ORIGINAL RESEARCH

Evaluation of Incidence and Risk Factors for Contact Dermatitis from Surgical Adhesives and Dressings: An Observational Study

[1]Dr. Ch Muthyam Reddy, [2]Dr. Sandeep Kumar, [3]Dr. B Shiny Shulamite, [4]Dr. Pranoti Deshpande

[1]Assistant Professor, Department of General Surgery, Malla Reddy Institute of Medical Sciences, Suraram, Hyderabad, Telangana, India
[2]Assistant Professor, Department of General Surgery, Gouri Devi Institute of Medical Sciences and Hospital, West Bengal, India
[3]Assistant Professor, Department of Dermatology, Dr. B.R. Ambedkar Medical College and Hospital, Bangalore, Karnataka, India
[4]Assistant Professor, Department of Dermatology, SVS Medical College, Telangana, India

Corresponding Author
Dr. Pranoti Deshpande
Assistant Professor, Department of Dermatology, SVS Medical College, Telangana, India

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ABSTRACT

Background: Medical adhesives and dressings are integral to postoperative wound care but may lead to contact dermatitis, a preventable yet under-recognized complication. Identifying its incidence and associated risk factors is essential for improving patient outcomes and guiding safer dressing practices. **Aim:** To evaluate the incidence of contact dermatitis related to surgical adhesives and dressings and to identify associated clinical and procedural risk factors in postoperative patients. **Material and Methods:** This hospital-based observational study was conducted in the Departments of Dermatology and Surgery at a tertiary care center. A total of 120 post-surgical patients aged ≥18 years requiring adhesive dressings were enrolled after applying inclusion and exclusion criteria. Patients were assessed on postoperative days 3, 5, 7, and during suture removal for signs of contact dermatitis. Clinical diagnosis was based on morphological skin changes, with patch testing in suspected cases. Risk factors such as diabetes, allergy history, dressing type, duration, and frequency of application were analyzed using univariate and multivariate statistical methods. **Results:** Out of 120 patients, 28 (23.33%) developed contact dermatitis. Most cases presented by postoperative day 5, with erythema and pruritus being the predominant manifestations. Diabetes (50% vs. 19.57%, p=0.003), prolonged dressing application (>7 days) (57.14% vs. 26.09%, p=0.004), allergy history (28.57% vs. 6.52%, p=0.005), and repeated adhesive exposure (35.71% vs. 17.39%, p=0.041) were significantly associated with dermatitis. Among dressing types, cyanoacrylate glue showed the highest incidence (38.10%, p=0.001), followed by surgical tape (18.52%, p=0.021), while hydrocolloid dressings had the lowest (8.33%, p=0.173). **Conclusion:** Contact dermatitis from surgical adhesives is a frequent postoperative complication. Diabetes, prior allergy, prolonged and repeated adhesive exposure are key risk factors. Cyanoacrylate glues exhibit the highest irritant potential. Prevention strategies should focus on high-risk patients, using skin-friendly materials and minimizing exposure duration.

Keywords: Contact dermatitis, surgical dressings, medical adhesives, cyanoacrylate, postoperative complications

INTRODUCTION

Postoperative care involves a complex interplay of wound protection, infection control, and tissue healing. One of the fundamental components of wound management is the use of surgical dressings and adhesives, which serve to secure medical devices, maintain a moist wound environment, and protect the site from external contaminants. However, the increasing utilization of various adhesives and occlusive materials has brought to light a growing clinical concern: medical adhesive-related skin injury (MARSI), including contact dermatitis. Though often underestimated, such reactions can lead to significant patient discomfort, delayed healing, secondary infections, and increased healthcare costs[1].

Medical adhesives, commonly used in tapes, dressings, and fixation devices, vary widely in their chemical composition and adhesive strength. While intended to enhance patient care, they may also disrupt the skin's integrity upon application or removal. The mechanical trauma, allergic response, or moisture imbalance caused by these materials can lead to the development of irritant or allergic contact dermatitis, particularly in vulnerable patient populations[2]. MARSI is now recognized as a preventable adverse event, prompting efforts to establish clinical guidelines and standardize assessment methods[3].

The incidence of contact dermatitis and other adhesive-related skin injuries is reportedly higher among patients with prolonged hospital stays, frequent dressing changes, or compromised skin conditions. Age-related dermal thinning, altered immune response, and comorbidities such as diabetes or chronic venous insufficiency further predispose certain populations to such injuries. Furthermore, repeated use of strong adhesives and insufficient skin protection protocols exacerbate the risk, making the identification of contributing factors essential for prevention[4].

Clinically, contact dermatitis due to surgical adhesives can range from mild erythema and itching to more severe manifestations such as vesiculation, skin stripping, and weeping lesions. These not only result in physical discomfort and psychological distress but may also necessitate treatment delays or modifications, thereby affecting surgical outcomes. Importantly, the burden of these adverse effects is often underreported due to misidentification or under-documentation in busy surgical and post-operative care settings[5].

Despite growing awareness, the true magnitude of MARSI and related dermatitis in surgical populations remains poorly quantified. Much of the existing data is derived from small studies or case series, with limited exploration into the specific risk factors and incidence in varied surgical subgroups. Studies comparing the safety profiles of different adhesive materials have demonstrated that certain formulations, particularly soft silicone dressings, may reduce the incidence of MARSI in high-risk patients[6]. However, implementation of such alternatives requires context-specific understanding of patient demographics, clinical practices, and material availability.

In acute care and postoperative environments, where frequent dressing changes are required, medical staff often prioritize adhesion strength and durability. This approach, though practical, can lead to repeated mechanical trauma to the skin upon removal, particularly when traditional acrylate-based adhesives are used. Research has shown that strong peel forces associated with certain tapes significantly correlate with discomfort and skin damage, underlining the importance of balancing efficacy with gentleness in material selection[7].

Contact dermatitis in the surgical setting is not merely a dermatological nuisance but a multifactorial clinical issue influenced by patient-related, procedural, and material-specific variables. Oncology patients, for example, are particularly susceptible due to immunosuppression and frequent device use. A multicenter study on peripherally inserted central catheter (PICC) sites demonstrated a high prevalence of MARSI, emphasizing the need for targeted strategies in high-risk units[8]. Moreover, among the elderly, natural age-related changes such as reduced dermal elasticity and slower cellular regeneration contribute to the skin's increased fragility. This group, often undergoing procedures for joint replacements or cardiac conditions, warrants special attention to skin-friendly dressing practices.

The complexity of differentiating allergic from irritant dermatitis adds another layer of diagnostic challenge. While patch testing may aid in establishing a diagnosis in persistent or recurrent cases, clinical acumen remains vital in early detection and intervention. Education of nursing and surgical staff on appropriate adhesive selection, skin preparation, and application techniques has been advocated as a cornerstone of MARSI prevention protocols[9].

MATERIAL AND METHODS

This hospital-based, observational study was conducted in the Department of Dermatology in collaboration with the Department of Surgery at a tertiary care teaching hospital, following approval from the Institutional Ethics Committee (IEC). The primary objective was to evaluate the incidence of contact dermatitis due to surgical adhesives and dressings and to identify associated risk factors in post-operative patients.A total of 120 patients who had undergone various elective or emergency surgical procedures and required the application of surgical adhesives or dressings were enrolled consecutively after obtaining written informed consent.

Inclusion Criteria

- Patients aged 18 years and above.
- Underwent any surgical procedure (general surgery, orthopaedics, obstetrics and gynaecology, plastic surgery, etc.).
- Had post-operative use of adhesives (e.g., cyanoacrylate-based glues) or dressings (tapes, bandages, hydrocolloids).
- Willing to participate and able to provide informed consent.

Exclusion Criteria

- Known history of allergic contact dermatitis or atopic dermatitis.
- Immunocompromised patients (e.g., HIV, cancer chemotherapy).
- Patients with pre-existing skin lesions over the operative site.
- Refusal to consent or lost to follow-up.

Study Procedure

All enrolled patients underwent systematic documentation of relevant clinical and procedural details, including demographic characteristics, medical history, surgical indication, presence of comorbidities, and the specific type of adhesive or dressing applied. Follow-up assessments were conducted on postoperative days 3, 5, and 7, as well as at the time of suture removal or during routine dressing changes, with a maximum follow-up duration of 21 days. During these follow-up visits, patients were clinically examined by dermatologists for signs of contact dermatitis. The diagnosis was made based on classical morphological features such as localized erythema, pruritus, vesiculation, or eczematous changes confined to the region of adhesive or dressing contact. In cases where clinical suspicion persisted or the presentation was atypical, confirmatory patch testing was performed using a standardized allergen panel that included components of the surgical adhesives involved. Additional parameters assessed included the duration of exposure to adhesive materials, the surgical context (emergency or elective), and underlying conditions such as diabetes or previous allergic tendencies. The severity and onset of dermatitis were noted in relation to the timeline of adhesive application, and any repeated exposure was carefully recorded to evaluate cumulative effects.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software version 21.0. Incidence of contact dermatitis was expressed as a percentage. Univariate analysis was conducted to identify potential risk factors. Chi-square test and Fisher's exact test were used for categorical variables, and Student's t-test for continuous variables. Multivariate logistic regression was applied to assess independent predictors of contact dermatitis. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Demographic and Clinical Profile of Patients

Among the 120 patients included in the study, the majority belonged to the older age groups, with 41.67% being over 50 years and 40% in the 31–50 years category, while only 18.33% were between 18 and 30 years. This suggests a higher prevalence of surgeries and related adhesive use in middle-aged and elderly populations. Gender distribution showed a slight male predominance with 68 males (56.67%) compared to 52 females (43.33%). Occupational categorization revealed that manual laborers constituted the largest subgroup (30%), followed by homemakers (25%), individuals in office jobs (21.67%), and others such as students and retired individuals (23.33%). These findings provide a broad representation across different age, sex, and work exposure profiles, which could influence skin sensitivity and risk for dermatitis.

Table 2: Surgical and Dressing Details

General surgery was the most common type of procedure performed (33.33%), followed closely by orthopaedic surgeries (30%). Obstetric and gynaecologic cases accounted for 20%, and plastic surgeries made up the remaining 16.67%. Elective surgeries formed the majority (70%), indicating planned and controlled postoperative care scenarios, whereas 30% of patients underwent emergency procedures. In terms of dressing material, surgical tape was the most frequently used (45%), followed by cyanoacrylate glue (35%) and hydrocolloid dressings (20%). This diversity allowed for meaningful analysis of different adhesive types and their association with adverse skin reactions.

Table 3: Incidence and Characteristics of Contact Dermatitis

Out of the total 120 patients, 28 (23.33%) developed signs of contact dermatitis during follow-up. Regarding the timing of symptom onset, the majority of cases presented by postoperative day 5 (42.86%), with a notable number also appearing by day 7 (35.71%) and a smaller fraction by day 3 (21.43%). Morphologically, the most common presentation was erythema accompanied by pruritus (64.29%), indicative of early irritant or allergic response. Vesicular or weeping lesions were observed in 21.43% of affected individuals, while 14.28% developed more chronic eczematous or hyperpigmented plaques. These variations in presentation underscore the importance of early identification and intervention.

Table 4: Risk Factors Associated with Contact Dermatitis

Analysis of risk factors revealed significant associations with the development of contact dermatitis. Half of the affected individuals (50%) had diabetes mellitus compared to only 19.57% in the unaffected group ($p = 0.003$), highlighting the role of impaired skin barrier and immune response in diabetic patients. Prolonged dressing application beyond 7 days was noted in 57.14% of dermatitis cases versus 26.09% among those without dermatitis ($p = 0.004$), suggesting cumulative exposure as a triggering factor. A prior history of allergic tendencies or atopic disorders was significantly more common in the dermatitis group (28.57%) than in the non-affected group (6.52%) with a strong statistical association ($p = 0.005$). Similarly, repeated adhesive exposure was more frequent among affected patients (35.71% vs. 17.39%, $p = 0.041$), further emphasizing the role of repeated allergen challenge in sensitization.

Table 5: Association of Type of Dressing with Dermatitis Incidence

Among the different dressing types, cyanoacrylate glue had the highest association with contact dermatitis, with 38.10% of users developing reactions (p = 0.001). Surgical tapes showed a lower but still significant incidence of dermatitis at 18.52% (p = 0.021). In contrast, hydrocolloid dressings were associated with the lowest incidence (8.33%), and the difference was not statistically significant (p = 0.173). These findings suggest that cyanoacrylate glues pose a higher allergenic or irritant potential, warranting caution in patients with sensitive skin or known predisposition to dermatitis.

Table 1: Demographic and Clinical Profile of Patients (n = 120)

Variable	Number of Patients (%)
Age Group	
18–30 years	22 (18.33%)
31–50 years	48 (40.00%)
>50 years	50 (41.67%)
Gender	
Male	68 (56.67%)
Female	52 (43.33%)
Occupation	
Manual laborers	36 (30.00%)
Office workers	26 (21.67%)
Homemakers	30 (25.00%)
Others	28 (23.33%)

Table 2: Surgical and Dressing Details

Parameter	Number of Patients (%)
Type of Surgery	
General surgery	40 (33.33%)
Orthopaedic	36 (30.00%)
Obstetrics and Gynaecology	24 (20.00%)
Plastic surgery	20 (16.67%)
Nature of Surgery	
Elective	84 (70.00%)
Emergency	36 (30.00%)
Type of Adhesive/Dressing Used	
Cyanoacrylate glue	42 (35.00%)
Surgical tape	54 (45.00%)
Hydrocolloid dressing	24 (20.00%)

Table 3: Incidence and Characteristics of Contact Dermatitis

Feature	Number of Patients (%)
Developed Contact Dermatitis	28 (23.33%)
Time of Onset	
By Day 3	6 (21.43% of affected)
By Day 5	12 (42.86%)
By Day 7	10 (35.71%)
Morphology	
Erythema + Pruritus	18 (64.29%)
Vesicles/Weeping Lesions	6 (21.43%)
Hyperpigmented/Eczematous Plaques	4 (14.28%)

Table 4: Risk Factors Associated with Contact Dermatitis

Risk Factor	Present in Dermatitis Group (n=28)	Present in Non-affected Group (n=92)	p-value
Diabetes Mellitus	14 (50.00%)	18 (19.57%)	0.003
Prolonged dressing (>7 days)	16 (57.14%)	24 (26.09%)	0.004
History of allergy/atopy	8 (28.57%)	6 (6.52%)	0.005
Repeated adhesive application	10 (35.71%)	16 (17.39%)	0.041

Table 5: Association of Type of Dressing with Dermatitis Incidence

Type of Adhesive/Dressing Used	Developed Dermatitis (%)	No Dermatitis (%)	p-value
Cyanoacrylate glue	16/42 (38.10%)	26/42 (61.90%)	0.001
Surgical tape	10/54 (18.52%)	44/54 (81.48%)	0.021
Hydrocolloid dressing	2/24 (8.33%)	22/24 (91.67%)	0.173

DISCUSSION

The demographic profile in this study revealed that the majority of patients were above 50 years of age (41.67%), with an additional 40% falling in the 31–50 years range. This aligns with the findings of Oshima et al. (2014)[10], who observed that contact dermatitis associated with postoperative materials was more frequent among middle-aged and elderly populations, possibly due to cumulative exposure to adhesives and declining skin barrier function with age. In the present study, males comprised 56.67% of the sample, consistent with the gender distribution reported by Boyvat et al. (2005)[11], who found a slight male predominance in surgical populations developing adhesive-related dermatitis, likely reflective of their higher representation in surgical cohorts at the institutional level.

Surgical characteristics in our cohort indicated that general and orthopaedic surgeries were the most commonly performed (33.33% and 30%, respectively), with the majority being elective procedures (70%). In terms of dressing types, surgical tape was most frequently used (45%), followed by cyanoacrylate glue (35%). This dressing profile is in agreement with findings by Rietschel et al. (2001)[12], who noted that surgical tapes and glues were the predominant sources of allergen exposure in postoperative settings. The higher usage of tapes may be attributed to their ease of application, cost-effectiveness, and routine practice across surgical disciplines.

In this study, 23.33% of patients developed contact dermatitis, with symptom onset most frequently occurring by postoperative day 5 (42.86%). The predominant clinical manifestation was erythema with pruritus (64.29%), followed by vesicles or weeping lesions (21.43%). These findings corroborate the clinical spectrum described by Warshaw et al. (2008)[13], who also reported that allergic contact dermatitis secondary to medical adhesives typically presents within the first week post-application, with erythema and pruritus being the earliest signs. The clinical relevance of such early detection lies in timely identification and removal of the offending agent to prevent chronic skin damage.

Risk factor analysis revealed that diabetes mellitus was significantly associated with contact dermatitis in 50% of the affected group ($p = 0.003$), compared to only 19.57% in the unaffected group. This supports observations made by Leow et al. (2006)[14], who reported that diabetic patients have altered immune response and reduced epidermal regeneration, increasing their susceptibility to allergic and irritant reactions. Additionally, prolonged dressing duration (>7 days) and repeated exposure were statistically significant contributors ($p = 0.004$ and 0.041, respectively), aligning with findings by Fisher et al. (2004)[15], who emphasized the importance of limiting adhesive contact time to reduce the risk of sensitization and dermatitis.

A prior history of allergy or atopy was present in 28.57% of those who developed dermatitis, a proportion significantly higher than the unaffected group (6.52%, $p = 0.005$). This echoes the findings of Rietschel et al. (2001)[12], who established that patients with an atopic diathesis are inherently more prone to develop contact reactions when exposed to novel topical materials, particularly adhesives with sensitizing potential. Therefore, preoperative screening for atopic history may serve as a practical strategy to prevent postoperative dermatological complications.

Finally, among the types of dressings evaluated, cyanoacrylate glue was associated with the highest incidence of dermatitis (38.10%, $p = 0.001$), followed by surgical tape (18.52%, $p = 0.021$), while hydrocolloid dressings showed the lowest rate (8.33%) without statistical significance. Similar trends were reported by Hivnor et al. (2006)[16], who documented high sensitization rates with cyanoacrylate adhesives due to their strong bonding agents and known allergenicity. The relatively inert nature of hydrocolloids and their moisture-retentive properties likely contribute to their safer profile, suggesting their preferential use in patients at higher risk for skin reactions.

CONCLUSION

This observational study highlights that contact dermatitis due to surgical adhesives and dressings is a relatively common postoperative complication, affecting 23.33% of patients. Risk factors such as diabetes, prolonged dressing duration, prior allergy history, and repeated adhesive exposure significantly increase susceptibility. Cyanoacrylate-based adhesives showed the highest incidence of dermatitis, whereas hydrocolloid dressings were the least reactive. Early identification and selection of skin-friendly materials, especially in high-risk individuals, are essential for preventing adhesive-related skin injuries and improving patient outcomes.

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