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Severity of Head Injuries Based on Computed Tomography in Patients Involved in Road Traffic Accidents in Taif, Saudi Arabia

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Abstract: ***Introduction and study problem: Head trauma now represents a major cause of death or disability among young Saudi population; it is claimed that it is more common than ever. Radiographs are now replaced by computed tomography (CT) scanning because of its superiority in cases of head and facial imaging. This study aim to assess the pattern of cranial and facial fractures on CT in head of injured patients following Road Traffic Accident(RTA). study methodology: This study was done at King Abdul-Aziz Specialist Hospital (KASH) ,Taif City , Saudi Arabia during the period from Jan to March 2014. Data collected from the medical records of 40 patients by using chick list. Main results: From 40 CT scan reports of brain and facial bone there were 34 (85%) male and 6(15%) female. Majority of injuries were in the brain (80%), while only (20%) were in the skull. Depressed skull fractures represent highest percentage (25%) among head injuries. Conclusion: The biggest group of ages was 18-25 year (40%) in this study , and this can be justified by the lack of experience and excess speed. The majority of injuries were in the brain (80%). Haemorrhage represent the highest percentage (17.5%), followed by (Rt) temporal bone fracture (12.5%) , (Lt) frontal regions subgaleal hematoma (10%). The Speeding and not wearing a seat belt were the highest two causes of accidents in Taif City (30% each).***

Keywords: Head, Facial, Trauma, CT, Injuries, RTA.

1. Introduction

Worldwide, the most common cause of head injuries is road traffic accident (RTA).[1] Trauma secondary to (RTA) constitutes a major cause of head injury, every trauma victim with altered level of consciousness must be evaluated for brain injury.[2]

Radiographs are now replaced by CT scanning as the primary method of assessing head trauma.[3]

Recent advances in high resolution CT imaging have provided marked improvement in bone imaging. Complex facial fractures, especially those associated with craniocerebral or spinal injuries, are better and more safely assessed by CT. [4] Head injury can arise from blunt or penetrating trauma and result in direct injury at the impact site .[5]

The bones of the head and neck include the skull, mandible and the cervical vertebrae. The skull (cranium) comprises the neurocranium, which contains the brain and menings and the bones of the face attached to the anterior aspect of the neurocranium. The facial bones enclose the orbits, the nose and paranasal air sinuses, and the mouth and pharynx. The mandible articulates with the neurocranium at the temporomandibular joints.[6]

The brain is composed of an enormous numbers of association neurons and accompanying neuroglia , arranged in regions and subdivisions. These neurons receive sensory information, direct the activity of motor neurons and perform such higher brain functions as learning and memory.[7] Most prominently effects cells because cells are more susceptible injury than are the noncellular connective tissue, cells maybe injured by any of the exogenous and endogenous causes listed. The critical differences between sublethal (reversible) cell injury and necrosis is whether the cell can recover or is dead.[8]

Senile atrophy is caused by aging. Tissues often become smaller and decrease in function. Disuse atrophy occurs when the cells are unable to carry out their normal function .Pressure atrophy result from steady pressure on its sue .Endocrine atrophy result from decreased hormonal stimulation.[8]

Fracture is any disruption of the continuity of bone . most fractures are caused by trauma . Pathogenic fractures caused by underlying disease of bone .[8]

Intracerebral hematomas were homogeneously hyperdense, with sharp margins surrounded by a rim of decreased density. Considerable mass effect was present, depending on the size of the lesion Serial CT scan showed a typical pattern of evaluation as blood products were gradually broken down and the hematoma became isodense with brain parenchyma. They exhibited ring-like enhancement from the surrounding capillary proliferation and thus were differentiated from hemorrhagic contusions. [9]

The radiological appearance of a typical epidural hematoma was biconvex, lentiform, biventricular, crescentic or irregular and was heterogeneous in attenuation, containing areas of hyperdense blood clot and isodense serum. The brain tissue adjacent to most epidural hematomas was severely flattened and displaced with secondary herniations in few patients.[9]

A CT or CAT scan is a diagnostic imaging procedure that uses a combination of x-rays and computer technology to produce cross-sectional images (often called "slices") of the body. A CT scan shows detailed images of any part of the

body, including the bones, muscles, fat, blood vessels and organs. [10]

CT scans may be done with or without contrast. "Contrast" refers to a substance taken by mouth (Oral) or injected through an intravenous (IV) line that causes the particular organ or tissue under study to be seen more clearly. Contrast examinations require special preparation. [10]

Injuries to the head often result in death or irreversible motor and/or sensory defect. The medical, social, psychological and economical problems of the disabled patients who survive such injuries can be considerable. Moreover, the impact on society because of the high cost and use of medical facilities for these patients is enormous.[11]
Computed tomography (CT) has become the diagnostic modality of choice for head trauma due to its accuracy, reliability, safety, and wide availability.[2]

In Saudi Arabia the motor vehicle is the main means of transportation. Between 1971 and 1997; 564.762 people died or were injured in road traffic accidents, a figure equivalent to (3.5%) of the total population in Saudi Arabia. During this period people have died on the roads in Saudi Arabia due to road accidents; amounting to one person killed and four injured every hour. Over (65%) of accidents occur because of vehicles travelling at excess speed and/or drivers disobeying traffic signals. According to deaths records in Ministry of Health hospitals in Saudi Arabia (81%) were due to road traffic accidents and (20%) of the hospitals beds are occupied by traffic accidents victims. Also, (79.2%) of patients admitted to Riyadh Armed Forces Hospital with spinal injuries has sustained their injuries as a result of a motor vehicle accidents. [11]

2. Main Problem

Head trauma now represents a major cause of death or disability among young Saudi population ; it is claimed that it is more common than ever because ; lack of knowledge regarding speeding and crossing red signal culture. The medical, social, psychological and economical problems of the disabled patients who survive and the difficult impact of them on society.

Aim

To assess the role of CT scanning in cases of acute head and facial trauma of different severity.

Methodologies

This study aim to assess the pattern of cranial and facial fractures on CT in head injured patients following Road Traffic Accident(RTA) at King Abdul-Aziz Specialist Hospital (KASH) ,Taif City , Saudi Arabia during the period from Jan to March 2014.

CT Protocol: Scan Range: Top of C1 lamina through top of calvarium.[12]

Contrast:

- Oral: None.
- Injection: some indications require injection of intravenous or intrathecal contrast media during imaging of the brain.
- intravenous contrast administration should be performed as directed by the supervising radiologist using appropriate injection protocols and in accordance with the practice guideline for the use of intravascular contrast media. a typical amount would be 100 cc at 300 mg/cc strength, injected at 1 cc/sec. a delay of 4 minutes between contrast injection and the start of scanning , fig (1) below.

Figure 1: CT Scan

Protocol of CT Facial Bones/Sinuses [12] as in the table below:

Scout	lateral (90 degrees)
Start	inferior maxilla below mandible (facial bones)
End	clear frontal sinuses
KVp	120
Ma	180 facial bones 60 sinuses (low dose)
Rotation Time	0.5sec
Raw Slice Thickness	16x0.5mm
Reconstructed Slice Thickness	0.5/0.4mm
Window Width/Window Level	3000/650 facial bones 2500/350 sinuses
Intravenous Contrast (if indicated)	Ultravist 370 50mls hand injected wait 5min
Multiplanar Reconstructions	axial 2-3mm thick coronal 1.5-2mm thick sagittal 1.5-2mm thick

Data collection: Data collected from the medical records of 40 patients. CT scan results were obtaining from evaluation of basic and diagnostic data of acute head and facial trauma by using chick list. The tool of the study was chick list which contained two parts:

- **First part include:** Age, sex, nationality and occupations.
- **Second part include:** The experience of the driver , cause of accident. site of injury, modality of investigations, result of radiological modality and place of accident.

Statistical Analysis: Statistical analysis was done by using SPSS version 16.0 for data analysis
.

3. Results

The sample of the study consisted of 40 patients, all had CT scan for brain and facial bone from them these were 34 male with percentage of (85 %) and 6 female with percentage of (15%) , and regarding the site of injury, majority of injuries in this study were in the brain (80%), while only (20%) were in the skull.

Table1: Frequency distribution of demographic characters of studied sample

Demographic characters	Frequency		Cumulative freq.
	No.	%	
Age (years)			
18-20 years	16	40	40
26-35 years	9	22.5	62.5
36-45 years	5	12.5	75
46-60years	10	25	100
Sex			
Male	34	85	85
Female	6	15	100
Nationality			
Saudi	30	80	80
Non Saudi	10	20	100
Marital status			
Single	36	90	90
Married	4	10	100
Occupation			
Student	14	35	35
Employee	12	30	65
Family-driver	6	15	80
Others	8	20	100
Total	40	100	

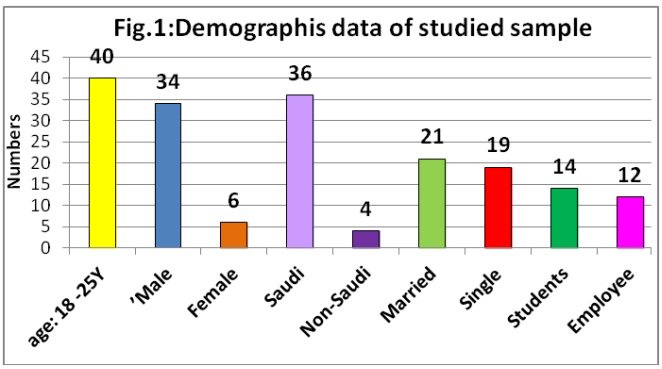

Table1 and Fig.1: show the Frequency distribution of demographic characters of studied sample .Majority of studied sample were in age group (18-25) years (40%), males (85%), Saudi(90%),married (52.5%),and student(35%).

Table 2: Years of experience of driving among studied sample

Years of driving experience	Frequency		Cumulative freq.
	No.	%	
One year	8	20	20
2 -3 years	9	22.5	42.5
> 5 years	16	40	82.5
Unknown	7	17.5	100
Total	40	100	

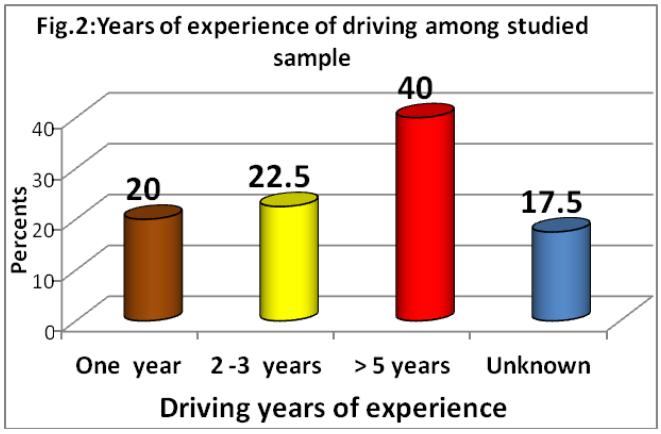

Table2 and Fig.2 demonstrate the Years of experience of driving among studied sample. Two fifth of them showed driving experience more than 5 years (40%).Those with an experience of (2-3) years constituted (22.5%), while those who were of one year experience constituted 20%. Missed data in this item was (17.5%).

Table 3: Frequency of causes of accidents among study sample

Causes of accident	Frequency		Cumulative freq.
	N0.	%	
Distracted driving	4	10	10
Speeding	12	30	40
Not wearing a seat belt	12	30	70
Tire blowouts	7	17.5	87.5
Teenage driving	5	12.5	100
Total	40	100	

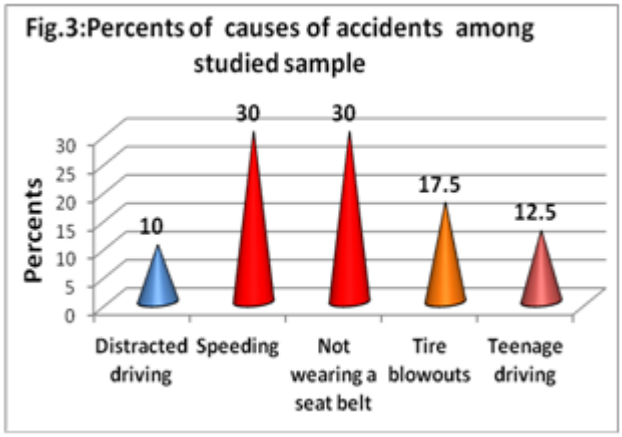

Table 3 and Fig.3 show the frequency of causes of accidents among studied sample. Speeding and not wearing a seat belt were the highest two causes of accidents in Taif (30%) each. Tire blowouts was constituting (17.5%) , followed by teenage driving (12.5%). Distracted driving was the lowest cause (10%).

Table 4: Place and percentage of accidents in Taif City

Place of accidents	Frequency		Cumulative freq.
	N0.	%	
Alhada	16	40	40
Alshafa	3	7.5	47.5
AlRodaf	10	25	72.5
AlHaweya	11	27.5	100
Total	40	100	

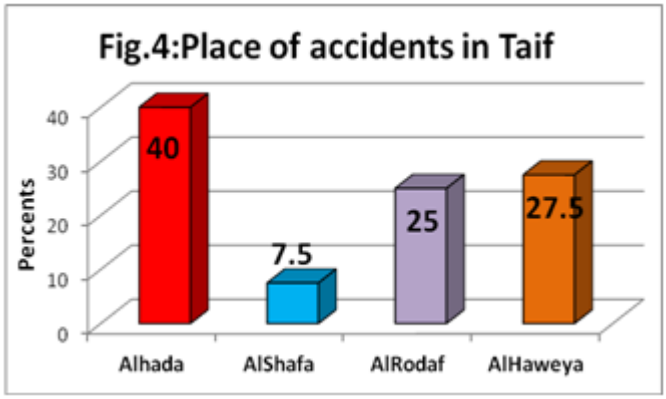

Table4 and Fig.4 show the place of accidents at Taif. Majority of accidents were in Alhada(40%), followed by AlHaweya(27.5%), then AlRodaf (25%). The lowest percent of accidents was in Alshafa(7.5%).

Table 5: Results of CT

Results of CT	*Frequency*	*Percent*	*Cumulative Percent*
Small (Lt) sided temporal lobe lipoma.	2	5.0	5.0
Chronic ischemic change	3	7.5	12.5
(Rt) temporal bone fracture	5	12.5	25.0
Internal cerebral haemorrage	2	5.0	30.0
Extra dural hematoma	2	5.0	35.0
Subgaleal hematoma	3	7.5	42.5
(Lt) frontal regions subgaleal hematoma	4	10.0	52.5
(Lt) sided weakness	3	7.5	60.0
Intra cerebral area of fresh blood densities	2	5.0	65.0
Trauma to head	2	5.0	70.0
(Rt) hypothalamic region acute focal infarct area	2	5.0	75.0
Depressed skull fractures	10	25	100
Total	40	100.0	

Table 5: Demonstrate the frequency of CT findings. depressed skull fractures represent highest percentage(25%),followed by (Rt) temporal bone fracture (12.5%), Lt frontal regions subgaleal haematoma (10%), Chronic ischemic change(7,5%), Subgaleal hematoma (7.5%), Lt sided weakness(7%), Small (Lt) sided temporal lobe lipoma (5%), Internal cerebral haemorrage (5%), extra dural hematoma(5%), Intra cerebral area of fresh blood densities (5%), Complaining of trauma to head(5%), Rt hypothalamic region acute focal infract area(5%).

4. Discussion

Cranio-facial trauma is one of the major causes of death and disability .This study aimed to evaluate the acute head and facial trauma of different severity by using CT. The sample of the study consisted from 40 patients, all had CT scan for brain and facial bones. The authors found that from 40 cases these were (85%) male and (15%)female , with male to female ratio of (5.6:1).

Regarding age (40%) of the patients belonged to the (18 to 25) years age group, (35%) from them were students while (30%)were employee. Reverdin [13] , reported that (60-70%) of head injuries occurred in young people and this can be justified by the lack of experience and excess speed. While in Gupta Prashant K ,et al.[9] study the common age group was between (20-50) years with percentage of (70.9%) and less than (13%) were elderly (> 60years).

There is no relation between the years of driving experience and percentage of accidents in this study because drivers with experience for five years represent the higher percentage (40%). This study found that speeding and not wearing a seat belt were the highest two causes of accidents in Taif city (30% each) and teenage driving accidents represent (12.5%) , a percentage of (80%) were Saudi. while in ansari ,et al.[11] study ,over (60%) of the traffic accidents were due to excess speed. Regarding place of accidents in this study Alhada region represented (40%) of the accidents followed by AlHaweya region with percentage of (27.5%).

According to site of injury in this study , majority of injuries were in the brain (80%),fig (1), while only (20%) and regarding type of trauma , depressed skull fractures represent highest percentage (25%), followed by (Rt) temporal bone fracture (12.5%), fig (2), then (Lt) frontal regions haematoma with (10%),fig (3).

Fractures was the lowest percentage with (17.5%). While in A Gupta Prashant ,et al.[9] study cerebral edema was detected in (63.4%) of the cases, followed by skull fracture (62%), hemorrhagic contusion (46.3%), extra dural hematoma (5%)and epidural hematoma was (30.4%) , fig (3) with (Rt) temporal bone fracture , while Zimmerman [14] stated that epidural hematoma was most common (65%) in temporo-parietal region. Subdural hematoma occurred in approximately (5% to 22%) of patients with severe head injury as reported by Seeling et al[15].

In this study depressed skull fractures represent (25%), while in O Adegbehingbe ,et al.[16] study was (16.3%). This study showed that intra-cerebral hematoma represent (25%), While in Gupta Prashant K, et al [14] study was (52.5%), and chronic ischemic change was present in three cases with percentage of (7.5%), While in Patrizio lancellotti,et al[17] study was (11%) ; the different may be due to different of traffic rules in different countries. Internal cerebral haemorrage was found in (5%) in this study , while Hirsh reported that intracerebral hematoma of frontal and temporal lobe was commonest in head injuries. [18]

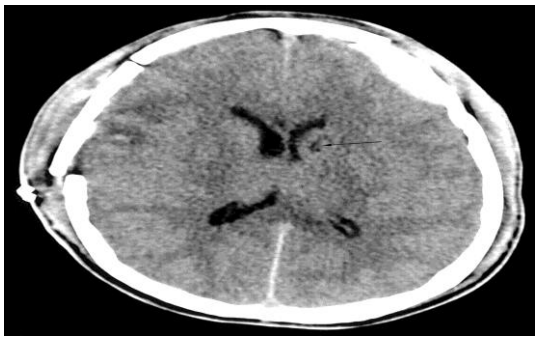

Figure 1: Demonstrate CT image of severe head injury (black arrow)

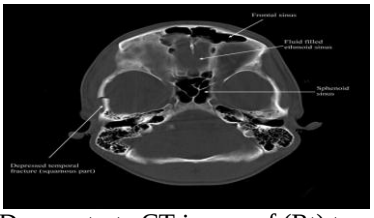

Figure 2: Demonstrate CT image of (Rt) temporal bone fracture (white arrow).

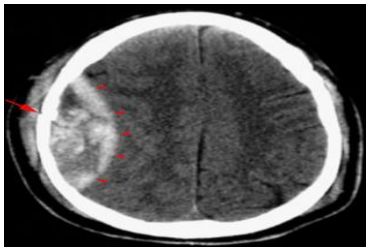

Figure 3: Demonstrate CT image of epidural hematoma (arrowheads) and parietal skull fracture (arrow)

5. Conclusion

The prevalence of cranio-facial trauma and significant CT findings justifies the use of CT in head and facial bone trauma patients. The biggest group of ages was (18-25) year with percentage of (40%) in this study , and this can be justified by the lack of experience and excess speed. The majority of injuries were in the brain (80%). Hemorrhage represent the highest percentage (17.5%), followed by (Rt) temporal bone fracture (12.5%) , (Lt) frontal regions subgaleal hematoma with (10%) , and trauma to facial bone with (5%). The Speeding and not wearing a seat belt were the highest two causes of accidents in Taif City (30% each) followed by tire blowouts and teenage driving with percentage of (17.5%& 12.5% respectively).

6. Recommendations

- Saudi young people must increase their awareness about dangerous driving without using seat belt and the speed driving.
- Al hada and al Hawaya regions in Taif need strict road traffic signals with firm punishment for those who violate traffic rules .Larger similar studies with larger sample size should be planed.

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