplasty were randomized into two groups. The intervention group received intraoperative adrenaline spray, while the control group underwent standard care. Primary outcomes included seroma incidence, assessed clinically and via ultrasound, while secondary outcomes were post-operative complications and hospital stay duration.

Results: The incidence of seroma formation was significantly lower in the intervention group (7.9%) compared to the control group (21.1%) (P = 0.021). Although seroma severity approached significance (P = 0.057), the intervention group showed milder cases. No significant differences were observed between the groups for post-operative complications (P = 0.241) or hospital stay duration (P = 0.876). Both groups were demographically and clinically comparable, ensuring robust results.

Conclusion: Adrenaline spray effectively reduces seroma formation without increasing post-operative complications or prolonging hospital stays. This cost-effective intervention has the potential to improve hernioplasty outcomes and could be explored in other surgical contexts prone to seroma formation. Further studies with larger sample sizes and longer follow-ups are recommended

Keywords: Seroma formation, Hernioplasty, Adrenaline spray, Vasoconstrictive agents, Post-operative complications, Surgical wound management, Randomized controlled trial

Main Text

Introduction

Seroma formation following hernioplasty is a frequent and challenging complication that can negatively impact patient recovery and overall surgical outcomes[1]. A study reported the incidence of seroma at 11% following hernia repair surgery[2]. Post hernioplasty, seroma formation is a common challenge, often causing discomfort, increasing the risk of infection, delaying wound healing, and

sometimes requiring further medical interventions [2, 3]. These complications can extend hospital stays and add to healthcare costs[3]. The usual methods for managing seromas, such as surgical drains and compression garments, while widely used, often fall short in effectively preventing or significantly reducing their occurrence[4 5]. These limitations highlight the need for better approaches to address this frequent post-operative complication.

Adrenaline (epinephrine), well-known for its potent vasoconstrictive properties, shows promise as a solution to this issue[5–7]. By constricting blood vessels and reducing capillary permeability, it may help to limit the fluid leakage responsible for seroma formation[8 9]. Although adrenaline is commonly used to control bleeding during surgery and has a well-established safety record, its use as a spray to specifically tackle seroma formation has not been extensively studied.

This study aims to bridge this gap by exploring the potential of adrenaline spray to reduce seroma formation. Innovative solutions like this are crucial to improving post-operative outcomes and patient recovery. The findings from this research could lead to significant advancements in surgical care, offering a simple and cost-effective strategy to minimize complications following hernioplasty.

Methods

The Surgical Unit at Ayub Teaching Hospital in Abbottabad, a tertiary care facility known for performing a large number of hernioplasty surgeries, was the site of our six-month randomized controlled study (RCT). Participants were recruited if they were scheduled for elective hernioplasty and satisfied the inclusion criteria. Adults between the ages of 18 and 65 who gave written informed permission and had a Body Mass Index (BMI) between 18.5 and 40 were eligible participants. Patients with known allergies to adrenaline, conditions that exclude its usage (such as uncontrolled hypertension), and those who were severely underweight or obese were not included in our study.

The required approval was obtained from the medical ethics committee of the institution for this research project. All data were anonymised, safely kept, and only the study team had access to them in order to preserve participant confidentiality. Participants were made aware that their participation was completely voluntary and that their medical care would not be impacted if they choose to stop at any time. This study has the potential to be beneficial since it can provide evidence for an affordable intervention to lower post-operative problems in patients who have had hernioplasty. To guarantee patient safety, the surgical team kept a careful eye on any dangers related to the use of adrenaline spray, such as uncommon allergic responses or variations in blood pressure.

The sample size was calculated using the WHO sample size calculator, considering an expected seroma incidence of 11%, a precision of 5%, and a confidence interval of 95% [10]. A total of 151 participants were recruited and randomly allocated to either the intervention group or the control group using permuted block randomization. This method ensured balanced group sizes and minimized selection bias. To make the distribution of patients equal in each group, we included a total of 152 participants in our study, with 76 subjects in each group. Participants in the intervention group received an intraoperative application of adrenaline spray to the wound site after hernioplasty. The control group underwent the standard surgical procedure without adrenaline spray. Both groups were managed post-operatively according to standard protocols, including appropriate pain management and wound care.

Data were collected at multiple time points: pre-operatively (baseline), during the ward stay post-operatively before discharge, and the thirtieth day post-surgery, usually the first or second follow-up visit. The primary outcome measure was the incidence of seroma formation, assessed clinically and through ultrasound if required. Secondary outcomes included post-operative recovery time (measured by length of hospital stay in days) and the incidence of post-operative complications such as infection and wound dehiscence assessed at the follow-up visits. Data were entered into SPSS version 27.0 for statistical analysis. Descriptive statistics including frequency and percentages were used to summarize the demographic and clinical characteristics of participants. Comparative analyses between the intervention and control groups were conducted using t-tests for continuous variables and chi-square tests for categorical variables. A p-value of <0.05 was considered statistically significant.

Results

We included two groups of 76 participants each. Table 1 compares the age and BMI of both the group participants. Both groups are similar, with no statistically significant differences observed in age (P = 0.870) or BMI (P = 0.897).

As can be seen in table 2, gender, age group distribution, BMI categories, and comorbid conditions showed no significant differences (P > 0.05) with respect to the group (experimental and control groups). Seroma formation was significantly higher in the control group (21.1% vs. 7.9%, P = 0.021), while seroma severity approached significance (P = 0.057). Post-operative complications and hospital stay duration were similar between the groups, with no statistical significance (P > 0.05).

Table 3 compares age and BMI between individuals with and without seroma formation. The mean age of individuals without seroma formation was 42.96 years (SD = 11.776), while those with seroma had a mean age of 45.50 years (SD = 12.420), with no statistically significant difference observed (P = 0.355). Similarly, the mean BMI was 29.054 (SD = 6.3170) for individuals without seroma and 29.868 (SD = 6.0600) for those with seroma, with no significant difference noted (P = 0.575).

Discussion

Our findings highlight the potential role of adrenaline spray in reducing seroma formation and its implications for post-operative recovery. The experimental group demonstrated a significantly lower incidence of seroma formation (7.9%) compared to the control group (21.1%) with a P-value of 0.021, indicating that adrenaline spray effectively minimizes fluid accumulation, likely due to its vasoconstrictive and anti-inflammatory properties. These results align with the principles outlined in previous literature, where topical agents that enhance hemostasis and reduce tissue inflammation have shown efficacy in similar surgical contexts [11, 12].

The use of adrenaline spray in surgical settings to reduce seroma formation finds support in the broader literature on topical hemostatic agents. Fibrin sealants, widely studied and utilized in surgical specialties, have demonstrated significant benefits in enhancing hemostasis, stabilizing clots, and reducing fluid accumulation. For instance, Albala et al. reviewed the applications of fibrin sealants in surgery, emphasizing their ability to improve surgical outcomes by preventing complications like seroma and hematoma [11]. Similarly, Clark's systematic survey highlighted the role of fibrin sealants in wound repair, particularly in minimizing post-operative fluid accumulation, suggesting that vasoconstrictive agents like adrenaline spray may achieve comparable benefits in hernioplasty wound management [13, 14].

Comparative studies also underline the effectiveness of advanced topical agents in hernia repair. Eriksen et al., compared fibrin sealants to titanium tacks for mesh fixation during laparoscopic hernia repair [15]. They reported significant reductions in post-operative pain and seroma formation, illustrating the impact of targeting inflammatory and hemostatic pathways [15]. These findings parallel the outcomes of the current study, where adrenaline spray significantly reduced seroma incidence. Furthermore, Olutoye et al. reviewed acute wound management strategies and emphasized the importance of mitigating fluid accumulation through effective interventions, reinforcing the relevance of adrenaline spray as a safe and effective adjunct in surgical procedures [16].

Historically, the development of hemostatic agents has focused on improving outcomes in challenging surgical environments. Di Benedetto and Tarantino traced the evolution of these agents, noting their effectiveness in managing surgical complications [12]. Adrenaline, as a potent vasoconstrictor, aligns with this trajectory, providing a practical and evidence-based solution for reducing seroma in hernioplasty. The integration of such agents into routine surgical practice is supported by findings from the present study, which contribute to the growing body of evidence that innovative topical agents can significantly enhance surgical outcomes. Although the severity of seroma approached statistical significance (P = 0.057), the experimental group exhibited a trend toward milder seroma cases compared to the control group. This indicates a potential role of adrenaline spray not only in reducing the incidence of seroma but also in mitigating its severity. These results highlight its clinical relevance, as seromas can delay wound healing and increase the risk of infection.

Infection, wound dehiscence, and other post-operative complications did not significantly differ across the groups in our research (P = 0.241). According to this, adrenaline spray is safe to use as a supplement in the care of hernioplasty wounds since it efficiently lowers seroma development without causing any problems or posing any new hazards. Additionally, the length of hospitalization was similar for both groups (P = 0.876), suggesting that using adrenaline spray had no detrimental effects on recovery time. These results most likely reflect comparable complication rates in both groups and consistent post-operative treatment.

Age, BMI, and concurrent health conditions were among the important demographic variables that were well-matched between the groups. This equilibrium guarantees that the intervention, not outside influences, is solely responsible for the observed decrease in seroma development. The study's validity and reliability are further supported by the lack of notable variations in baseline parameters. All things considered, our findings show that adrenaline spray is a viable and secure choice for lowering seroma development in patients undergoing hernioplasty. This strategy has great potential for clinical practice by enhancing patient outcomes and maybe lowering the healthcare cost related to seroma treatment.

Conclusion

We observed that the use of adrenaline spray can significantly reduce seroma formation without extending recovery time or increasing the risk of complications. Our findings are a strong evidence to support the efficacy of adrenaline spray as a standard intervention in hernioplasty procedures.

Recommendations

1. **Adopt adrenaline spray in routine hernioplasty protocols.**
2. **Larger-scale studies to confirm these findings and evaluate long-term outcomes.**
3. **Investigation of the use of adrenaline spray in other surgeries to expand its benefits across various surgical specialties.**

Figures

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Ethics Statement

Approved by the medical ethics committee of Ayub Medical Teaching Institution (AMTI), Abbottabad (RC-EA- 2025-015).

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Tables

Table 1. Comparison of Age and BMI Between Experimental and Control Groups

Group		N	Mean	SD	P value
Age (years)	Experimental Group	76	43.49	12.552	0.870
	Control Group	76	43.17	11.212	
BMI (Kg/m^2)	Experimental Group	76	29.11	6.285	0.897
	Control Group	76	29.24	6.291	

Table 2. Demographic and Clinical Characteristics of Experimental and Control Groups

Categories		Experimental Group N (%)	Control Group N (%)	Total N (%)	P value
Gender	Female	35 (46.1%)	38 (50.0%)	73 (48.0%)	0.626
	Male	41 (53.9%)	38 (50.0%)	79 (52.0%)	
Age Groups	18-30	15 (19.7%)	16 (21.1%)	31 (20.4%)	0.674
	31-45	24 (31.6%)	30 (39.5%)	54 (35.5%)	
	46-60	31 (40.8%)	26 (34.2%)	57 (37.5%)	
	61-65	6 (7.9%)	4 (5.3%)	10 (6.6%)	
BMI Category	Normal	25 (32.9%)	24 (31.6%)	49 (32.2%)	0.982
	Obese	33 (43.4%)	34 (44.7%)	67 (44.1%)	
	Overweight	18 (23.7%)	18 (23.7%)	36 (23.7%)	
Comorbid	Both	5 (6.6%)	12 (15.8%)	17 (11.2%)	0.320
	Diabetes	14 (18.4%)	14 (18.4%)	28 (18.4%)	
	Hypertension	18 (23.7%)	14 (18.4%)	32 (21.1%)	
	None	39 (51.3%)	36 (47.4%)	75 (49.3%)	
Seroma Formation	No	70 (92.1%)	60 (78.9%)	130 (85.5%)	0.021
	Yes	6 (7.9%)	16 (21.1%)	22 (14.5%)	
Seroma Severity	Mild	4 (5.3%)	13 (17.1%)	17 (11.2%)	0.057
	None	70 (92.1%)	60 (78.9%)	130 (85.5%)	
	Severe	2 (2.6%)	3 (3.9%)	5 (3.3%)	
Post-Op Complications	Infection	8 (10.5%)	15 (19.7%)	23 (15.1%)	0.241
	None	66 (86.8%)	58 (76.3%)	124 (81.6%)	
	Wound Dehiscence	2 (2.6%)	3 (3.9%)	5 (3.3%)	
Hospital Stay (Days)	3	14 (18.4%)	10 (13.2%)	24 (15.8%)	0.876
	4	13 (17.1%)	11 (14.5%)	24 (15.8%)	
	5	8 (10.5%)	12 (15.8%)	20 (13.2%)	
	6	7 (9.2%)	10 (13.2%)	17 (11.2%)	
	7	13 (17.1%)	13 (17.1%)	26 (17.1%)	
	8	11 (14.5%)	12 (15.8%)	23 (15.1%)	
	9	10 (13.2%)	8 (10.5%)	18 (11.8%)	

Table 3. Comparison of patients with and without Seroma on the basis of Age and BMI

Seroma Formation		N	Mean	Std. Deviation	P value
Age	No	130	42.96	11.78	0.355
	Yes	22	45.50	12.42	
BMI	No	130	29.05	6.32	0.575
	Yes	22	29.87	6.06	