

Rare Thermal Injuries: Silencer Burns Affecting the Face and Chest

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ABSTRACT

Motorcycle injuries are a significant issue in both developed and developing countries. Although the mortality and morbidity from motorcycle accidents are well-documented, silencer burns commonly affecting the lower limbs are less often reported, particularly when they occur in unusual areas. This article presents two rare cases of silencer burns on the head, neck, and face, which are not typically affected by such injuries.

In both cases, the patients sustained burns from exhaust pipes reaching temperatures of up to 250°C. The burns on the head, neck, and face varied in severity, from superficial to full-thickness injuries. Detailed treatment plans were implemented, including debridement, grafting, and flap cover in one. Both patients experienced significant recovery, with improvement noted in functional and cosmetic outcomes.

This article highlights these unusual cases to underscore the importance of recognizing and addressing silencer burns outside the typical lower limb area. It advocates for continuous research and motorcycle design improvements to prevent such injuries and emphasizes the need for specialized treatment for optimal outcomes.

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INTRODUCTION

Motorcycles have become the most popular mode of transport in developing nations due to their affordability compared to four-wheelers, lower maintenance costs, and ability to navigate narrow lanes and uneven roads. Young people, especially students, often choose motorcycles as a style statement in addition to their practical use. Currently, there are approximately 600 million motorcycles worldwide, with India alone contributing around 200 million.¹ Recent economic growth in developing countries like India has increased the

per capita income of the general population. This progress has led to a wider acceptance of comfort and luxury across all societal sectors, not just the affluent. The consistent rise in motorcycle sales reflects this economic advancement.

A typical Indian motorcycle engine ranges from 100 to 250cc, is usually four-gear, and features a front fork supported by a head tube that allows for pivot motion. The design commonly includes a rear suspension and a muffler positioned near the engine. While mufflers primarily function as acoustic dampeners to reduce engine noise, they are also part of the exhaust system, which vents hot gases reaching temperatures of around 250°C. The proximity of the rider's leg to the muffler makes it a vulnerable site for thermal contact burns.²

A study by Masoodi et al. found that the majority of silencer burn cases involved men (96%), with only 4% affecting women. The study also highlighted that burns were most common near the right medial malleolus. In contrast, Lai *et al.* reported a higher incidence of silencer burns in women (69%), which

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may be attributed to their unique sitting position as pillion passengers. A retrospective study on contact burns from motorcycle exhaust pipes found that most injuries were superficial or partial-thickness burns, which can be managed conservatively. However, cases involving deeper skin structures require coverage with grafts or flaps.³

In this article, we will discuss two cases requiring surgical intervention following exhaust pipe contact burn. The uniqueness is the site of burn, the first case has face while the second case has chest as the affected site.

CASE 1

A 40-year-old male sustained a deep second-degree burn to the right side of his face following a collision with cattle at a traffic crossing. The accident caused the patient's motorcycle to fall on his face, with the exhaust pipe making direct contact with his right cheek. The patient lost consciousness briefly and was subsequently transported to a private hospital for treatment.

He sustained a head injury and received bed rest with dressing for his burns. Approximately six weeks later, he presented to us with complaints of right lower eyelid ectropion and a hypertrophic scar extending from the right medial canthus to the upper lip, causing upper lip deformity and deviation of the right ala. After achieving surgical fitness, the patient underwent ectropion release with full-thickness skin grafting and excision of the hypertrophic scar, along with a forehead flap to address the nasal deformity. The procedure was performed under general anesthesia. The flap and graft were initially successful, with an uneventful postoperative period. Flap detachment and inseting were carried out three weeks later. However, the patient reported flap bulkiness, leading to flap debulking three months post-detachment (Figure 1 a to f).

CASE 2

A 30-year-old male sustained thermal burn injuries to the chest and anterior cervical region in an accident. Initially treated at a private hospital, his burns failed to heal after 20 days, prompting him to seek further management at our Burn Unit. The patient reported riding his motorcycle at high speed with friends, who were also on motorcycles. One of the



Figure 1 (a & b): Preoperative photograph of patient (CASE 1).



Figure 1 (c): Post-operative follow-up case after deformity correction with well settled forehead flap cover.



Figure 1 (d): Follow-up after detachment and inseting of forehead flap.

Figure 1 (e & f): Follow-up photograph after debulking of forehead flap.



Figure 2 (a & b): Pre-operative photograph of patient (CASE 2).

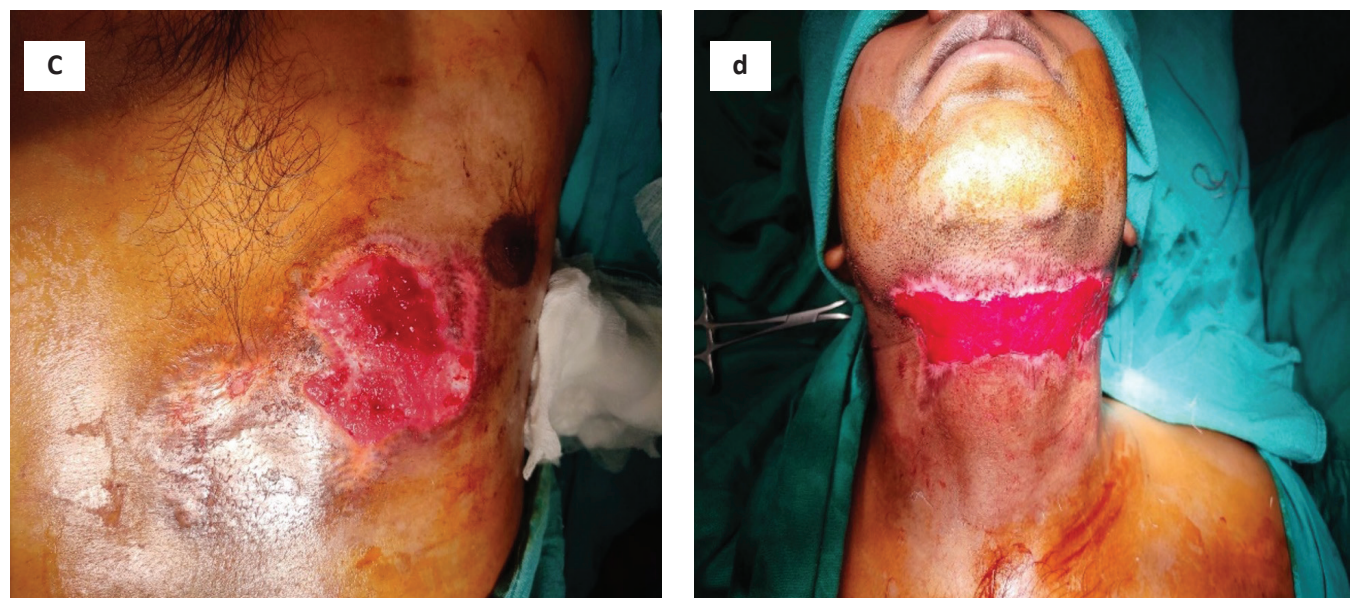


Figure 2 (c & d): Intra-operative photograph post debridement.

friends experienced a tire burst, causing their bike to topple and entangle with the patient's motorcycle. This resulted in the patient's anterior chest wall coming into contact with his bike's exhaust pipe.

At our facility, the patient underwent debridement of necrotic tissue, and split-thickness skin grafting was performed once the burn wound was deemed suitable for surgery. Postoperatively, after the graft



Figure 2 (e & f): Split thickness skin graft harvested and applied over raw area after debridement.



Figure 2 (g & h): 1-month follow-up photograph of patient.

had settled, the patient was advised to use pressure garments and massage therapy. (Figure 2 a to h)

DISCUSSION

All burn injuries are a type of bodily insult or a trauma. Hence upon arrival of any burn patient in the emergency department, they should be examined and managed as per Advanced Trauma Life Support (ATLS). Nowadays every government hospitals and almost majority of private hospitals have burn specialists or plastic surgeons which are involved in treatment planning of burn patients. It is always prudent to have a thorough assessment of patient once they are stabilized and other forms of life threatening injuries have been ruled out. Thereafter a detailed history regarding the mechanism of burn

injury, type of burn, duration of contact with the inflicting agent (in case of chemical burns), Total Body Surface Area (TBSA) burnt, extent and depth of burns, time of presentation post burn injury, type and volume of fluid resuscitation obtained and examination for respiratory tract in case of inhalational burns should be carried out.⁴

The wounds are initially cleaned with saline and chlorhexidine and any sort of devitalized or necrotic tissue is removed. Antibiotic ointment along with paraffin gauze is used to dress the wound and then covered with gauze dressing. Soft and fluffy padding of the limb is done and patient is advised to keep limbs elevated. Whether the patient is at home or admitted at hospital, it is advisable that the wounds be dressed daily so that the assessment and change of treatment plan if any can be decided in timely manner.

The burn wounds are classified as superficial or first degree burns (limited to epidermis), partial thickness burn which is further divided into superficial partial thickness or second degree burns (limited to superficial papillary dermis), deep partial thickness or third degree burns (involving epidermis and dermis) and full thickness or fourth degree burns (involving underlying muscle, bone etc.). Usually burn injury present as a mixed form of all the above varieties and primary assessment can be difficult initially as these wounds can further change into deeper varieties owing to infection or sepsis.

In a study conducted by Masoodi et al, most of the silencer burns were of second degree (73.6%) followed by first and second degree.⁵ As already mentioned, nearly 96% of their cases had male preponderance. The most common affected site was right lower limb (96%). In another study done by Yoshitaka et al. also found out that nearly 11.5% of motorcycle exhaust burns were full thickness burns. A study done by Rebecca et al on 24 children of age group from 1-year to nearly 15-years-age group found out nearly 50% cases had full thickness burns, while superficial and partial thickness burns had equal share of 25% each.⁶ In children the area most commonly affected was below knee region. Involvement of arms and hands were less common. In contrast to above studies, Chung Lai et al. had 69.3% as female patients in his findings. Majority of them were wearing skirts or short pants (75.7%) at the time of silencer burn injury. The most common site of involvement in them was lateral aspect of lower leg which occurred during parking of their motorbikes. Their study also mentioned that the temperature in exhaust pipes ranged from 90 to 250°C depending on the speed and design of the motorcycles. Generally this high temperature peak is attained within 10 minutes of the engine start and gradually decreased after around 30 minutes of turning off the engine.⁷

As previously stated, motor vehicle accidents have been reported by many articles but motorcycle exhaust burn cases documentation are meagre in amount because of sporadic cases. Two other studies have reported 9.0 and 6.5% cases of burns, respectively, arising from motorcycle exhausts.^{8,9} The mechanism of this injury can be due to accidentally touching the exhaust pipe while climbing or getting down which usually affects medial side of right leg. This mode of burn applies both to the driver and also

to the rear passenger which in most cases is male, as females have habit of sitting with both legs towards left side of the two wheeler. The lateral aspect of left leg too can get burnt by exhaust if accidentally the person comes in contact with the exhaust pipe in congested traffic or in parking area. As previously stated, temperature attained by muffler can be as high as 250°C, which is enough to cause second to third degree burns.¹⁰

Incidences of exhaust burns have some evidence of seasonal variation. In the study carried out by Matzavakis *et al.*¹¹ most of these burns (nearly 70.5%) occurred during the summer seasons. Similar results were obtained from study by Masoodi *et al.*, where he mentioned more number of cases (nearly 70%) being reported in hotter seasons across India. This seasonal affinity can be attributed to the fact that during summers, there is obvious decrease in wearing of socks, shoes and full length pants which do not provide adequate protection.

Hansen et al divided the management of exhaust burns into conservative management and operative intervention. In their study, nearly 35% of patients required some sort of surgical intervention in form of tangential excision, debridement, grafting etc. Going by the previous literature, operative intervention in such cases ranged from 26% to 86%. The management of such wounds are carried out as per standard burn wound protocols. Most of them respond to conservative management in form of dressings and antibiotics while some of the cases might require skin cover in form of graft or flaps post debridement. Since the burn area involved is usually small, majority of the wounds are allowed to heal by secondary intention which eventually happens in 3 to 4 weeks.

PROTECTIVE MEASURES

Following measures can be adopted for prevention of such injuries.¹²

- taking caution while riding or climbing down the t-Lwo wheeler keeping in mind the location of the exhaust pipe.
- timely maintenance and servicing of motorcycles, repair of broken foot rests (if any) both for the driver and rear passenger.
- wearing long length pants, full length socks and footwear to mitigate the effect of contact burn.
- strict adherence to parking rules regarding adequate spacing between vehicles (>120 cm).
- external shields for exhaust pipes which should be insulated and thermoresistant.

- public awareness regarding safe riding.
- switch over to new technologies like usage of electric two-wheelers.

CONCLUSION

The literature available has ample data on RTA caused by motorcycles. But the distinct group of motorcycle exhaust burns are scantily mentioned in them.¹³ This is attributed to fact that these cases are more or less sporadic, scattered and under-reported. Going by the previous studies and data available, it is safe to say that exhaust pipe injuries are preventable. The preventive measures stated above can go a long way in decreasing such incidences. Though the area of burn involved is less, it shouldn't be neglected and proper treatment under guidance of burn care specialist is advisable.

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