

# Research Paper: Death Due To Traumatic Asphyxia in Varanasi Region, India



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## ABSTRACT

**Background:** Traumatic asphyxia occurs when a powerful compressive force is applied to the thoracic cavity. This is most often observed in motor vehicle accidents, industrial and farming accidents, as well as the collapse of bridges, mansions, and during stampedes.

**Methods:** During the period of October 2016 to May 2018, 33 cases of traumatic asphyxia were recorded in the Varanasi district autopsy center, i.e. the Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh State, India. We conducted a prospective study on these incidents.

**Results:** The incidence of traumatic asphyxia is irrespective of gender. However, men are more viable to it due to their outdoor activities. In the present study, males outnumbered females in the distribution of cases. The external and internal features in combination were congestion 26(78.8%), cyanosis 25(75.0%), and subconjunctival hemorrhage 10(30.3%). In the internal examination, rib fracture with flail chest was recorded in 5(15.2%) cases.

**Conclusion:** Accidental death as a result of traumatic asphyxia is a major contributing factor to violent asphyxia. It results in asphyxia due to the compression of the chest by an external powerful compressive force.

## 1. Introduction

Asphyxial deaths may consist of "traumatic asphyxia" or "crush asphyxia" or "Perthe's disease" which is associated with the prevention of respiratory movements due to compressive or penetrative trauma to the chest. Traumatic asphyxia is mostly accidental in nature. It presents with facial cyanosis and congestion, subconjunctival hemorrhage, marked petechial hemorrhages on the face, neck and

upper part of the chest due to compressive force to thoraco-abdominal regions [1].

Crushing in crowds also leads to traumatic asphyxia; it has caused mass disasters, with the largest probably in Mecca. Most of the football stadium disasters such as Botron, Ibrox Park, Lima, Hillsborough, and the Heisl stadium in Belgium resulted from uncontrolled crushing in crowds [2]. Nine people died of traumatic asphyxia due to an uncontrolled crowd

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at a community basketball game in New York City in 1991 [3].

A human stampede at the Hindu temple of Naina Devi occurred on August 03, 2008 in the Indian state of Himachal Pradesh. In total, 162 people died after being crushed, trampled, or forced over the side of a ravine by the movement of a large panicking crowd. In another incident, at least 65 people died and over 100 were injured in the Ram Janki temple stampede on March 04, 2010. A gate collapsed in the Pratapgarh district of Uttar Pradesh, triggering panic among 10000 strong crowds who had converged for a ritual [4]. Heavy pressure on the chest primarily compresses the thinner right side of the heart, but the left side continues to pump the blood for a while. The retrograde displacement of blood from the superior vena cava into the subclavian veins and the veins of the head and neck results from the sudden compression of the chest or abdomen [5].

Associated injuries include pulmonary contusion, myocardial contusion, hemopneumothorax, and broken ribs. The sudden impact on the thorax increases intrathoracic pressure [6]. Traumatic asphyxial deaths can occur in a variety of situations, such as motor vehicle accidents, railway-related fatalities, elevator accidents, building collapses, landslides, and stampedes.

## 2. Materials and Methods

The present prospective study was conducted in the Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, in Varanasi State, India. We investigated medico-legal autopsies performed on bodies brought from various police stations of Varanasi and surrounding areas. In total, 33 cases of asphyxial death due to traumatic asphyxia were studied from October 2016 to May 2018. The study cases were selected from the victims of violent asphyxial death, confirmed by the post-mortem examination. Additionally, those not reported by the police as the cases of violent asphyxial death, but recognized so by post-mortem examination were included in the present study.

A total of 33 cases were investigated from the two different incidents of major traumatic asphyxia death which occurred during this study tenure. The first incidence of stampede occurred on October 16, 2016, at Rajghat Bridge in Varanasi. In that incident, 18 deceased of the total 24 were referred to our department for medico-legal post-mortem examinations. The mass rally at rajghat Bridge is shown in Figure 1. The second incident occurred on May 15, 2018, near the cantonment railway station, where a flyover under construction collapsed. In this incident, 15 people died and their bodies were referred to our department for medico-legal post-mortem examinations.

## 3. Results

As per Table 1, of the total 33 traumatic asphyxial deaths, 23(69.7%) cases were male, and 10(30.3%) were female. According to the age-wise distribution presented in Table 2, the majority of cases were in the age group of 51-60(33.3%) years, followed by 41-50 years age group with 8(24.2%) cases; the lowest incidence rate was found in 11-20 years age group as 1(3.0%) person. The traumatic asphyxial cases were observed for their external features. According to Table 3, 26(78.8%) cases presented with the congestion of face, 25(75.8%) presented with cyanosis, and 24(72.7%) with abrasion/contusion. Moreover, in 15(45.5%) cases, oral and nasal bleedings were recorded and 10(30.3%) cases represented subconjunctival hemorrhages.

Table 4 lists the internal findings in the present study, with the congestion of viscera in 29(87.9%) cases, thoracic contusion in 14(42.4%) cases, rib fracture(flail chest) in 5(15.2%) cases, liver laceration in 6(18.2%) cases, lung contusion in 6(18.2%) cases, as well as the fracture of upper and lower limb bones in 6(18.2%) and 7(21.2%) cases, respectively.

## 4. Discussion

Table 1 concludes the data about the gender-wise distribution of studied traumatic asphyxia cases. Out of the total 33 traumatic asphyxial deaths, 23(69.7%) cases were male, and 10(30.3%) were female. Similar observations were reported by Singh A et al. who investigated 7 medico-legal deaths due to traumatic asphyxia from 2000 to 2003; of whom 6 were

**Table 1.** Gender-wise distribution of traumatic asphyxia

Gender	No.	%
Male	23	69.7
Female	10	30.3
Total	33	100

**Table 2.** Age-wise distribution of traumatic asphyxia

Age Group	No.	%
0-10	0	0
11-20	1	3.0
21-30	2	6.0
31-40	5	15.2
41-50	8	24.2
51-60	11	33.3
61-70	5	15.2
71-80	1	3.0
Total	33	100

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**Table 3.** External features of traumatic asphyxia

Features	No.	%
Congestion of face	26	78.8
Oral and nasal bleeding	15	45.5
Cyanosis	25	75.8
Petechiae on the neck	17	51.5
Facial edema	8	24.2
Subconjunctival hemorrhage S	10	30.3
Abrasion/ contusion	24	72.7

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males [7]. Gill JR et al. study reported 9 people who died of traumatic asphyxia due to an uncontrolled crowd at a community basketball game in New York City in 1991 [3]. Mariam Arif et al. explored 8 cases of traumatic asphyxia, of whom, 6 were female; this data is in contrast with the study by Karachi who documented male predominance [8].

Table 3 presents the external features of traumatic asphyxia. In our study, 26(78.8%) subjects presented with the congestion of face, 25(75.8%) with cyanosis, 24(72.7%) with abrasion/contusion, and 15(45.5%) cases presented with oral and nasal bleeding. The petechiae of the neck were observed in 17(51.5%) subjects and 10(30.3%) cases presented with subconjunctival hemorrhage. These observations are in line with

**Table 4.** Internal features of traumatic asphyxia

Features	No.	%
Thoracic contusion	14	42.4
Rib fracture (flail chest)	5	15.2
Lung contusion	6	18.2
Congestion of viscera	29	87.9
Liver laceration	6	18.2
Fracture of upper limb bones	6	18.2
Fracture of lower limb bones	7	21.2

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**Figure 1.** Mass rally at rajghat Bridge



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**Figure 2.** Falling down of Bridge pillar at Cantt, Varanasi



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the study by Sklar et al. who described the autopsy findings in 24 deaths due to traumatic asphyxia; the petechiae of the skin, subconjunctival hemorrhage, and purple facial coloration were noted in 58% of the decedents. At least 2 of the aforementioned 3 findings were noted in 88% of these victims [9].

Gill JR et al. argued that the majority of people had the petechiae of the conjunctivae and face consistent with chest compression [3]. Montes-Tapia et al. reported 2 clinical manifestations occurred in the 3 cases; multiple petechiae on the face, and bulbar conjunctival hemorrhage; however, facial cyanosis and facial edema were only evident in 2 and 1 patients, respectively [10]. Sah B et al. autopsy examination revealed distinct cyanotic, edematous, and multiple petechiae on the chin, and the upper left side of the neck of the victim. Bilateral subconjunctival hemorrhage was detected, as well [11]. According to Hurtado TR et al. and Esme H et al., petechiae may

be more prominent in the conjunctiva and oral mucosa, most frequently at 2 to 3 hours after the accident [12, 13]. Pathak H et al. studied traumatic asphyxial deaths in car accidents, aiming to diagnose traumatic asphyxia based on typical findings consisting of cervicofacial congestion with swelling, multiple petechial hemorrhages in skin and conjunctiva with a history of traumatic compression [14].

Table 4 concludes the data on the internal injuries in the cases of traumatic asphyxia. We detected the congestion of viscera in 29(87.9%) cases, thoracic contusion in 14(42.4%) cases, and rib fracture with flail chest in 5(15.2%) cases. Liver laceration/rupture was observed in 6(18.2%) cases, lung contusion in 6(18.2%) cases, and the fracture of upper and lower limb bones in 6(18.2%) and 7(21.2%) cases, respectively. Similar findings were achieved by Sah B et al. who observed fractures in the left seventh, eighth, ninth, and tenth ribs. In-



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**Figure 3.** Congestion in Upper Region of Body (i.e. Chest, Face and Neck)



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**Figure 4.** Dissected chest wall of victim showing the contusions and fracture site at costo-chondral junction



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**Figure 5.** Contusions in the muscles at front of sternum area, subjacent sternal body part found fractured as well as fractures over the chest wall

ternally, the hematoma was present in the chin and the adjacent neck region; the lungs were congested and cut surface revealed the oozing of frothy blood [11].

Montes-Tapia et al. reported a patient with lung contusion, relating to the mechanism of injury. They obtained a favorable outcome with the patient being managed with supplemental oxygen; he was discharged without complications. Other described lungs manifestations are hemothorax and pneumothorax [10]. Young EK et al. stated that the differential diagnosis includes the superior vena cava syndrome and skull base fracture where conjunctival hemorrhage and periorbital ecchymosis exist [15]. Newquist MJ et al. argued that traumatic asphyxia is most often secondary to severe crushing injuries, and other traumatic injuries, such as pneumothorax, hemothorax, flail chest, pulmonary contusions, blunt abdominal injuries (i.e. lacerations in spleen and liver), and blunt pelvic injuries must be considered [16].

## 5. Conclusion

The study of medico-legal autopsy provides important statistical death-related data. Asphyxia is a form of violent death contributing to approximately 10% of overall deaths in the

world. As Varanasi is a holy city, it caters to huge pilgrimage every day from around the globe; thus, the odds of recurrence of such incidents are possible. For instance, Falling down of Bridge pillar at Cantt, Varanasi is shown in Figure 2. The obtained findings highlight the odds of mass casualty due to slight errors on the part of administrative authorities. In Figures 3-7 you can see some cases of incidents.

Any assemblage of the crowd in such bottleneck-like areas of the city can lead to stampede and mass disasters. One probable reason is the spread of hoax in any form; the other may be the uncoordinated movement of the crowd, while one rare possibility is the fall of poorly constructed skyscrapers. Therefore, the concerned authorities must take adequate measures to ensure the safety of human lives before organizing or permitting any mass gatherings. Furthermore, the quality of constructions in high rise buildings should be closely monitored by state and central urban development authorities, so that it can sustain collapse leading to catastrophes at any cost.

In case of such incidents, people must not panic, but rather keep calm and help in admitting the victims to the nearest hospital as early as possible. The trauma victims require prompt,



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**Figure 6.** Liver Laceration



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**Figure 7.** The Puncture of lung due to penetrating end of fractured ribs

effective and adequate medical help, preferably within 1 hour (golden hour). This is possible by improving the services at pre-hospital and hospital levels, along with prompt well-equipped ambulance services. This will improve the maximum odds of survival of trauma victims. There is a need to establish well-equipped hospitals having trauma settings for sufficient and high-tech diagnostic and surgical facilities to restrict mortality in trauma victims (dedicated trauma centers). High-Tech trauma centers should be equipped with air ambulance for the fast transportation of the trauma victims.

## Ethical Considerations

### Compliance with ethical guidelines

The present study was approved by the Institutional Ethical Committee of the Institute of Medical Sciences, Banaras Hindu University in Varanasi. All the information has been obtained under the consideration of the medical ethical committee. As this case report was prepared from medico-legal autopsy performed at our departmental mortuary, we had statutory authority to conduct post-mortem examination as well as to publish the findings in the field of scientific journals for literary benefit of young and budding Forensic Science as well as Forensic Medicine aspirants; also to suggest adequate safety measures to the administration. As per the rules of the consent described in Forensic medicine textbooks as well as different scientific kinds of the literature of Forensic Medicine, informed consent is needed only in a pathological autopsy, not in the medico-legal autopsy. No human right and animal right was violated in this case study.

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### Authors' contributions

Statistical analysis, writing: Satish Kumar Khalkho; Conceptualization, review, supervision, methodology: Manoj Kumar Pathak.

### Conflict of interest

The authors declared no conflict of interests.

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