

## Degloving Injury: Evaluation and Management

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### ABSTRACT

**Objective:** To study the frequency, clinical presentation, management and outcome of degloving soft-tissue injuries.

**Study Design:** Case series.

**Place and Duration of Study:** Department of Surgery, Federal General Hospital, Islamabad Pakistan, from Jan 2018 to Dec 2019.

**Methodology:** This study included 28 consecutive patients with degloving injuries. Patients with degloving injuries of the soft tissue were included. Initial assessments of all patients were done according to advanced trauma life support. Regular clinical examination for abnormalities such as excessive local pain that was out of line with the intensity of the trauma, extensive ecchymosis or hematomas, and especially, local and regional hypermobility of the skin, capillary refill and perfusion of the area.

**Results:** Out of 28 patients, there were 25 males (9.28%) and three females (10.72%). The mean age was 33.07±9.04 years with a range of 6-50 years. The thigh was the most frequently involved area by degloving injury (25.00%). The back was involved in 17.85% of patients. Leg (10.71%) and foot (10.71%) were involved in 21.42% of patients. From the management point of view, 42.85% of patients had some form of debridement and healing by secondary intention, 17.85% patients were managed conservatively, and 10.71% of the patients' primary closure was successful.

**Conclusion:** Degloving soft-tissue injury is debilitating and, if not taken care may lead to ischemia necrosis, infection and septicemia of the tissues, which needs extensive debridement, prolonged use of broad-spectrum antibiotics, which result in disability and protracted course of rehabilitation.

**Keywords:** Degloving injury, Morel-lavallée lesions, Trauma.

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### INTRODUCTION

Degloving soft tissue injuries are avulsion injuries of soft tissue. It occurs when the skin and subcutaneous tissue detaches from the underlying structures such as fascia, muscles and bone; as a result, the blood supply to affected tissue is compromised.<sup>1</sup> Degloving injury can involve any area, but Common areas at risk for degloving injuries are limbs, trunk, scalp, face, and genitalia. The blood loss in multiple trauma patients makes the degloved area more ischemic and may be dead from the beginning.<sup>2</sup> The factors increasing the complications are the patients' age, mechanism of injury, the anatomic area involved, multiple injuries, and type of degloving injury, whether open or closed.<sup>3</sup>

Morel Lavallee lesion is a closed degloving injury where the skin is not breached. It results from trauma with the collection of fluid in created space. The

collected fluid may contain blood, lymph, serous fluid, fats dissolution and necrotic tissue.<sup>4</sup> Commonly involved areas by Morel Lavallee lesion are greater trochanter or anterolateral aspect of the thigh, but the head, abdominal wall, gluteal area, pelvis, calf and knee can be involved as well.<sup>5</sup>

Initial inspection of the involved skin is deceptive, and differentiating between viable and compromised skin is difficult. That is why treatment of degloving injury is often delayed. Thus there is a high chance that severe degloving injuries may get severely infected or progress to necrotizing fasciitis.<sup>6,7</sup> Early recognition of degloving soft tissue injuries is essential. It needs repeated examination and strict surveillance. Regular clinical examination of the area especially noted the abnormalities such as excessive local pain that was out of line with the intensity of the trauma, extensive ecchymosis or hematomas, and local and regional hypermobility of the skin, capillary refill and perfusion of the area.

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There are very no studies conducted on this subject in our set-up. Trauma is one of the leading causes of morbidity and mortality. This study aimed to study the frequency, clinical presentation, management and outcome of degloving soft-tissue injuries. We conducted this study to make our local guidelines for early identification of patients with degloving injuries to reduce morbidity and mortality.

## METHODOLOGY

This case series included 28 consecutive patients with degloving injuries presented to the Department of Surgery of Federal General Hospital, Chak Shahzad, Islamabad Pakistan, from January 2018 to December 2019. The same surgical team managed all patients. Informed consent was obtained from all patients or their attendants about inclusion in the study. Prior Ethical Committee approval was taken. All patients presented in the emergency department were managed according to ATLS guidelines.

**Inclusion Criteria:** Patients with degloving injuries of the soft tissue (open or closed) were included through consecutive sampling technique.

**Exclusion Criteria:** The patients with traumatic amputations of the part or whole limb were excluded.

Initial assessments of all patients were done according to advanced trauma life support, and radiographs of the injured area were performed. Regular clinical examination of the area noted the abnormalities such as excessive local pain that was out of line with the intensity of the trauma, extensive ecchymosis or hematomas, and especially, local and regional hypermobility of the skin, capillary refill and perfusion of the area.

If detachment of the skin with or without subcutaneous cellular tissue was suspected or occurred, we waited for another three to five days for the lesion to become delimited with initial signs of necrosis. Then, surgical debridement was performed by washing with saline at the appearance of the initial sign of necrosis.

The study did not include patients with degloving injuries and underlying bony fractures. Initial empirical antibiotics and later antibiotics according to culture and sensitivity were not included in the tables for analysis. Detailed history and examination were performed. All degloving injuries were classified, and data which included anatomical details, type of management, complications, loss of limb and mortality, was recorded on predesigned proforma.

All the data was entered and analyzed through a Statistical Package for Social Sciences (SPSS version 23:00). Mean and standard deviation was calculated for quantitative variables, and frequency with percentages was presented for qualitative variables.

## RESULTS

Of 28 patients, 25(89.28%) were males, and 3(10.72%) were females. The mean age was 33.07±9.04 years, with a range of 6-50 years. The most frequently involved area in degloving injury was the thigh (7, 25%). The back was involved in (5, 17.85%) of patients. Leg (3, 10.71%) and foot (3, 10.71%) were involved in 6 patients (Table-I).

**Table-I: Anatomical Area Wise Distribution of the Patients (n=28)**

Anatomical Area	Frequency (%)
Thighs	7 (25)
Back	5 (17.85)
Abdomen	3 (10.71)
Legs	3 (10.71)
Foot	3 (10.71)
Scalp	2 (7.14)
Forearm	2 (7.14)
Hand	2 (7.14)
Arm	1 (3.57)

Together Lower limb involved degloving injury in 11(46.6%) of the patients. The majority (19, 67.8%) of the patients had the open injury, while 9(32.14 %) had closed injuries (Table-II).

**Table-II: Wound Classification Wise Distribution of the Patients (n=28)**

Classification	Frequency (%)
Open	19 (67.8)
Non-circumferential	11 (39.28)
Closed	9 (32.14)
Incision and Drainage	2 (7.14)
Debridement	3 (10.71)
Non-circumferential	11(39.28)
Abrasion/avulsion	9 (32.14)
Circumferential single plane	5 (17.85)
Circumferential Multiplane	3 (10.71)

12(42.85%) patients had some form of debridement and healing by secondary intention while 5 (17.85%) patients were managed conservatively, and in 3(10.71%) of the patients, primary closure was successful (Table-III). There was no mortality and major morbidity, such as limb amputations. Complications were observed in 18(64.28%) patients (Table-IV). There was no mortality in our study.

**Table-III: Type of Management (n=28)**

Management	Frequency (%)
Conservative	5 (17.85)
Incision & Drainage	4 (14.28)
Debridement	19 (67.85)
<b>Wound Coverage</b>	
Primary closure	3 (10.71)
Skin grafting	3 (10.71)
Flap coverage	1 (3.57)
Healing by Secondary Intention	12 (42.84)

**Table-IV: Complications (n=28)**

Complications	Frequency (%)
Overall	18 (64.28)
Hemorrhagic	4 (14.28)
Infection	6 (21.42)
Necrosis	5 (17.85)
Septicemia	2 (7.14)
Necrotizing fasciitis	1 (3.57)

## DISCUSSION

Degloving soft tissue injuries are avulsion types resulting from high-intensity contact, compression, stretching friction or torsional forces which disrupt the perforating vessels to the subcutaneous tissue.<sup>7</sup> Degloving injuries can be open or closed. The factors responsible for increased morbidity and mortality are the age of the patient, mechanism of injury, anatomic area involved, multiple injuries, co-morbid and type of degloving injury, whether open or closed.<sup>8</sup> Morel Lavallee lesion is a closed soft tissue degloving injury in which avulsion injury results in separating the subcutaneous tissue from the deep fascia, but there is no laceration on the skin. It remains intact.<sup>9</sup> The potential space created due to the separation of the subcutaneous tissue from the deep fascia is filled with fluid.<sup>10</sup>

Degloving injuries may cause necrosis of wide and deeper areas such as skin, subcutaneous tissue, fasciae, muscles, tendons and nerves. This wide necrosis of either superficial or deep tissues makes this area very susceptible to infection, which may progress to septicemia or necrotizing fasciitis, further increasing morbidity and mortality of such patients.<sup>11</sup> To clear the extensive necrotic tissue or clean the infected area and for prevention or treatment of the necrotizing fasciitis, multiple debridements need to be done, which causes loss of the tissues such as skin, subcutaneous tissue, fasciae and muscle tissues.<sup>5</sup> This may result in functional loss of the area involved, especially around the joints. It may disturb the biomechanics of the joints.<sup>12</sup> Further to add to the problem, to make for the extensive skin and tissue debridement, patients must have

some additional reconstructive procedure to cover the area and restore the functionality.<sup>13</sup>

Degloving injuries are missed easily, and awareness of this condition is important for clinicians in preventing complications.<sup>14</sup> To improve the outcome of degloving injuries and avoid morbidity and mortality, early recognition is essential in its management.<sup>15</sup> We performed regular clinical examination of the area noting the abnormalities such as excessive local pain that was out of line with the intensity of the trauma, extensive ecchymosis or hematomas, and especially, local and regional hypermobility of the skin, capillary refill and perfusion of the area. If the skin detachment with or without subcutaneous cellular tissue was suspected or occurred, we waited for another three to five days for the lesion to become delimited with initial signs of necrosis. At the appearance of the initial sign of necrosis, surgical debridement was performed to prevent infection and septicemia.

Degloving soft tissue injuries involve lower limbs commonly and have high rates of complications, morbidity and potentially mortality.<sup>16</sup> Scalp, upper limb, and heel degloving injuries occur in many patients and may cause considerable morbidity and functional loss.<sup>17</sup> Degloving injuries in younger patients especially involving the foot, could be very disabling.<sup>18</sup> To restore the functional foot in children, reconstructive surgeries and prolonged rehabilitation may be needed.<sup>19</sup>

Degloving soft tissue injuries are missed easily and pose difficulties in diagnoses.<sup>20</sup> Even the extent of the area involved cannot be judged on mere clinical examination.<sup>21</sup> Fluorescein injections have been used for evaluation, but it overestimate the line of demarcation between viable and nonviable skin.<sup>20</sup> In our study, we did not use this method, relied on clinical examination, and waited till early signs of necrosis. A meticulous examination is suggested for tissue circulation and viability.<sup>22</sup> Margins of the avulsed tissue should be checked for any bleeding. In case of good arterial flow, the wound can be closed after trimming the margins and debridement. The diagnosis of Morel Lavallee lesions is missed initially in one-third of patients because of skin bruising which can mask the deep injuries. Even white blood cell count and C reactive proteins are normal, and later fluid fluctuation reveals underlying avulsion injury.<sup>23</sup> Therefore, the reliance on blood CP and C- reactive proteins cannot be made. Ultrasound can be used for locating a subcutaneous collection of fluid.<sup>24</sup> Treatment options for degloving

injuries are simple conservative management, primary closure, minimal to extensive debridement and healing by secondary intentions, vacuum-assisted closure, skin grafting, flap coverage and different types of amputations.<sup>25</sup> We managed 12(42.8%) by secondary intention.

In our study, most patients were males (89.28%), and all patients were young, aged 22-50 years. The most frequent area involved was the thigh (25%) followed by the back (17.85%). The lower limb was involved in almost half of the patients (46.6%). From the management point of view, 42.85% of patients needed some form of debridement and healing by secondary intention. In comparison, 17.85% of patients were managed conservatively, and in 10.71% of the patients, primary closure was successful. One patient needed rotation flap coverage. Overall complications (64.84%) rate was on the higher side, with infection (21.42%) being the commonest, followed by necrosis (17.85%) and haemorrhage (14.28%). Palacio *et al.* reported 66.7% males and 33.3% females in their study.<sup>4</sup> The age range in their research was from 25 to 55 years, with a mean of 39.8 years. Latifi *et al.* reported thigh involvement in (20%) of patients and an association of Morel-Lavallee type of injury in 30% of pelvic trauma.<sup>5</sup> Placiao *et al.* reported severe infectious processes and superficial and deep necrosis in 50% of his patients needing extensive debridement.<sup>4</sup>

Treating degloving injuries is challenging, difficult, and requires prolonged hospitalization and rehabilitation.<sup>3</sup> The treatment principles are adequate resuscitation, salvage of as much tissue as possible, primary closure with skin cover, and any secondary procedures such as debridement, which may be multiple or reconstructive procedures by a team of surgeons, plastic surgeons and rehabilitation medicine specialists for early return of function.<sup>14,15</sup>

### CONCLUSION

Degloving soft tissue injuries are serious and potentially devastating. A high index of suspicion is needed for a closed type of degloving injury. A radical treatment approach should be used to prevent morbidity and mortality.

**Conflict of Interest:** None

### Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SNM: Data analysis, data interpretation, approval of the final version to be published.

SFS & BAK: Data acquisition, Critical review, approval of the final version to be published.

SHS: Conception, study design, drafting the manuscript, approval of the final version to be published.

MWK & AQK: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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## Valuation and Management

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