Medico-Legal Comparative Study Between Traumatic and Spontaneous Intracerebral Hemorrhage

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ABSTRACT:

BACKGROUND:

Traumatic intracerebral hemorrhage (TICH) is a subtype of intracranial hemorrhage that occurs within the brain tissue itself and lead to displacement or destruction of brain tissue with high rate. Spontaneous intracerebral hemorrhage (SICH) is defined as a blood clot that arises in the brain parenchyma in the absence of trauma or surgery.

OBJECTIVE:

The aim of this study is to determine the frequency of fatal traumatic and spontaneous intracerebral hemorrhage, and to differentiate between them in postmortem examination.

METHODS:

This cross-sectional study is performed in the medico-legal institute of Baghdad for (6) months duration from (1-10-2011) to (1-4-2012). Complete medico-legal history was obtained, and full proper autopsy including external and internal examination of all corpuses was performed specially the head.

RESULTS:

The study included (38) cases of intracerebral hemorrhage; (27) of them were (TICH). Their ages ranged between (5 –65) years, and (11) of them were (SICH) with an age ranging between (15 –75) years. Traumatic group was associated with male preponderance and younger age, while spontaneous group were females and older age. The most common cause of head injuries in the traumatic group was "missiles" followed by road traffic accidents. Comminuted fractures were the most common type of skull fracture. Brain laceration and contusion were the two most frequently observed associated lesions in the traumatic cases. The "intraventricular"

Site was the most frequent in traumatic group, while the "Basal ganglia" was the most frequent in the spontaneous group. The anterior cerebral artery was the most frequently affected artery in traumatic group, while the middle cerebral artery was the most frequently affected artery in spontaneous group.

CONCLUSION:

we identified seven basic rules that can be used during autopsy examination in all cases of intracerebral hemorrhage to differentiate easily between traumatic and spontaneous intracerebral hemorrhage.

KEYWORDS: medico-legal study, traumatic intracerebral hemorrhage (TICH), Spontaneous intracerebral hemorrhage (SICH).

INTRODUCTION:

Intracerebral hemorrhage may be pathological or traumatic in nature. It may be primary or secondary [(1)]. Intraparenchymal and intraventricular hemorrhages are the two main kinds of intracerebral hemorrhage which are in their turn intra-axial hemorrhages that occur within the brain tissue rather than outside on its surface. [(2).]

As with other types of hemorrhages within the cranial cavity, intraparenchymal hemorrhage is a serious medical emergency because it can increase intracranial pressure, which if left untreated can lead to coma and death. The mortality rate for intraparenchymal hemorrhage is over (40%)[(3)]. It could occur in any part of the brain. Blood may accumulate in the brain tissues itself, or in the space between the brain and the membranes covering it. The bleeding may be

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isolated in a part of one hemisphere of the brain, or it may occur in other brain structures, such as the thalamus, and basal ganglia [4]. Blood irritates the brain tissues, causing swelling (cerebral edema). It can collect into a mass called hematoma. Either swelling or hematoma will increase pressure on brain tissues and can rapidly destroy them [5]. Bleeding in the brain can cause severe swelling which can lead to high levels of intracranial pressure (ICP). If this pressure does not relieved quickly, brain damage becomes a likely possibility and can adversely affect brain function [6].

Al-Qazzaz mentioned that traumatic brain injuries often result in very serious situations; intracerebral hemorrhages are one of them. Those hemorrhages together with skull fractures had constituted a major cause of death in his study about road traffic accident [7]. Brain trauma can be caused by a direct impact or by acceleration alone. In addition to the damage caused at the moment of injury, brain trauma causes secondary injury, a variety of events that take place in the minutes and days following the injury. These processes, which include alterations in cerebral blood flow and the pressure within the skull, contribute substantially to the damage from the initial injury[8]. A Traumatic Intracerebral hemorrhage (TICH) is a subtype of intracranial hemorrhage that occurs within the brain tissue itself. (TICH) is usually caused by penetrating head trauma, but can also be due to depressed skull fractures, acceleration-deceleration trauma [9].

The deleterious effects of (TICH) are considered to be a combination of primary injury (the local tissue destruction caused by the hematoma itself and accompanying increased ICP), and secondary effects produced by the toxic effects of blood on adjacent tissue. For these mechanisms, we should consider adding the effects of diffuse cerebral fluid percussion injury caused by internal barotrauma. Such a mechanism for diffuse brain injury may account for the alterations in consciousness after (TICH) which is not always easily explained by increased (ICP), mass effect, or herniation. Furthermore, the changes described above that occur in the brain for several days after acute (TICH) demonstrate that ongoing processes in response to injury may be indicative of a prolonged window for intervention to improve neurological outcome [10].

Traumatically caused central brain haemorrhages are relatively rare. Central lesions could only be found in about 3% of the injured. They generally occurred in combination with other severe damage of the skull and skull contents. Most frequently, such central haemorrhages could be found in the basal ganglia occasionally extending into the adjacent medullary layer resulting in large intracerebral haematoma [11].

In a previous study the right hemisphere was affected significantly more frequently and more severely by such large-size haemorrhages than the left hemisphere. The thalamus region ranking second in localization of central traumatic haemorrhages was virtually never found to be the origin of large hematomas. [12]

Bleeding may lead to displacement or destruction of brain tissue. Extensive hemorrhage is usually fatal. Depending on the extent and the location of the damaged tissue, residual effects may include aphasia, diminished mental function, hemiplegia, or disturbance of the function of a special sense [13]. Post traumatic intracerebral hematoma can expand or develop late after head injury; it could be due to venous infarct developing in the contused brain region.

A spontaneous intracerebral hemorrhage (SICH) is defined as a blood clot that arises in the brain parenchyma in the absence of trauma or surgery. A (SICH) can be classified as either primary or secondary depending on the underlying cause of the hemorrhage [14]. Primary (SICH) accounts for approximately (70 to 80%) of cases and is due to spontaneous rupture of small vessels damaged by hypertension or amyloid angiopathy. Secondary ICH is associated with a number of congenital and acquired conditions such as vascular anomalies, coagulopathies, tumors, and various medicines [15].

Predilection sites for (SICH) include the basal ganglia, lobar regions, thalamus, pons, cerebellum, and other brainstem sites, and intraventricular hemorrhage occurs in one third of (SICH) cases from extension of thalamic ganglionic bleeding. Isolated intraventricular hemorrhage frequently arises from subependymal structures including the germinal matrix [16]. Primary (SICH) due to hypertension occurs in areas of the brain that are perfused by the perforating arteries that arise directly from the large basal cerebral arteries, These perforating arteries are directly exposed to the effects of hypertension because they lack the protection normally afforded by a vessel caliber

[17]. Cerebral amyloid angiopathy is the other major cause of primary (SICH) and an important cause of lobar (SICH) in elderly populations. Vascular anomalies are the second most common cause of (SICH), like Berry Aneurysms, and venous malformations all can lead to secondary (SICH). The hemorrhage due to a ruptured aneurysm almost always has a subarachnoid component and often extends into the ventricles. There should be a high index of suspicion in young patients with frontal or temporal lobe clots [18].

The expanded volume of clots increases intracranial pressure and puts pressure directly on cerebral cells and vessels. The formation of a clot further increase the pressure, decreasing the blood supply and oxygen content available to cerebral tissue leading to cellular anoxia and cell death [19].

Study objectives

1. To describe the types of brain injury, types of skull fractures, causes of spontaneous and traumatic intra-cerebral hemorrhage.
2. To study the association between type of intra-cerebral hemorrhage (traumatic Vs spontaneous) and in relation to age, gender, intra-cerebral sites of hemorrhage and type of injured intra-cerebral artery identified during autopsy examination as this differentiation carries a major medico-legal importance.

METHODS:

Study design: cross-sectional postmortem study

Study population: Post-mortem on dead individuals referred to the medico-legal institute in Baghdad.

Study sample: all cases with evidence of intracerebral hemorrhage reaching the institute within a period of 6 months from 1-10-2011 to 1-4-2012. Cases that suffered from (TICH) in all types of head injuries (closed and open) were included in this study with or without injuries to other parts of the body. The cause of death in all cases were due to head injury, while cases where death occurred due to other types of injuries or contributed to the fatal outcome were excluded from the study. All cases that suffered from spontaneous intracerebral hemorrhage (SICH) and implicated as the cause of death were included in this study.

Information about the victims were collected from the hospital records or interviewing the family members including: age, gender, cause of head injury. A proper detailed autopsy examination including external and internal examination of the cadaver for all cases were performed specially the head to determine the following: The type of skull fracture, the Site of distribution of hemorrhage, name of the artery damaged and the type of other brain injuries.

Ethical consideration

Necessary formal clearance was obtained from relevant authorities to use the information in scientific research.

Statistical analysis

Statistical analysis was computer aided using SPSS ver 20. Frequency distribution for selected variables was done first. The statistical significance of association between 2 dichotomous variables in a small sample size setting was done using Fisher's exact significance test. The difference in median age group between 2 study groups was assessed by Mann-Whitney test. P value less than the 0.05 level of significance was considered statistically significant.

RESULTS:

The results presented in this study were based on the analysis of data on a sample of 27 cases with traumatic intra-cerebral hemorrhage and 11 cases with spontaneous intra-cerebral hemorrhage. Males were more frequent among traumatic group (63%), while females were the more frequent gender in spontaneous group (63.6%). Being a male increase the risk of traumatic type of intra-cerebral hemorrhage by 3 times compared to females. The calculated risk estimate, however failed to reach the level of statistical significance, (table 1) The most common age group for spontaneous type of intra-cerebral hemorrhage (46-65 years of age) was significantly higher than that of traumatic type (26-45 years of age), (table 2).

The most common cause of head injuries in traumatic group was "missiles" constituting 37.1%, followed by road traffic accidents (29.6%) and fall from height (18.2%). "Direct blow to head" was responsible for 11.1% of cases only,(figure 1).

Comminuted fractures were the most common type of skull fracture observed in 40.8% of cases, followed by separated fractures (25.9%) and depressed fractures (22.2%). Linear and diastase fracture types were the least frequently identified (7.4% and 3.7% respectively), (figure2).

Brain laceration was the most common type of

other brain injuries associated with traumatic intra-cerebral hemorrhage (48.2%). Ranked second in frequency was "Brain contusion" (25.9%) , followed by brain concussion (14.8%). "Pituitary gland injury and cranial nerve injuries" were the least frequently identified (7.4% and 3.7% respectively), (figure 3).

The most commonly reported cause of hemorrhage in spontaneous type of intra-cerebral hemorrhage) was hypertension (36.4%), followed by aneurysms (27.2%), amyloid angiopathy (36.4%) and coagulopathy (9.1%),(figure 4).

As shown in table 3, the "intra-ventricular" site of hemorrhage was more frequently identified in traumatic group (44.4% compared to 18.2% in spontaneous group). Similarly the "thalamus" was more frequently identified as the site of hemorrhage in traumatic group (25.9% compared to 9.1% in spontaneous group). On the other hand the "Basal ganglia" and "Gray matter" were more frequently affected by hemorrhage in spontaneous group (45.5% and 18.2%) compared to traumatic group (14.8% and 3.7% respectively). The differences observed between traumatic and spontaneous groups in their predilection for selected brain sites failed to reach the level of statistical significance, possibly because of very small sample size. The "intra-ventricular" site was the most frequent in traumatic group, while the "Basal ganglia" was the most frequent in spontaneous group.

As shown in table 4, the "posterior cerebral artery" was more frequently affected in traumatic group (22.2%) compared to spontaneous group (9.1%). On the other hand the "middle cerebral artery" and "anterior communicating artery" were more frequently affected in spontaneous group (36.4% and 18.2% respectively) compared to traumatic group (18.5% and 11.1% respectively). The differences observed between traumatic and spontaneous groups in their predilection for selected arteries failed to reach the level of statistical significance. The anterior cerebral artery was the most frequently affected artery in traumatic group, while the middle cerebral artery was the most frequently affected artery in spontaneous group.

Table 1: The difference in gender distribution between traumatic and spontaneous intra-cerebral hemorrhage groups.

	Type of intra-cerebral hemorrhage				
	Traumatic (n=27)		Spontaneous (n=17)		
site of hemorrhage	N	%	N	%	P (Fisher's exact)
Male	17	63	4	36.4	0.13[NS]
Female	10	37	7	63.6	
Total	27	100	11	100	

OR for traumatic in males compared to females = 3 (95% confidence interval 0.7-12.8)

Table 2: The difference in age distribution between traumatic and spontaneous intra-cerebral hemorrhage groups.

	Type of intra-cerebral hemorrhage				
	Traumatic		Spontaneous		
	N	%	N	%	P (Mann-Whitney)
Age in years					0.03
<25	8	29.6	1	9.1	
25-45	13	48.1	3	27.3	
>45-65	6	22.2	7	63.6	
Total	27	100	11	100	
Median age group	26-45		46-65		

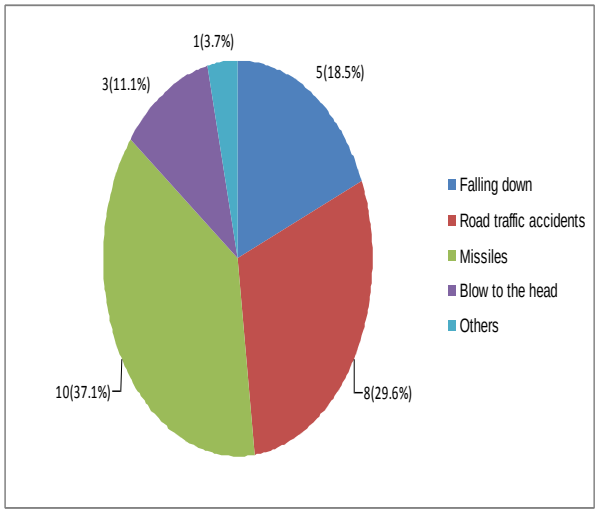

Figure 1: Pie chart showing the relative frequency for selected causes of traumatic head injury.

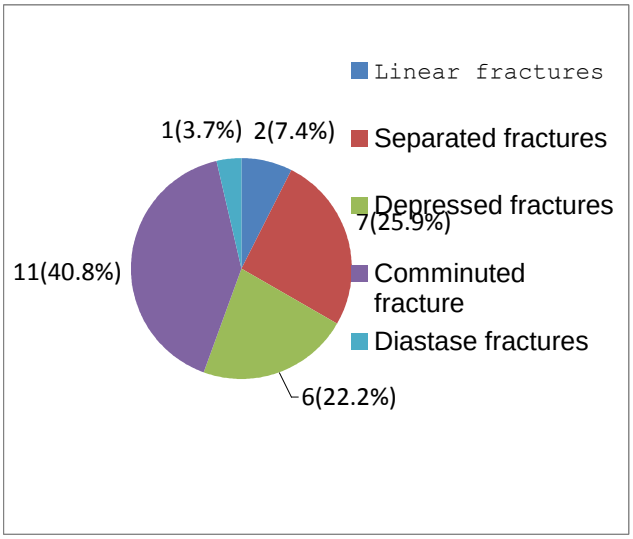

Figure 2: Pie chart showing the relative frequency for selected types of skull fractures.

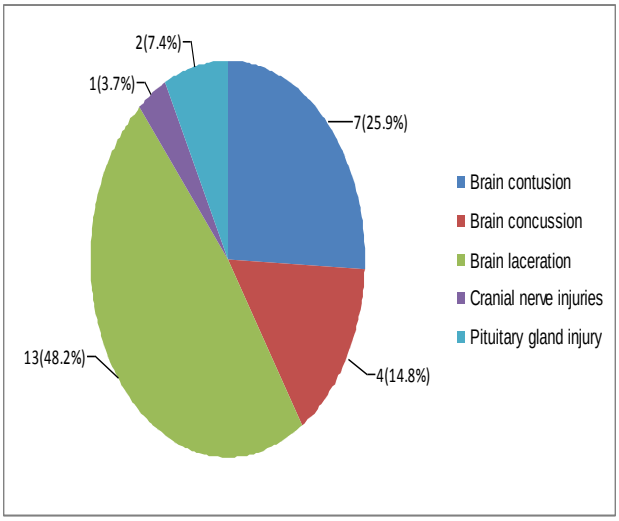

Figure 3: Pie chart showing the relative frequency for selected categories of traumatic head injury.

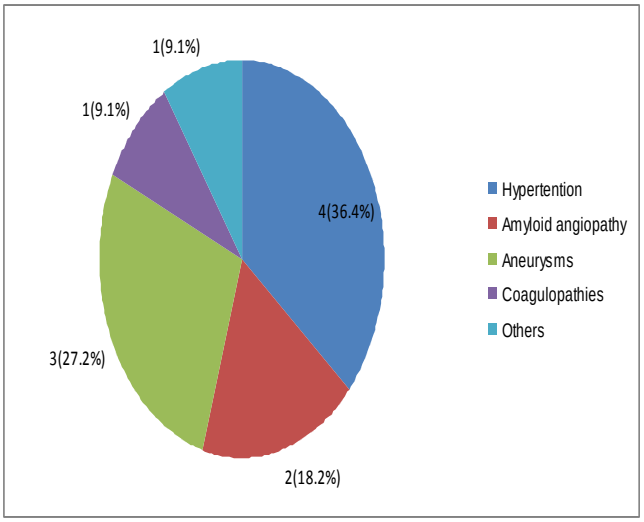

Figure 4: Pie chart showing the relative frequency for selected causes of spontaneous intra-cerebral hemorrhage.

Table 3: The difference in relative frequency of selected intra-cerebral sites of hemorrhage between traumatic and spontaneous intra-cerebral hemorrhage groups.

	Type of intra-cerebral hemorrhage				
	Traumatic (n=27)		Spontaneous (n=11)		
site of hemorrhage	N	%	N	%	P (Fisher's exact)
Intra-ventricular	12	44.4	2	18.2	0.16[NS]
Thalamus	7	25.9	1	9.1	0.39[NS]
Basal ganglia	4	14.8	5	45.5	0.09[NS]
White matter	3	11.1	1	9.1	1[NS]
Gray matter	1	3.7	2	18.2	0.2[NS]

Table 4: The difference in relative frequency of selected injured intra-cerebral artery between traumatic and spontaneous intra-cerebral hemorrhage groups.

	Type of intra-cerebral hemorrhage				
	Traumatic (n=27)		Spontaneous (n=11)		
	N	%	N	%	P (Fisher's exact)
Type of intra-cerebral artery damaged					
Anterior cerebral	9	33.3	3	27.3	1[NS]
Posterior cerebral	6	22.2	1	9.1	0.65[NS]
Middle cerebral	5	18.5	4	36.4	0.4[NS]
Anterior communicating	3	11.1	2	18.2	0.65[NS]
Posterior communicating	4	14.8	1	9.1	1[NS]

DISCUSSION:

The forensic pathologist should differentiate in autopsy between (TICH) and (SICH), as it is not always easy to do so. Some authors had mentioned the important points for that differentiation like the cause, the age, the site (within the head), the mechanism, and the presence or absence of coma and signs of brain concussion [20]. This study found some facts for that differentiation.

The first found fact by this study was that the (TICH) had mostly occurred in males because they usually expose to violence and trauma more than females. (SICH) had mostly occurred in females, and that may be due to their higher reaction to emotional stress than that of males [21].

The second one was that the (TICH) had mostly occurred in young age group (26-35) years and that may be attributed to their high daily life activity, a finding that agreed with that of Karaguiosov and Ramadhan. [22]On the other hand the (SICH) had mostly occurred in older age group (66-75) years and that may be due to many pathologies may be suffered by that age group like aneurysms and atherosclerosis [23].

Thirdly it was noticed that most of the (TICH) had happened by missiles which are the major causes of injuries in Iraqi society nowadays, while the (SICH) had caused by certain diseases such as aneurysm and atherosclerosis [20].

The fourth one was the most common site of occurrence. In relation to (TICH) it was inside the ventricles of brain (intraventricular) rather than (intraparenchymal) and this could be due to a large amount of bleeding, but in (SICH) the most common site was in basal ganglia rather than (intraventricular) because of a little amount of bleeding.

The fifth noticeable fact was that (TICH) had mostly occurred due to rupture of the anterior cerebral artery, while (SICH) had mostly occurred due to rupture of the middle cerebral artery. Rupture of anterior artery usually cause larger amount of bleeding [24].

The sixth fact was that all cases of (TICH)in this study were associated with skull fractures especially comminuted fractures (fig. 2) as their most common cause was missiles injuries. All cases of (SICH) was not associated of course with skull fractures simply because they are not traumatic [25].

The seventh and last fact was that all cases of (TICH) versus the cases of (SICH) were associated with other types of brain injures and the most common type of those injures was brain laceration that was also due to missiles.

CONCLUSION:

Putting in consideration the above mentioned seven basic facts during autopsy examination of cases of intracerebral hemorrhage we can

differentiate more easily between traumatic and spontaneous intracerebral hemorrhage.

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