



Original Research Article

Retrospective Comparative Observational Study of Poly Trauma and Road Traffic Accident (RTA) Injury Case Profile At Visakhapatnam, AP

Authors

V Dharma Rao¹, Kodandarao Kuna P^{2*}

¹Prof. & HOD, Dept of Orthopedics & Trauma, King George Hospital, Visakhapatnam, AP

²Faculty, Professor Dept. of General Surgery, GIMSR (Gitam Institute of Medical Sciences & Research)
Ex. I/C, Trauma care centre, King George Hospital, Visakhapatnam, AP

*Corresponding Author

Dr Kodandarao Kuna MS (GS)

Faculty, Dept. of General Surgery, GIMSR – Address: Flat No. 401, Orchid's Apartment, Ocean View
Layout, Pandurangapuram, Visakhapatnam – 530003, India
Cell No. 70950 17766, Email: kkraomsgs@gmail.com

Abstract

Introduction & Background: *In the light of increasing rise of vehicular traffic and the accident rate causing great loss to the economy, effective measures have to be taken to control it and to treat the injured victims.*

Aim: *To study the case profile of road traffic accident (RTA) injured patients reported at the trauma care center, King George Hospital (KGH), Visakhapatnam, situated in North Andhra along the National Highway – 5 (NH-5).*

Material & Methods: *It is a study of data related to trauma cases reported at the trauma care center, KGH for the period 2011 – 2018. It is a retrospective comparative observational study of about 6532 inpatients out of which 1082 poly trauma cases, 5723 head injury cases, 334 spine injuries.*

Results & Discussion: *About 10% are IP admissions and death rate ranges from 3 – 4%. 13 – 30% of IP admissions underwent emergency surgery at trauma OT. About 90% are MLC cases and death rate has been decreasing from 2011 to 2018 even with increasing number of accidents. Alcohol intoxicated cases constitute about 17 – 46%, are high in this study which is about 15% in other studies. Age group involved is 21 – 50 years young driving two wheelers, mostly occurred from 7PM to 1AM in the ratio of 1:3 morning to evening which conforms with other studies. Most of the total trauma cases are due to road traffic accidents followed by cases due to falls. Head injury is the commonest RTA injury followed by poly trauma which includes soft tissue and bone & joint injury.*

Conclusions: *Though head injury is the commonest, injury due to poly trauma and falls is also significant in India. Most fatal accidents are preventable and a comprehensive multi programme approach can mitigate most of them. Cashless treatment policy in emergency trauma victims is obligatory. Controlled incremental release of traffic at junctions can prevent accidents. Helmet and seat belt usage must be made compulsory on state and national highways. L and U road bends must be eliminated along highways. De-addiction centers have to be opened at all highway hospitals.*

Introduction

Trauma is a major public health problem. 50% die immediately at the time of accident, 25% die in golden hours of trauma (first 4 – 6 hours of trauma), and another 25% die during treatment due to sepsis and other complications. Injuries may be penetrating, blunt, blast, chemical and electrical.

Of the several causes of trauma, RTA (Road Traffic Accidents) take maximum chunk of share of about 70 – 80%. The economic burden to the family of victims and to the society and nation is significant even affecting the Nation's GDP to the extent of 2 – 3%. The growing incidence of RTA Trauma has attained an epidemic proportion at present due to some important factors like increase in traffic, population and number of vehicles, bad and narrow roads, poor lighting along road side, poor traffic control at junctions and alcoholism.

Triage: Means “sort out” in French. It is system to attend trauma patients formulated by committee of trauma of the American College of Surgeons.

Definition: It is the process of clinical sorting out a group of trauma victims at the reception room according to severity of injuries and the urgency of threat to their lives or limbs also means avoiding the ineffective use of time and scarce resource and concentrating on those victims having better chance of survival. The criteria of triage are BP<90mm of Hg, pulse >120/min, respiratory rate >35 or < 12/min, penetrating injuries, unconscious patients, traumatic amputation of extremities, flail chest and two long bone injuries.

Atls & Phtls are the two components in triage. ATLS is Advanced Trauma Life Support which is essential for the first hour care of the injured patient. PHTLS is Pre-Hospital Trauma Life Support is to prevent deaths during transport to the hospital.

RTS: It is revised trauma score. Glasgow coma scale, systolic blood pressure and respiratory rate are used as parameters. It comes between 0 – 8. Value < 4 needs critical care.

Polytrauma: injury to atleast two organ systems with a potential life threatening condition of the patient. Injuries of RTA, Train Accidents, Warfare blast injuries, fall from heights come under polytrauma. It is either multiple fractures in limbs and spine or multiple system injuries involving head, thorax, abdomen and pelvis of victims of accidents.

Seat belt injuries: In an individual with seat-belt during impact, violent deceleration of human body occurs. Seat-belt impinges heavily on its point of contact with trunk and viscera continue to move forward. It leads into severe contusion of abdominal contents; detachment of bowel from its mesentery due to free forward rapid mobility of the bowel over a relatively fixed mesentery Solid organ injury occurs only occasionally. Two point anchorages causes solid organ injuries like of liver/spleen. Lap-belt causes contusion and bowel injury commonly. It is often difficult to identify the injuries due to presence of more obvious other injuries. CT Chest and Abdomen, diagnostic peritoneal lavage (DPL) are very useful. Petechiae around iliac crest of costal margin are signs wherein one can suspect seat-belt injuries. Distraction fracture of lumbar spine (chance fracture) with hyper-aesthesia of T12 and L1 level is often associated. 10% of such fractures are associated with intra-abdominal injuries. Treatment is immediate laparotomy and proceed – bowel suturing/resection/suturing of the organ injuries/splenorrhaphy/splenectomy.

Risk factors : Speed drive, violating traffic rules, poor lighting, narrow and bad roads, heavy traffic, more usage of three and four wheelers, non use of helmet or seat belt, poor traffic control at junctions all the 24 hours, usage of vehicles of more than 15 years old are the main factors risking RTA.

ICMR Study

On causes of death by verbal autopsy revealed that injury ranked among the first five major cause of death in adults, it is the leading cause of mortality for young adults less than 45 years and a

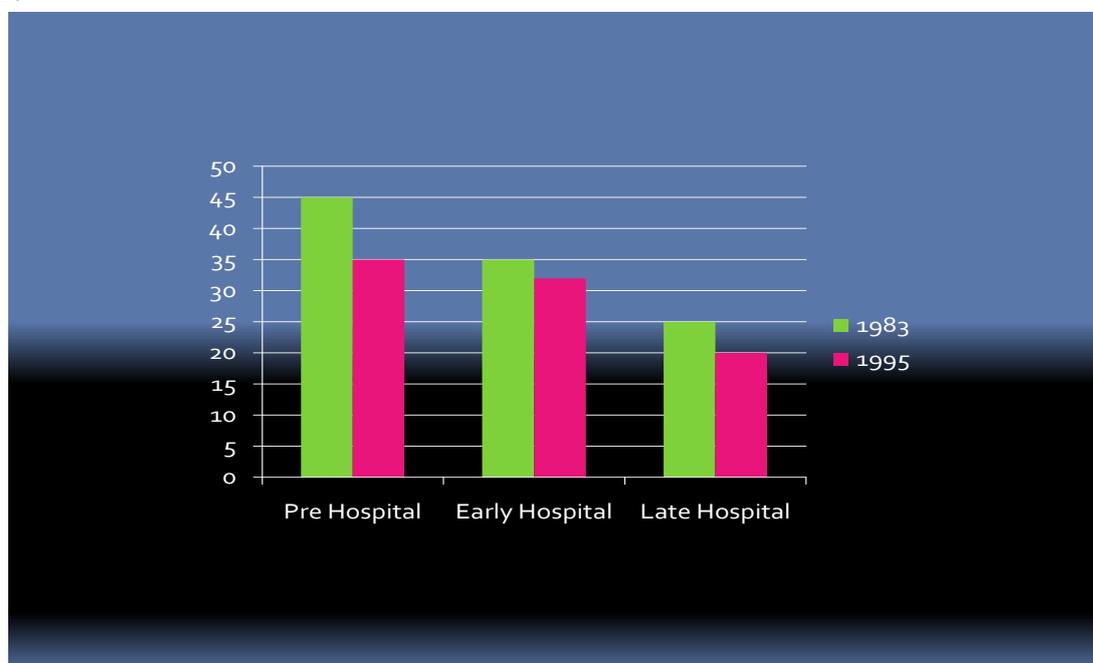
major burden of disease across all age groups placing heavy burden on nation economy and family.

Epidemiology

Between 15- 44 years of age, RTA is the leading cause of death. Between 15-24 years, 8 out of every 10 deaths in young are due to injuries. Injuries account for more premature deaths than cancer, heart disease, or HIV. 50%% of deaths occur at the scene within minutes or en route to the hospital due to bleeding, 20-30% die of neurological dysfunction within several hours to 2 days post-injury, 10 – 20% die of infection or multiple organ failure within days or weeks. Every year 1.9 million are hospitalized due to injury 27 million are treated in the emergency department. Injuries account for an estimated 8% of all hospital discharges, 37% of emergency department visits, and 35% of all emergency medical services transport. Nonfatal injuries lead to reduced quality of life and high costs accrued to the health care system, employers and society in general. Persons more than 65 years account for

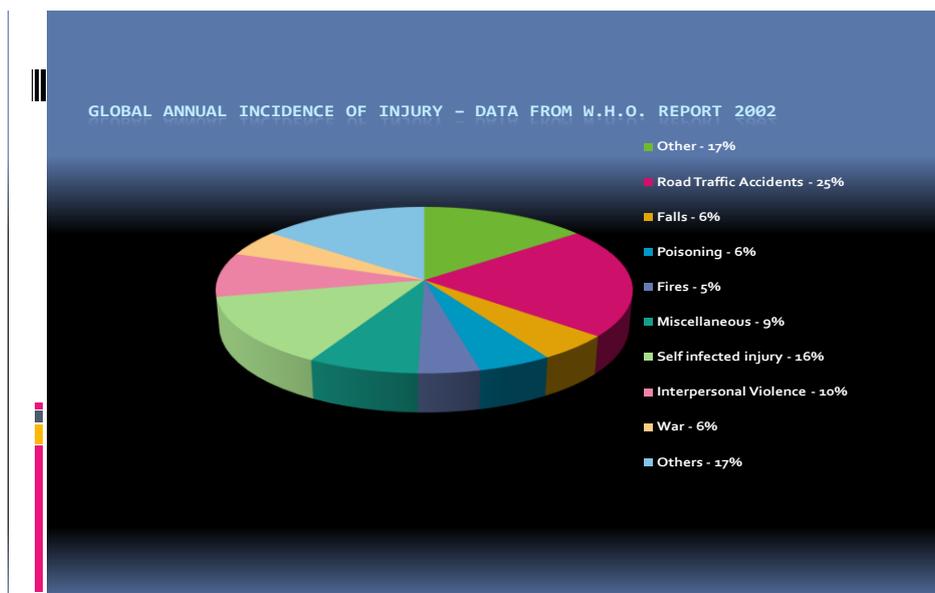
25% of all injury deaths and 30 % of injury related hospitalization. 70% of injury deaths and more than 50% of non fatal injuries occur among males. Rate of injury deaths ratio for male and female is 2:1. Rate of nonfatal injury for male and female is 1.3:1. But over 65 years of age the ratio for male and female is 1:1.3. The above statistics are frightening and calls for immediate attention to rein the deleterious effects of injuries on the mankind. RTA is the tenth leading cause of death worldwide, will become the third leading cause of disability adjusted life years lost world wide by 2020. 90% of global RTA occur in developing countries RTA is the most common cause of death of people between 5 – 25 years of age. According to World health report 2002 of the global burden of injuries 30% of morbidity and another 30% mortality occur in South East Asia region. By 2020 the road traffic death in India will increased by 147% according yr 2000 estimate the economic loss of India due to RTA is 3% of India's GDP. Kuppu Swamy's Socio Economic Index is applicable here.

Diagram: 1.



Trimodal distribution of death at all the stages of managing the injured patients there is decrease in death rate over years from 1983 to 1995. In the early hospital modal the cause of death is due to bleeding.

Diagram: 2.



As per WHO report above the most common cause of trauma is RTA.

Diagram: 3.

Incidence of Death – 42% CNS Injuries, 39% bleeding.

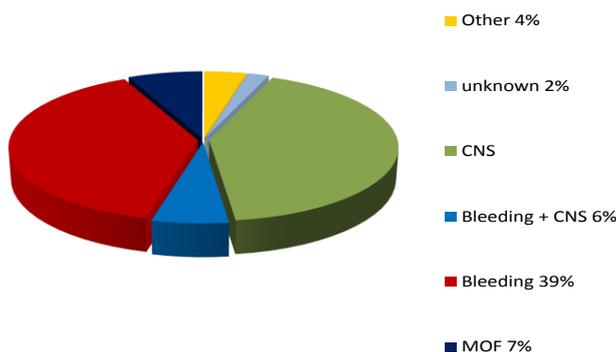
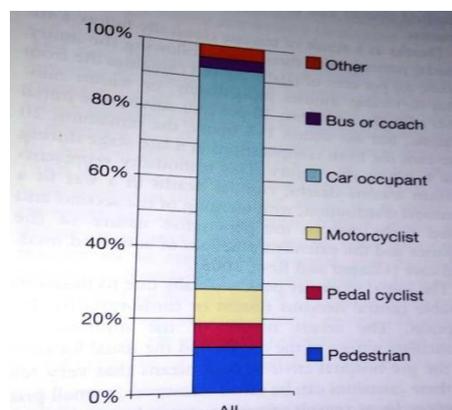


Diagram: 4.



Proportion of casualties by road user type (UK 2007 Dept. of transport data) 26 – 92% of accidents are car occupants in UK.

Material & Methods**Methodology**

Study design – Retrospective observational.

Setting – tertiary hospital level one 30 bedded trauma care center (Including ICU) situated at King George Hospital, Visakhapatnam, caters to North Andhra consisting of the districts of Visakhapatnam, Vizianagaram and Srikakulam for a population of about 80 lakh. The national highway NH-5 starting from Chennai ending at Kolkata passes through North Andhra districts. The KGH is a premier level one super speciality tertiary care hospital estd. in 1926 consisting of about 2000 beds, one of the busiest hospitals in

India. Data acquired with permission and clearance for the study. 6532 cases of trauma on admission out of which 5723 are head injury cases (87.61%), 2255 are injuries due to falls (34.52%), 1082 are polytrauma cases (16.56%), 334 are spine injury cases(5.11%). - is the component of the present study. Demographic variables like the rate, ratio, incidence and the parameters like age, sex, type of vehicle, factors influencing driving like alcohol, MLC, ventilator use, ICU role are considered for the present study at the present gitam institutional level of research center. The data collected was analysed in excel sheet of MS-Office with SPSS software application.

Table : 1.

TRAUMA - RTA CASE PROFILE STATISTICS - 2011 TO 2018									
YEAR	2011	2012	2013	2014	2015	2016	2017	2018	TOTAL
O.P.	8246	8554	8710	8424	9425	10191	9885	8422	71857
IP.	662	736	640	797	802	971	1142	782	6532
IP %	8.03	8.60	7.35	9.46	8.51	9.53	11.55	9.29	72.3166
MALE	544	588	503	650	637	833	888	651	5294
FEMALE	118	148	137	147	165	138	254	131	1238
M/F RATIO	4.61	3.97	3.67	4.42	3.86	6.04	3.50	4.97	4.38
DISCHARGE	4	0	2	31	17	127	23	7	211
LAMA	97	108	74	99	88	114	85	52	717
SHIFT	250	265	243	330	410	436	770	508	3212
RTA	404	388	359	453	490	493	543	321	3451
FALLS	179	184	142	198	204	387	535	426	2255
ASSAULT	12	25	16	21	14	29	28	20	165
MLC	550	598	517	686	766	954	1139	773	5983
NON-MLC	112	138	123	114	36	17	3	9	552
CONSERVATIVE	530	515	434	638	673	841	994	662	5287
SURGICAL	132	221	206	159	129	130	148	120	1245
HEAD INJURY	622	682	590	721	722	822	914	650	5723
SPINE INJURY	30	43	39	36	24	24	80	58	334
POLY TRAUMA	154	153	81	112	98	169	192	123	1082
DEATHS	311	363	321	337	287	294	264	215	2392

LAMA - LEFT AGAINST MEDICAL ADVISE.

RTA - ROAD TRAFFIC ACCIDENT.

MLC - MEDICO LEGAL CASE

In the present study RTA constitute about 58% of the total IP trauma cases. Head injury constitutes

87.61% of the total RTA. Death rate is 3.33% of the total OP trauma cases reported.

Table: 2. CT Scan Brain Findings Data Analysis of Head Injury of RTA Patients 2011 - 2018

YEAR	CONTUSION	SUB ARACHNOID HAEGE	SUB DURAL HAEGE	EXTRA DURAL HAEGE	DIFFUSE AXONAL INJURY	QUADRI PLEGIA	OBSTRUCTIVE HYDROCEPHALUS	MASS EFFECT	MILD LINE SHIFT
2011	105	187	104	86	52	24	6	12	3
2012	262	223	155	72	16	29	30	34	52
2013	268	128	159	88	35	20	29	31	87
2014	316	183	165	92	56	10	30	19	94
2015	331	203	203	103	110	5	10	37	80
2016	378	210	182	111	92	6	4	47	113
2017	385	255	187	129	42	31	1	101	214
2018	299	144	163	86	44	21	2	57	94
TOTAL	2344	1533	1318	767	447	146	112	338	737

SCALP HEMATOMA - 125 , INTRA CEREBRAL HAEMORRHAGE - 4, NO INJURY ON CT - 123. TOTAL -7742.

As per the CT brain data in the table above, the commonest finding is contusion followed by sub arachnoid haemorrhage (SAH) and Sub Dural Haemorrhage (SDH). About 10% have mid line

shift and about 5.8% are cases of diffuse axonal injury which are of poor prognostic concern. SAH, SDH and EDH constitute about 50% of cases of head injury.

Table : 3.

COMPARATIVE INDIAN STUDIES ON RTA INJURIES				
PLACE	PERIOD	AUTHOR & SAMPLE SIZE	TYPE OF STUDY & SETTING	FINDINGS
Bhopal	Jan 2009 - Oct 2011	Khare neeraj - 1268	retrospective observational - tertiary care hospital	age 16 - 31 yrs (51%), 6 pm - 12 pm(62%), 3.15% mortality, 64% head injuries
Pune	Oct 2009 - Feb 2011	S M Pathak - 182	cross sectional - tertiary care hospital	age 20 - 30 yrs, 6pm - 10 pm & monsoon, 27.35% junior drivers, 48.6% soft tissue injuries
Udaipur	Jul 2010 - Dec 2010	Solanki S L - 400	retrospective observational - tertiary care hospital	age 15 - 45 yrs, 5pm - 9 pm (50%), 77% fatigue/lack of sleep, 8.50% mortality.
New Delhi	Jan 2011 - Dec 2011	Puneet misra - 900	cross sectional - tertiary care hospital	age 16 - 30 yrs, midnight - 6 am, 63% used helmet, 32% used seat belt
Amritsar	Jan 2012 - Dec 2012	Tejinder singh - 1425	descriptive - tertiary care hospital	age 25 - 44 yrs, 4 am - 12 pm, 6% alcohol, 10% used mobile phone while driving, 20% never used helmet, 15% not used seat belt. 25.30% mortality.
Present study Visakhapatnam	Jan 2011 - Dec 2018	Kodandarao K - 6532	retrospective observational - tertiary care hospital	age 21 - 50 yrs, 7 pm - 1 am, 17 - 46% alcohol consumed, 3-4% mortality.

Common factors to all studies - younger age group involved, mostly males, two wheelers.

Kenya study - 31% pedestrians affected in RTA.

Donald A. observations - cell phone use has four times higher rate of accidents - New Eng J. of Medicine

Gregerson & Bjurulf Postulates - Inexperience is more important factor than youth in causing accidents.

National Crime Records Bureau, New Delhi - Maximum number of RTA cases reported between age group 15 - 44 yrs.

Diagram: 5

Protective devices and RTA

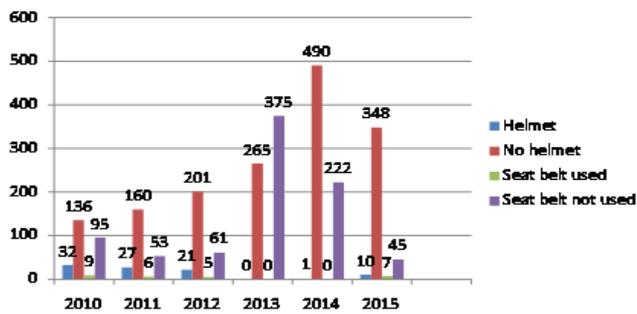


Diagram: 6

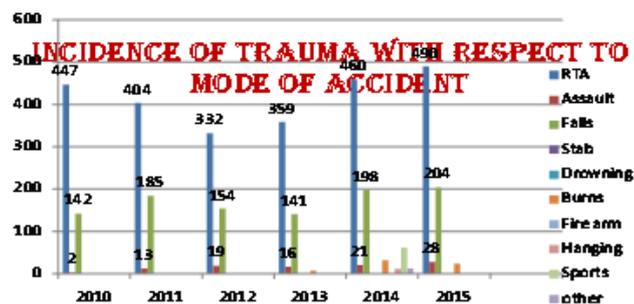


Diagram: 7

Pathology wise

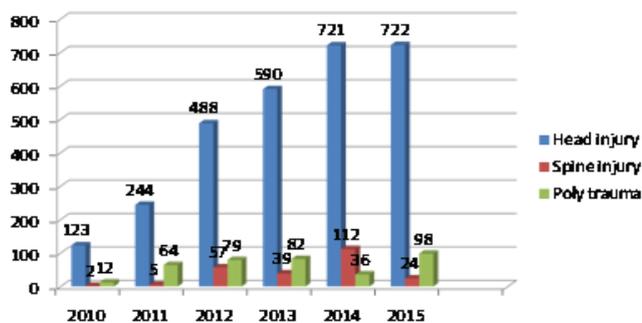


Diagram : 8

Ventilator requirement

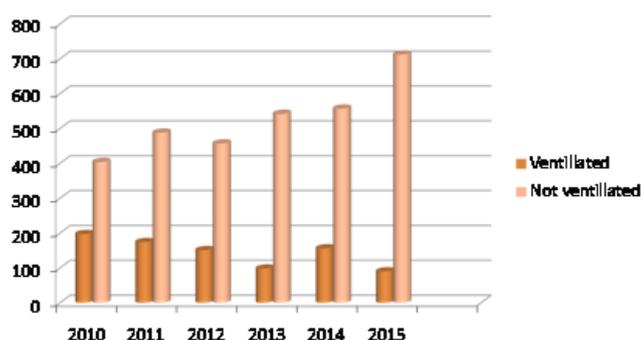


Image: 1



Heavy vehicle accident – external fixator to lower limb long bones, compound fracture – GITAM HOSPITAL.

Image: 2.



Severe degloving injury lower limb with muscle and tissue loss – RTA.

Results & Discussion

Of the total cases of trauma reported at casualty EMD, OPD of King George Hospital, Visakhapatnam, about 10% are IP admissions and death rate ranges from 3 – 4%. From 13 – 30% of IP admissions underwent emergency surgery at trauma OT. Majority cases are males with male to female ratio of 4 : 1. About 90% are MLC cases and the death rate has been decreasing from 2011 to 2018 even with increasing number of accidents. Alcohol intoxicated cases constitute about 17 – 46%, are high in this study which is about 15% in other studies. 6532 cases of trauma on admission out of which 5723 are head injury cases (87.61%),

2255 are injuries due to falls (34.52%), 1082 are polytrauma cases (16.56%), 334 are spine injury cases(5.11%).- is the component of the present study.

As per the present study of 6235 cases of inpatient admission of RTA cases most commonly happen in the age group of 21 – 50 years. Majority occurred in the evening (7 PM – 1 AM) in the ratio of 1:3 which conforms with other studies. Most of the total trauma cases are due to road traffic accidents followed by cases due to falls. Head injury is the commonest RTA injury followed by poly trauma which includes soft tissue and bone & joint injury. Whereas as per the data analysis of a level 2 peripheral highway hospital at Rajmundry the commonest RTA injury is polytrauma and not head injury. This is due to the non availability of Dept. of Neuro Surgery in secondary care hospitals, despite the availability of CT scan even in such centers.

Conclusions and Future Perspective

Though head injury is the commonest amount trauma patients, poly trauma including spine injury is also significant apart from injury due to falls. Injury due to falls causes significant burden to the economy in the west esp. after the age of 75 years. Even in India it is no less significant that constitutes about 34% of trauma. In the peripheral centers data above head injury shows less significant cause due to the non availability of department of neurosurgery and the diagnostic CT. Most fatal accidents are preventable and a comprehensive multi programme approach can mitigate most of them. Cashless treatment policy in emergency trauma victims is obligatory. Controlled incremental release of traffic at junctions can prevent accidents. Helmet and seat belt usage must be made compulsory on state and national highways. L and U road bends must be eliminated along highways. De-addiction centers have to be opened at all highway hospitals.

RTA are more common in younger age group two wheelers are more vulnerable, good number of drivers are junior drivers even without licence and

insurance. Fatigue, listening to music, talking in mobile phone, smoking & tobacco products and thereby lack of concentration are the problems with drivers. Most fatal accidents are preventable and a comprehensive multi programme approach can mitigate most of them.

- 1) Traffic training and comprehensive safety education must be made essential part of school curriculum/education.
- 2) Traffic rules awareness programmes must be carried out regularly..
- 3) Emergency health services should be strengthened along the course of all state and national highways functioning round the clock with good network of transport of trauma victims.
- 4) Cashless treatment policy in emergency trauma victims is obligatory.
- 5) Controlled incremental release of traffic at junctions can prevent accidents.
- 6) Helmet and seat belt usage must be made compulsory on state and national highways.
- 7) L and U road bends must be eliminated along highways.
- 8) De-addiction centers have to be opened at all highway hospitals.
- 9) All arterial roads have to be widened without encroachment.
- 10) Air bags fitted on the sides of four wheelers also apart from the front ones is another improved safety measure.
- 11) Road safety committee at each district consisting of senior orthopaedician, DIG police, District Judge, has to be formed under the chairmanship of district minister.
- 12) Road safety service police van has to monitor the cases of RTA one each for every 20 km along the course of highways.
- 13) The existing trauma care centers have to be strengthened with network of transport facility connecting the accident spot and the hospital all the 24 hrs. Public must be made comfortable to help victims.

Acknowledgement

We are thankful to the KGH admn. for providing the data and for issuing permission to conduct the present research . We are thankful to GIMSR admn. for facilitating to conduct research at the centre providing necessary infrastructure.

Financial Support: Nil.

Conflict of Interest: No.

References

1. Dr. Vineet Bal, Dr. Tejinder Singh, Dr Tejbir Singh, Dr Shyam Sunder Deepthi - An epidemiological study of road traffic injuries reporting in casualty department of guru nanak dev hospital, Amritsar – JMSCR Vol 06 Issue 11 Page 607-615 November.
2. Puneet Mishra, Anindo Majumdar, Mahesh Chandra Misra Shashi Kant, Sanjeev Kumar Gupta, Amit Gupta, Subodh Kumar - Epidemiological study of patients of road traffic injuries attending emergency department of trauma center in New Delhi - Indian Journal of Critical care Medicine – 2017 Vol 21 Issue 10 Pages 678-683
3. Dr. Solanki S. L., Mittal Hemlata - An epidemiological study of road traffic accident cases at a tertiary care hospital in Udaipur – Int J Cur Res Rev , Vol 8, Issue 7, April 2016.
4. S.M. Pathak, Maj, A. K. Jindal, Col, USM, A.K. Verma, Brig, and A. Mahen, Air Cmde - An epidemiological study of road traffic accident cases admitted in a tertiary care hospital – Med J Armed Forces India. 2014 Jan 70(1) 32-35.
5. Khare Neeraj, Gupta Sanjay K, Varshney Atul, Athavale AV - Epidemiological study of road traffic accident cases attending tertiary care hospital, in Bhopal Madhya Pradesh – National Journal of Community Medicine, Volume 3, issue 3, July – Sept 2012.
6. Transport Research Wing, Ministry of Road Transport and Highways, Motor transport statistics of India [Internet], New Delhi; Governement of India; 2001 02 [cited on 2013 oct 15].
7. World Health Organization. Road Traffic Injuries. [Internet], 2013 Mar [cited 2013 Nov 22]
8. Batra Vs, Bedi RB. Effects of drunken driving on raffic safety. [Internet]. [cited on 2013 Nov 22].
9. Hsiao M, Malhotra A, thakur JS. Sheth JK. Nathens AB, Dhingra N, et al. Road traffic injury mortality and its mechanisms in India: Nationally representative mortality survey of 1.1 million homes BMJ open 2013; 3:e002621.
10. Mishra B. Sinha Mishra ND, Sukhla S, Sinha A. Epidemiological study off road traffic accident cases from western Nepal. Indian J Community Med 2010; 35:115-21.
11. Dsouza C, Rao V V, Kumar A, Diaz E. Epidemiological trends of trauma in tertiary care centre in Dakshina Kannada district of Karnataka, India. J Clin Diagn Res 2014;8:66-8.
12. Pathak SM, Jindal Ak, Verma Ak, Mahen A. An epidemiological study of road traffic accident cases admitted in tertiary care hospital. Med J Armed Forces India2014;70:32-5.
13. Patil SS, Kakade R, Durgawale P, Kakade S. Pattern of road traffic injuries: A study from western Maharashtra, Indian J community Med 2008; 33:56-7.
14. Rastogi D. Meena S. Sharma V, Singh GK. Causality of injury and outcome in patients admitted in a major trauma center in North India. Int J Crit Illn Inj Sci 2014;4:298-302. [PUBMED] [Full text]
15. Nilambar Jha, D.K. Srinivasa, Gautam Roy, S. Jagdish. Epidemiological Study of Road Traffic Accident Cases Indian Journal of Community Medicine Vol. XXIX, No. 1, Jan-Mar., 2004, 20-24.
16. P. Shruthi, V. T. Venkatesh, B. Viswakanth, C. Ramesh, P.L. Sujatha, I. R. Dominic

- Analysis of Fatal Road Traffic Accidents in a Metropolitan City of South India J Indian Acad Forensic Med. October-December 2013, Vol. 35, No. 4.
17. Banerjee KK, Agarwal BB, Kohli A. Agarwal NK. Study of head injury victims in fatal road traffic accidents in Delhi. Indian J Med Sci. 1998; 52(9); 395-398.
 18. Michale Johnson R. McCarthy MC, Miller SF. People JB. Craniofacial trauma in injured motorcyclists; the impact of helmet usage. J Trauma 1995; 38(6); 876-8.
 19. Vimla Thomas, Lavany Sridhar Epidemiologic profile of road traffic accident cases admitted in tertiary care hospital. Int J med Pharm Sci. Feb 2013 Vol 03 (06) 30-36.
 20. Gururaj G, Shastry KVR, Chandramouli AB, Subbakrishna DK, Kraus JF (2005) Traumatic brain injury. National Institute of Mental Health and neuro Sciences, Publication no. 61.
 21. Manisha Ruikar, National statistics of Road Traffic Accidents in India; Journal of Orthopaedics, Traumatology and Rehabilitation 2013 vol. 6(1)
 22. Mehta S. P. An epidemiological study of road traffic accident cases admitted in Safdarjang hospital, New Delhi, Indian J Med Res. 1968;56(4):456-466[PubMed]
 23. Sood S. Survey of factors influencing injury among riders involved in motorized two-wheeler accidents in India: a prospective study of 302 cases. J Trauma 1988;28(4):530-534[PubMed]
 24. Mishra B., Sinha N., Shukla S.K., Sinha A. K. Epidemiological study of road traffic accident cases from western Nepal. Indian J Community Med. 2010;35(1):115-121.[PubMed]
 25. Kiran E.R., Saralaya K.M., Vijaya K. A prospective study on road traffic accidents. J Punjab Acad Forensic Med Toxicol. 2004;4:12-16.
 26. Jha N., Srinivasa D.K., Roy G., Jagdish S. Epidemiological study of road traffic accident cases: a study from South India. Ind J Community Medicine. 2004;29(1):20-24.
 27. Gunjan B., Ganveer, Tiwari R. R. Injury pattern among non-fatal road traffic accident cases: a cross sectional study in central India. Ind J Med Sci. 2005;59(1):9-12.
 28. Dandona R, Mishra A. Death due to road traffic crashes in Hyderabad city in India: Need for strengthening surveillance Natl Med j India 2004;17:74-9.
 29. Epidemiology of road traffic accident in Hyderabad-deccan, Andra Pradesh, India. Available on:http://www.ihsnet.org.in/burden_of_disease/road_traffic_accident.htm updated on May 3rd 2003.
 30. Jha N. Epidemiological study of road traffic accident cases: A study from eastern Nepal : Region Health forum WHO South – East Asia Region : vol.8:2004.
 31. Nantulya MV. Reich MR, The neglected epidemic: Road Traffic Injuries in developing countries. BMJ 2002; 324:1139-41
 32. P Mondal, A Kumar. A silent tsunami on Indian road: A comprehensive Analysis of epidemiological aspect of road traffic accidents. BJM 1(1):14-23, 2011.
 33. Mehta SP. An epidemiological study of Road Traffic accident cases admitted in Safdargang Hospital, New Delhi. Indian Journal of Medical Research 1968;56(4):456-66.
 34. Abhishek S. An epidemiological study of road traffic accident cases at tertiary care hospital in rural Haryana. 2011 IJCM Vol.23, No 2, 53-55.