ANIL AGGRAWAL'S
Internet Journal of Forensic Medicine and Toxicology
The world's first online journal devoted entirely to forensic medicine and toxicology · Published 1 January and 1 July

VOL. 3, NO. 2
Downloaded from www.anilaggrawal.com · ISSN 0972-8074 (Online) · https://www.anilaggrawal.com/ij/vol_003_no_002/others/thesis_avneesh/chap003.html

REVIEW OF LITERATURE

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REVIEW OF LITERATURE

Special Boards of Inquiry investigated fatal traffic accidents. Within the main project 300-400 accidents were investigated annually. The main project was included those motor vehicle accidents in which a person in the vehicle dies within three days of accidents. The causes causing fatalities were Human factors accounted for 79.7%. Condition of vehicle for 10.7% and traffic conditions for 9.6% of the cases1.

A study was conducted with the object of studying various aspects of cranio-intracranial injuries in road side vehicular accidents cases in Delhi. The analysed 1132 vehicular accidents pedestrians (50.7%) and motocyclists (18.28%) comprised most common victims. Common age group involved was 21-40 years (46.01%). Head injury was responsible for causing death in 71.99% of cases. Most of the victims died on the spot (36.30%) incidence of cranio-intracranial injuries was highest in cyclist (78.9%) and motor cyclist (72.46%) pedestrians (6.02), fracture skull was observed in 79.87% of cases the most common bone involved was temporal bone (58.67%). The commonest variety of intracranial haemorrhage was subarachnoid haemorrhage (66.9%). Commonest complication observed in head injuries was bronchopneumonia2.

A study was conducted to explain the Mechanism of Facial Injury. The study illustrated the practical significance of biodynamics by looking at the comparative frequencies and aetiologies of facial fractures. The mandibular fractures are twenty times commoner than maxillary fractures. There is a 2:1 ratio of single to double mandibular fractures. Cyclist, motor cyclist and ejected occupants of car often fracture their maxillae3.

An epidemiological study conducted on 556 autopsies of persons having craniocerebral damage by blunt force impact observed that involvement of males was five times than that of females and victims were mostly from 3rd and 4th decades. Vehicular accidents were involved in 4365 cases, while fall from height in 18%. Commonest victims involved were pedestrians (36%) followed by

cyclist (9%). Survival of a victim after sustainance of injury varied from spot-death to 56 days survival. Majority (53%) expired within first 24 hours of sustaining the injuries. Paradoxically, 15% survived for over a week or more in 7th decade onwards, while only 10% survived for over one week in earlier age group. In 104 cases cerebral decompression operations were carried in hospital. In this group 24% died within first 24 hours after sustaining injuries, as compared to the non operated group where 61% expired during first 24 hours. Thus emphasizing the beneficial effect of operative decompression procedures in such cases. Relatively the external injuries with the internal ones, about 19% of the cases did not have any external injury, inspite of having significant intracranial damage. 83% cases showed skull fractures and the rest 16.7% did not show cranial damage. In 8 cases there was only fracture of skull without intracranial damage and death was due to injuries in other parts of the body. Majority (57.6%) showed fracture of both vault and base of skull. In 21 cases of these, there was neither external visible injury on scalp/face nor fracture in any part inspite of there being intra-cranial damage of certain degree present4.

Analysis of 524 autopsies carried out on the victims of road accidents in Srilanka. 51.4% of fatalities were among pedestrian. The highest number of fatalities were in the age group 20-29 years. Craniocerebral injury was the commonest cause of death in all groups of victims5.

Analysing the intracranial injuries, Tyagi et al found that in all but 8 cases primary intracranial lesions that had contributed to the death of the individual, were seen. Extradural and cerebral lesions were seen in 94.5% and 771.% respectively. This was as against secondary cerebral damage, which were seen in 24.1% cases. Thus indicating that in one out of four cases secondary brain damage played an important role in causing death. Amongst all types of intracranial haemorrhage, subdural was commonest (69.3%) followed by subarachnoid (55.1%). Extradural haemorrhage was seen in 18% cases only, while intraventricular in 13.4% cases. In other cases, various combinations of intracranial haemorrhage were seen, of which subdural and subarachnoid was commonest (31.8% cases). Of the extradural haemorrhage, unilaterality was seen in 86% cases and the rest had bilateral involvement. The commonest region involved was temporo paritetal, followed by frontal; occipital region was least involved. About one fourth cases of the persons with extradural haemorrhage did not show any visible injury on scalp or face.

On the cases of subdural haemorrhage, in 43.4% it was all alone while in 56.6% it was associated with other types of haemorrhages. Subarachnoid haemorrhage was the commonest type, associated with it in 31.8% cases. In half of the cases it was unilateral while in the rest it was bilateral. Fracture skill, a common accompaniment, was not seen in 16.8% cases. In 16.8% cases there was no visible external injury either on face or on scalp.

In his analysis of subarchnoid haemorrhage, Tyagi et al found that it was present in 55.1% cases of intracranial haemorrhage. One fourth of these were all alone and the rest 3/4th were associated with other types, subdural association being the commonest (57.7%). 37.6% cases were unilateral while 62.3% bilateral. Most of the unilateral haemorrhages were localized. In several cases, it was patchy in nature. Associated fractures were common but not seen in 10.9% cases. A significant finding was absence of associated cerebral contusions in 28.1% cases, they concluded that the incidence of subarachnoid haemorrhage in his study was less than that of subdural.

Intraventricular haemorrhage was seen in 13.4% cases of intracranial haemorrhages. This was always seen in association with other types of intracranial haemorrhages of which subarachnoid association was commonest. A significant findings was that it was never present alone.

Cerebral contusions were the commonest finding in cases of cranio-cerebral damage (95.2%) cases. It was present alone in 52.9% cases while with lacerations in 42.3% cases. In 7 cases (1.7%) it was present pall alone. Contusion of the brain was unilateral in 43% cases and the commonest sites were frontal and temporal, bases and poles. Fracture skull and visible injury on face and scalp were commonly associated but were not in 7.9% and 11.6% cases respectively.

Cerebral lacerations were seen in 45.1% cases having any cerebral lesion. While taking into consideration all the intracranial lesions, this lesion was not seen as a lone injury and was always associated with some other intracranial lesion. Cerebral lacerations were unilateral in distribution in 112 (58.6%) cases and bilateral in 79 (41.4%) cases. The common sites of lacerations were again, frontal and temporal lobes of the brain. Fracture of the skull was an accompaniment in all of these External injuries on face/scalp were associated except for in 12 (6.2%) cases.

Deep brain substance haemorrhage was seen in 47 (11.1%) cases of those showing cerebral lesions.

Secondary alterations were seen in a significant 24.1% cases out of 548 cases showing intracranial lesions.

A study was conducted on road traffic deaths in fifteen years of age and under from 1979 to 1985. 336 (26%) children aged 15 years and under died out of a total fatality of 1293. Among this number 83% were pedestrians and 3% were pedal cyclist. The most common cause of death in this age group was fracture of the skull with haemorrhage and laceration of the brain6.

A study of motorcycle fatalities in period 1977-83 was studied. Among the operators killed one fifth were illegally operating the motorcycle. The most severe lesion were located in the cranium-brain and thorax. Ninety two percent had lesions located to the brain and skull, 75% had thoracic lesions and 50% abdominal injuries7.

Review of 375 injured children and found that 83 suffered from head injury, 70 boys and 13 girls. Ages ranged from 2 to 15 years with a mean of 10.4 years. Dirtbikes were implicated in 34 accidents, snow mobiles in 28, 3-wheel ATV's in 19 and 4 wheel ATV's in 2. About 85% of the accidents occurred in a rural setting. Loess of vehicle control was the most common case of injury. Alcohol and drug abuse were not factors. Fifty (60.2%) patients suffered loss of consciousness prolonged in 6 (7.2%). All head injured children also suffered at least one associated injury, mainly involving the musculoskeletal system. Associated spinal injury occurred in 18%. The average hospital stay was 13 days. Three (3.6%) patients died as a result of head injury8.

Analysis of 1116 pediatric trauma cases in an urban setting in Sydney, Australia. The overall group and all deaths were analysed as to their cause and possible preventability as well as salvageable factors. Most of the children were not seriously injured, with the most common injury being due to a fall (57%) and involving a single injury to the upper limb. With the subgroup of 143 children (13% of the total who suffered serious injuries the cranial cavity (90%) was the most common site of injury, occurring most often in pedestrians (31% of the total injured). There were 16 deaths in the series, representing 1.4% of all pediatric trauma admissions and 11% of the admission who were seriously injured. All deaths were related to motor vehicle accidents and associated with serious head injury9.

A retrospective study analysis for a 10 year period (1976-1985) of road traffic accidents (RTA) fatalities was in port. Moresby, the capital of Papua New Guinea. Highest fatality rates are in the age group between 15-44 years, followed by children below 14 and then adults above 45 years of age. Males were far more prone to be involved in RTA fatalities than females. In 40.2% of all the

fatalities the accidents occured between 6PM to 6AM, in 35.3% between 6AM to 6PM. The monthly occurrence in the number of fatal road accidents was seen to less between May-August for both five year periods of study. Multiple injuries involving many organs appear to be more common in pedestrians and passengers than among drivers. About two out of three victims died either at the site of the accident or soon after arrival at the hospital casualty department. Only one third of the victims survived long enough to receive some form of treatment at the hospital and died later. Most fatal accidents occurred during the weekend. Head injury was the dominant and possible cause of death in all these categories of victims10.

A study was conducted in Coperrhagen Denmark to known the role of fatigue in multiple car fatal accidents. 334 fatal multiple car accidents were studied. Twenty one of these accidents happened between midnight and 0600 hours and 11 drivers were found to intoxicated drivers in night time accidents with that of control group, it is concluded that fatigue in an overlooked but most obvious cause of otherwise unexplained accidents in night time traffic11.

An experimental study was conducted using physical models of the head and neck and ones of the skull. They found an impact incurred by the movable head may bring about a change in intracranial pleasure and this change may play an important part in the occurrence of cerebral contusion. The model analysis revealed an unbending in the frontal and occipital regions of the skull and on out bending in parietal and temporal regions immediately after impact, followed by a reverse deformation12.

The autopsy material was analysed for the Traumatic Basal subarachoid haemorrhages. Fourteen cases of traumatic basal subarachnoid haemorrhage were examined in the year 1980-1988. Bleeding was connected with fracture of transverse process of the atlas in eleven cases and with atlanto occipital dislocation in three cases. The source of haemorrhage vertebral artery rupture was determined only four times13.

A case was reported in Institute of Forensic Medicine, Odense Denmark 20 year old alcohol intoxicated man was admitted to the hospital after minor head injury. Intiially there was no neurological disturbance or complaints, but after a few hours the become comatose and he died four days later without regaining consciousness. No traumatic lesions could be seen in upper cervical spine or the vertebral arteries, but the basilar artery was occluded in its entire length. The detailed study showed the incomplete arterial rupture with occluding luminar thrombosis superimposed and more well known fatal complication to a minor head injury a subarachnoid haemorrhage14.

In March 1990 study of road traffic accidents involving fatalities were studied. The number of person killed in road accidents in March 1990 rose by 30.7% (to 217) compared to previous month (166). Of the 217 person killed in road accidents in March, 1990, drivers of motor vehicles accounted for 81 (37.3%) passengers in motor vehicles (57(26.3%), drivers of motor cycles 22 (10.1%) pedestrians 42 (19.4%) and pedal cyclist 12 (5.5%)15.

The study during the continuous period of one month round the clock of 670 patients injured in road traffic accidents attending the Govt. General Hospital, Madras revealed. 82.5% of the injured were males. Twenty of them were brought dead. 29.2% of the injured were cyclists and 28.1% were pedestrians. 11.2% have received life threatening injuries, 10.5% seriously disabling and 37.4% disabling injuries. Head and face were the most commonly injured regions to the extent of 37.9%. Single vehicle accidents were the most common cause of RTA injuries collision with heavy vehicles

were the next common cause of RTA injuries. Only 32.2% of the cases were reported to police records from the hospital16.

The study conducted in Coimbatore city for a period of 1985-1988. A total of 450 deaths from traffic accidents was reported during these years constituting 18% of all unnatural deaths and 32% of accidental deaths. 83% constituted males and 17% were females. Pedestrians accounted for 32.7% of the victims and bicyclists for 27.2%. Commonest offender involved heavy vehicles responsible for an average of 70% fatalities. Most of the accidents occurred between 8 p.m. and 12 a.m. every day. Comparisons have been made with data obtained in other parts of the country and abroad and similarities and contrasts have been highlighted17.

Study presented as case review reported many causes contribute to road accidents among which bad driving occupies a major percentage including the care free behaviour of the driver, without taking adequate care for the effect of weather, road conditions and breaking violently at the last moment, risking a skid18.

In 203 fatal cases of head injuries due to vehicular accidents brought to the All India Institute of Medical Sciences, New Delhi, Fimate found that 139 (68.46%) had scalp injuries, 167 (82.26%) skull fractures, 178 (87.67%) brain lesions, 197 (92.11%) intracranial haemorrhage, 34 (19.21%) brain stem haemorrhage. Thus intracerebral haemorrhage constituted the highest incidence (82.26%) among the cranio-intracranial lesions19.

Relating the survival time to period of survival, they found that 172 of them had history of unconsciousness. None of the victims who died within 6 hours were conscious. Eight victims who died within 3-14 days and 4 victims who died in 31-53 days showed history of unconsciousness of varying period. The survival time in altogether varied from spot death to up to 53 days. Most persons (142) who remained unconscious died within 72 hours of sustaining the injury while most persons who had a history of consciousness (13) after sustained head injury died between 3 and 7 days.

Analysing consciousness in relation to head injury it was observed that unconsciousness is very high when intracranial haemorrhages were associated with skull fracture (18.71%) whereas in case of brain lesions in combination with intracranial haemorrhage the incidence of consciousness and unconsciousness is the same (5 cases each).

They also observed that maximum number of victims 50.15% had the combination of skull fracture, intracranial haemorrhage and brain lesions as the degree of head injury (grade IV). This correlated well the survival time of less than one day in these cases (82). Nineteen cases of grade IV injury survived for 3 to 7 days. Surprisingly, two cases of grade IV victims survived for more than 8 days and one case survived for 30 days. Thus concluding that the assumption that survival time is shorter in cases of extensive cranio-intracranial lesion than those with minimal lesion in the brain, does not hold true in all the cases.

Two cases were reported of rupture of posterior inferior cerebellar artery from blunt basal head trauma in Sweden. The authors propose that the forensic term traumatic subarachnoid haemorrhage ought to be abandoned and replaced by the nature and localization of the source of bleeding, analogous to clinical practice at the spontaneous haemorrhage from rupture of aneurysm20.

The study was conducted in Hartford Hospital in Connecticut over a period of 5 years. The study included 83 motorcyclists, helmeted and non helmeted, involved in crashes. The study showed that

majority of these patients were male and under age of 30 years. Sixty nine (69%) percent who were non helmeted and statistically a significant number in this category had a Glasgow Coma Scale (GCS) score of 8 or under. The study concluded that helmets provide protection and certainly do not increase the incidence of cervical spine injuries21.

Head trauma is the major source of morbidity and mortality among injured motorcyclists. The effectiveness of helmets in reducing head injuries has been well documented. Michael Johnson studied 331 injured motorcyclists during a 4 year retrospective period to analyse the impact of motorcycle helmet usage and associated factors on the type and incidence of craniofacial injuries. These patients were admitted in a level I trauma center at Ohio. Ohio does not have a helmet law, therefore, helmet use was infrequent in these motorcyclists. Only 77 (23%) of those studied wore helmet, whereas 254(77%) were not helmeted. They observed that nonhelmeted motocyclists were three times more likely to suffer facial fractures than those wearing helmets. There were no LeFort fractures wearing helmets while there were seven Le Fort fractures in the nonhelmeted group. The orbit was the most commonly fractured facial bone in this study. Skull fracture occurred in only one helmeted patient, compared with 36 (12.3%) of nonhelmeted patients. Soft tissue injuries of the head occurred in 15.6% helmeted patients, compared with 39.8% non helmeted patients. The chin was the most common location of soft tissue injury in the helmeted group, whereas the scalp was the most common location in the nonhelmeted group. The majority of deaths, 21 of 24 (87.5%) in the non helmeted group were secondary to head injuries. There were no deaths from head injury in helmeted group. In nonhelmeted patients, 9.4% of patients suffered basilar skull fractures while not a single cases of basilar skull fracture was seen in helmeted patients22.

Head injury accounts for >60% of bicycle-related deaths and about one third of emergency room treated bicycle injuries. Many studies have demonstrated consistent evidence that use of helmets can significantly reduce the risk of head injury among bicyclists and the severity of head injury when a crash occurs.

Study of 2333 patients aged 0-14 years who were admitted to trauma centers in the USA because of bicycle related injuries during 1989 through 1992, more than one half (54%) sustained head injury, predominantly concussions and skull fractures. The most common head injury reported was concussion (48%) followed by skull fracture (24%), intracranial haemorrhage (7%) and cerebral laceration/contusion (5%). Among patients with skull fractures, 83% also sustained intracranial injury. Of the patients with concussion, 68% lost consciousness for a certain time period subsequent to injury. 7% had skull fractures and 6% had intracranial injury. Among patients with head injury. 83% also had other injuries, predominantly fractures to the limb and neck. Head injury was the primary diagnosis for 44% of the study population. Other injuries that frequently occurred were neck fracture (13% of patients), fracture of humerus/radius/ulna 911%), fractures of face bones (10%), internal injury (10%) and femur fracture (9%). Multiple injuries were common : 27% had two, 18% had three and 25% had four or more injuries23.

Helmets have been shown to be effective in preventing head injuries in motorcyclists, but some studies have suggested that helmets may cause injury to parts of the head or neck because they add mass to the head. This study examined patterns of fatal injuries in helmeted and unhelmeted motorcyclists. Coroner reports, hospital records, and police reports for motorcyclists fatally injured in crashes from July 1, 1988 through October 31, 1989 were examined. All injury diagnoses were abstracted and coded to the 1990 version of The Abbreviated Injury Scale and the International Classification of Diseases, 9th revision. Cerebral injury, intracranial hemorrhage, face, skull vault,

and cervical spine injuries were more likely to be found in fatally injured unhelmeted motorcyclists than in helmeted motorcyclists. These results expand earlier reports showing that helmets provide protection for all types and locations of head injuries, and show that they are not associated with increased neck injury occurrence24.

A review of 481 deaths in an accident and emergency department of a major general hospital in Singapore, over a 3 year period from 1992 to 1994 was undertaken. Full medico legal autopsies were conducted in 236 (55.1%) of the cases. There was a marked male preponderence in the age, race and sex distribution. Seventy (29.7%) of these had died a traumatic death as compared to the rest 166 (70.3%) due to natural causes. Out of these 70, closed head injury was seen in 10 and open head injury in 4 of the victims. Thirty four of these had multiple injuries. The other had various injuries on other parts of the body25.

A study was undertaken to verify a possible connection between the weight of the helmet worn and the occurrence of a ring fracture of the base of the skull surrounding the foramen magnum. One hundred twenty two fatally injured motorcyclists were studied retrospectively. In all cases, an autopsy had been performed. The following data was observed. Ninety eight riders were involved in collisions with motor vehicles. Sixty motorcyclists (49%) died primarily as a result of their head injuries. The mean survival time was 0.5 hour. The overall prevalence of circular fractures of the base of the skull was 9.2%. Bleeding from the external auditory meatus were an obligatory finding. Basal veins were lacerated in most cases of complete fractures. The lightest helmet in the fracture group weighed 960 grams the heaviest 1950 grams (median 1255 grams). An increase in the prevalence of fractures correlated with a helmet weight above 1500 grams. The weight of the helmet had no effect on the incidence or severity of spinal cord injuries. It was concluded that the accidents with axial load shift, helmets weighing more than 1500 grams increase the risk of a basal skull fracture. Therefore high weight helmets should be avoided. They suggested that a safe upper weight limit for helmets remains to be defined26.

Statistics available with the Delhi traffic police show in the first four months of 1996 maximum people were killed between midnight and 6 AM on Delhi road. More than 50% of all road victims, and about 90% of two wheelers riders, who are brought the hospital at night are found to be drunk. In the first four months of 1996, 114 people were killed between 8AM and 12 PM, 77 people lost their lives between 8PM and midnight. The accidents fatalities show a steep rise between midnight and 6AM-136. It is a custom observed by the elite and middle classes that they drunk in the evening and return home late at night. This is the time when maximum hit and run cases occur (30% of the total fatalities are hit and run cases), though curiously, this is also the time when the density of traffic is at its lowest. The guilty drivers get away easily since there is hardly anybody to given them a chase. The traffic police call it a day by 10 PM in most areas. Most of the late night accidents occur in the peripheral areas of Delhi such as Najafgarh Road, Mathura Road, Ring Road and Rohtak road. Of the 136 people killed between midnight and twilight, 64 were hit and run cases, mostly caused by HTVs. Drinking and driving go together for most truck drivers. Many of their unsuspecting victims are residents of villages that fall along the highways.

Head injuries are the commonest cause of death in the surgical wards in Port Moresby and the commonest cause of death in road accidents. Three prospective and retrospective studies performed over the last decade aimed to determine the pathology and outcome in 274 head injuries admitted to Goroka in 1988-1991 (4 years) and Port Moresby in 1984-1985 and 1992-1993 (total 2.5 years). Head injuries were managed by general surgeons without CT scanning or intracranial

pressure monitoring. There were 196 adults and 78 (28%) children; 195 were male and 79 female. Assaults (32%), motor vehicle accidents (49%) and falls (17%) were the commonest modes of injury. The case fatality rate was 21% (57 of 274 cases). Six of the deaths were avoidable. The fatality rates for admission Glasgow Coma Scores of 3-5, 6-8 and over 9 were 81%, 21% and 3% respectively. Two patients died of infection complicating open depressed fractures. The case fatality rate for extradural haematoma was 20% and subdural haematoma 67%. Nine patients died of associated abdominal injuries. Most of the deaths were unavoidable because of the severity of primary brain injury. The speed of diagnosis and quality of care could have been improved but the most important area is management of the airway. General surgeons properly trained in trauma vcare (which includes emergency airway management) are well able to cope with the majority of head-injured patients in Papua New Guinea27.

The study of total of 159 victims from bicycle accidents treated as in patients at the Department of Neurosurgery, University of Bonn between January 1987 and June 1995 with an aim to define the severity and features of bicycle-related head injuries in a defined population. Results showed that 33% of admitted bicycle victims sustained severe head injuries (Glasgow Coma Score 3-8). Neurosurgical operations were performed in 49% of patients and were mainly related to the evacuation of an extracerebral hematoma. Of the 159 bicycle victims, 112 (70%) made a good recovery, 11 (7%) remained moderately and 4 (3%) severely disabled, and 26 (16%) had died at follow-up (mean 2 years). In conclusion, data indicate that bicycle-related trauma accounts for substantial proportion of all head injuries requiring neurosurgical treatment. Active (e.g. traffic regulations, education of riders) and passive measures (e.g. safety helmets) can be expected to reduce both incidence and severity of head injuries among bicyclists28.

The first year of the mandatory bicycle helmet laws in Australia saw increased helmet wearing from 31% to 75% of cyclists in Victoria and from 31% of children and 26% of adults in New South Wales (NSW) to 76% and 85%. However, the two major surveys using matched before and after samples in Melbourne (Finch et al. 1993; Report No. 45, Monash Univ. Accident Research Centre) and throughout NSW (Smith and Milthorpe 1993; Roads and Traffic Authority) observed reductions in numbers of child cyclists 15 and 2.2 times greater than the increase in numbers of children wearing helmets. This suggests the greatest effect of the helmet law was not to encourage cyclists to wear helmets, but to discourage cycling. In contrast, despite increases to at least 75% helmet wearing, the proportion of head injuries in cyclists admitted or treated at hospital declined by an average of only 13%. The percentage of cyclists with head injuries after collisions with motor vehicles in Victoria declined by more, but the proportion of head injured pedestrians also declined; the two followed a very similar trend. These trends may have been caused by major road safety initiatives introduced at the same time as the helmet law and directed at both speeding and drunken-driving.

The initiatives seem to have been remarkably effective in reducing road trauma for all road users, perhaps affecting the proportions of victims suffering head injuries as well as total injuries. The benefits of cycling, even without a helmet, have been estimated to outweigh the hazards by a factor of 20 to 1 (Hillman 1993. Cycle helmets-the case for and against. Policy Studies Institute, London). Consequently, a helmet law, whose most notable effect was to reduce cycling, may have generated a net loss of health benefits to the nation. Despite the risk of dying from head injury per hour being similar for unhelmeted cyclists and motor vehicle occupants, cyclists alone have been required to wear head protection. Helmets for motor vehicle occupants are now being marketed and a

mandatory helmet law for these road users has the potential to save 17 times as many people from death by head injury as a helmet law for cyclists without the adverse effects of discouraging a healthy and pollution free mode of transport29.

A prospective study was performed to analyze the particular injuries of 76 cyclists who required in-patient treatment in our department in 1994. There were 50 male and 26 female cyclists, with a median age of 33 years (range: 4-87 years). The most frequent diagnosis, in 50% (n = 38), was head injury. The series included 63 cyclist (83%) who had not been wearing helmets, and 33 of these sustained a head injury; in the helmet group head injury was found in only 38% (5 out of 13). It is remarkable that more serious head injuries did not occur in the helmet group. In 24 of these 33 head-injured patients (73%) without helmets additional intra- and extracranial diagnoses were made: pathologic EEG in 18 patients (55%), skull fracture in 13 patients (39%), intracerebral haemorrhagic contusion in 4 patients (12%) and an increase in intracerebral pressure (edema) in 3 patients (9%). In contrast to these findings, only 2 of the 5 head-injured patients (40%) in the helmet group showed slight changes in the EEG. In our opinion the bicycle helmet can reduce the incidence and the grade severity of head injuries significantly, particularly as we had 2 deaths in the non-helmet group and none in the helmet group. The use of a bicycle helmet is therefore strongly advocated30.

Bicycle-related head injuries are an important cause of injury and death among bicycle riders. The use of bicycle helmets could reduce the rate of serious head trauma among bicyclists involved in accidents. A nationwide survey was conducted in Israel to determine the usage of such helmets. This survey preceded a media campaign encouraging the use of bicycle helmets. A second survey compared the rates of helmet usage following the media campaign with those rates prior to the campaign. A modest but significant increase in the use of bicycle helmets was observed. In order to further increase this rate, additional educational campaigns are needed and possibly the enactment of legislation31.

The report of three cases of ruptured traumatic aneurysms of the peripheral anterior cerebral artery after closed head injury has been described. These cases were all young men with closed head injury due to traffic accidents. Consciousness level on admission was coma in all three cases. Case 1 was a 19-year-old man with interhemispheric hematoma on initial CT, then 7 days later his consciousness cleared. However, 14 dayslater he suddenly lapsed into a deep coma with a severe frontal hemorrhage. Case 2 was a 13-year-old boy. Plain skull films demonstrated a frontal depressed fracture, but CT scan showed no bleeding. Four days later his consciousness cleared but 11 days after trauma, he lapsed into a deep coma with a frontal hemorrhage. Case 3 was a 22-year-old man. Initial CT showed a slight ventricular hemorrhage. Fourteen days later, his consciousness had almost cleared, but then he lapsed into a deep coma with a large frontal hemorrhage 11 weeks after the trauma. All these patients died within a few days after intracranial bleeding. All patients underwent cerebral angiography but none of them showed filling defect. Autopsy was performed and ruptured aneurysms were found on the distal anterior cerebral artery that had no relation to the branch of bifurcation. Histological examination demonstrated a lack of elastic lamina and media in all of these three cases, so each of them was a victim of so-called false aneurysm. Twenty reported cases of ruptured traumatic aneurysms of the peripheral cerebral artery with delayed hemorrhage after closed head injury were reviewed. Factors in the traumatic aneurysm showed no relation to the duration of disturbed consciousness. Within one month, delayed hemorrhage due to ruptured traumatic aneurysm occurred. None of the delayed hemorrhages involved

subarachnoid hemorrhage. Subdural hematoma was seen in the distal middle cerebral artery and frontal hemorrhage was found in the distal anterior cerebral artery. We consider that frontal hemorrhage is a predictive finding for the type of delayed hemorrhage due to traumatic aneurysm in the distal anterior cerebral artery32.

A motorcycle safety survey conducted in Colorado. Sixty five percent of respondent believed that motocycle riders of all age should be required to wear helmets as motorcycle riders have a higher risk of Traumatic Brain Injury disability and death33.

One hundred fatal cases who died due to traumatic head injury were studied at the mortuary of Guru Teg Bahadur Hospital, Shahdara, Delhi. Though all ages were affected, peak incidence was found in the third decade (25%) followed by the 4th decade (22%). Individuals in the 2nd decade were least effected.

The male : female ratio was 4.5:1 overall and 7.3:1 in the most commonly affected age-group (20-29 years). Females comprised 18% of the cases, the rest were males. Most of the cases occurred between 6PM and 6AM (50%) with peak incidence between 6PM and 12 midnight (44%) and between 6PM 9PM (23%). The least incidence occurred between 12 midnight and 6AM (6%). P.S. Seema Puri Recorded the maximum number of cases (26%) followed by P.S.Seelam Pur (19%), P.S.Bhajan pura (13%) and P.S. Welcome (12%). Most were Hindus (77%) while Muslims were only 23% of the cases.

Among those brought alive to the hospital 67% of the cases reached within 30 minutes while 79.1% within 60 minutes of the incident. Eight percent were brought dead to the hospital and 22% were cases of spot death.

Seventy five percent victims survived for a variable period after the incident. Among them, 26% survived utpo 1 to 6 hours and 19% up to 1 hour of the incident. Sixty victims died within 24 hours while 66 within 3 days of the incident. There were 5 cases operated (craniotomies for drainage of EDH). Among these, three lived between 3-20 days and the other two died within 24 hours.

Accidents were responsible for 89% deaths, homicides for 8% and suicides for 1% only. Sixteen percent women were victim of accidents and 2% of homicides. The rest 80% were male. In 2% cases, manner of death was not known.

RTAs were responsible for maximum (65%) deaths (73% of the accidents), followed by fall from a height (14%), blunt trauma (homicidal) (7%) train accidents (6%), collapse of a wall (3%), firearm (2%) and machinery accident (1%), Scalp injuries were present in 77% of the cases, crushing injury in 12% and none in 1% of the cases. Bruises were commonest (68%) followed by lacerations (46%) and abrasions (29%). The commonest region of scalp involved was frontal, followed by temporal, parietal and occipital. Puncture wounds of skull were seen in 10 cases.

Skull fractures were observed in 80% of the cases with both, skull base and vault fractures in 42%, skull base alone in 34% and vault alone in 4% cases. All the fractures were commonest in the age group 20-29 years, followed by 30-39 years, followed by 30-39 years (25% and 22% respectively).

Linear fractures of the skull vault were the commonest type (29%) followed by comminuted (18%) and the depressed (13%) type, most frequently present in the parietal followed by temporal and frontal regions.

Base of the skull fractures were most frequent in the age group 20-39 years (50.8% of skull base fractures) and linear fractures were more common than comminuted (65.2% vs 50.8%). There were

2 cases with ring fractures. Middle cranial fossa was the commonest fossa involved (44.9 % fractures), followed by posterior (35.6%) and anterior (19.5%) cranial fossa.

Intracranial injuries were present in 87% cases. Out of these SAH was the commonest (86.2%), followed by SDH (63.2%), ICH (51.7%), contusion 923%), EDH (10.3%) and IVH (4.6%). Age wise SAH, ICH, SDH were common in the group 20-29 years while contusions in 0-9 years group.

All intracranial lesions were most frequent in temporal region, followed by parietal occipital and frontal. The combination of SDH and SAH was the most common, present alone in 21% cases.

There were 71% victims of vehicular accidents. Among them, most were pedestrians (66.2%), followed by scooterists (15.5%). Among offending vehicles, most were trucks (22.7%), followed by buses (12.7%) and tempos (11.3%). Vehicle was unidentified in 32.4% cases.

There were 47% pedestrians as victims of vehicular accidents. Out of these, most were hit by a vehicle/train while crossing the road (48.9%) or railway track (12.8%), About 17% were hit while walking by the side of the road and 6.4% while standing by the side of road, waiting for a bus. In 14.9% pedestrian cases, circumstances were unknown.

External facial injuries were present in 38% cases and crush injury in 12%. Face was uninvolved in 50% victims. Abrasions were the commonest of facial injuries (external 94.7%) followed by lacerations (86.8%) and bruises (15.8%). Most of these were present on cheek, nose, chin and ear.

Associated injuries on the body (other than the head) were present in 83% of the cases. Abrasions were commonest (92.8% of these cases), followed by lacerations (28.9%) fracture ribs (26.5%) fracture of limb bones (24.0%) and bruises (9.6%). Most of these injuries were present on chest, followed by shoulder, legs, forearms, abdomen and knees, elbows and arms. None of these were responsible in causing death of the victim.

Out of the 77% victims with scalp injuries, 89.6% had cranial injuries (fracture vault or base of skull) and 97.4% had intracranial injuries. Out of 80% cases of cranial injuries, 86.3% had extracranial injuries (of the scalp) and 87.5% had intracranial injuries. Also out of 87% cases of intracranial injuries, 86.2% had associated extracranial and 80.4% cranial injuries34.

A study was conducted to study the pattern of Cranio-cerebral injuries in road traffic accidents. In the study 80 victims of road traffic accidents brought for autopsy over a period of 5 years were studied. Out of them 54 (67.5%) were having cranio cerebral injuries; pedestrian was commonest victim group accounting for 42.59% of all cases, male out numbering females. Most of the victims were young adults in the age group of 21 to 30 years. Commonest injuries were found to be fracture of the vault (62.96%), injury to brain (70.62%) and extradural haemorrhage (20.37%). Study pointed lack of road safety measures and awareness on the part of public poor road conditions35 In another study on fatal head injury victims in road traffic accidents in North East Delhi during November 91-October 92, about 31% of those autopsied (405 cases) had died of head injury alone and 116 (29%) were the victims of road traffic accidents. A male preponderance (86%) and 31-40 years of age as the most susceptible group was found. It was found that 22.2% cases of head injury had not external injury on the scalp although intracranially 62.% such cases had fracture skull, 12.5% had brain injury and intracranial haemorrhage was present in 87.5% cases. Victims of head injury with external scalp injury (77.7% cases) had fracture skull in 50% cases, injury to the brain in 27.7% cases and intracranial haemorrhage was found in 58.3% of such cases. Head injury victims were mostly pedestrians (47.3%) and the offending vehicles were mostly heavy vehicles (47.3%).

Cyclist (44.4%) were the most common victims amongst the occupants in vehicle to vehicle accidents with 75% being hit by heavy transport vehicles. Spot death was seen in 55.5% cases. Out of the surviving head injury victims, 56.6% died within first 6 hours of the accidents and only 12.5% persons survived for more than one day. The combination of subdural and subarachnoid haemorrahge was the commonest of all the intracranial haemorrhages. It was also observed that cerebral oedema took about 6 hours after the accident to develop as none of the victims who survived for less than 6 hours had developed cerebral oedema35.

A study was conducted with a query of "Does Traumatic subarachnoid haemorrhage caused by diffuse brain injury cause delayed ischemic brain damage? Comparison with subarachnoid haemorrhage caused by ruptured intracranial aneurysms. 99 patients with diffuse brain injury with traumatic cause and 114 patients with aneurysms were subjected to CT and cerebral blood flow studies. The traumatic subarachnoid haemorrhage is not confined to Circle of Willis only but extended to supratentorial regions and interhemispheric cisterns. The cerebral blood flow decreased maximal on 0 day in traumatic causing maximal neurological deterioration with no peaks. The finding suggest that incidence of vasospasm is low in association with traumatic cases and there is no evidence that in the traumatic cases diffuse brain injury leads to delayed ischemic brain damage and secondary deterioration of outcome.37.

A study was conducted for traumatic intracranial carotid tree aneurysms. Twelve cases of traumatic aneurysms intracranial carotid tree were analysed in this study. Neurological examination results, CT and pre and post embolization of cerebral angiogram were included. In 11 of 12 cases, traumatic aneurysms were of cranial base origin, in 1 case the aneurysm was located in the distal anterior cerebral artery. Study suggested that patients with head trauma who presents with sphenoid sinus fracture and massive epistaxis should be evaluated for development of traumatic aneurysms38.

The prospective study was to quantify the anatomic severity of head and cervical spine injuries in hospital admitted victims of motorcycle and moped accidents in relation to helmet use and controlled for non-head injuries (i.e. kinetic impact). Two hundred and twenty-three patients entered the study group, of which 152 were motorcyclists and 71 were moped riders. Our results reveal that helmets do prevent head injury in motorcycle and moped accidents, especially in those crashes involving relatively low kinetic energy transfers. Helmet use does not lead to an increase of the incidence or severity of cervical spine injury. As a result compulsory helmet laws should not be limited to motorcyclists but also focus on all moped riders and probably also bicyclists. This study illustrates that emergency departments can provide important epidemiological information for injury control purposes. However, the epidemiological use of emergency department data and hospital data in general requires cautiousness. Confounding is a common problem which should be dealt with during analysis39.

A case of 34-year-old man struck over the left mastoid region by a hockey puck, who suffered a fatal rupture of a left vertebral artery berry aneurysm is reported. He became apneic within seconds of the injury and had no brainstem reflex within minutes. The postmortem examination showed massive subarachnoid hemorrhage in the posterior fossa and the remnants of a berry aneurysm near the intradural origin of the left vertebral artery, 11 mm proximal to the posterior inferior cerebellar artery. Rupture of a saccular aneurysm as a result of head trauma is rare. This is the first reported case of a posterior circulation aneurysm rupture as a result of head trauma40.

The review of the findings from 86 motorcycle accidents during a 1-year period at the Trauma Center "Bergmannsheil" in Bochum, Germany is described. A study of the case histories supplemented by telephone conversations yielded the following results: 90.7% of the patients were men, and the average age was 28.8 years; most of the accidents occurred in the 25- to 30-year-old age group (27.9%). Motorcycle accidents happened mostly during recreational rides on weekends in the summertime. Although there was a high rate of helmet use (98.8%), the head region was affected in 12 victims. Two patients died because of their severe head injuries (2.3%). Lower extremity injuries (46%), especially open tibia fractures (19.7%), were among the most common injuries sustained. Fractures of the distal radius constituted the largest portion of upper extremity injuries (18.8%). The average stay in our hospital was 35.4 days; 23.4% of the patients had to change jobs after the accident. Fifty percent of the crashes happened with motorcycles between 500 and 750 cc stroke volume. Although 34.5% possessed their driver's licenses for more than 8 years, they had not had much experience handling a motorbike. These results underline the fact that motorcycle accidents are sustained by young men in their working prime; as a result, these accidents pose a tremendous burden to individuals and society and every attempt should be made to offer highly qualified surgical and trauma care to minimize the damage to the motorbiker. A plea is made for more preventive measures like driver education, better road conditions, or legislative changes to prevent motorcycle crashes. The wearing of a helmet is strongly advocated41.

The neuropathology of trauma is reviewed based on the mechanism of injury. Pathology is divided into primary and secondary injury, based on the relationship to the time of injury. It is further divided by mechanism, with primary impact injury including skull fracture, epidural hematoma, brain contusion and laceration, and intracerebral hemorrhage; primary inertial injury including subdural hematoma, diffuse axonal injury, and diffuse vascular injury; and secondary injury including hypoxia/ischemia, brain swelling, infection, and increased intracranial pressure42.

The regional pediatric trauma center in Buffalo, NY, has been active in pediatric injury prevention programs, including community education and distribution of bicycle helmets, since 1990. Since June 1, 1994, the use of bicycle safety helmets for children under 14 years of age has been mandated by a state law in New York. The authors undertook this study to assess the impact of this legislation on the frequency of helmet use in children involved in bicycle crashes presenting to the regional pediatric trauma center, and to assess the impact of helmet use on the number and severity of head injuries. Bicycle crash victims (n = 208) admitted to a regional pediatric trauma center from 1993 to 1995 were studied retrospectively. Head injuries were classified as concussion alone, skull fractures, intracranial hemorrhages (ie, epidural, subdural, and subarachnoid), cerebral contusions, or diffuse cerebral edema alone (without any other intracranial injury). Helmeted children (HC) were compared with nonhelmeted children (NHC) using chi2 and Fisher's Exact test. P value less than .05 was considered significant. Only 31 children (15%) wore helmets at the time of the crash. Helmet use increased from 2%, during the period of education alone, to 26% after the legislation went into effect (P < .00001). The proportion of children suffering head injuries was similar in both groups (HC, 68%; NHC, 61%; P = NS). However, the type of head injury was different. HC were more likely to sustain concussion alone (HC, 65%; NHC, 44%; P < .03). HC were less likely to have skull fractures (HC, 0%; NHC, 13%; P < .02), and exhibited a trend toward less intracranial hemorrhages (HC, 0%; NHC, 9%; P = NS), cerebral contusions (HC, 3%; NHC, 5%; P = NS), and cerebral edema (HC, 0%; NHC, 0.6%; P = NS). Excluding the isolated concussions, head injuries were noted in only one HC, compared with 30 NHC (P < .04). None of the three children

who died wore helmets at the time of the crash, and all died of multiple head injuries. The bicycle helmet safety law resulted in a 13-fold increase in the use of bicycle helmets among the children admitted to a regional pediatric trauma center after bicycle crashes, but the helmet use remains inadequate. Helmet use reduced the severity of head injuries, and might have prevented deaths caused by head injuries43.

Car surfing is an infrequent cause of traumatic injuries treated by emergency physicians. This very dangerous activity can result in serious injury or death. We report 5 cases of injuries caused by car surfing seen at our hospital during 1996 and 1997. All involved head injuries after a fall from a moving motor vehicle. There were 3 male and 2 female patients, and 3 cases were fatal. Health care providers should be aware of this type of injury and support efforts to prevent it43.

Study conducted upon pedestrian reported children and the elderly were found to be at high risk as pedestrians. Lack of knowledge by children about the safe crossing behaviour and the inability of the elderly to sustain and or easily recovery from injury. Pedestrian safety measures in Jordan should be designed to overcome the limitations of children and elderly pedestrians as a prime target45 Study conducted in Argentina in a population of approx. 33 million and almost 6 million vehicles, it has one of the highest rates of fatalities in traffic accidents a total of 7714 in 1996 that is 22 fatalities a day more than 100,000 injured people in a year and huge material losses caused by chaotic traffic and accidents estimated in $10,000 million a year in Argentia. In 1996, 1270 died in traffic accidents here46 A study examined the effect of helmet wearing and the New Zealand helmet wearing law on serious head injury of cyclists involved in on road motor vehicle and non motor vehicle crashes. The study population consisted of three age groups of cyclists (primary school children (ages 5-12 yrs) secondary school children (ages 13-18 years) and adults (19+ years) admitted to public hospitals between 1988 and 1996. Data were disaggregated by diagnosis and analysed using negative binomial regression models. Results indicated that there was a positive effect of helmet wearing upon head injury and this effect was relatively consistent across age groups and head injury (diagnosis) types. They concluded that the helmet law has been an effective road safety intervention that has lead to a 19% (90% CI :14,23) reduction inhead injury to cyclists over its first 3 years47.

The study of two cases of traumatic rupture of the basilar artery are reported. In the first case, severe basal subarachnoid hemorrhage (SAH) due to a complete transverse tear of the basilar artery was observed in a 53 year old restrained male driver who was involved in a head on collision while intoxicated and drowsy. He lost consciousness shortly after the accident and was admitted to hospital in cardiopulmonary arrest. Intensive resuscitative therapies produced cardiac response, but he died 50 minutes after the accident. The ethanol concentration in his blood and urine was 0.35 and 0.55 mg/ml respectively. In the second case, SAH due to a similar tear of the basilar artery was observed in a 47 year old man who received several fist blows to the face while intoxicated. He suddenly lost consciousness after the final blow and was admitted to hospital in cardiopulmonary arrest. Intensive resuscitative therapies produced cardiac response, but he died 4 hours after the event. In these cases, the mechanism of the traumatic rupture of the basilar artery is thought to be overstretching due to hyperextension of the head, and intoxication, drowsiness, or both may have interfered with the decedents ability to protect themselves, thus the hyperextension of the head may have been rather forceful48 In a rear end crash if an occupants head is unsupported it lags behind as the torso is accelerated forward. This causes the neck to change shape, first taking an S-shape and then bending backward in whiplash motion. This sudden

differential movement of the head and torso can cause whiplash injuries to the neck. This paper reviews methods to minimize the differential head/torso movement and reduce the resulting injuries focusing on the necessary first step for prevention, which is a head restraint that is behind and close to the back of an occupants head during the crash. The history of head restrains since the 1950s is reviewed with particular attention to advanced restraint designs that are proving effective in reducing whiplash injury risk in dynamic tests using a new crash test dummy neck and a new neck injury criterion49.

