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A Descriptive Profile of Trauma Patients Related to Road Traffic Collisions Admitted in a Tertiary Level Intensive Care Unit: A Concurrent Cohort Study

KEYWORDS: Road traffic collisions, trauma, Intensive care

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ABSTRACT *Background : Trauma secondary to road traffic accidents is a pandemic in India for various reasons. However data on trauma, it's burden on healthcare and specifically on Intensive care is scarce. Thus from a clinical, epidemiology and health care perspective we intended to verify the burden of trauma in a tertiary level ICU. In a single centre concurrent cohort study, our objective was to verify the morbidity and mortality of patients admitted to the ICU following road traffic collisions.*

Methods : Patients admitted with polytrauma following road traffic collisions over a 10 month period were included. Baseline characteristics including vehicles involved, site of injury, acuity scores were recorded. Primary outcomes measured were days in ICU mortality. Secondary outcomes planned were, number of days in ICU, Hospital stay and ventilator free days, prevalence of rhabdomyolysis (defined by the authors as creatine kinase level above > 500), a clinical diagnosis of fat embolism syndrome, and acute renal failure.

RESULTS: Trauma related to road traffic accidents accounted for 15% of all admissions. 84.4% were male and average age was 35.4.Commonest vehicles implicated were two wheelers and commonest injuries were to extremities and abdomen. Mortality was 21.9% and average ICU stay was 4 days, hospital stay was 12 days. Injury Severity score was most predictive of mortality.

Conclusion: Trauma related to road traffic collisions results in a significant burden to the ICU (and the individual) and is associated with significant mortality and morbidity. ISS is predictive of mortality. Preventive measures, training and resources need to be improved to deal with the burden of trauma, and the mortality and morbidity associated with it.

INTRODUCTION:

Trauma is one of the leading causes of death world wide (1) and perhaps the highest cause of death and morbidity in the young and the middle aged in India(2). A trauma related death occurs almost every 1.9 minutes in India (3). The cause for this is multifactorial – partly behavioral, cultural, educational(4)based on the Culture's Consequences framework, in road traffic risk perception, attitudes towards traffic safety and driver behaviour in samples from Norway, Russia, India, Ghana, Tanzania, Uganda, Turkey and Iran. An additional aim was to examine cluster differences in road traffic culture as symbol use and to investigate whether this theoretical cultural framework predicts risk perception, attitudes towards traffic safety and driver behaviour in the country clusters. The sample consisted of a total of 2418 individuals who were obtained by convenience sampling in the different countries. The countries segmented into four Culture's Consequences clusters; Norway, Russia and India, Sub-Saharan Africa, and Near East countries. The findings showed that Norwegians reported overall safer attitudes towards traffic safety and driver behaviour than the remaining country clusters. Individuals in Africa reported the highest risk perception. The countries also differed substantially in road traffic culture as symbol use. Contrary to established cultural theory, prediction models revealed that cultural factors were stronger predictors of driver behaviour than of risk perception. Also, the social cognitive risk constructs (i.e. risk perception and attitudes(5)(6)India, to evaluate collision-prone vehicle and pedestrian behaviors.\nMETHODS: We used a cross-sectional survey design with photograph- and video-based data collection. The study was performed at 3 purposively sampled high traffic volume roadways in New Delhi, India. The authors reviewed preliminary photographs and came to a consensus pertaining to the definition and criteria for dangerous and collision-prone behaviors. Analysis was descriptive and was based on frequency data.\nRESULTS: A total of 11,214 subjects were evaluated. Eighty-six percent were vehicles (n = 9624 and organizational (7).

However, data on road traffic collision is scarce in India (8)"container-title":"BMC public health","page":"55","volume":"4","source":"PubMed","abstract":"BACKGROUND: Systematic assessment of recent health research output from India, and its relation with the estimated disease burden, is not available. This information would help understand the areas in health research that need improvement in India to enhance the health of India's population.\nMETHODS: The health research output from India during 2002, which was accessible in the public domain, was assessed by searching PubMed and other internet health literature databases, and was related to the disease burden

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suggested by the Global Burden of Disease Study. The main outcome measures were number of health papers with abstracts in basic, clinical and public health sciences; quality-adjusted research output based on the impact factors of journals in which the papers were published; classification of papers in disease/condition categories and comparison of research output with the estimated disease burden in each category. Comparison of the health papers from India during 2002 included in PubMed was done with those from Australia during one quarter of 2002.\ nRESULTS: Of the 4876 health papers from India in 2002 in PubMed, 48.4%, 47.1% and 4.4% were in basic, clinical and public health sciences, respectively. Of the 4495 papers based on original research, only 3.3% were in public health. Quality-adjusted original research output was highest for non-communicable diseases (62% of total. It is also probable that burden on the health system is tremendous and conversely to the individual level is likely to be substantial (9)let alone the vulnerable segments of population such as children and adolescents. This study aims at measuring the burden of disease caused by urban road traffic injuries among children and adolescents in South Asia. This study selected 26 studies for review and data extraction out of 1505 published articles. Data from the studies were pooled to calculate the proportion and characteristics of child and adolescent RTI, regional RTI incidence and mortality rates, and an estimate of the burden of disease caused by these injuries through the use of the healthy life years lost (HeaLY but data in regard to this is limited(3). A rare, but recently completed study on trauma patients from 4 urban centers estimated that mortality and morbidity is high (in-hospital mortality 21.4%)(10). Thus, the individual costs and the burden on hospitals are likely to be appreciable.

From an ICU perspective, it is important to know the burden trauma patients pose on the practice of intensive care for various reasons.From a clinical and patient care perspective, it is unclear what the exact mortality related to trauma is in ICU. Factors influencing mortality it have not verified by studies from this country. From an epidemiological point of view, data on trauma needs to be verified in order to plan trials and analyze trends in mortality. From a health care perspective, resource allocation and appropriate training of ICU staff in regard to trauma would depend on burden of disease in the ICU.

Thus from a clinical, epidemiology and health care perspective we intended to verify the burden of trauma in a tertiary level ICU.

A single centre concurrent cohort study was conducted at the division of critical care of a tertiary level Hospital in south India, with the primary objective to verify the morbidity and mortality of patients admitted to the ICU following road traffic collisions. Secondary objectives were to verify vehicles involved and factors that effect mortality.

MATERIALS AND METHODS:

Study design:

A descriptive concurrent cohort study conceived and conducted by the staff of the Surgical ICU of a tertiary level hospital in south India. The study was conducted during a 10 month period in May 2012 to Feb 2013. The study was conducted after Institutional Review Board and Ethics approval of the research committee of the hospital. For all patients enrolled in the study, patient consent or assent from the relatives of the patient was taken.

Setting:

The study was conducted in the Surgical ICU (SICU) of a tertiary level hospital that caters to patients from all across Tamil Nadu as well as the rest of India.

The SICU is a 13 bed ICU, which has 95% occupancy and 90 percent mechanical ventilation rate. The ICU receives patients from the Emergency, Ward and Operation Theatre. Majority of admissions relate to Trauma. The type of injuries is limb and pelvic injuries, blunt trauma abdomen, chest injuries, Major maxillofacial injuries, head injury as part of polytrauma. Other admissions are major post-operative cases, cases stemming from surgery related complications, Obstetric complications. The annual admission rate is about 800 to 1000. The SICU is attached to a 9 bedded High Dependency Unit (HDU) that functions as a step down unit. The hospital also has a Neuro-ICU which admits isolated head injuries. For logistic reasons, patients admitted in that unit could not be included in the study.

Inclusion & Exclusion criteria

All adult patients admitted to ICU following polytrauma within a 72 hour period were included. Patients were excluded if they refused consent to participate or if trauma was related to mechanisms other than road traffic collisions.

Outcomes and Data Collection

Primary outcomes measured were days in ICU mortality

Secondary outcomes planned were, number of days in ICU, Hospital stay and ventilator free days, prevalence of rhabdomyolysis (defined by the authors as creatine kinase level above > 500), a clinical diagnosis of fat embolism syndrome, and acute renal failure.

All data were incorporated into study data collection sheet and later transcribed into Microsoft Excel (©Microsoft 2013). Data analysis was undertaken using MS Excel (2013) and IBM-SPSS version 22.0

Definitions

ICU mortality was defined as a death in ICU or if patients were discharged against medical advice. Injury severity score was classified into mild (score of 12 to 15), moderate (score of 16 to 24) and severe (score of >24) (11)Ventilator free days was defined as 28 days minus the days on ventilator, thus a patient that did not required mechanical ventilation would have 28 ventilator free days. Ventilation for 28 days or more, and death would result in zero ventilator free days.

RESULTS

During the 10 month period, extending from May 2012 to February 2013, a total of 640 patients were admitted. Out of these, 96 of them were admitted due to trauma secondary to road traffic accidents (15% of all admissions).

Eighty one of the 96 (84.4%) were male. The average age of the patients was 35.4 years.

On admission the average ISS was 24.5 and APACHE was 11.7 (Table 1).

Common vehicles implicated in the collisions were two wheeler, four-wheelers (cars) and heavy vehicles (truck/buses) (Table1).

Common sites of injury resulting in ICU admission included extremities, abdominal (forty three blunt injuries and 2

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penetrating), head and neck, and chest related injuries.

In regard to primary outcomes, ICU Mortality was 21.9% (Twenty one out of 96 patients). Most of these were men (seventeen of the 21 patients that died). Twelve of these were discharged against medical advice and the other 9 died in ICU. Sepsis accounted for 5 out of the 9 deaths in ICU. Other causes for death was intractable bleeding, severe traumatic brain injury (2 patients), and hypoxemic arrest due to an obstructed tracheostomy tube.

Average ICU stay was 4 days and hospital stay was 12 days and ventilator free days were 25 (Table 2).

In regard to the secondary outcomes, eighty-two of the 96 (85.4 %) some evidence of rhabdomyolysis (CK > 500) and 32 of the 96 (33.3%) had CK above 5000mIU/L requiring forced alkaline diuresis (crush protocol). Seventeen of the 96 (17.9%) had acute kidney injury (S. Creat of >1.5 mg/dL). Three patients required Renal Replacement Therapy in ICU. The incidence of Fat embolism 5 of the 96 (5.3%)

Table 1 : Study Population Characteristics (n = 96)

Characteristics	No. (%)
Sex : Male	81 (84.4)
Age in years[a]	35.4(14.7)
APACHE score[a]	11.7 (5.6)
ISS [a]	24.5(11.5)
Most common vehicles used by victim	
Two wheeler	44 (45.4)
Four wheeler Heavy vehicles (Trucks, buses,tractor)	20 (20.6)
Autorickshaw	14 (14.4)
Cycle	7 (7.2)
Pedestrian	2 (2.1)
Not documented	2 (2.1)
	7 (8.2)
Common injuries (number of patients with injury)‡	
Extremity	70 (72.9)
Abdomen	45(46.8)
Head and Neck	30 (31.3)
Chest	24 (25)
Deaths: In ICU Deaths	9 (9.4)
Discharged against medical advice(DAMA)	12 (12.5)
DICU deaths and DAMA	21 (21.9)

[a]Mean and SD for normally distributed variables, ‡ injuries are not mutually exclusive

Table 2 Primary outcome and risk factors

	Alive (n=56)	Dead (or DAMA) (n=21)	P Value
Age in years [a]	35.9(15.7)	33.9(10.9)	0.60
APACHE [a]	11.1 (5.4)	13.7 (5.9)	0.07
ISS [a]	21.8 (9.9)	33.6(11.9)	<0.001
CK on admission [b]	3456(1623-7402)	4024(2440-9821)	0.25

[a]Mean and SD for normally distributed variables, [b]Median (IQR) for skewed variables

Table 3: SecondaryOutcomes

	No. (%)
Duration of ICU stay in days [b]	4 (2 - 7)
Duration of hospital stay in days [b]	12(9-19)
Ventilator free days(28 minus days on ventilator) [b]	25 (12.7-27)
Rhabdomyolysis (Creatine Kinase>500 IU/L)	82 (85.4)
Crush Injuries (Creatine Kinase > 5000 IU/L)	32 (33.3)
Acute Kidney Injury (Creatinine> 1.5 mg/dL)	17 (17.9)
Clinical diagnosis of fat embolism	5 (5.3)

[b]Median (IQR) for skewed variables

DISCUSSION

Trauma related to road traffic accidents in India is a pandemic (12). Morbidity and mortality is thought to be high (10) owing to poor prehospital systems and the lack of organization. The burden on the health care system is tremendous. Morbidity and mortality in a recent multicenter study demonstrates a significant burden to the healthcare system (10). However, the burden of trauma in Indian ICUs has not been verified and is needed for patient care, epidemiological and healthcare perspectives.

In a concurrent cohort study we attempted to describe the burden and profile of trauma patients related to road traffic accidents, which were admitted to ICU of a tertiary level ICU, in India.

In total, a significant burden of patients (15%), were related to trauma alone. To our knowledge there is no data on the burden of trauma in Indian ICUs. This was higher proportion compared to studies from African(13)(14) and lower than the western intensive care units (15)(16)

A significant proportion of patients were young males, which is consistent with larger multicenter studies and reports on trauma outside of ICU in our country(17)(18). The financial burden is thus compounded by the fact that the "bread winner" of the family is unable to pay for treatment. Majority of vehicles implicated where two wheelers which is a consistent finding from other studies on demographic data on trauma(17)(19). In regard to distribution of injuries, extremity and abdomen injuries are most common. This again is not unusual in literature (20) from our region. In total, twenty one patients of the of the 97 admitted in the study died. Twelve of these were discharged against medical advice (all for financial reasons).It is well described that patients and their relatives in this country have to resort this unfortunate method of ceasing health care due to financial constraints.(21)(22) Of the patients that died in ICU, most succumbed to septic complications. The median length of ICU and hospital stay was 4 and 11 days respectively (Table 2). These findings (mortality and morbidity) is consistent with a recent multicenter study conducted by Roy et al where the focus was on in hospital trauma related mortality (10).

A significant proportion of patients had evidence of rhabdomyolysis with a large proportion (39%) needing forced alkaline diuresis for renal protection. The incidence of Acute kidney injury was 17.5 % which is similar to recent data from other trauma units outside of India(23). The incidence of fat embolism in our study seems to be higher

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than other reports from outside ICU.(24) Severity of injury (measured with ISS) was strongly associated with mortality and APACHE scores had a trend toward significant association with mortality.

Thus, it is important for medical staff and health care authorities to aware of the morbidity and mortality related to trauma in the ICU. Resource allocation in terms of staffing should be adequate to undertake these seriously ill patients. Preventive measures will help reduce the financial and health care burden of these patients.

With regard to limitations of our study, we did not define the total burden of patients of the hospital and the proportion of those that need Intensive care. This is difficult to measure, especially as many trauma patients (especially with minor trauma) get admitted though the outpatient services into the ward.

Secondly, some trauma patients (especially those with extremely high mortality) may have been discharged from ED against medical advice. In an ideal set up, many of these patients may have required admission the ICU.

However, our study is crucially important to data on trauma related to road traffic accidents and its burden on ICU and the health care system.

CONCLUSION

Trauma related to road traffic injuries is a significant burden to the ICU and accounts for 15% of all admissions. Most if these patients are young males have mainly extremity and abdominal injuries. Most common vehicles implicated are 2 wheelers. Mortality is significant (21.9%) and length of ICU and hospital stay is appreciable (4 and 12 days respectively). Acuity scores, particularly ISS score is predictive of mortality.

Healthcare personal and medical staff need to aware of the acuity of illness and high mortality of trauma patients admitted to ICU. Preventive measures need to be upgraded so as to reduce both the burden on individuals an on the health care system.

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