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A Study on Physiological Causes and Temporal Pattern of Trauma Death in a Tertiary Care Trauma Centre

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ABSTRACT

Background: Trauma is a major public-health problem in India. With a population over one billion and an annual urbanization rate of 26%, the magnitude of the problem is a cause for concern. An unpresented increase in number of vehicles has outpaced the development of adequate roads and highways. Trauma especially RTA'S are the invariable fall out in the rapid motorization and urbanization in India. Aim: To study the physiological causes and temporal pattern of trauma death in the study population.

Materials and Methods: Study Design: Institutional based Retrospective and prospective study. Study area: The study was done in the Department of in medical college. Study Period: Retrospective period of 6 months and Prospective for 6 months. Study population: All trauma patients fatalities in the hospital and Patients brought dead to accident and emergency. Sample size: A total of 92 patients were included in the study. Prevalence of head injury = 60% (last year records) with an Absolute precision of 10% at 95% confidence interval. Required sample size = 92. Sampling method: Simple Random sampling method. Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study. Study tools and Data collection procedure: All severely injured patients will be evaluated from the time they arrive to the duration of stay in the hospital and eventual cause of death will be estimated. The reported time of death will be noted and its significant pattern of trauma deaths will be noted. A graphical illustration of modal distribution of death with a simple bar diagram showing the physiological cause of death and time duration from 0 - 6 hours, 6 – 12 hours, 12 – 24 hours, 24- 48 hours, 48 – 72 hours ,72 hours – 1 week, > 1 week will be done respectively. Statistical Analysis: The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%).

Results: Among these causes in our study Intractable intracranial hypertension was seen in 63% (n-58) cases, Hemorrhagic shock/ Bleeding 25% (n- 23), Sepsis/Multi organ failure 6% (n– 5), Intracranial Hypertension and Sepsis 3% (n- 3), Ventilation associated Problems 1% (n- 1), Intracranial Hypertension and Hemorrhagic shock 1% (n – 1), Hemorrhagic Shock and Sepsis 1% (n- 1).

Conclusion: Retrospective judgments on clinical decision-making, based on case record findings, must be examined with extreme caution, and this study has been careful to use only objective parameters, like prolonged operative time, or pre-operative physiological status. If the results remain valid in other Indian hospitals, it is worth noting that better identification and management of trauma patients could save a quarter of million lives each year, based on a 50% reduction of the estimated half a million annual hospital trauma deaths in India.

Keywords: Trauma, Hemorrhagic shock/ Bleeding, Road Traffic Accidents.

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INTRODUCTION

Trauma is a major public-health problem in India. With a population over one billion and an annual urbanization rate of 26%, the magnitude of the problem is a cause for concern.[1] An unpresented increase in number of vehicles has outpaced the development of adequate roads and highways. Trauma especially RTA'S are the invariable fall out in the rapid motorization and urbanization in India.

Road Traffic Accidents are the most common cause of trauma related death in India in the age group of 24-44 yr. Spurt in vehicular density however has been so rapid that there has been little time spent by citizens and policy makers alike, on safety measures of high level of mechanization.

There are various factors contributing to the present scenario of trauma in India – both urban and rural. Attitude of the public are devoid of basic sense of safe driving, as seen by driving without seat belts. The younger generation violated speed limits, don't follow traffic rules and widespread neglect of using helmets as protective gears.[2]

The three tenets of a trauma system are the prehospital, hospital and rehabilitative phase. Trauma systems in India are in the evolving stage. We proposed to look into the hospital deaths their causes and temporal pattern. The trimodal distribution of trauma death is a standard teaching as reported first by Trunkey.[3]

The first and highest peak of deaths included immediate or very early deaths (60 minutes) and accounted for about 50% of all deaths. Most of these victims had major head trauma or cardiovascular injuries. The second peak included early deaths (within 1 to 4 hours) and accounted for about 30% of deaths. Most of these deaths were a result of cardiovascular or neurologic injuries.

The third peak included late deaths (1 week) and accounted for about 20% of deaths, most of them a result of multi organ failure or sepsis. The temporal distribution of death is influenced by mechanism of injury, age of patient, body area with severe trauma. Knowledge of time of distribution of death help in allocating better resources.[4]

But the in – hospital trauma deaths do not necessarily follow this pattern. In high income countries trauma mortality has steadily declined but not a similar trend found in low- and middle-income countries. Trend of in hospital trauma deaths have remain unchanged, despite advances in imaging and medical equipment. High clinical load, low resources and high out of pocket expenditure are commonly named as barriers for a better trauma care in India.[5]

Analyzing in hospital trauma deaths is a very informative tool to asses a trauma system. Among important factors affecting trauma mortality, the time interval from injury to death has attracted much attention in the modern world of trauma epidemiology.[6]

Hence the present study was undertaken to study the physiological causes and temporal pattern of trauma death.

Aim: To study the physiological causes and temporal pattern of trauma death in the study population.

MATERIALS & METHODS

Study Design: Institutional based Retrospective and prospective study.

Study area: The study was done in the Department of in Medical college.

Study Period: Retrospective period of 6 months and Prospective for 6 months.

Study population: All trauma patients fatalities in the hospital and Patients brought dead to accident and emergency.

Sample size: A total of 92 patients were included in the study.

Prevalence of head injury = 60% (last year records) with an Absolute precision of 10% at 95% confidence interval. Required sample size = 92.

Sampling method: Simple Random sampling method.

Inclusion Criteria:

- All trauma patients fatalities in the hospital
- Age more than 12 years.
- Patients brought dead to accident and emergency

Exclusion Criteria:

- Patients brought only for post mortem purpose.
- Age less than 12 years
- Patients brought alive to the hospital

Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedure:

All severely injured patients will be evaluated from the time they arrive at P.I.M.S Pondicherry to the duration of stay in the hospital and eventual cause of death will be estimated. The reported time of death will be noted and its significant pattern of trauma deaths will be noted. A graphical illustration of modal distribution of death with a simple bar diagram showing the physiological cause of death and time duration from 0 - 6 hours, 6 – 12 hours, 12 – 24 hours, 24- 48 hours, 48 – 72 hours ,72 hours – 1 week, > 1 week will be done respectively.

Parameters to be studied:

Length of hospital stay, Direct causes of trauma death includes: Intracranial hypertension, Hemorrhagic shock/ Bleeding, Ventilation associated Problems, Sepsis/Multi organ failure. Associated causes of trauma death which includes intracranial hypertension, Hemorrhagic shock/ Bleeding, Ventilation associated Problems, Sepsis/Multi organ failure with less severity.

Statistical Analysis:

The data was collected, compiled and compared statistically by frequency distribution and percentage proportion. Quantitative data variables were expressed by using Descriptive statistics (Mean ± SD). Qualitative data variables were expressed by using frequency and Percentage (%).

RESULTS

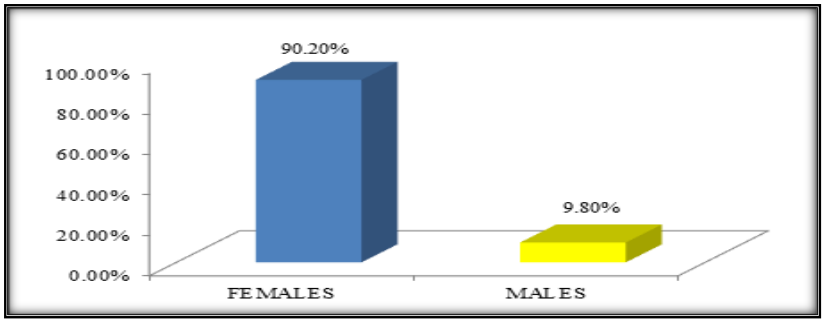


Figure 1: Sex distribution in the study population

In our study of 92 cases of in hospital trauma deaths due to multiple causes, Males – n=83, Females – n=9; in a ratio of 10:1 where affected by road traffic accident, resulting in eventual death.

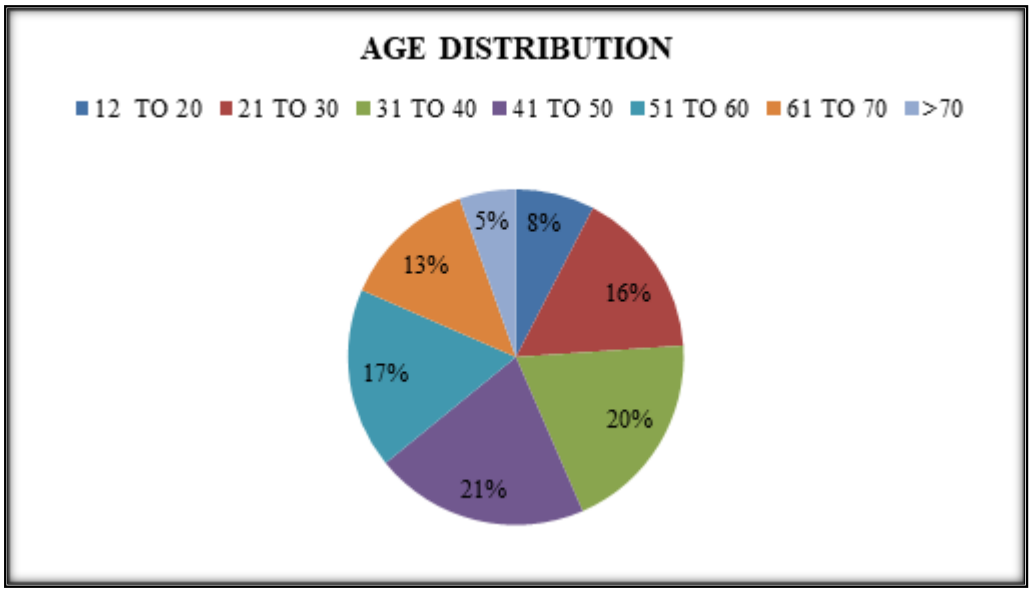


Figure 2: Age distribution in the study population

Age among which most among amount of trauma death occurred were categorized and found that 12 – 20 years-8% (n=7), 21-30 years-16% (n= 15), 31 – 40 years-20% (n= 18), 41-50- 21% (n= 19), 51- 60-17% (n= 16), 61 -70-13% (n=12),>70 -5%(n= 5).

In our study the predominant age of in hospital deaths was found between the age group of 41- 50 (21%), followed by 31 to 40 years (20%). Higher percentage of mortality was noted from 12 to 50 years of age about 65%, with a decreasing trend in the later age group.

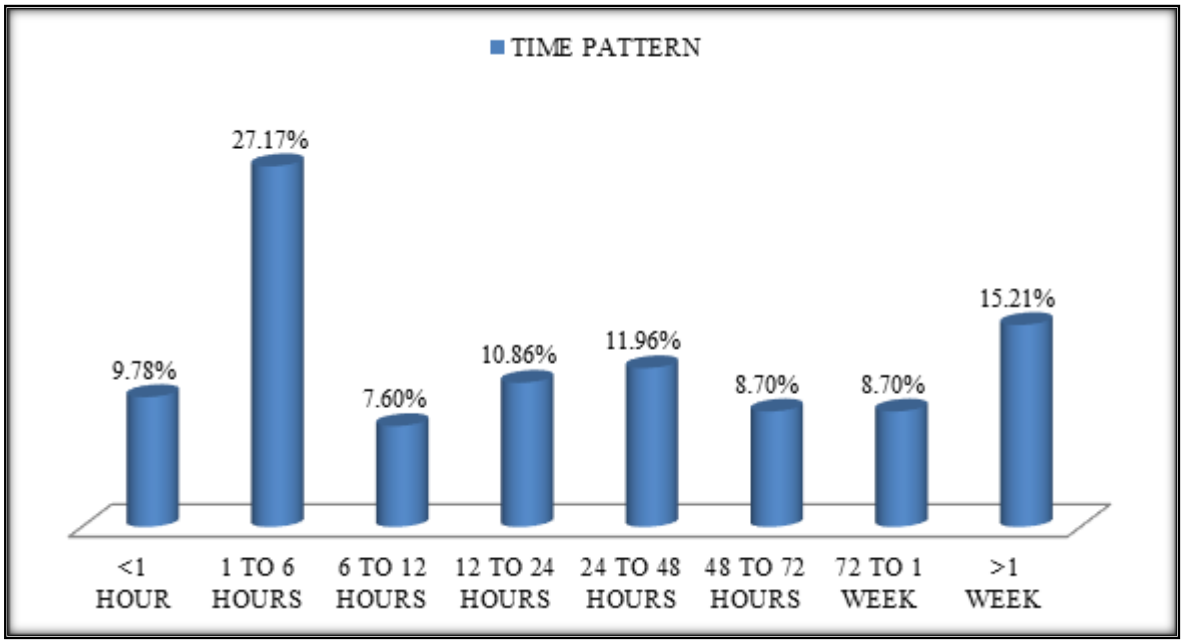


Figure 3: Time distribution of trauma death in the study population

Time pattern of trauma deaths from the time of arrival to eventual death was estimated and found that in Less than 1 hour 9.78% (n-9), 1 hour to 6 hours 27.17% (n– 25) ,6 hours to 12 hours 7.6%(n– 7),12 hours to 24 hours 10.86%(n– 10) ,24 hours to 48 hours 11.96% (n– 11), 48 to 72 hours 8.70%(n– 8),72 to one week 8.70% (n– 8) ,More than One week 15.21%(n- 14).

So here in this study the peak percentage of in hospital deaths were noted in duration of 1 to 6 hours about 27.17 % followed by late onset of >1 week about 15.21%. About 67.36 % of trauma deaths were noted within 48 hours arrival to emergency.

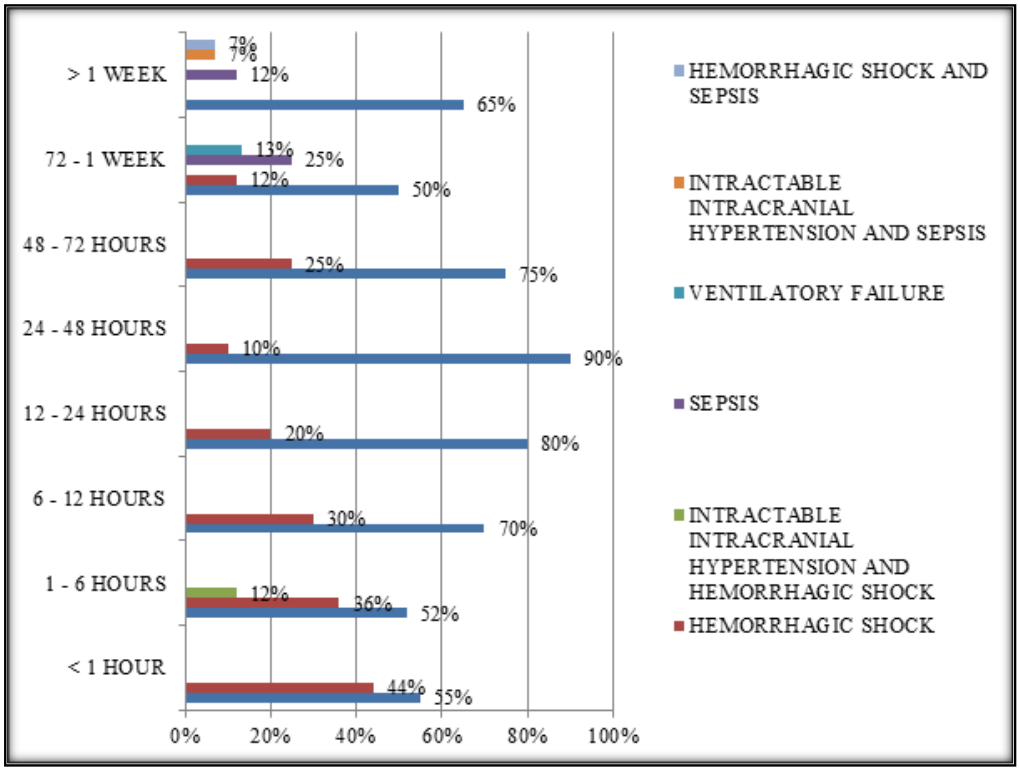


Figure 4: Cause of trauma death in the study population

Regarding the cause of trauma deaths the most significant causes were classified into Intractable intracranial hypertension, Hemorrhagic shock, Sepsis associated multiorgan dysfunction syndrome, Ventilator associated problems and combination of multiple factors all leading to in hospital death.

Among these causes in our study Intractable intracranial hypertension was seen in 63% (n-58) cases, Hemorrhagic shock/ Bleeding 25% (n- 23), Sepsis/Multi organ failure 6% (n– 5), Intracranial Hypertension and Sepsis 3% (n- 3), Ventilation associated Problems 1% (n- 1), Intracranial Hypertension and Hemorrhagic shock 1% (n – 1), Hemorrhagic Shock And Sepsis 1% (n- 1).

On evaluating the cause of traumatic death in individual time frame , In period of <1 HOUR – Intractable intracranial hypertension 56%(n-5), hemorrhagic shock 44%(n-4) ; 1- 6 hours were Intractable intracranial hypertension 52 % (n -13), Hemorrhagic shock 36% (n-9), Combined cause of intracranial hypertension and Hemorrhagic shock 12% (n -3) ; 6 – 12 Hours Intracranial hypertension 70%(n-5), Hemorrhagic shock 30% (n-2); 12 – 24 Hours Intracranial hypertension 80% (n-8), Hemorrhagic shock –80% (n-2); 24 – 48 Hours Intracranial hypertension 90% (n-10), Hemorrhagic shock 10% (n-1) ; 48 – 72 Hours Intracranial hypertension 75% (n-6), Hemorrhagic shock 25% (n-2) ; 72 Hours – 1 Week Intracranial hypertension 50% (n-4), Sepsis 25% (n-2),

Hemorrhagic shock 12.5 %(n-1), Ventilator Failure 12.5% (n-1) ;> 1 Week Intracranial hypertension 65% (n-9), Sepsis 21% (n-3), Intracranial hypertension and Sepsis 7% (n-1), Hemorrhagic shock and Sepsis 7% (n-1).

Intractable intracranial hypertension (Head injury) was the predominant cause of in hospital trauma deaths accounting for the most common cause in each time frame. Hemorrhagic shock/Bleeding found to be next cause with more severity during the initial hours, followed by downward trend as the time frame progressed. Sepsis was found to appear as a late cause of in hospital death peaking above hemorrhagic shock during the time frame from 72 Hours to > 1 Week duration.

DISCUSSION

Knowledge of the spectrum of trauma in particular related to fatal outcome is the backbone for trauma system planning and injury prevention. RTI-related morbidity and mortality is a major public health problem worldwide and more so in less developed countries.

In our study at Tertiary Trauma Centre, 83 being males and 9 being females. These injuries were significantly higher among males than females in a ratio of (10: 1) possibly due to their greater exposure of driving. Motor vehicle crashes were the leading cause of death, in our study, where accidents between motor vehicles where seen in 70 cases (76%) of our study, which included two wheeler, three wheeler and four wheeler drivers.

According to ATLS Student Course Manual (Tenth edition), injury-related deaths are expected to rise dramatically by 2020, with deaths due to motor vehicle crashes projected to increase by 80% from current rate in low- and middle-income countries.[7] The standard traffic safety recommendations are based on three areas of concern: epidemiology, prevention and advocacy, The findings of this study also indicated that most of road crash fatalities occurred pedestrians and motorcyclists. It has been shown that in developing countries, passengers and cyclists account for around 90% of deaths due to road traffic accidents, in our study motorcyclists deaths seen in 67.34% (62 cases), Pedestrians were seen in 19.5% (18 cases), Other vehicular deaths(three wheeler, four wheeler) seen in 8.7% (8 cases), other causes in 4.34% (4 cases).

Injuries were more prevalent among young subjects aged 21 – 50 years, yet the incidence of mortality was found to be high in geriatric age group (> 60 years) where 25% (23 cases) nearly one fourth of the mortality involved. As reported in series of studies, head injury remains a frequent killer, which is related mainly to the road traffic crashes as we have also noted in our study.

The historical trimodal distribution of trauma deaths, described by Baker et al,[8] and Trunkey et al,[3] played an important role in the establishment and implementation of trauma systems and centers. Currently, the trimodal distribution no longer applies, and the distribution of trauma deaths has changed due to the maturation of trauma systems.[9]

Head injuries (Intractable intracranial hypertension) are one of the most common injuries sustained by patients. In this series of patient the most common cause of death following trauma was CNS injury (Intractable intracranial hypertension), multiple authors have concluded that CNS trauma is the leading cause of death for those who survive long enough to reach the hospital.[10]

However, in our study they were the cause of death in 63% of all deaths, followed by hemorrhagic shock about 25% Intractable intracranial hypertension has been found to be the predominant factor in all time period of the study.[11-13]

In our study we observed multiple peak the maximum between 1 to 6 hours (27.17%) which constituted Intracranial hypertension 52% cases(n- 13), Hemorrhagic shock 36%(n – 9), both intracranial hypertension and

hemorrhagic shock which was seen in 12%(n – 3); followed by a late peak after > 1 week among which Intracranial hypertension constituted 65%, followed by Sepsis 21%, hemorrhagic shock and sepsis, intracranial hypertension and sepsis constituting 7% each in our study.[14]

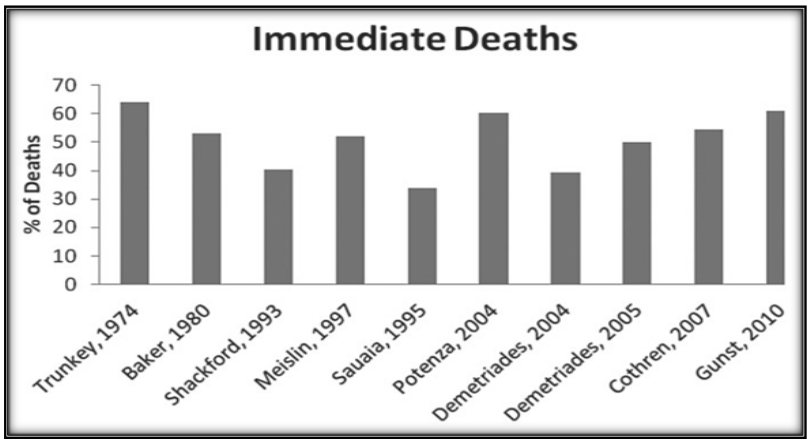
Time has always been a crucial factor in determining the outcome of patients after trauma. Our study found that over 67% of victims died within 48 hours after injury, and remaining 33% deaths were involved after 48 hours. The change in distribution of trauma deaths could be the consequence of better resuscitation methods and, thereby, prolonged survival of unsalvageable patients. This corresponds with the theory that, after the implementation of trauma systems and trauma care, a shift to the right in trauma deaths is to be expected, due to improved prehospital care and resuscitation methods in unsalvageable patients.[15]

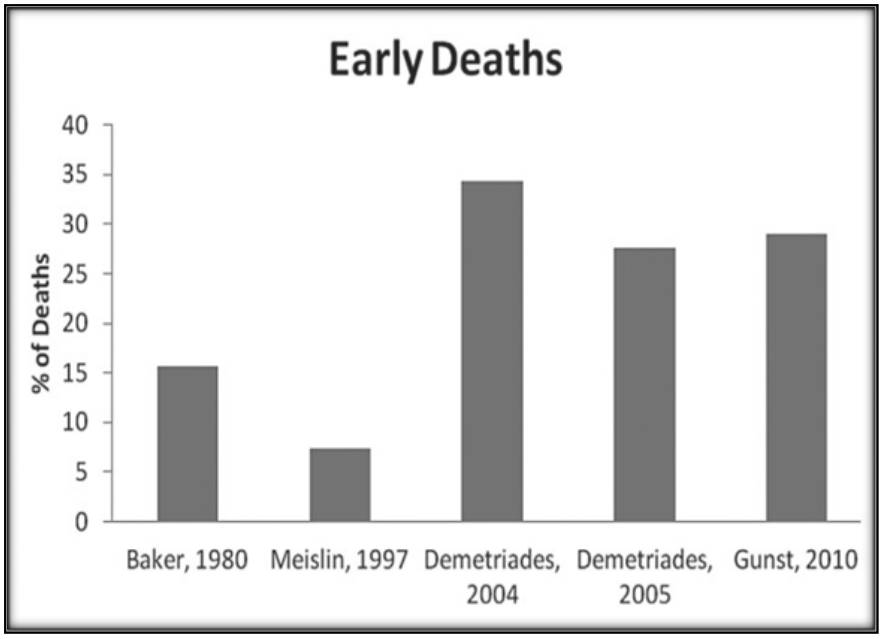
Similarly in this study, the delayed of cause of death accounting from 72 hours to > 1week had multi organ failure and other related complications such as sepsis and disseminated intravascular coagulation (DIC). In order to reduce the trauma deaths and disability in both the CNS Injury, hemorrhagic shock deaths, access to immediate surgical care is needed in order to attain acceptable results.

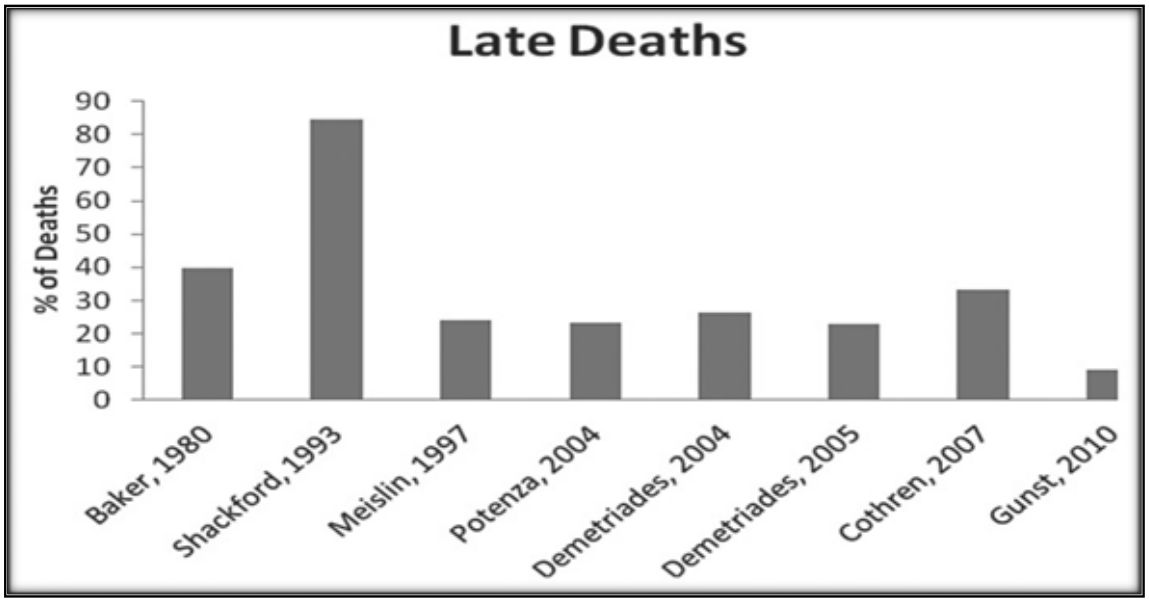
The Advanced Trauma Life Support (ATLS) course or similar training initiatives are likely to improve the understanding of surgical physiology of the injured and the body's response to trauma. Deaths that occurred before reaching the hospital and also after discharge are missing in the dataset. Therefore, this study of in-hospital deaths represents only a part of the whole trauma picture in our tertiary care system.

Patients with nonsurvivable CNS injury previously died due to other worsening injuries, such as associated severe haemorrhagic shock which was noted in 3% of cases in our study. Presently, these patients survive the first phase due to better initial management and resuscitation methods; however, they die in a later stage due to the non-survivable CNS injury in the present trauma system. To provide a more accurate overview of the temporal distribution of trauma deaths, a study on a regional level and trauma registration, which includes all trauma deaths in the trauma region, is recommended.

Retrospective judgments on clinical decision-making, based on case record findings, must be examined with extreme caution, and this study has been careful to use only objective parameters, like prolonged operative time, or pre-operative physiological status. If the results remain valid in other Indian hospitals, it is worth noting that better identification and management of trauma patients could save a quarter of a million lives each year, based on a 50% reduction of the estimated half a million annual hospital trauma deaths in India.







CONCLUSION: Retrospective judgments on clinical decision-making, based on case record findings, must be examined with extreme caution, and this study has been careful to use only objective parameters, like prolonged operative time, or pre-operative physiological status. If the results remain valid in other Indian hospitals, it is worth noting that better identification and management of trauma patients could save a quarter of million lives each year, based on a 50% reduction of the estimated half a million annual hospital trauma deaths in India.

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