

## Adrenal Haemorrhages and Burns - An Autopsy Study

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### Abstract

An estimated 1,95,000 deaths every year are caused by burns—the vast majority occurs in low- and middle-income countries. In India, over 10, 00,000 people are moderately or severely burnt every year. Women in the WHO South-East Asia Region have the highest rate of burns, accounting for 27% of global burn deaths and nearly 70% of burn deaths in the region. Adrenal haemorrhage occurs secondary to both traumatic conditions and atraumatic conditions. Burns accounts for maximum number of cases of traumatic haemorrhages. The purpose of this study was to investigate the prevalence of adrenal haemorrhage in non-surviving patients with burns by evaluating the compiled autopsy study data. During the period between 1<sup>st</sup> July 2009 to 31<sup>st</sup> June 2011, totally 51 burns cases were autopsied, among them, adrenal haemorrhage was seen in 14 cases, of which 10 cases showed bilateral haemorrhages and 04 cases showed unilateral haemorrhages. Extensive, bilateral adrenal haemorrhages were more commonly seen in males. Acute adrenal insufficiency is an uncommon but devastating complication of severe burn injury. The diagnosis is rarely made ante-mortem. The clinical importance of bilateral adrenal haemorrhage is that it may lead to acute adrenal insufficiency and possible death. Therefore, when a sudden deterioration in the patient with thermal injuries is encountered, adrenal insufficiency must be considered.

**Keywords:** Burns; Adrenal hemorrhage; Septicemic shock

### Introduction

An estimated 1,95,000 deaths every year are caused by burns—the vast majority occurs in low- and middle-income countries. In India, over 10, 00,000 people are moderately or severely burnt every year. Women in the WHO South-East Asia Region have the highest rate of burns, accounting for 27% of global burn deaths and nearly 70% of burn deaths in the region. [1]

Adrenal haemorrhage occurs secondary to both traumatic conditions and atraumatic conditions. Burns accounts for maximum traumatic hemorrhages. Atraumatic causes of adrenal hemorrhage include Stress, Haemorrhagic diathesis, Neonatal stress, Underlying adrenal tumors and Idiopathic disease [2].

Thermal injuries elevate corticosteroid secretion for weeks after injury, severely stressing the adrenal glands. Overload of the hypothalamic-pituitary-adrenal axis is thought to make this system unusually vulnerable to acute infarction. Although the actual mechanism of adrenal hemorrhage is not clear, the combination of excessive adrenocorticotropic hormone stimulation and hemodynamic instability have been implicated in its evolution.

Bilateral adrenal haemorrhages are a common condition that may lead to acute adrenal insufficiency and death. The clinical features of adrenal insufficiency are nonspecific and are easily confused with sepsis or common postoperative complications leading to haemodynamic abnormalities and multiorgan involvement. The pathogenesis of adrenal haemorrhage in burn cases is typically multifactorial. Necrosis and haemorrhage may occur during burns as a result of ischemia or during adrenal stimulation from vascular engorgement and stasis [3-5].

The diagnosis of adrenal insufficiency resulting from adrenal haemorrhage is often overlooked because of the nonspecific nature of the clinical presentation. Until recently, most diagnoses of adrenal haemorrhage were made at post-mortem examination. The reported prevalence of adrenal haemorrhage in general hospital autopsy studies

is 0.14% to 1.8% although extensive bilateral adrenal hemorrhage may be present in 15% of individuals who died of burns [6].

### Aims and Objective

The purpose of this study was to investigate the prevalence of adrenal haemorrhage in non-surviving patients with burns by evaluating the compiled autopsy study data.

### Material and Methods

In this study, all the burn cases that were brought for post-mortem examination at mortuary of Adichunchanagiri Institute of Medical Sciences, Mandya District, Karnataka, India between 1<sup>st</sup> July 2009 to 31<sup>st</sup> June 2011 have been studied. The ethical clearance and permission from institutional ethics committee and review board has been obtained. The majority of burns cases were from rural villages and semi rural places in and around the place of study.

### Results

During the period between 1<sup>st</sup> July 2009 to 31<sup>st</sup> June 2011, 51 burns cases were autopsied.

Table 1: In the present study, 35% of victims were between 21-30 years of age. Women were more involved than men with a ratio of 2.6: 1.

Table 2: Survival period of up to 2 days were seen in 41% of cases.

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**Received** June 18, 2012; **Accepted** August 24, 2012; **Published** August 30, 2012

**Citation:** Vijay Kumar AG, Kumar U, Shivaramu MG (2012) Adrenal Haemorrhages and Burns - An Autopsy Study. J Forensic Res 3:162. doi:10.4172/2157-7145.1000162

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Table 3: Around 39% of victims sustained burns over 76-100% of their total surface area.

Table 4: The most common cause of death was septicemic shock (41%), followed by multiorgan failure (30%).

Table 5: Adrenal haemorrhage was seen in 14 cases, of which 10 cases showed bilateral hemorrhages and 4 cases showed unilateral hemorrhages. Extensive, bilateral adrenal hemorrhages were more commonly seen in males (male-to-female ratio of 2:1).

## Discussion

Acute adrenal insufficiency is an uncommon but devastating complication of severe burn injury. The diagnosis is rarely made ante-mortem [7].

In our study, women of age group 21-30 were more involved than men. The cause for their burn's deaths are more due to suicidal or homicidal immolations in their household's (DOWRY DEATHS being more prevalent in India) rather than suffering from accidental burns. However accidental burns deaths resulting from house fire, cooking gas explosions and motor vehicle explosions (road traffic accidents) are also prevalent.

In a study done by Kallinen and Koljonen, maximum numbers of victims were males and all of them were beyond 30 years age group and survival period was more than seven days in most of the cases [7].

Age group	Male	%	Female	%	Total	%
<10	00	00	00	00	00	00
11-20	04	18.2	00	00	04	7.8
21-30	07	31.8	11	37.9	18	35.3
31-40	05	22.7	09	31	14	27.5
41-50	03	13.6	06	20.7	09	17.6
>50	03	13.6	03	10.3	06	11.8
Total	22	100	29	100	51	100

Table 1: Distribution of cases according to age and sex.

Period of survival	No. of cases	%
Brought dead	00	00
<1 day	03	5.8
1-2 days	21	41.2
3-4 days	12	23.5
>5 days	15	29.4
Total	51	100

Table 2: Distribution of cases according to survival period.

TBSA (total body surface area)	No. of cases	%
<25%	07	13.7
26-50%	09	17.6
51-75%	15	29.4
76-100%	20	39.2
Total	51	100

Table 3: Distribution of cases according to total body surface area involved.

Mode of death	No. of cases	%
Neurogenic shock	03	5.8
Septicaemic shock	21	41.2
Acute renal failure	12	23.5
Multi organ failure	15	29.4
Total	51	100

Table 4: Distribution of cases according to mode of death.

Total no. of burn cases	Adrenal hemorrhage seen	Unilateral Adrenal hemorrhage	Bilateral Adrenal hemorrhage
51 cases	14 cases (27.5%)	04 cases (28.6%)	10 cases (71.4%)

Table 5: Autopsy Findings.

In our study, majority of the victims (41%) had the least survival rate of up to two days. This explains the sudden deterioration of the clinical status of the patient, which may be attributed to adrenal hemorrhage and demonstrated post-mortem in our study.

According to Rao, most patients with non-traumatic, extensive, bilateral adrenal haemorrhage were aged 40-80 years at the time of the acute event. In contrast, patients with traumatic adrenal haemorrhage typically are in the second to third decade of life [8].

Our study demonstrates that higher TBSA (total body surface area) is directly proportional to the mortality suffered by burns victim.

Reiff et al. found higher % TBSA (total body surface area) and older age to be risk factors for acute adrenal insufficiency in severely burned patients by case-control study [9].

Since adrenal insufficiency is rarely diagnosed ante-mortem due to unspecific clinical features, taking into consideration, the clinical versus autopsy diagnosis of burns victims, our study shows that the patients going for septicemia and multiorgan failure will invariably show adrenal haemorrhages demonstrated post-mortem in significant number of cases.

In a study done by Kallinen and Koljonen, out of four victims, three members died due to multiple organ failure [7].

Our study shows majority of adrenal haemorrhages are bilateral in nature. Adrenal haemorrhage was seen in 14 cases, of which 10 cases showed bilateral hemorrhages and 4 cases showed unilateral hemorrhages. Extensive, bilateral adrenal hemorrhages were more commonly seen in males (male-to-female ratio of 2:1).

According to a study done by Kallinen and Koljonen, bilateral adrenal haemorrhages were found in 3 cases and unilateral adrenal haemorrhage was seen in one case [7].

According to a study done by Botteri and Orell, adrenal haemorrhages were observed in 19 cases and a minor bleeding in adrenal gland was found in 4 cases [10].

A study done in University of Texas Southwestern Medical Center shows acute, fatal, adrenal insufficiency in 3 patients among 807 critically ill patients with burns treated at their institution [11].

A study done by Sammy et al., Texas Tech University Health Sciences Center found adrenal hemorrhage in a 3 year old burns patient [12].

In a study of 2000 consecutive general hospital autopsies, only 22 (1.1%) revealed bilateral AH [6]; however, as many as 15% of patients dying in shock have been demonstrated to have bilateral AH [13]. The above study shows that, the sudden deterioration and death of burns patients with features of shock were found to have bilateral adrenal hemorrhage.

Our study shows adrenal hemorrhages in majority of burns victim dying either due to septicemic shock or neurogenic shock (low survival rates).

## Conclusion

Acute adrenal insufficiency may occur in association with extensive,

bilateral adrenal haemorrhage, and it is uniformly fatal if unrecognized and untreated. Patients with adrenal haemorrhage may die because of underlying disease or diseases associated with adrenal haemorrhage, despite treatment with stress-dose glucocorticoids.

Overall, adrenal haemorrhage is associated with a high mortality rate, which varies according to the severity of the underlying illness predisposing to adrenal haemorrhage. Bilateral adrenal haemorrhage is rarely diagnosed clinically as its presentation is generally non-specific. The clinical importance of bilateral adrenal haemorrhage is that it may lead to acute adrenal insufficiency and possible death. Therefore, when a sudden deterioration in a patient with thermal injuries is encountered, adrenal insufficiency must be considered.

#### Competing Interests

The authors declare that they have no competing interests. The authors have read and approved the final manuscript.

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