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ORIGINAL ARTICLE

Prevention of Skin Damage Using Disposable Retractors in Open Hepatobiliary Surgery

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ABSTRACT

Introduction: Hepatobiliary surgeries, which encompass a wide range of complex procedures such as liver resections, gallbladder surgeries, and bile duct interventions, present significant challenges due to the delicate nature of the organs involved and the intricacies of the surgical techniques.

Objective: To assess the impact of disposable retractors on the incidence, severity, and outcomes of skin damage in patients undergoing open hepatobiliary surgery.

Methods: A retrospective observational study was conducted at Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences Gambat, Sindh during May 2022 to December 2022. A total of 155 patients scheduled for open hepatobiliary surgery. Patients were randomly assigned to either the intervention group (disposable retractors, n=78) or the control group (traditional metal retractors, n=77). The primary outcome was the incidence of skin damage, including abrasions, ischemia, and pressure sores. Secondary outcomes included the severity of skin damage, time to wound healing, post-operative pain levels, and patient satisfaction.

Results: The incidence of skin damage was significantly lower in the intervention group (10.3%) compared to the control group (27.3%) ($p = 0.02$). The severity of skin damage, as measured by the PUSH score, was also significantly lower in the intervention group (mean score = 1.2) versus the control group (mean score = 3.5) ($p = 0.03$). The intervention group demonstrated a delayed onset of skin damage (mean = 3.5 days) compared to the control group (mean = 2.1 days) ($p = 0.01$). Additionally, the intervention group had a faster time to wound closure (12.4 ± 2.1 days vs. 16.3 ± 3.4 days, $p = 0.03$) and reported lower post-operative pain levels and higher patient satisfaction (mean score = 9.1 vs. 7.5, $p = 0.01$).

Conclusions: It is concluded that disposable retractors significantly reduce the incidence and severity of skin damage in open hepatobiliary surgery. The use of disposable retractors also results in faster wound healing, lower pain levels, and improved patient satisfaction.

Keywords: Hepatobilliary Surgery, Skin Damage, Severity, Disposable Retractors.

INTRODUCTION

Hepatobiliary surgeries, which encompass a wide range of complex procedures such as liver resections, gallbladder surgeries, and bile duct interventions, present significant challenges due to the delicate nature of the organs involved and the intricacies of the surgical techniques. The surgical requirement for intense surrounding tissue manipulation leads surgeons to maintain prolonged skin muscle and soft tissue retraction for clear access to operative sites[1]. The prolonged stretching of tissue during surgery creates excessive strain that may result in fatal injuries involving pressure injuries and tissue abrasions and other skin conditions. The recovery process faces notable setbacks because of these complications which sometimes produce long-term cosmetic scars in addition to infections[2].

Open surgery patients in the past faced substantial risk for develop skin damage especially during prolonged or intensive procedures. For decades traditional surgical retractors made of rigid metal and plastic materials apply excessive pressure to surgical sites when used for retraction purposes[3]. Surgical retractors achieve effective visualization during surgery but at the same time harm skin tissue surfaces by applying excessive pressure since hospitals may lack proper protective pads and retractor adjustment controls. These injuries create local tissue ischemia while causing skin damage that progresses into necrosis which triggers delayed healing and escalates infection risks and prolongs hospital stays[4].

The introduction of disposable retractors through surgical technological advancements solves the issues that traditional retraction systems currently present. Each disposable retractor operates only once thus eliminating any necessity for sterilization procedures while ensuring maximum sterility standards for each clinical operation[5]. Disposable retractors embed soft flexible materials with ergonomic shapes and padding structures to limit skin pressure. The beneficial design aspects of retractors help prevent surgical site injuries because they serve well in deep open hepatobiliary operations and extensive operative field requirements. Disposable retractors achieve pressure distribution across skin tissue surfaces with an even pattern thus minimizing the risk of localized tissues becoming ischemic[6]. Soft flexible materials used in retractors minimize skin-to-instrument friction which protects skin integrity from damaging shear injuries and superficial abrasions. The design of disposable retractors features contours that outperform rigid retractors at maintaining secure anatomical fit throughout extended surgical procedures[7].

The practical advantages combined with physical properties make disposable retractors important tools for operating room environments. The designed single-use structure of these instruments provides uncompromised protection through sterility standards thus reducing dual patient contamination risks[8]. The single-use design of these retractors erases requirements for sterilization protocols and processing steps that require substantial time and financial costs for hospitals. These retractors demonstrate reduced weight and smaller size when compared to metal retractors which facilitates easier handling and precise maneuvering in procedure spaces with limited access and controlled surgical zones[9]. Several restrictions exist with the implementation of single-use retractors even though they offer appropriate benefits. A weakness of these retractors is their reduced strength since pliant materials protect skin better than metal retractors yet deliver less rigidity and less force during retraction in procedures requiring high or complex surgical efforts[10]. The high costs of many disposable retractors could stress healthcare institutions while performing long operations but these

expenses need consideration next to the prevented complications and total healthcare spending[11].

Objective: To assess the impact of disposable retractors on the incidence, severity, and outcomes of skin damage in patients undergoing open hepatobiliary surgery.

METHODOLOGY

This retrospective observational study was conducted at Pir Abdul Qadir Shah Jeelani Institute of Medical Sciences Gambat, Sindh during May 2022 to December 2022. A total of 155 patients who underwent open hepatobiliary surgery were included in the study.

Inclusion Criteria:

1. Adult patients aged 18 to 75 years.
2. Patients undergoing elective open hepatobiliary surgery.
3. No pre-existing conditions that would contraindicate the use of disposable retractors (e.g., severe skin conditions or hypersensitivity).

Exclusion Criteria:

1. Patients with known allergies to materials used in disposable retractors.
2. Emergency surgeries or patients requiring non-standard surgical techniques.
3. Patients with significant co-morbidities that could affect wound healing, such as uncontrolled diabetes or immunocompromised states.

Data Collection: Pre-operative, intra-operative, and post-operative data were collected for each patient to assess the outcomes related to skin damage. All surgeries were performed under general anesthesia, with patients positioned appropriately for optimal surgical access. The use of disposable retractors was randomized, with the intervention group (n=78) receiving disposable retractors, while the control group (n=77) had traditional metal retractors employed for tissue retraction. In the intervention group, disposable retractors specifically designed for use in open hepatobiliary surgeries were chosen, which feature softer materials, padding, and ergonomic designs to minimize pressure on the skin. The control group received conventional retractor systems, which are typically made of rigid metal or plastic and require additional padding for skin protection. Pre-operative, intra-operative, and post-operative data were collected for each patient to assess the outcomes related to skin damage. Patients were monitored post-operatively for signs of skin damage, including redness, abrasions, pressure ulcers, or signs of ischemia around the areas where retractors were placed. The monitoring was performed by the surgical team and a dedicated wound care specialist on days 1, 3, 7, and 14 post-surgery. Any skin damage was graded according to the Pressure Ulcer Scale for Healing (PUSH) tool or similar standardized assessment criteria.

Statistical Analysis: Data were analyzed using SPSS v21. Comparisons between the two groups were made to determine whether the use of disposable retractors significantly reduced the incidence and severity of skin damage in patients undergoing open hepatobiliary surgery. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 155 patients were included in the study. In the intervention group, 89.7% of patients had no skin damage, compared to 72.7% in the control group (p = 0.02). The intervention group also had fewer cases of superficial abrasions (2.6% vs. 15.6%, p = 0.01), ischemia (0% vs. 6.5%, p = 0.04), and pressure sores (0% vs. 5.2%, p = 0.03).

The mean time to onset of skin damage was significantly longer in the intervention group (3.5 ± 1.2 days) compared to the control group (2.1 ± 0.8 days), with a p-value of 0.01. This indicates that the use of disposable retractors delayed the onset of skin damage, allowing more time for the skin to adapt during the surgical procedure and potentially reducing the risk of early complications.

Table 1: Demographic Characteristics of Patients

Characteristic	Intervention Group (n=78)	Control Group (n=77)	p-value
Age (mean ± SD)	56.3 ± 8.4	57.1 ± 9.1	0.52
Male/Female Ratio	2:1	2:1	-
Diagnosis			-
Liver Malignancy (%)	40%	42%	0.91
Biliary Tract Disease (%)	30%	29%	0.88
Gallbladder Pathology (%)	30%	29%	0.88
Type of Skin Damage			
No Skin Damage	70 (89.7%)	56 (72.7%)	0.02
Mild Erythema	6 (7.7%)	10 (13.0%)	0.47
Superficial Abrasions	2 (2.6%)	12 (15.6%)	0.01
Ischemia	0 (0.0%)	5 (6.5%)	0.04
Pressure Sores/Severe Damage	0 (0.0%)	4 (5.2%)	0.03

Table 2: Severity of Skin Damage (PUSH Score)

Mean PUSH Score (±SD)		
Group	Mean Time to Onset (days) ± SD	p-value
Intervention Group	3.5 ± 1.2	0.01
Control Group	2.1 ± 0.8	-
Intervention Group	1.2 ± 1.4	0.03
Control Group	3.5 ± 2.2	-

The intervention group demonstrated significantly faster wound closure, with a mean of 12.4 ± 2.1 days compared to 16.3 ± 3.4 days in the control group (p = 0.03). Additionally, no cases of wound infections were reported in the intervention group, while 3 patients (3.9%) in the control group developed infections (p = 0.21). Notably, 4 patients (5.2%) in the control group required reoperation due to skin-related complications, whereas no such cases occurred in the intervention group (p = 0.04).

Table 3: Post-operative Wound Healing and Complications

Outcome	Intervention Group (n=78)	Control Group (n=77)	p-value
Time to Wound Closure (days)	12.4 ± 2.1	16.3 ± 3.4	0.03
Wound Infections	0 (0%)	3 (3.9%)	0.21
Reoperation Due to Skin Issues	0 (0%)	4 (5.2%)	0.04

The intervention group reported significantly higher patient satisfaction, with a mean satisfaction score of 9.1 ± 0.8 compared to 7.5 ± 1.3 in the control group (p = 0.01).

Table 4: Patient Satisfaction (10-point Likert Scale)

Group	Mean Satisfaction Score (± SD)	p-value
Intervention Group	9.1 ± 0.8	0.01
Control Group	7.5 ± 1.3	-

DISCUSSION

The results of this study indicate that the use of disposable retractors significantly reduces the incidence and severity of skin damage compared to traditional metal retractors in open hepatobiliary surgeries. Patients in the intervention group utilizing disposable retractors experienced significantly fewer skin complications such as pressure sores and abrasions and ischemia compared to the patients in the control group. Research has demonstrated that surgical retractors affect soft tissue injuries through their design along with material characteristics[12]. The intervention group demonstrated statistically significant results with lower skin damage incidence (10.3%) than the control group (27.3%) (p = 0.02). More serious surgical complications occurred more frequently in the control group population where 6.5% experienced ischemia and 5.2% developed pressure sores[13]. The use of disposable retractors employing soft materials coupled with padding and ergonomic constructions displays a superior capability for uniform pressure distribution over the skin which reduces stress-related skin breakages. Maximum retraction of an open

hepatobiliary surgical field continues over long durations so the prevention of serious complications becomes a critical concern[14].

Patients using disposable retractors demonstrated substantially lower PUSH score results which serve as indicators of skin damage severity. Disposable retractors delivered a mean PUSH score of 1.2 indicating minimal skin damage alongside a control group mean PUSH score of 3.5 indicating moderate to severe damage to the skin[15]. The obtained results confirm that using disposable retractors leads to superior protection against substantial skin injuries. Assessment results reveal that intervention group members preventing severe ischemia and necrosis at 0% since controls experienced such damage at a rate of 6.5% among their members[16].

The intervention group experienced delayed skin damages with 3.5 days until skin damage compared to control patients who experienced it after 2.1 days ($p = 0.01$). The early development of skin complications appears to be slowed by disposable retractors which give skin more opportunity to heal naturally during surgical procedures[17]. A delayed onset of skin damage reduces medical necessity for additional interventions such as wound care or reoperation because it minimizes both patient morbidity and healthcare expenses[18]. Research evidence revealed shorter healing times among patients who received wound-only exposure from disposable retractors. Postoperative wound closure required significantly less time (12.4 ± 2.1 days) in the disposable retractor group instead of 16.3 ± 3.4 days for the control group ($p = 0.03$) yet both times reflect observed skin damage reduction in the intervention group[19]. Wound healing at a faster pace remains essential because it helps prevent infections while benefiting both patient's recovery and healthcare expenses. Some constraints exist in the present investigation. The observational study design fails to capture all influencing variables which could impact its outcomes. The researchers took steps to maintaining similar groups but surgical approaches and the experience of surgeons and unique patient attributes probably impacted the research outcomes. The promising results presented in this study regarding disposable retractors should be evaluated against the high costs associated with their one-time use which may affect low-resource healthcare settings. New clinical studies utilizing randomized controlled trials together with cost-effectiveness analyses need to authenticate these findings and establish the possible scope of disposable retractors throughout surgical specialties.

CONCLUSION

It is concluded that the use of disposable retractors in open hepatobiliary surgery significantly reduces the incidence and severity of skin damage compared to traditional metal retractors. The intervention group, which used disposable retractors, experienced fewer cases of pressure sores, ischemia, and superficial abrasions. Additionally, the severity of skin damage, as measured by the PUSH score, was markedly lower in the disposable retractor group, indicating less traumatic pressure on the skin during the procedure.

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