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Traumatic Intracerebral Hemorrhage: Risk Factors Associated with Progression and overall recovery in 3 month duration -observational cross sectional study

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ABSTRACT

Background

Traumatic intracerebral hemorrhage (TICH) volume increase is a well-researched phenomenon that directly affects patient prognosis. Finding the risk factors related to the development of traumatic intracerebral hemorrhage was the aim of this investigation.

Methods

This prospective study was done on 114 patients with Traumatic intra cerebral hemorrhage in Neurosurgery Department, Cairo University Hospitals from 1/7/2022 till 31/12/ 2022.

Results

Our results revealed that Among the 114 patients included in our study, (82) patients were males speaking to (71.9%) and (32) patients were females speaking to (28.01%). The most common clinical picture were, 17 of them presented mainly with headache, 18 cases with disturbed conscious level, 13 cases with visual field defects, 24 cases with convulsions, 16 cases had behavioral changes and 26 present with vomiting. As regard to side of the lesion, (51) patients (44.7%) had right ICHs while (49) patients (43%) were with left lesion and 14patients (12.3%) were bilateral. As regard to Cause of injury there were (58) Patients (50.8%) had Road traffic accident and 24 patients had fall domestic (21.05%) and 20 patients (17.5%) had fall outside home but 12 patients had other mechanisms. According to the factors associated with progression, the most common factors were old age, hematoma volume, multiple hematoma, hypertension, bleeding profile disturbance, renal failure, liver cirrhosis, smoking, subdural extension and time to first CT.

Conclusion

The factors associated with progression, the most common factors were old age, hematoma volume, multiple hematoma, bleeding profile disturbance, hyper tension, liver cirrhosis, renal failure, subdural extension, mode of initial trauma and perihematomal edema. Early CT is a valuable tool in the diagnosis of TICH and early treatment for prevention of hematoma progression. Edema after TICH plays an important role in TICH -induced injury and is associated TICH expansion and overall worsening of the patients outcome. There is a strong relation between Traumatic brain injury and long term development of memory disorders especially in older patients. There is a strong relation between TICH and stroke development in older patients.

Keywords: Overall recovery; surgical intervention; traumatic intracerebral hemorrhage

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INTRODUCTION

After suffering a traumatic brain injury (TBI), 13–48% of patients get traumatic intracerebral hemorrhage (TICH). One well-researched phenomena that directly affects patient prognosis is the rise in volume of a TICH. According to several writers, a TICH's size increases in 38–59% of instances, mostly in the initial hours following a head injury. While the majority of TICHs with growing volume do not require surgical intervention, there are certain cases where the lesions advance and cause neurological impairment, symptoms of refractory elevated intracranial pressure (ICP), or a mass effect on a computed tomography scan. In these cases, surgical evacuation is necessary. [1] Up to 20% of patients in certain TBI trials underwent surgery as a result of TICHs. This finding emphasizes the need of identifying the subset of patients who would experience a significant increase in the volume of the traumatic intraparenchymal lesion. Overall, a number of variables, including the degree of the trauma, advanced age, the presence of numerous lesions, radiological indicators (such as cisternal compression or midline deviation), and coagulopathy, have been linked to the growth of TICH and the ensuing neurological decline. [2] This study's main goal was to define a set of factors related to the development of TICH in a significant number of patients with severe or moderate traumatic brain injuries as well as the patient's overall recovery within three months of the injury. [3]

PATIENTS AND METHODS

This prospective study was done on 114 patients with Traumatic intra cerebral hemorrhage in Neurosurgery Department, Cairo University Hospitals from 1/7/2022 till 31/12/ 2022.Patients who were admitted consecutively after sustaining a TBI, and those with Glascow comma score of 15 points or less on the Glasgow Coma Scale (GCS) the first 24 h after trauma, Patients fit for surgery (which includes: admitted consecutively after sustaining a traumatic brain injury (TBI), Glasgow Coma Scale (GCS) score of 15 points or less, fit for surgery as determined by a multidisciplinary team, considering factors such as age, overall health status, hematoma location, severity of neurological symptoms, presence of other injuries, intracerebral hematoma of 1 cc or more) and 1 cc or more of Intra cerebral hematoma were included in this study. While, patients with spontaneous intra cerebral hematoma, post operative patients underwent neurosurgical intervention not related to trauma, missile injuries were excluded from the study for the following reasons: distinct mechanism of injury: These injuries often involve high-energy projectiles, resulting in extensive tissue damage, foreign body retention, and severe complications, unique clinical presentation: Patients with missile injuries may have immediate, life-threatening conditions that require urgent intervention, making them less suitable for the specific focus of this study, limited data availability: The study may have had insufficient data on the long-term outcomes of patients with missile injuries, making it difficult to compare them with other types of TBI.The study received approval from the local research ethical committee. Prior to study participation, first-degree relatives of the patients were asked for their informed written consent. Every patient's information was kept private. Throughout the course of the study, participant confidentiality and privacy were ensured. The study's findings were solely utilized for scientific purposes; no legal authority made use of them.Any unexpected concerns that arose during the study were promptly disclosed to both the ethics committee and the subjects. Patients enrolled in the study were subjected to full history taking, complete neurological examination with emphasis on conscious level and motor power, routine laboratory investigations, radiological examination specifically CT brain on admission and follow up after 6 hours, 12hours and 24 hours and along the patient hospital stay till discharge.

Clinical Assessment

Traumatic intraparenchymal hemorrhagic lesions (TICHs) are characterized by fewer well-defined areas of mixed attenuation and a solid, well-defined appearance (hematoma). A complete neurological evaluation was performed for detection of improvement of presenting symptoms or occurrence of complications. The evaluation focused on the conscious level, visual acuity and field, cranial nerves, motor power, hypothalamic symptoms, and other neurological impairments. Morbidity in the form of CSF leak, wound infection, visual and neurological impairments, diabetes insipidus, and other endocrinopathies were documented. Mortality causes and timing were also documented. Urine output was recorded, and an input/output chart was created. Serum electrolytes were regularly checked.

Radiological Assessment

The period between the head trauma, the original CT,

and the control CT was documented. CT scans were categorized using the Marshall classification.Individual radiological findings, such as traumatic subarachnoid hemorrhage (TSAH), which was described as the existence of blood in the subarachnoid space either over the convexity or fissures or in the basal cisterns; The following criteria were used: presence or absence of intraventricular blood (IVH), normal or abnormal basal cisterns (compressed or absent), presence and type of mass lesions, such as epidural hematoma (EDH), acute subdural hematoma (ASH), or TICH, and midline shifts (MLS) (shifts ≤ 5 mm versus shifts >5 mm).The volumes of intraventricular hemorrhage, perihematomal edema (PHE), and hematoma were measured. The following computation was used to establish the TICH volume in accordance with the Brain Trauma Foundation's Surgical Guidelines: A x B x C / 2 (cm3), where A, B, and C are the largest hematoma dimensions as measured perpendicular to one other.**[4]**Radiological adjudication, including hematoma location and IVH presence, was done. Identifying the risk factors affecting the size of the intra cerebral hematoma and the effect of surgical intervention if needed in the patient recovery and the possibility of the recurrence of the hematoma on the same site of initial hematoma or another site of the brain. When multiple hematomas were present, the largest or most clinically significant hematoma was counted for the purposes of the study. This decision was based on the assumption that the primary hematoma would likely have the greatest impact on patient outcomes. The term "hematoma expansion" refers to a rise in the intraparenchymal hematoma volume of more than 33% or 6 mL from the baseline volume on the 24-hour follow-up scan. The development of END or death prior to day-2 clinical examination, or the combination of intraparenchymal, intraventricular, or subarachnoid hemorrhagic enlargement in the absence of follow-up scans, was considered hematoma advancement. [5]The following groupings of TICHs were created based on volume: 1–5 cc, 6–10 cc, 11–15 cc, 16–20 cc, 21–25 cc, 26–30 cc, 31–35 cc, and ≥36 cc. TICHs were classified as single, focal, multiple unilateral, or multiple bilateral hematomas according to their location and quantity.Patients were divided into two categories: non-operative (conservative) and in need of surgical care. The surgical procedures were categorized as follows: decompressive craniectomy, which involves removing the bone flap without evacuating the TICH; elevation of bone fragments; burr hole drilling; and craniotomy, which involves lobectomy, debridement, and replacement of the bone flap.Follow up were done after 6 hours, 12hours and 24 hours. It included evaluation of any neurological symptoms or signs, visual acuity and field, post-operative complications, post-craniotomy headache, cosmoses, patient satisfaction with their general condition, and postoperative radiology.Statistical Analysis: Statistical Package of Social Science version 20 was used on a personal computer to gather, tabulate, and statistically analyze data. For the statistical comparison, appropriate statistical analyses were used. The allowable margin of error was set at 5%, while the confidence interval was set at 95%.

RESULTS

Age of patients in the study ranged from 5 to 64 years, mean age was 41.7, 82 patients (71.9% of cases) were males and 32 patients (28.01% of cases) were females (Table 1).

Table (1): Distribution of the age and sex of the cases (SD: standard deviation)

Descriptive Statistics				
	Range	Mean	±	SD
Age	5 - 64	41.794	±	15.061
Gender	Number of patients	Percentage	Number of patients with hematoma expansion	Percent of patients with haematoma expansion
Male	82	71.9%	35	30.70%
Female	32	28.01%	12	10.52%
Total	114	100%	47	41.22%

We have 114 cases, 17 of them presented mainly with headache following a traumatic event, 18 cases with disturbed conscious level, 13 cases with visual field defects, 24 cases with convulsions, 16 cases had behavioral changes and 26 present with vomiting (Table 2)

Table (2): Number and percentage of patients according to their main clinical picture: n= number, % = percentage

Clinical picture			
	N	%	expansion
Vomiting	26	22.8	13
Convulsions	24	21.05	18
Disturbed conscious level	18	15.78	15
Headache	17	14.91	14
behavioral changes	16	14.03	10
visual field defects	13	11.4	11

The study included different medical history of the studied cases, most common were smoking with 30 patients (Table 3).

Table (3): Clinical data of studied patients No.=114:

Significant medical history	Number of patients	Percent of over all patients	Number Of patients with TICH expansion	percentage of patients with TICH Expansion
Smoking	30	26.3%	12	40%
Mixed risk factors	26	22.8%	14	53.8%
0	20	17.5%	5	25%
Anti coagulation therapy	17	14.9%	10	58.8%
Diabetes mellitus	10	8.7%	4	40%
Previous ischemic stroke	11	9.6%	5	45.45%
Hyperlipidemia	11	9.6%	3	27.2%
Renal failure	5	4.38%	4	80%
Ischemic heart disease	5	4.38%	4	80%
Liver cirrhosis	3	2.6%	1	33.3%

Thirty patients (26.3%) admitted to the ICU with a mean duration in ICU about 9 days as in table (4). In our study, (51) patients (44.7%) had right ICHs while (49) patients (43%) were with left lesion (Table 4).

Table (4): Comparison between ICU admission, duration of ICU stay, the mean time since trauma and until first CT (hours) was 7.3hours and Side of ICHs

Variable		No. (N=30)	% (100%)
ICU admission	Yes	30	26.3
	No	84	73.6
Duration of ICU admission (days)	Mean±SD	9.9±12.3	
	Median (Range)	4 (1-7)	
Onset-to-CT time (hours)	Mean±SD	2.3±2.9	
	Median (Range)	2 (1-4)	
The mean time between trauma and admission	Mean±SD	1.65±0.6	
	Median (Range)	1.5 (1-2)	
Side	Right	51(44.7%)	
	Left	49(43%)	
	Bilateral	14(12.3%)	

As regard to site affected there were (45) Patients (40%) had Frontal lobe affection and 22 patients (20%) in parietal lobe, 13% of patients or 15 patients had Temporal affection, 30 patients or 27% had an

occipital lobe affection and 6 patients had More than one lobe as shown in table (5).

Table (5): Site affected among 114 patients included in our study.

Site	N	%	Pt developing TICH EXPANSION
Frontal	45	39.4%	18
Occipital	30	26.3%	12
Parietal	22	19.2%	9
Temporal	17	14.9 %	8

As regard to Cause of injury there were (58) Patients (50.8%) had Road traffic accident and 24 patients had Fall domestic (21.05%) and 20 patients (17.5%) had Fall outside home but 12 patients had other mechanisms as shown in table (6).

Table (6): Cause of injury and classification of the patients according to Primary Outcome.:

Cause of injury	N	%
Road traffic accident	58	50.8%
Fall from height 1 meter or less	24	21.05%
Fall from height more that 1 meter	20	17.5%
Others	12	10.5%
Primary Outcome		
Unfavorable	48	42.1%
Favorable	66	57.89%

One hundred forteen patients in this study with 48 unfavorable primary outcome (42.1%) and 66 favorable primary outcome (57.89%) according to Modified Rankin Score identifying a Favorable outcome as 3 or lees and an unfavorable outcome as 4 or more (table 7).

Table (7): Classification of the patients according to Primary Outcome

Primary Outcome	N	%
Unfavorable	48	42.1%
Favorable	66	57.89%

As regard to neurological examination there were (16) Patients (14.03%) had Motor weakness and Drowsiness and disorientation, 15 patients had Language disorder (13.15%), 12 cases had urine incontinence, 24 cases had Seizures and convulsions and 13 cases had Memory impairment while mixed findings were in 18 cases as shown in table 8.

Table (8): Neurological examination among 114 patients included in or study.

Neurological examination	N	%
Seizures and convulsions	24	21.05%
Mixed neurological findings	18	15.78%
Drowsiness and disorientation	16	14.03%
Motor weakness	16	14.03%
Language disorder	15	13.15%
Memory impairment	13	11.4%
Urine incontinence	12	10.52%

Table (9) showed that there were 16 patients had Second haematoma, the mean volume of hematoma was 5.33±5.30 ml, there were 24 patients had Subarachnoid extension and the mean perihematomal edema volume was 15.33±10.42.

Table (9): Radiological findings of the studied cases

		N	%
Second haematoma present	Yes	16	14.0 %
	No	98	85.96 %
Volume of haematoma (ml)	Mean	5.33±5.30	
Subarachnoid extension	Yes	24	21.05%
	No	90	78.94%
perihematomal edema volume (mL)	Mean	15.33±10.42	

According to the factors associated with progression, the most common factors were old age, anti-coagulant medications intake, hematoma volume, multiple hematoma, subdural extension and time to first CT (Table 10).

Table (10): Radiological findings of the studied cases (Multiple linear regression model of independent predictors for factors associated with progression).

Predictors	B	p-value	OR	95% CI	
				Lower limit	Upper limit
Age	-0.161	0.026*	0.851	0.739	0.981
Hematoma volume	-0.323	0.043*	0.724	0.529	0.990
Multiple hematoma	-0.035	0.041*	0.965	0.584	1.596
Subdural extension	1.839	0.047*	6.290	0.944	41.895
falls as the mechanism of trauma	0.019	0.067	1.019	0.999	1.041
first CT	0.637	0.026*	1.034	0.375	1.184
Site	0.842	0.246	1.055	0.376	1.643
perihematomal edema	0.542	0.032*	0.247	0.352	1.368

DISCUSSION

Finding the risk variables related to TICH development was the main objective of the current investigation and over all recovery of the patient in a 3 month period in either way (operated upon or not). To elucidate this aim 114 patients with Traumatic intra cerebral hemorrhage included in the current study.In the current study 41.2% of the patients had an increase at the size of the traumatic intra cerebral hematoma in comparison to:

According to Cepeda et al., a rise in a TICH's size happens in 38 to 59% of subjects and mostly happens in the initial few hours following head trauma.[6] In the current study 7 patients or 7,14% needed a surgical intervention 5 of those patients died (71%) while 2 patients improved and were discharged in comparison to

Cepeda et al. reported that 20%of the patients with TICH needed surgical intervention.In the current study 3 of the patients had liver cirrhosis, 1 of which had an increase in the size of the hematoma in comparison to Lai et al. [7] who found that intracerebral hemorrhage were found in 1.3% of patients with liver cirrhosis and 1.0% of individuals in the comparator cohort over the follow-up period. The log-rank test analysis revealed no significant difference between the two cohorts (P=0.39). A stratified Cox proportional regression model revealed an adjusted hazard ratio of 1.62 (95% CI, 0.85 to 3.10) for patients with liver cirrhosis developing intracerebral hemorrhage compared to individuals without liver cirrhosis.The current study had a mortality rate of 17.5%, similar to 20 patients, which is consistent with the findings of Gregson et al., [8], who found that the mortality rate for isolated traumatic brain injury ranges from 16% to 40%.In the current research, 5.2%, or seven patients, were on anticoagulation treatment. Four patients, or 57%, showed an increase in the size of the hematoma; two of those patients died as a result. According to Claassen et al. [9], of the 88 consecutive patients diagnosed with TICH, only 52 (59%) were released from hospital. The remaining 36 patients died at the hospital or under hospice care.In the current study 5 patients or 4.38 % of the patients had chronic renal failure 4 of which had an increase of the size of the

hematoma, 3 of them died or 60 % in comparison to Kim et al.[10] Which found that the prognosis for ICH patients with CKD is dismal and overall mortality rates have been reported to be 34.4%

In the current study 20 or 17.5% of the patients had hypertension 5 of them or 25%experienced and increase in the size of the hematoma.In the current study, there were 82 patients (71.9% of cases) were males and 32 patients (28.01% of cases) were females while 621 (79%) of the patients were male, and 161 (21%) were female, according to Cepeda et al. findings [6].In the current study As regard to age, the mean age in the current study 41.7, ranged between 5 to 64 years and that agree with Cepeda et al.,[11] Who found that The mean age was 48.6 years, ranging from 15 to 87 years. Also in another study by Gregson et al.[8] patients ranged in age from 16 to 83 years with a median age of 50 years.In the current study the mean time between trauma and CT it was 2.3±2.9 hours, 9.6% of the cases in the current investigation had experienced an ischemic stroke in the past. There is evidence of a link between ischemic stroke and traumatic brain injury (TBI); several possible explanations exist for this interaction. For instance, TBI modifies the coagulation cascade, thereby raising the risk of stroke[12]. But since these changes are transient, they probably only partially account for the correlation this study discovered. Vascular dissection, a well-established ischemic stroke mechanism, is another documented effect of TBI[13]. More ischemic strokes were caused by TBI than by hypertension. Although a number of factors and presumptions that could change the stroke-TBI relationship were taken into account in secondary analyses, the association between TBI and ischemic stroke remained. However, patients who have previously experienced an ischemic stroke are more likely to receive prophylactic anticoagulation therapy, which raises the incidence of TICH. [12]Regarding to the mean time between trauma and admission it was 1.65±0.6 hours.In the current study As regard to cause of injury there were (58) Patients (50.8%) had Road traffic accident and 24 patients had Fall from less that 1 meter (21.05%) and 20 patients (17.5%) had Fall from height more than 3 meters but 12 patients had other mechanisms. In the present investigation, regarding the location, 45 patients (40%) had affection in the frontal lobe, 22 patients (20%) in the parietal lobe, 15 patients (13%), in the temporal lobe, and 30 patients (27%), in the occipital. and six of the individuals had several lobes. In contrast to Cepeda et al. study [11], the distribution of TICH locations was as follows: (a) Frontal or anterior: 172 (49.1%) of cases; (b) Lateral or temporal: 156 (44.6%) of cases; and (c) This result is consistent with earlier research and is comparable to CT image-based and post-mortem series[15–17]. According to earlier studies, frontal TICHs are commonly caused by occipital hits (46%), but rarely by frontal blows. Temporal TICHs are caused by lateral hits (61%), which are ipsilateral in 58% of cases[11]. Fifty one patients (44.7%) had right ICHs while (49) patients (43%) were with left lesion and 14 patients (12.3%) were bilateral. Regarding the neurological examination, of the patients in the current study, 16 (14.03%) had motor weakness, drowsiness, and disorientation, 15 (13.15%) had language disorder, 3 cases had urine incontinence, 24 cases had seizures and convulsions, 23 cases had memory impairment, and 18 cases had mixed findings. Before and during hospitalization, neurological decline is frequently observed and may signal an early hematoma growth or worsening of edema[18]. In the current study, the mean volume of hematoma was 5.33±5.30 ml but in the study done by Cepeda et al.,[6] the mean volume of the TICH on the CT scan was 7.29 cc. But in the study done by Gregson et al., [8] the volume of the largest haematoma varied between 10 and 97 ml with a median of 23 ml. in the study done by Narayan et al.,[19] the mean volume of hematoma was 8.8 ±1.30 ml. According to the outcomes, 48 had unfavorable primary outcome (42.1%) and 66 had favorable primary outcome (57.89%) and in the study done by Cepeda et al.,[11] the outcome at the 6-month follow-up was favorable in 162 (48.2%) cases and unfavorable in 174 (51.8%) cases.

In the present study, there were 24 (21.05%)patients had Subarachnoid extension but in the study done by Cepeda et al.,[6] the presence of TSAH in 611 (78%) patients and that difference could be due to the difference in sample size as they worked on a large scale of people. According to Ivascu et al. [20], patients who presented with higher grade TICH died mostly due to bleeding progression. More advanced age, reduced brain volume, and the kind of TICH (subdural, epidural, subarachnoid, etc.) are all associated with a higher risk of adverse neurological consequences following TICH. In particular, individuals who have brain atrophy may be able to withstand more significant subdural bleeding and bleeding progression with less severe mental

decline[21]. In the research conducted by Gregson et al. [8], 61 patients (36%) experienced a second hematoma, compared to 16 patients (14%) in our study. According to Stein et al. research [22], patients (n 149) with delayed brain injury (hematoma progression or fresh hematoma) had worse outcomes, a slower rate of recovery, and a greater death rate when it came to traumatic brain injury. According to the factors associated with progression, the most common factors were old age, hematoma volume, multiple hematoma, and subdural extension, hypertension, bleeding disturbance, renal failure,liver cirrhosis and that coincide with the results in the study done by Cepeda et al.,[6] who found that the factors associated with TICH growth included a higher mean age, falls as the mechanism of trauma, hypoxia, shock, cisternal compression, subdural hematoma, multiple TICHs hematoma volume and time to first CT. Also, Kim et al. study [23] discovered that the initial magnitude and kind of the bleeding, coagulation abnormalities, admission thrombocytopenia, and decreased platelet function are among the factors that have been related to the advancement of hemorrhage. Large hematoma volume, hematoma growth, intraventricular bleeding, infra-tentorial position, advanced age, contrast extravasation on CT scan (spot sign), and anticoagulant usage were reported to be poor predictive variables of ICH by An et al. [24].

These findings are consistent with a research by Stein et al. [25] in which the authors hypothesized that older adults' increased capillary fragility and stiffness may have a role in the development of hemorrhagic progression. Regarding the trauma mechanism, precipitation and falls were factors related to growth, presumably because of the coup-contrecoup damage mechanism involved and the exchange of kinetic energy associated with this specific mechanism of injury. Our results are consistent with earlier research[6] that did not find any appreciable variations between the trauma mechanism and TICH development. Similar to earlier studies by Oertel et al.,[26], a longer time lapse between the trauma and the first CT scan appears to increase the chance of advancement.

Chang [14] suggested that big lesions are in a "active" growing phase while tiny lesions are more stable in relation to the hematoma volume. We discovered in our research that hematoma size is a factor linked to progression; these findings are consistent with those of earlier studies by Wu et al. [27] and Juratli et al. [28]. A possible theory explaining this outcome is that whereas big TICHs must overcome the greater stresses of surrounding tissues in order to expand, tiny lesions have more room inside the cranial cavity.

Also in another study by Narayan et al.,[19] they also found a significant association between hematoma volume and progression. While a universally accepted definition of lesion progression in traumatic brain injury has to be developed, lesion enlargements smaller than 2 mL might not have an impact on the patient's clinical outcome. Increases of 25% [26] and 50% [29] in at least one tICH dimension, which indicate a traumatized ICH volume, have been deemed noteworthy. A mean volume increase of more than 5 mL in a 24-hour period has been associated to late surgery and is likely significant to patient outcomes and management[14].

As regard to subdural hematoma, we found a significant correlation between progression and subdural hematoma and that coincide with other studies by Servadei et al.,[30] and Chieregato et al.,[29] who revealed the existence of an association. In TICH participants with intermediate CT scans, Narayan et al. [134] found a correlation between lesion advancement and potential clinical deterioration. This finding suggests that TICH expansion may have a negative impact on TBI and supports the idea of restricting lesion expansion.Multiple TICH prevalence was another feature that we discovered to be significantly associated with advancement. A plausible interpretation for this outcome might be the combination of many minor lesions, which when combined provide a larger volume in the reference CT scan[6].

In this study different sites of the brain affected had similar percentage of patients who developed hematoma expansion however the incidence of frontal lobe hematoma was significantly higher. This agrees Cepeda et al.,[11] who had the same results. Regarding to perihematomal edema, there was a significant correlation in between perihematomal edema and hematoma progression. Studies have revealed that cerebral edema is substantially related

with hematoma growth and higher midline displacement, which contribute to a worse functional result of ICH. [31]

Twelve patients over 60 years old who had survived the 3-month follow-up period experienced memory impairment, probably as a result of TBI's potential to start a chronic disease process that could lead to cell deaths months or years later [32]. Neural impairments following traumatic brain injury are mostly caused by cell death[33]. Forty nine patients returned to their normal life style resembling 42.9% of all patients, five patients developed language disorder resembling 4.3% of all patients, six patients had an episode of fits resembling 5.2% of all patients. Ten patients needed rehabilitation and physical therapy resembling 8.7% of all patients. Ten patients had an associated non neural injury that caused them not to be able to return to their normal life resembling 8.7% of all patients. Two of the patients couldn't be reached resembling 1.7% of all patients.

CONCLUSION

The factors associated with progression, the most common factors were old age, hematoma volume, multiple hematoma, bleeding profile disturbance, hyper tension, liver cirrhosis, renal failure, subdural extension, mode of initial trauma and perihematomal edema. Early CT is a valuable tool in the diagnosis of TICH and early treatment for prevention of hematoma progression. Edema after TICH plays an important role in TICH -induced injury and is associated TICH expansion and overall worsening of the patients outcome. There is a strong relation between Traumatic brain injury and long term development of memory disorders especially in older patients. There is a strong relation between TICH and stroke development in older patients.

DECLARATIONS

Ethics approval and consent to participate

The Declaration of Helsinki's guiding principles were followed in the conduct of this investigation and Cairo University Faculty of Medicine's Research Ethics Committee (REC) Approve it.

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