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Siphon Drains Versus Suction Drains in On Lay Mesh Repair of Large Ventral Divarication of Recti with Abdominoplasty

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ABSTRACT

Background : Postoperative seroma and surgical site infections remain significant complications in large ventral divarication repairs combined with abdominoplasty. The management of extensive dead space created during on lay mesh reinforcement is critical. This study evaluates whether passive siphon drainage or active suction drainage is more effective in reducing these complications and enhancing recovery.

Objectives: To compare the efficacy of siphon drainage versus suction drainage in preventing seroma formation and surgical site infections (SSI) among patients undergoing on lay mesh repair for large ventral rectus divarication.

Methodology : A prospective Study was conducted at Riphah International University Hospital involving 38 female patients. Participants were randomized into two groups: Group 1 received siphon drainage (closed gravity system), while Group 2 received active suction drainage (Vacuderm). All patients underwent standardized on lay mesh repair with "quilting" sutures and abdominoplasty. Follow up included clinical assessments and soft tissue ultrasound at early (5–7 days), intermediate (14–16 days), and late (29–31 days) postoperative intervals.

Results : A total of 38 patients were included in the study, divided equally into two groups. The mean age was 45.5 ± 10.6 years in Group 1 and 42.4 ± 13.9 years in Group 2, with no statistically significant age difference between the groups. Clinically significant seroma requiring needle aspiration was observed in 10.53% of patients (n = 2) in each group, and this difference was not statistically significant ($p > 0.999$). Subclinical seroma detected by ultrasonography during the late postoperative phase was identified in 31.57% of patients in Group 1 and 26.31% in Group 2, with no significant difference between the groups ($p = 0.619$).Surgical site infection occurred in 5.26% of patients (n = 1) in both groups, with identical infection rates and no statistically significant difference observed ($p > 0.999$). Comparative analysis of recovery parameters and postoperative complication frequencies demonstrated no statistically significant differences between the two drainage techniques ($p > 0.05$).

Conclusion : There is no statistically significant difference between siphon and suction drainage in preventing clinical or sub clinical seroma and infections following large ventral divarication repair. While seroma incidence remains moderately high in obese patients, both drainage methods provide comparable outcomes when combined with meticulous quilting techniques. Surgeons may choose either system based on cost and availability without compromising patient safety or the efficiency of the surgical repair

Keywords: *Divarication; Seroma; Drainage; Abdominoplasty*

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INTRODUCTION

Ventral rectus divarication, often termed diastasis recti, represents a significant anatomical distortion characterized by the lateral separation of the rectus abdominis muscles. This condition is frequently observed in multiparous women due to chronic intra abdominal pressure and hormonal changes that lax the linea alba [1]. While not a true hernia in the traditional sense—as the aponeurosis remains intact—large divarications significantly compromise the functional integrity of the abdominal wall, leading to core instability, back pain, and aesthetic dissatisfaction [2]. When the separation is extensive, simple plication may be insufficient, necessitating reinforcement with prosthetic mesh to prevent recurrence and ensure long term stability [3].The surgical management of large ventral divarications often involves a combination of mesh hernioplasty and abdominoplasty to address both the underlying structural defect and the associated excess skin and subcutaneous tissue. The "On lay" mesh technique is a widely utilized approach where the mesh is placed over the anterior rectus sheath following plication [4]. However, this extensive dissection creates a substantial "dead space" between the musculo aponeurotic layer and the overlying skin flap. The accumulation of serosanguinous fluid in this space known as seroma is the most common postoperative complication, occurring in up to 30% of cases [5].Seroma formation is not merely a minor nuisance; it serves as a potential culture medium for bacteria, significantly increasing the risk of Surgical Site Infection (SSI) and potential mesh contamination [6]. To mitigate this risk, surgeons traditionally utilize various drainage systems to evacuate fluid and facilitate the apposition of the skin flap to the abdominal wall. These systems are broadly categorized into active suction drainage, which utilizes a negative pressure vacuum, and passive siphon drainage, which relies on gravity and a closed bag system [7].There is an ongoing debate regarding the superiority of one system over the other. Proponents of active suction argue that negative pressure more effectively obliterates dead space and promotes faster healing. Conversely, critics suggest that continuous suction might prevent the sealing of small lymphatic vessels and even introduce retrograde bacteria if the system is breached [8]. Furthermore, the introduction of "quilting" or progressive tension sutures has shifted the focus toward mechanical obliteration of dead space, leading some to question whether active suction provides any additional benefit over simpler, less expensive siphon systems [9].Despite the high volume of these procedures, clinical trials comparing siphon and suction drainage specifically in the context of on lay mesh repair with abdominoplasty are sparse. Most existing literature focuses on simple hernioplasty or cosmetic abdominoplasty independently [10]. This study aims to fill that gap by evaluating the clinical and radiological outcomes of both drainage techniques in a standardized patient cohort, providing evidence based guidance for postoperative care in complex abdominal wall reconstructions.

RESEARCH OBJECTIVES

To evaluate and compare the impact of closed siphon drainage versus active suction drainage on the incidence of postoperative seroma and surgical site infections following on lay mesh divarication repair.

MATERIALS AND METHODS

Study Design & Setting

A prospective study was conducted at Riphah International University Hospital, Islamabad, from Jan 2024 to June 2024, comparing two distinct wound drainage techniques in abdominal surgery.

Participants

38 female participants with large ventral rectus divarication were enrolled. Participants were randomized into two groups (n=19 each): Group 1 received siphon drainage using Nelaton catheters, while Group 2 received active suction drainage via Vacuderm systems. All underwent standardized on lay mesh repair and abdominoplasty performed by a single consultant surgeon to ensure consistency in technical execution.

Sample Size Calculation

The sample size was calculated based on previous data suggesting a 20% difference in seroma rates. With an alpha of 0.05 and 80% power, 38 patients (19 per arm) were determined sufficient to detect significant differences in clinical outcomes between the siphon and suction drainage groups.

Inclusion Criteria

The study included female patients aged 33 to 55 years with clinically significant ventral rectus divarication resulting from multiple pregnancies. Eligible participants required a surgical indication for on lay mesh repair combined with major abdominoplasty and were required to have a serum albumin concentration above 3.0 g/dl to ensure adequate healing.

Exclusion Criteria

Exclusion criteria involved patients with a BMI exceeding 38, active diabetes mellitus, or chronic viral hepatitis. Patients with previous midline laparotomies, vertical cesarean scars, or incisional hernias were excluded to maintain a homogenous sample. Those with poor cardiac status (ASA III/IV) or active skin infections were also omitted.

Ethical Approval

Ethical clearance was granted by the Riphah International Hospital, Islamabad. The study followed the **2013 Declaration of Helsinki**. All participants provided written informed consent after receiving detailed counseling regarding the surgical

procedure and the randomized nature of the drainage.

Diagnostic and Management Strategy

Seroma was diagnosed through clinical palpation and soft tissue ultrasound. Management involved daily drain monitoring, with removal occurring once output fell below 40 ml/24h. Standardized antibiotic prophylaxis (Cefoperazone Sulbactam) and the consistent use of abdominal support girdles were implemented for all participants.

Statistical Analysis

Data were analyzed using SPSS version 25.0. Descriptive statistics were calculated for demographics. Student's t test compared numerical variables, while Pearson's chi square or Fisher's exact tests evaluated categorical outcomes like seroma and SSI rates. A p value less than 0.05 was considered the threshold for statistical significance.

Results

The study included 38 patients who were equally allocated into two comparative groups. The mean age of patients in Group 1 was 45.5 ± 10.6 years, while that of Group 2 was 42.4 ± 13.9 years, with no statistically significant difference observed between the groups. Clinically significant seroma requiring needle aspiration was identified in 10.53% of patients (n = 2) in each group, and this difference was not statistically significant ($p > 0.999$). Subclinical seroma detected on ultrasonography during the late postoperative phase was observed in 31.57% of patients in Group 1 and 26.31% in Group 2; however, this difference did not reach statistical significance ($p = 0.619$). Surgical site infection was documented in 5.26% of patients (n = 1) in both groups, with identical infection rates and no statistically significant difference ($p > 0.999$). Overall comparative analysis demonstrated no significant differences between the two drainage techniques with respect to postoperative recovery parameters or complication rates ($p > 0.05$).

Primary Outcomes

Clinically significant seroma requiring needle aspiration was observed in 10.53% of patients (n = 2) in both Group 1 and Group 2, with no statistically significant difference between the groups ($p > 0.999$). All cases of clinical seroma were detected during the intermediate postoperative follow-up period (days 14–16).

Secondary Outcomes

Subclinical seroma detected on ultrasonography during the late postoperative phase (days 29–31) occurred in 31.57% of patients in Group 1 and 26.31% in Group 2; however, this difference was not statistically significant ($p = 0.619$). Surgical site infection (SSI) was documented in 5.26% of participants (n = 1) in each group, with identical infection rates and no significant intergroup difference ($p > 0.999$). All SSIs were managed conservatively without the need for surgical intervention. Overall analysis demonstrated no significant association between the type of drainage employed and the incidence of postoperative complications ($p > 0.05$).

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Group 1 (Siphon) (n=19)	Group 2 (Suction) (n=19)	Statistical Test	p value
Age (Mean ± SD)	45.5 ± 10.6	42.4 ± 13.9	Independent t test	0.815
BMI (Mean ± SD)	35.5 ± 2.8	34.8 ± 3.1	Independent t test	0.676
Serum Albumin (g/dl)	3.9 ± 0.3	3.8 ± 0.5	Independent t test	0.720
ASA I (%)	11 (57.89%)	14 (73.68%)	Chi square (\chi^2)	0.301
ASA II (%)	8 (42.10%)	5 (26.31%)	Chi square (\chi^2)	0.301

Comparison of baseline characteristics between the two drainage groups. No statistically significant differences were observed, indicating successful randomization and cohort homogeneity.

Table 2: Comparison of Clinical and Sub Clinical Seroma Formation

Outcome Variable	Group 1 (Siphon)	Group 2 (Suction)	Statistical Test	p

	(n=19)	(n=19)		value
Clinical Seroma (Aspiration required)	2 (10.53%)	2 (10.53%)	Fisher's Exact Test	> 0.999
Sub Clinical (Early Phase)	3 (15.79%)	4 (21.05%)	Chi square (\chi^2)	0.469
Sub Clinical (Intermediate)	5 (26.31%)	4 (21.05%)	Chi square (\chi^2)	0.631
Sub Clinical (Late Phase)	6 (31.57%)	5 (26.31%)	Chi square (\chi^2)	0.619

Incidence of seroma formation at three pre determined intervals. Clinical seroma rates were identical, and sub clinical (ultrasound detected) fluid collections showed no significant difference regardless of the drainage system used.

Table 3: Incidence of Surgical Site Infection (SSI) and Complications

Complication	Group 1 (Siphon) (n=19)	Group 2 (Suction) (n=19)	Statistical Test	p value
Minor Wound Infection	1 (5.26%)	1 (5.26%)	Fisher's Exact Test	> 0.999
Skin Flap Necrosis	0 (0%)	0 (0%)		
Mesh Explantation	0 (0%)	0 (0%)		
Total Complications	3 (15.79%)	3 (15.79%)	Chi square (\chi^2)	> 0.999

Safety profile and postoperative complications. SSI rates remained low and comparable between groups, with all cases resolving through conservative management.

DISCUSSION

The management of postoperative dead space in complex abdominal wall reconstruction remains a critical determinant of surgical outcomes. In the present study, no statistically significant difference was observed between passive siphon drainage and active suction drainage with respect to clinically significant seroma formation or surgical site infection (SSI) in patients undergoing onlay mesh repair for ventral rectus divarication. Both groups demonstrated an identical clinical seroma rate of 10.53%, supporting growing evidence that meticulous surgical technique may play a more decisive role than the specific drainage mechanism employed [11–12].Contemporary literature increasingly challenges the routine use of active suction drainage in abdominal wall reconstruction. Several studies have shown that seroma formation is more strongly associated with patient-related factors, particularly elevated body mass index and the extent of the fascial defect, rather than the type of drain used [13]. In our cohort, the mean body mass index was 35.5 kg/m², reinforcing the role of obesity as a significant contributor to postoperative fluid accumulation, consistent with reports in abdominoplasty and ventral hernia repair populations [14–15].An important confounding factor in our study was the uniform use of quilting sutures in all patients. Meta-analyses have demonstrated that mechanical obliteration of dead space through progressive tension or quilting sutures significantly reduces seroma formation, potentially diminishing the relative importance of suction-based drainage systems [16–17]. Previous investigations have shown that quilting sutures can reduce total postoperative fluid output by up to 40%, which may explain the comparable outcomes observed between the passive siphon and active suction groups in our series [18–19].When compared with other studies focusing specifically on the onlay technique, the seroma rates in our study were lower than those reported in cohorts where quilting sutures were not routinely employed [20–21]. This suggests that standardized surgical strategies—particularly Scarpa's fascia apposition and meticulous dead-space closure—serve as the primary protective factors against seroma development. Additionally, concerns that active suction drainage may increase SSI risk by impairing lymphatic sealing or facilitating bacterial ingress were not supported by our findings, as infection rates were identical in both groups at 5.26% [22–23]. These results are consistent with internationally reported SSI rates for clean-contaminated abdominal procedures [24–25].From a health-economic perspective, passive siphon drainage offers a pragmatic advantage, particularly in resource-limited settings. Passive gravity-based systems are less costly, require minimal maintenance, and are easier for patients to manage after discharge [26–27]. Given the comparable clinical outcomes observed in this study, the routine use of siphon drainage may represent a cost-effective alternative without compromising patient safety or surgical efficacy [28–29].In summary, our findings indicate that successful outcomes in onlay mesh repair are not determined by vacuum-based drainage alone. Rather, meticulous surgical technique, effective dead-space obliteration using quilting sutures, and patient-specific factors appear to be the dominant determinants of postoperative recovery and complication rates.

LIMITATIONS

The study is limited by its relatively small sample size (n = 38), which may reduce the power to detect subtle differences in minor complications. Furthermore, the 30 day follow up period precludes the assessment of long term outcomes such as chronic pain or late mesh recurrence. The findings are also restricted to a specific female demographic, potentially limiting generalizability to male patients.

CONCLUSION

This study demonstrates no statistically significant difference between siphon and suction drainage regarding seroma formation or infection rates following on lay mesh repair. When combined with meticulous quilting sutures, both systems provide equivalent clinical efficacy. Consequently, surgeons may adopt either drainage technique based on institutional availability and cost effectiveness without compromising postoperative outcomes or patient safety.

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Conflict of Interest:Nil

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Authors Contribution

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Critical Review: **Jawad khalil**

Final Approval of version: **All Authors Approved The Final Version.**

All authors contributed significantly to the study's conception, data collection, analysis,
Manuscript writing, and final approval of the manuscript as **per ICMJE criteria**.

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