Original Research

"Fatality of Non-Compressive Mechanical Injuries to Neck – A Prospective Study"

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Abstract

A study titled —fatality of non-compressive mechanical injuries to neck amongst autopsies conducted at M.S. Ramaiah Medical College, Bangalore was carried out in the department of forensic medicine, M. S. Ramaiah Medical College Bangalore from October 2011 to March 2013 over a period of 18 months with an aim to know the fatality of non-compressive mechanical injuries to neck.

Of the 1478 cases which underwent post-mortem examination during the study period, 133 cases (8.99%) had non-compressive mechanical injuries to neck. Out of 133 cases of non-compressive mechanical injuries to neck, injury to respiratory air passages were involved in 50.4% cases, vertebrae and spinal cord in 45.1% cases, strap muscles in 44.4% cases and major vessels in 19.5% cases, with or without injuries involving other parts of the body. In 59 cases (47.2%) even though there were no external injuries to the neck still we observed injury to internal structures of the neck.

Key Words: Non-compressive mechanical injuries, Neck, Fatality

Introduction:

Vitality of neck for maintenance of the life cannot be over emphasized, as it allows great deal of mobility for the head and since it connects the head to trunk. The neck is protected by relatively broader area of head and chest, above and below respectively. Usually head and chest is involved in injury, but with extensive force for a considerable duration, neck is also involved.[1]

Many vital structures are crammed in the neck, which acts as conduit carrying blood, impulses, and air in both directions as well as food, usually only downwards, to the rest of gastro-intestinal tract. Such a region is therefore vulnerable to severe injury, the incidence and extent of which may not readily appreciated. In cases where there are multiple injuries not confined to the neck, there may be tendency for the inexperienced observer to concentrate on the more obvious lesions thus overlooking or delaying the diagnosis of significant injuries to this region.[2]

Non-compressive mechanical injury to neck defined as injuries which are produced by physical violence, where force being blunt/sharp/firearm/thermal/chemical/physic al to neck and neck structure, except hanging and strangulation (which are considered as compressive mechanical injuries).[3]

In addition, non-compressive injuries may also follow sudden movements of the head or neck without any form of contact like in road traffic accidents.[4]

Recent studies showed a steady increase in the neck injuries by 25% not only in RTA but also in other unnatural/ suspicious deaths with 20% of cases having neck trauma.[4]

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Since value of neck in sustenance of life is of great significance, studies related to neck injuries are of worthwhile.

Materials and Methods:

The present study was conducted for a period of one and half year from October 2011 to March 2013, in the mortuary, department of Forensic Medicine M. S. Ramaiah medical college Bangalore. During this period cases of non-compressive mechanical injuries to neck dissected and examined as per standard forensic autopsy procedures mentioned in the —Autopsy diagnosis and technique‖ by Ottosap hire[49] and injuries were noted. General particulars were gathered from police or from relatives and entered in proforma along with various details of mechanisms of injury to neck. Various observations inferred from them were discussed in detail as regard to various medico-legal-facets. All cases of non-compressive mechanical injuries to neck were included in the study whereas decomposed cases were excluded. Descriptive statistics comprising mean, standard deviation, proportion and percentage were used to describe the data. Prior ethical clearance was obtained.

Results and Observations:

The present study was conducted for a period of one and half year from October 2011 to March 2013, in the mortuary, department of Forensic Medicine M. S. Ramaiah medical college, Bangalore. During our study period, the following observations were made as for as fatality of non-compressive mechanical injuries to neck were concerned.

The percentage of non-compressive mechanical injuries to neck, in our study period is 8.99%. (Table 1)

During the study period, a total of 371 cases of RTA related deaths subjected for autopsy, of which 38 (10.2%) cases showed involvement of neck region. In the same way in a total 139 cases of railway injuries 35 (25.1%) cases showed neck involvement. Similarly, 31% assault cases, 8% fall from height cases, 33.3% of thermal injuries which include burns, electrocution and chemical burn cases showed neck involvement. (Table 2)

Table 1: Proportion of Non-Compressive Mechanical Injuries during Study Period.

Autopsies done between October 2011 to March 2013	1478
Cases having Non-Compressive Mechanical Injuries	133
% of cases having Non-Compressive Mechanical Injuries	8.99 %

Table 2: Types of Cases, with Non-Compressive Mechanical Injury to the Neck.

Type of Cases	No. of Cases	Cases with Neck involvement	%
RTA	371	38	10.2
Railway Injuries	139	35	25.1
Assault	29	9	31
Fall From Height	62	5	8
Thermal Injuries	33	11	33.3

Out of 133 cases only 19 cases were admitted to hospital, and in rest of the cases that is 114, were either died on spot or died on the way to hospital. (Table 3)

Table 3: Place of Death

Place	No. of Cases	%
Hospital Death	19	14.3
Spot Death	114	85.7
Total	133	100

This indicates that injury to the neck structures are so fatal that death will occurs in few minutes if not treated immediately which was evident by 114 cases (85.7%) in

which death occurring before the patient reach the hospital.

Neck injuries involving major structures of the neck like fractures of the cervical vertebrae, damage to the spinal cord, blockage of respiratory tract and injury to major vessels of the neck were considered as fatal injuries. In 105 cases (78.9%) injuries to internal structures of the neck so severe that, they considered as fatal enough to cause death of an individual. In 8 cases (6%) injury to the neck structures contributed to other injuries caused elsewhere in the body leading to death. In 20 cases (15.1%) injuries to the neck structures were non-fatal. (Table 4)

Table 4: Fatality of Cases in Non-Compressive Mechanical Injury to Neck.

Non-Compressive Mechanical Injury To Neck	No. of Cases	%
Fatal	105	78.9
Non-Fatal	20	15.1
Contributary	8	6
Total	133	100

Death due to asphyxia as a result of drowning was observed in 24 cases (18.1%) where respiratory airways obstructed and resulted in death. In 15 cases (11.3%) death due to decapitation consistent with railway run over was given. In 3 cases (2.3%) death due to asphyxia as a result of choking was given as cause of death where upper respiratory tract at the level of larynx was obstructed. In another 3 cases (2.3%) death due to crush injury to the head and neck sustained was given. In 2 cases (1.5%) death due to spinal injuries sustained in RTA was given as cause of death. In another 2 cases (1.5%) death due to aspiration of gastric contents into the respiratory passages was given as cause of death. In remaining 72 cases were non-compressive mechanical injuries to neck were seen (non-fatal) the cause of death was either multiple injuries sustained/head injury or other cause. (Table 5)

During study period 53 cases showed no obvious external injury to the neck but still we observed severe injuries to internal structures of the neck. In 53 cases, drowning with 25 cases shared major portion. In drowning, even though there were no external injuries to the neck, the respiratory tract was obstructed by inhaled water and froth leading to death by asphyxia. In 17 cases of RTA there were no appreciable injuries to the neck externally but still we were able to appreciable injuries to cervical vertebra and spinal cord in these cases. (Table 6)

These types of injuries were produced by hyperextension, hyper-flexion, rotational movements or combination of any of the types leading to fracture or dislocation of vertebrae and contusion or laceration of underlying spinal cord. In 2 cases of RTA we observed atlanto-occipital joint dislocation. In 3 cases with history of fall from height where no external neck injuries were seen but internally severe injury to the cervical vertebra and spinal cord were observed. This may be due to transmission of force along the vertebral column and resulting in fracture and spinal cord injuries.

Discussion:

Examination of Walker's data shows that, the mean head-neck weight was 6,075 gm. The mean head weight was 4,463 gm. and by difference, the mean neck weight was 1,609 gm. This seemingly insignificant portion of the total body weight is important far beyond the ratio of weights since many vital structures which are vulnerable to many injuries are present in this narrow passage.[2]

During our study period we made various observations related to non-compressive mechanical injuries to neck and results were placed in number of tables. TABLE 1 show, the percentage of non-compressive mechanical injuries to neck, in our study period is 8.99%.

The study conducted by Jani CB et al. revealed that out of 877 cases of medico-legal autopsies conducted during the period

of year 2000, in 31 cases (3.53%) non-compressive mechanical injuries to neck was observed.[1]

The study by Harvey et al states that, in their study of 312 deaths at scene, observed that in 26 cases (8.33%) neck was involved.[2]

When compared to study conducted by Jani CB, the incidence of non-compressive mechanical injuries to neck in our study was more by approximately 5% which may be due to more number of RTA and Railway injury cases at our center.[1]

When compared to study by Harvey et al. percentage of non-compressive mechanical injuries to neck were almost same, because sample size in Harvey study was less (312 cases) when compared to our study sample size (1478).[2]

Table 2 shows various types of cases in which involvement of non-compressive mechanical injuries to neck was explained.

Study done by Murthy V revealed that out of 52 cases of fall from height neck injuries were observed in 7 cases accounting for13.46 cases.[3]

Larsen et al in their study of 41 fatalities due to motor cycle accidents reported that in 4 cases (9.75%) neck was involved.[4]

In Bener et al. study, victims of road traffic crashes were observed, out of 6709 cases, neck injuries are seen in 1344 cases accounting for 20% cases.[5]

In a study done by N T Satish revealed that 35 cases out of 75 railway injuries involved neck accounting for 46% of cases.[6]

Mohanthy et al. in their study on death due to traumatic railway injury observed that out of 88 victims 71 were accidental in nature. 12 cases (16.9%) of 71 accidental cases showed neck injuries.[7]

Sahoo et al in their study of pattern of injuries by railway deaths observed that neck was involved in 39 cases (26.17%).[8]

TABLE 6 shows, number of cases where there was no obvious external injury to the neck but severe injuries to internal structures of the neck were observed.

One injury that frequently overlooked at autopsy in RTA cases is the atlanto-occipital dislocation, but in 1978 study done by Mant AK revealed that one third of his case series had atlanto-occipital dislocation.[9]

Tonge et al. survey revealed, out of 908 cases of RTA an incidence of 15.3% of posterior neck injuries were found.[10]

Alker et al. and Huelke et al. in their study revealed incidence of posterior neck injuries to be 20% or over in RTA cases. [11,12]

In a study done by N T Satish revealed that 35 cases out of 75 railway injuries involved neck accounting for 46% of cases.[6]

Conclusion:

The incidence and extent of injury to the neck region in many times cannot be readily appreciated. In cases where there were multiple injuries not confined to neck, (particularly in RTA) there may be tendency to concentrate on the more obvious lesions, thus overlooking or delaying the diagnosis of significant injuries to the neck and thus increasing the morbidity and mortality. Acceleration and Deceleration forces acting on neck region was most common in RTA and in fall from height cases where there were no external injuries to neck, the treating doctor should suspect injuries to neck and advice proper investigations like X-rays, CT scan or MRI so that life threatening neck injuries were detected and treated earliest thus decreasing the suffering.

The autopsy surgeon should be well versed with the injuries seen in case of non-compressive mechanical injuries to neck particularly in cases like RTA, railway injuries, fall from height and fall of object wherein hidden injury to cervical vertebrae, spinal cord and major vessels are common and in time turns into fatal for life. So in such cases observing the injury and recording it is of lot significance since more than scanning modalities, autopsy findings stands high in courtroom.

References

1. Jani CB, Gupta BD. An autopsy study of non-compressive mechanical injuries to the neck using multiple parameters. Journal of Indian Academy of Forensic medicine 2002; 24(4):130-35.

Table 5: Cause of Death Where Neck is the Major Site of Injury

Cause Of Death	No. of Cases	%
Asphyxia As A Result Of Choking	*3*	*2.3*
Asphyxia As A Result Of Drowning	*24*	*18.1*
Aspiration Of Gastric Contents Into Respiratory Passages	*2*	*1.5*
Blunt Injury To Neck Sustained	*1*	*0.8*
Cardio-Respiratory Arrest As A Result Of Atlanto -Occipital Joint Dislocation	*1*	*0.8*
Cervical Spine Injury Sustained	*1*	*0.8*
Choking As A Result Of Aspiration Of Blood Consequent Upon Head Injury	*1*	*0.8*
Choking As A Result Of Obstruction Of Oro-Pharyngeal Air Passages By Mud Particles	*1*	*0.8*
Crush Injury To Head And Neck Sustained.	*3*	*2.3*
Decapitation Consistent With Railway Run Over	*15*	*11.3*
Meningitis Secondary To *C5*-C6 Subluxation, Consistent With Fall From Height	*1*	*0.8*
Multiple Chop Injuries Sustained	*1*	*0.8*
Respiratory Failure As A Result Of Consolidation Of Lungs Consequent Upon Injuries To Head And Spine	*3*	*2.3*
Shock And Haemorrage As A Result Of Cut Throat *Injury*	*1*	*0.8*
Spinal Injuries Sustained In Rta	*2*	*1.5*
Spinal Shock Consequent Upon Neck Injuries Sustained	*1*	*0.8*

Table 6: Cases where there is no Obvious External Injury to Neck but Internal Structures were injured.

Type of Cases	Injury to Internal Structures of the Neck	No of Cases	%
RTA	Cervical Vertebra & Spinal Cord	17 (Total Cases-371)	*4.5*
Railway Injuries	Cervical Vertebra & *Spinal Cord*	5 (Total Cases-*139)*	*3.5*
Drowning	Airway Passages	25 (Total Cases-*25)*	*100*
Fall From Height	Cervical Vertebra & Spinal Cord	3 (Total Cases-*62)*	*4.8*
Assault	Cervical Vertebra & Spinal Cord	1 (Total Cases-*29)*	*3.4*
Fall of Object on Head	Cervical Vertebra & Spinal Cord	1 (Total Cases-*1)*	*100*
Fall From Bullock *Cart*	Cervical Vertebra & Spinal Cord	1 (Total Cases-*1)*	*100*
Total		53 [Total Cases Without Neck Injuries-*1345 (1478-133)]*	*3.9*

2. Vanezis P. Pathology of neck injury. 1st ed. London: Butterworth and CO; 1989.
3. Reddy KSN. Mechanical injuries: The essentials of forensic medicine and toxicology. 33rd ed. Haryana: Jaypee brothers medical publishers. 2014
4. Ewing CL. Injury criteria and human tolerance for the neck: Aircraft Crashworthiness. University Press of Virginia: Charlottesville; 1975.

5. Murthy VCR. Study of pattern of injuries in fatal cases of fall from height. Rajiv Gandhi University of health sciences. Bangalore. March 2008.
6. Bener A, Yassir SA, Mitra B. Incidence and severity of head and neck injuries in victim of road traffic crashes: In an economically developed country. International Emergency Nursing 2009; 17: 52-59.
7. Satish NT. Study of pattern of injuries in fatal railway accidents. Rajiv Gandhi University of health sciences. Bangalore. 2004-2007.
8. Mohanty MK, Panigrahi MK, Mohanty S, Patnaik KK. Death due to traumatic railway injury. Med. Sci. Law 2007; 47(2):156-160.
9. Sahoo PC, Kar SM. Pattern of injuries in railway deaths -A retrospective study in MKCG Medical College, Berhampur (Ganjam). Journal of Indian Academy of Forensic Medicine 1998; 20(3):67-68.
10. Knight B, Saukko P. Knights Forensic Pathology. 3rd ed, London: Arnold A member of the Hodder Headline Group. 2004. P284.
11. Tonge JI, O'reilly MJJ, Davison A, Johnston NG. Traffic crash fatalities. Injury patterns and other factors. Medical journal of Australia 1972; 2: 5-13.
12. Alker GJ, Oh YS, Leslie EV. High cervical spine and cranio-cervical junction injuries in the fatal traffic accidents: A radiological study. Orthopedic clinics of North America 1978; 9: 1003-1010.
13. Huelke DF, O'day J, Mendelsohn A. cervical injuries suffered in automobile crashes. Journal of neurosurgery 1981; 54: 316-322.