International Journal of Clinical Science and Medical Research

ISSN(print): Applied, ISSN(online): Applied

Volume 01 Issue 01 July 2021

Page No : 18-24

Head Injury-Related Mortality in Ulaanbaatar of Mongolia, 2018-2020

Dolgormaa Dagva[1,2], Batbayar Khasbagana[1], Tserenbat Minjuur[1], Bayarmaa Enkhbat[1]

[1]Department of pathology and forensic medicine, school of biomedicine, Mongolian National University of Medical Sciences, Ulaanbaatar, Mongolia

[2]National institute of forensic science, Department of forensic medicine; Ulaanbaatar, Mongolia.

ABSTRACT

Background: This study aims to determine the causes and risk factors of head injury cases, and causes of head injury-related mortality.

Methodology: All deaths registered in Department of Forensic Medicine, National Institute Forensic Science, National Trauma and Orthopedic Research Center from 2018 to 2020, total 5450 mortality cases were reviewed and 536 head injury-related cases were collected for this study.

Results: We reviewed 536 head injury-related deaths, which represented 8% of all mortality cases during 2018-2020. 470 (87.7%) were male and 66 (12.3%) were female. Male to female ratio was 7:1 and mean age was 42±15. Among head injury-related deaths, 363(67.7%) cases were from direct by firm and dull stuffs, 130(24.3%) from road traffic accidents and 34 (6.3%) falls from height. One hundred eighty three cases (34.1%) showed alcoholic consumption at the injury time. By the characteristics of injury, 286 (53.3%) cases showed subdural, 129 (24%) epidural hematoma, 400(74.6%) subarachnoid hemorrhage, and 332 (64%) cases showed cerebral contusion.

Conclusion: Male adults have more deaths due to direct head injury from assaults. Head injury progresses to death by its own pathogenesis.

*Published Online: 31 July 2021

Keywords:
Head injury, cause of death, intoxication, blood type, autopsy

Abbreviations

EDH - Epidural hemorrhage
SDH - Subdural hemorrhage
SAH - Subarachnoid hemorrhage
SKD - Songinokhairkhan district
SBD - Suhbaatar district
CHD - Chingeltei district
KUD - Khan-Uul district
BZD - Bayarzurkh district
BGD - Bayangol district

1. INTRODUCTION

Traumatic brain injury is defined as damage to the brain resulting from external mechanical force. Traditional Classification of Head Injuries: open injuries, closed injuries, scalp injuries, skull fractures. Skull fractures are usually associated with some degree of brain injury, varying from mild concussion, to devastating diffuse brain injury, to intracranial hematomas [1].

Mechanisms of injury: Primary brain injury: is caused at the time of impact and is a function of the energy transmitted to the brain by the offending agent. Types of primary brain injury are: (a) Diffuse axonal injury: results from shearing of grey-white matter interface (b) Cerebral concussion: defined by a period of amnesia, (c) Cerebral contusion and (d) Laceration. Secondary brain injury results from disturbance of brain and systemic physiology by the traumatic event. It is defined as subsequent or progressive brain damage arising from events developing as a result of the primary brain injury. Types of secondary brain injury are: (a) Intracranial hematomas, (b) Cerebral edema, (c) Ischemia, (d) Infection, (e) Epilepsy seizures and (f) Metabolic endocrine disturbances [1].

Among five most common causes of death in Mongolian population, trauma is still at third place. Center for health development reported, totally from 15812 mortality registred in Mongolia in 2017, 2630 were death by injury, intoxication and external causes. From these 544 were women [2].

The questionnaire study, held in 2011, Mongolia, showed that one in two men of total 741 males and one in three women of

*Corresponding Author: Dolgormaa Dagva

Cite this Article: Dolgormaa Dagva, Batbayar Khasbagana, Tserenbat Minjuur, Bayarmaa Enkhbat (2021). Head Injury-Related Mortality in Ulaanbaatar of Mongolia, 2018-2020. International Journal of Clinical Science and Medical Research, 1(1), 18-24

total 1292 females had experienced trauma and the male trauma rate was higher by 15.4-22.5 units in urban area [3].
Fatal injuries represent an important public health problem all over the world. Traumatic brain injury is a serious condition, can lead to death depending on its location, intensity, tissue damage and can progress asymptomatically [4].
Many foreign researchers studied cause of death, pathogenesis, pathology of head injury, and association of age, gender, location, intoxication and head injury in their country. Popov V.L et.al studied 216 cases of death from head injury in Russia. In their study, 79% was male, 21% was female, and age groups below 19 ages were 13%, 20-49 ages were 66%, over 50 ages were 21%. Mortality rate was 63% and common causes of mortality were traffic accidents, 22% was fall from height, 15% was from direct by firm and dull stuffs [5].
Therefore, we studied it and we studied association of other causes, employed, blood type, with cases of mortality from head injury in Mongolia. Determining causes, mechanism, injury time of head injury-related death is still important issue in forensic medicine practice in Mongolia. The studies about head-injury-related death have rarely been done.
Objectives: This study aims to determine the causes and risk factors of head injury cases, and causes of head injury-related mortality.

2. MATERIALS AND METHODS

2.1 Collection data: All deaths registered in Department of Forensic Medicine, National Institute Forensic Science, National Trauma and Orthopedic Research Center from 2018 to 2020, total 5450 mortality cases were reviewed and 536 head injury-related cases were collected for retrospective analysis.
In each case, the following parameters were considered:

1. Month and year of death
2. Gender and age group
3. Location of the mortality and crime
4. Cause of head injury
5. Intoxication
6. Type of head injury
7. Complication of head injury

2.2 Statistical analysis: All data on the spreadsheets were analyzed by practicing Statistical Package for Social Sciences (SPSS 25.0) software. We analyzed association between percentile independent variables using Chi-Squared test, Fisher's exact test. All expected values ≥5 used Chi-Squired test, either one <5 used Fisher's exact test.
And calculated the distribution of quantitative variables used Colmogorov Smirnov method. Differences with P-values < 0.05 were considered normal distribution. When distribution was normal, we used Independent sample T test. If distribution was abnormal, we used Mann Whitney U test. Differences with P-values < 0.05 were considered significant. The mean values, standard deviations, fluctuations, and distributions were determined using quantitative value of age and size of hematoma.
2.3 Ethical review: Bioethical permission of research is given by the protocol of the Biomedical Ethics Committee of Mongolian National University of Medical Sciences, May 22, 2015 (Number of ethics permission: 15/3/201515). And authorized by director of Department of Forensic Medicine, National Institute Forensic Science.

3. RESULTS

3.1 Results of cause and some risk factors of mortality due to head injury

We reviewed 536 head injury-related deaths, which represented 9.8% of all mortality cases during 2018-2020 in Ulaanbaatar.
Among total 536 cases, 470 (87.7%) were male and 66 (12.3%) were female. Male to female ratio was 7:1 and mean age was 42±15 (Figure1).

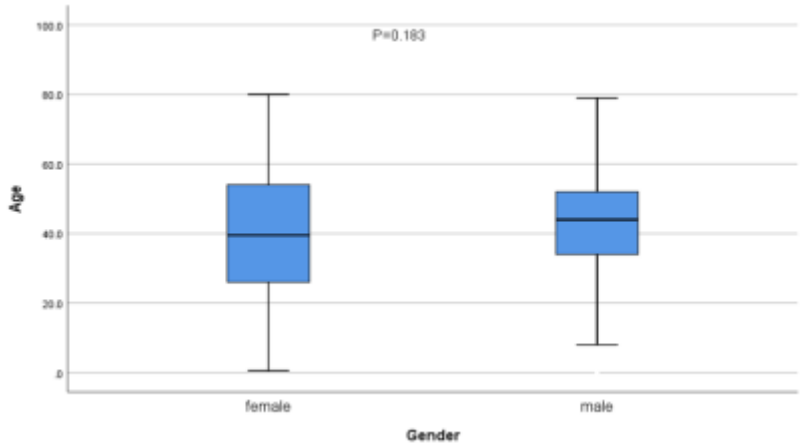

Figure 1. Mean age and gender

By age groups, 34(6.3%), 66(12.3%), 111(20.7%), 146(27.2%), 126 (23.5%), 53 (10%) cases were in 0-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, and over 60 year old group, respectively. In 20-59 year old age groups, there were 449 (83.7%) cases, respectively, which shows the head injury rate is high in working age population.

(Table 1). Among total 536 cases, 506 (94.4%) were closed head injury, 30 (5.6%) were open head injury.

Table 1. Association of age group and gender

Age group	Male		Female		Total	P
	n	%	N	%	n	value
below 19	26	76.5%	8	23.5%	34	0.007
20-29	51	77.3%	15	22.7%	66	
30-39	101	91.0%	10	9.0%	111	
40-49	135	92.5%	11	7.5%	146	
50-59	113	89.7%	13	10.3%	126	
over 60	44	83.0%	9	17.0%	53	
Total	470	87.7%	66	12.3%	536	

Among head injury-related deaths, 363(67.7%) cases were from direct by firm and dull stuffs, 130(24.3%) from road traffic accidents and 34 (6.3%) falls from height. Other rare causes include train accident 6(1.1%), gunshot 2(0.4%), and injury caused by plane crash 1(0.2%).

Time of death due to head injury, 20.3% (n=109) was winter (12-2 months), 21.6% (n=116) was spring (3-5 months), 26% (n=140) was summer (6-8 months), 31.9% (n=171) was autumn, showing that head injury-related deaths were the most high in the autumn. But no statistically significant difference was found the time and cause of head injury (P>0.617). (Table 2)

Table 2. Time and cause of trauma

Cause	Total		Winter		Spring		Summer		Autumn		P value
	n	%	n	%	n	%	n	%	n	%	
Blunt trauma	363	67.7%	73	67.0%	80	69.0%	95	67.9%	115	67.3%	0.617
Traffic accident	130	24.3%	26	23.9%	27	23.3%	38	27.1%	39	22.8%	
Other	43	8%	10	9.2%	9	7.8%	7	5.0%	17	10%	
Total	536	100.0%	109	100.0%	116	100.0%	140	100.0%	171	100.0%	

Most common location of the mortality and crime was Bayanzurkh district (28%), than other location were Bayangol district (22%), Songinokhairkhan district (20.6%), Chingeltei district (12%), Khan-Uul district (9%), Sukhbaatar district (8.4%). (Table 3)

Table 3. Association of location and cause of head injury

Location	Total	SKD&SBD	CHD&KUD	BZD	BGD	P
Cause	**N (%)**	**N (%)**	**N (%)**	**N (%**	**N (%)**	**value**
Blunt trauma	363(67.7)	106(68)	80(71.4)	107(71.3)	70(59.3)	0.0001
Traffic accident	130(24.3)	44(28.2)	24(21.5)	34(22.7)	28(23.7)	
Other	43(8)	6(3.8)	8(7.1)	9(5.5)	20(17)	
Total	536(100)	156(100)	112(100)	150(100)	118(100)	

Songinokhairkhan district (SKD), Suhbaatar district (SBD), Chingeltei district (CHD), Khan-Uul district (KUD), Bayarzurkh district (BZD), Bayangol district (BGD)

The association between the cause and location were significant(p=0.0001), showing that blunt trauma was more common in Bayanzurkh district, and traffic accident was the most high in Songinokhairkhan district, Bayanzurkh district, but fall from height was the most high in Bayangol district.

From out of 536 cases, 183 (34.1%) showed alcoholic consumption, 137 (25.6%) were sober and 216(40.3%) were unavailable to define and treated. (Table4) The association between the intoxication and age group were no statistically significant(p=0.053)

Table 4. Association age group and intoxication

Age group	Total		Intoxication		No toxication		Unavailable to define		P value
	N	%	n	%	n	%	N	%	
below 29	100	18.6%	32	17.5%	23	16.8%	68	20.8%	0.053
30-39	111	20.7%	35	19.1%	29	21.2%	47	21.8%	
40-49	146	27.2%	59	32.2%	34	24.8%	53	24.5%	
50-59	126	23.5%	42	23.0%	36	26.3%	48	22.2%	
over 60	53	9.9%	15	8.2%	15	10.9%	23	10.6%	
Total	536	100.0%	183	100.0%	137	100.0%	216	100.0%	

Employment of total cases was 54 retirees, 8 students, 3 cattlemen, 326 cases were employed and private works, and 24 cases were 0-15 years old, 123 cases were unemployed. Therefore, 22.9% (n=123) was unemployed of totally 536 cases. (Figure 2)

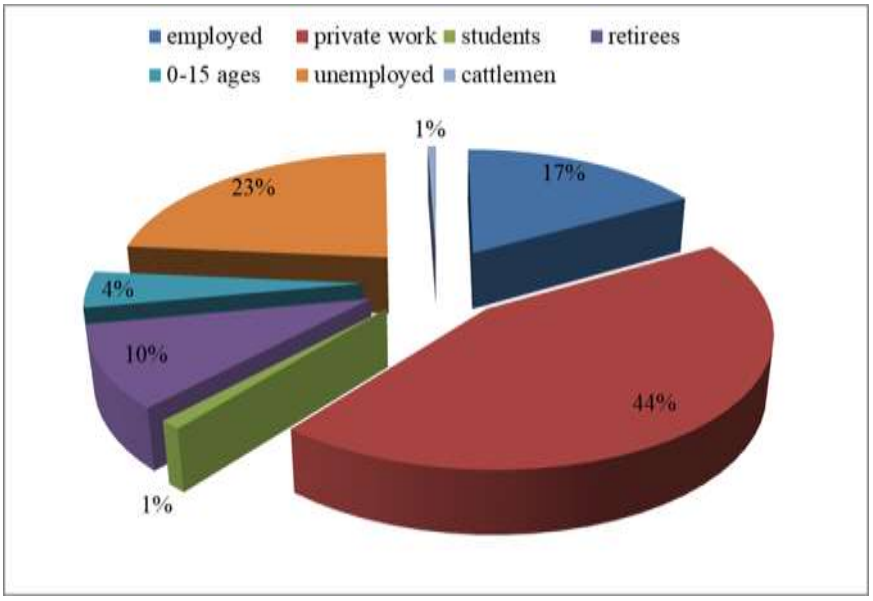

Figure 2. Employment of total case

Statistically significant difference was found while comparing intoxication and employment (p=0.0001). Thus meaning that the unemployed cases than more the employed cases drank alcohol.

When we studied association blood type and head injury, 36.7% (n=197) was blood group O, 24.2% (n=130) was blood group A, 32% (n=171) was blood group B, 7.1% (n=38) was blood group AB. No statistically significant difference was found the blood type and cause of head injury (P=0.892), showing that people with any blood type assaulted head injury. (Table5)

Table 5. Association blood type and cause of trauma

Blood group	Blunt trauma		Traffic accident		Fall from height		Total	P value
	n	%	N	%	n	%	N	
Group O	144	39.7	37	28.5	16	37.2	197	0.893
Group A and AB	109	30	46	35.4	13	30.2	168	
Group B	110	30.3	47	36.1	14	32.6	171	
Total	363	100	130	100	43	100	536	

3.2 Results of characteristics of pathology in head injury

To analyze from the characteristics of pathology, 74.6% (n=400) was subarachnoid hemorrhage, 65.5% (n=351) was skull fracture, 62% (n=332) was cerebral contusion, 54% (n=289) was scalp bruise, 53.3% (n=286) was subdural hematoma, 24% (n=129) was epidural hematoma, 1.1% (n=6) was diffuse axonal injury were detected. The association intoxication and subdural hematoma (p=0.004), epidural hematoma (p=0.001), cerebral contusion (p=0.0001), skull fracture (p=0.045), scalp bruise (p=0.020) were statically significant. (Table6) Thus meaning that subdural hematoma, epidural hematoma, cerebral contusion, skull fracture were more common among unavailable to define and treated cases and the most low among intoxication cases. But scalp bruise was the most high among intoxication cases.

Table 6. Association of first heat injury and intoxication

Characteristics		Total	Intoxication		No intoxication		Unavailable to define		P value
		n	N	%	n	%	N	%	
Subdural hematoma									0.004
	Yes	286	85	29.7%	67	23.4%	134	46.9%	
	No	249	97	39.0%	70	28.1%	82	32.9%	
Epidural hematoma									0.001
	Yes	129	35	27.1%	24	18.6%	70	54.3%	
	No	407	148	36.4%	113	27.8%	146	35.9%	
Subarachnoid hemorrhage									0.680
	Yes	400	135	33.8%	100	25.0%	165	41.3%	
	No	135	48	35.6%	37	27.4%	50	37.0%	
Scalp bruise									0.020
	Yes	289	110	38.1%	78	27.0%	101	34.9%	
	No	247	73	29.6%	59	23.9%	115	46.6%	
Skull fracture									0.045
	Yes	351	107	30.5%	93	26.5%	151	43.0%	
	No	185	76	41.1%	44	23.8%	65	35.1%	
Brain contusion									0.0001
	Yes	332	92	27.7%	81	24.4%	159	47.9%	
	No	204	91	44.6%	56	27.5%	57	27.9%	

Statistically significant difference was found the gender and epidural hematoma (P=0.034), the age group and subdural hematoma (p=0.0001). No statically significant difference was found the blood group and characteristics of pathology in head injury (p>0.05). Epidural hematoma was the more than females in males 93% (n=120), and subdural hematoma was the most high 75.5% (n=216) in 30-59 ages.

The mean size of epidural, subdural, intracerebral hematoma was 148.3±62 grams, correlation of the intoxication and size of hematoma was no statically significant(r=-0.28, p=0.106). Thus meaning was no correlation.

Complications of head injury and cause of some death were cerebral edema 346(64.6%), intracerebral and intraventricular hemorrhage 132(24.6%), lung edema 293(54.7%), meningitis 13(2.4%), stasis pneumonia 30(5.6%), ischemia 6(1.1%), asphyxia 4(0.7%). Statically significant difference was found the complications and hospitalized (p<0.05) (Table7) All these complications came out after hospitalization.

Table 7. Association complications and hospitalized

Complications		Hospitalized		P value
		n	%	
Lung edema				0.007
	Yes	157	53.6%	
	No	102	42.0%	
Stasis pneumonia				0.0001
	Yes	26	86.7%	

	No	233	46.0%	
Meningitis				0.037
	Yes	10	76.9%	
	No	249	47.6%	
Intracerebral and intraventricular hemorrhage				0.027
	Yes	75	56.8%	
	No	184	45.5%	
Brain edema				0.0001
	Yes	188	54.3%	
	No	71	37.4%	

When we studies association between complications and gender, age group, blood type; showing that intracerebral and intraventricular hemorrhage were the most high 95.5% (n=126) males (p=0.002), brain edema was the most high 74.5% (n=258) in 30-59 ages (p=0.046). Cases with blood group O the more than cases with other blood group detected brain edema (p=0.033) and lung edema (p=0.024).

4. DISCUSSION

Epidural hemorrhage (EDH) is a contact injury and occurs as a result of impact to the head. About 85% are associated with skull fractures [6]. Bleeding in an EDH is usually from a torn branch of a middle meningeal artery but may also result from tears of a dural sinus or diploic vein. Whether the bleeding is venous or arterial determines the rate at which the EDH occurs. EDH greater than 100 ml in adults will produce a mass lesion but smaller amounts of epidural blood can cause increased intracranial pressure in young children [6]. Subdural hemorrhage (SDH), the most common finding at autopsy of inflicted head trauma is the presence of subdural hemorrhage, which is found in about 90% to 98% of such cases [7]. But in our study, SDH was 53.3%, EDH was 24%, skull fracture was 65.5%. The mean size of epidural, subdural, intracerebral hematoma was 148.3±62 grams.

Subarachnoid hemorrhage (SAH) generally accompanies SDH caused by rotational inertial brain injury in which tearing of bridging veins occurs. SAH can result from other causes of blood entering the subarachnoid space whether natural causes such as a ruptured aneurysm or vascular malformation or from non-inertial traumatic causes produced from contact force such as contusions and lacerations [8]. When we study pathology of head injury, SAH was the most high and 74.6% (n=400).

Isik.H.S et.al. conducted a retrospective study of 954 patients with head injury treated in the Neurosurgery Department, including 721 male (75.5%) and 233 female (24.5%) patients. Fifty two percents (n=521) of patients were between 15-40 years old and 18.5% (n=177) had subdural and epidural hematoma. Mortality rate after operation was 19.4% (n=185) and common causes of mortality were traffic accidents (77%) and gunshot injuries [9]. Compared to their study results, the patient age and sex distribution of our study were similar with high rate of head injury in young men. But the rates of death of traffic accident 130(24.3%) were significantly high and gunshot injuries 2(0.4%) were significantly low in our study. According the study by Cheung.P.S et.al in Hong-Kong, 70(79%) of patients diagnosed with epidural hematoma were male and the mean age was 37.7. The causes of the injury were traffic accident in 50 (56%) cases, fall from height in 27(30%) cases, direct head trauma in 10(11%) cases. Mortality rate was 10% (n=9) [10]. Sex distribution with male dominance in their results was similar to our results.

The study by Rehman.L et.al. analyzed 30 patients with traumatic epidural hematoma treated by surgery. Out of total 30 patients, 22 were males and 8 were females. Patient age group of 20-30 years comprised 30% of all cases. The causes of injury were road traffic accident (50%), fall from height (33%) and assault (17%) [11]. As their result, traumatic epidural hematoma incidence is high in young men. In contrast, our result showed no association between epidural hematoma with patient age and sex.

Acute epidural and subdural hematomas are one of the most common causes of mortality and disability resulting from traumatic brain injury. Taussky.P. et.al. studied patients who underwent emergency craniotomy for acute traumatic epidural and subdural hematoma. Fifty five (73%) patients were male and 21 (27%) were female. Thirty-seven patients presented with an epidural hematoma, 46 with a subdural hematoma and 7 with both hematomas. The mean age was 54. Total mortality rate was 28% (n=21) with 3% (1/37) for patients with epidural hematoma and 41% (19/46) for subdural hematoma [12]. From their results, subdural hematoma 53.3% (n=286) showed high mortality rate, which is similar to our results.

Our study has limitation, the study subject was derived from Ulaanbaatar's population and the obtained parameters could not represent the state of the whole population worldwide and other country.

Regarding future studies, the outcome, complication, survival time, cause of death of head injury is still an area of scientific debate in forensic medicine. We will continue our research in this field and will precisely investigate the histological features of brain tissue morphology in head injury.

5. CONCLUSION

5.1 Head injury resulted from the firm and dull things rate is high in working age men occupies most of the percentage in our research.

5.2 In case of mortality, because of head injury that involved in our research subarachnoid hemorrhage, skull fracture, brain contusion were most of the percentage. Head injury progresses to death by its pathogenesis in most cases.

6. ACKNOWLEDGEMENT

We express our deepest gratitude to the following organizations and people who support our research: Department of forensic medicine, National institute of forensic science of Mongolia, all the staff who assisted us.

7. FUNDING SOURCES

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

REFERENCES

I. A. Pushkarna, H.S.Bhatoe, S.M.Sudambrekar. Head injury, Med J Armed Forces India. 66 (2010) 321-324 https://doi: 10.1016/S0377-1237(10)80008-5.

II. B. Narantuya, Health indicators 2017, Ulaanbaatar, Mongolia, Center of health development. 2018, pp 88-96

III. U. Ganchimeg, Prevalence of trauma in Mongolian population, Mongolian Journal of Health science 14 (2010) 45-49

IV. K.K. Vyacheslavovich, Dynamics of morphological changes of fibrin in the soft membranes and the substance of the brain in acute traumatic brain injury [dissertation], Novosibirsk, Russia, Medical University of Novosibirsk, 2009

V. V.L. Popov, Effect of the characteristics of the traumatic impact on the diffusion of traumatic subarachnoid hemorrhage, Sud Med Ekspert, 23(4) (1980) 20-21

VI. J.J. Rivas, R.D. Lobato, R. Sarabia, F. Cordobés , A. Cabrera, P. Gomez, Extradural hematoma: analysis of factors influencing the courses of 161 patients. J Neurosurgery 23 (1988) 44–51 https://doi: 10.1227/00006123-198807000-00010.

VII. A.C. Duhaime, T.A. Gennarelli, L.E. Thibault, D.A. Bruce, S.S. Margulies, R. Wiser, The shaken baby syndrome: a clinical, pathological and biomechanical study, J Neurosurg 66 (1987) 409–15 https://doi: 10.3171/jns.1987.66.3.0409.

VIII. M.E. Case, Distinguishing accidental from inflicted head trauma at autopsy, Pediatr Radiol. 44 (2014) 632-40 https:// doi: 10.1007/s00247-014-3061-6.

IX. H.S. Isik, U. Bostanci, O. Yildiz, C. Ozdemir, A. Gokyar, Retrospective analysis of 954 adult patients with head injury: an epidemiological study. Ulus Travma Acil Cerrahi Derg. 17 (2011) 46-50 https://doi: 10.5505/tjtes.2011.57431.

X. P.S. Cheung, J.M. Lam, J.H. Yeung, C.A. Graham, T.H. Rainer, Outcome of traumatic extradural haematoma in Hong Kong, Injury, 38 (2007) 76—80. https://doi: 10.1016/j.injury.2006.08.059.

XI. L. Rehman, A. Khattak, A. Naseer, Mushtaq. Outcome of acute traumatic extradural hematoma. J Coll Physicians Surg Pak, 18 (2008) 759-62.

XII. P. Taussky, H.R. Widmer, J. Takala, J. Fandino, Outcome after acute traumatic subdural and epidural haematoma in Switzerland: a single-centre experience, Swiss Med Wkly, 3;138 (2008) 281-5.

XIII. Oehmichen M, Auer RN, Konig HG Kurt A.J. Physical Trauma and Injuries of the Brain's Coverings, Forensic Neuropathology and Neurology, 2nd edition, Germany, Springer-Verlag Berlin Heidelberg, 2006 pp 97- 103; 126-142