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Research Article

Computerized Tomography Imaging Value in Diagnosing Head Injuries, Compared with Conventional Skull X-rays

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Abstract: Head injuries are the main causes of death in Sudan. The emergency neurosurgery department of Teaching Khartoum Hospital , is the only specialized department in Sudan , which deals with the management of head injury patients. The objective of the study is to maintain the efficiency of CT in diagnosing head injuries as a first accurate radiological Investigation in emergency department. This study is descriptive case study concerning patients with head injuries in order to compare between CT and conventional skull x-ray investigations. The incidence of the head injuries is higher in males rather than females, and the occurrence had been at the age of 16-30 years. Most of the head injuries were caused by road traffic accidents (RTA) (158 cases – 63.2%). No difference between the CT scanning and the conventional skull x-ray in demonstrating the linear fractures of the skull (100% to 98.7%). The incidence of the head injuries is higher in males rather than females, and the occurrence had been at the age of 16-30 years. Most of the head injuries were caused by road traffic accidents (RTA) (158 cases – 63.2%).
Keywords: CT, Head injuries, Spiral and Conventional

INTRODUCTION

Head injuries are the main cause of death in Sudan. The emergency neurosurgery department of Teaching Khartoum Hospital, is the only specialized department in Sudan, which deals with the management of head injury patients.

Head injury, may be associated with skull fractures, which may cause intracranial haemorrhage, or brain tissue damage. The degree of severity of the injury varies from patient to another due to the type and violence of trauma and resultant fractures. Head injury may lead to complications which may lead in some cases to death. In the United Kingdom head trauma is responsible for more deaths in all age groups under 45 years old than any other single cause, and brain damage resulting from a head injury is the most important factor contributing to death or serious incapability due to trauma [1]. In 1981 the Royal Collage of Radiologists (RCR) supported a prospective study to investigate the use of skull radiography in the management of patients with head injury. Patients were divided into two categories: complicated head injury with additional injury or pathological findings and uncomplicated head injury [2]. The main investigations which were applied to diagnose the head injuries routinely is conventional x-ray, which has low resolution and inefficient to demonstrate the brain tissues [2].

It has been discovered that X-rays are a part of electromagnetic radiation which are derived from electromagnetic spectrum. Because of their short wavelength, x-rays can penetrate materials which do not transmit light. They were discovered in 1895 by Conrad Roentgen who was a German physicist. X-rays are produced by a process which converts energy from one form into another. When fast moving electrons possess kinetic energy, which is converted into radiation energy when the electrons are suddenly slowed down [3]. Nevertheless, skull radiographs ordered routinely and with alacrity in most casualty departments to determine whether there is a skull fracture. Furthermore, there is the old medico-legal teaching that every head injury must have skull examination [4]. Computerized Tomography is a diagnostic Imaging procedure that uses a combination of X-ray (tomography) and computer technology to produce cross sectional images (slices) both horizontal and vertical of the body. Computerized tomography shows detailed images of any part of the body, including bones, muscles, fats and organs with more details [5]. The use of Computerized tomography in Sudan is not wide spread because the

numbers of Computerized Tomography Centers are not more enough in Khartoum State, that receives all cases referred from hospitals, emergency departments and clinics.

Objective

To maintain the efficiency of CT in diagnosing head injuries as a first accurate radiological Investigation in emergency department.

METHODOLOGY

This study is experimental, comparative study concerning with patients with head injuries in order to compare between CT and conventional skull X-ray investigations, the variables divided into two categories: Dependant variables like skull fractures, brain haemorrhage and independent variables: computerized tomography and conventional x-ray. The patients with head injuries were selected to satisfy the need of the study. The data were collected by the technique of non probability method. The data collected by sheet which documented 250 random patients with head injuries. Those patients of different ages (1-80 years), sex (male-female), signs and symptoms referred to the emergency Neurosurgery Department at Khartoum Teaching Hospital. Their radiological investigations (Skull X-ray – CT scan brain) will be done in different X-ray Department & CT centers in Khartoum State, from June 2004 to February 2005.

The data analyzed by using soft ware computer system (SPSS) for quantitative statistical techniques mainly frequencies and correlation to study the relationship between the different variables.

RESULT

Table 1: Sex distribution

Sex	Frequency	Percent
Male	216	86.0%
Female	34	14%
Total	250	100.0%

Table 2: The causes of the head injuries

Cause	Frequency	Percent
Assaulted By Iron	15	6.0%
RTA	158	63.2%
Assaulted By Stick	33	13.2%
Fall From A height	17	6.8%
Object Fall On Him	8	3.2%
Gun Shot	6	2.4%
Kicked By Stone	13	5.2%
Total	250	100.0%

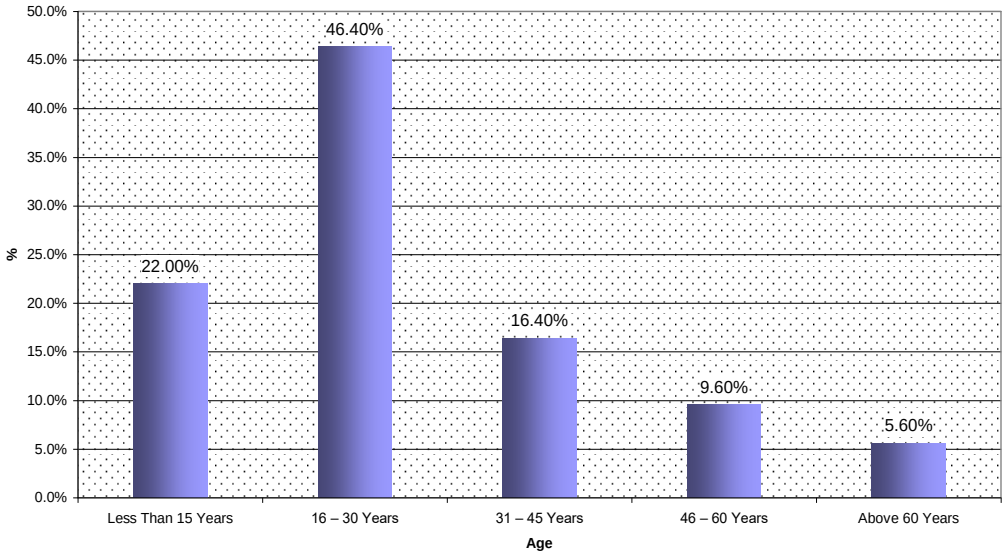

Fig. 1: The age distribution

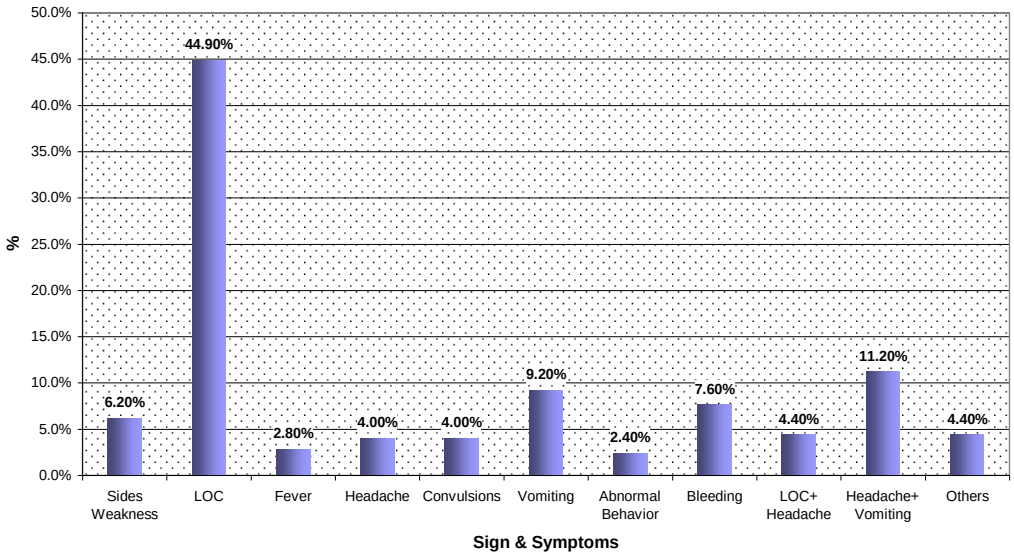

Fig. 2: The signs and symptoms of the head injuries

Table 3: Comparison between CT scan and conventional skull X-ray in detecting fractures of the skull

Fractures	CT		Skull X- Ray	
	Frequency	Percent%	Frequency	Percent%
Linear Fractures	77	100%	76	98.7%
Depress Fractures	59	100%	56	94.9%
Compound Fractures	23	100%	23	100%
Fractures Base of Skull	12	100%	0	0%
Fracture Vault of the Skull	2	28.6%	7	100%
Multiple skull Fractures	6	100%	4	66.7%

Table 4: Comparison between CT scan and conventional skull X-ray in detecting haemorrhage

Haemorrhage	CT		Skull X- Ray	
	Frequency	Percent%	Frequency	Percent%
Subdural Haemorrhage	20	100%	5	25%
Extradural Haemorrhage	39	100%	0	0%
Intracerebral Haemorrhage	67	100%	0	0%
Intracerebral Haemorrahagic Contusions	54	100%	0	0%

Table 5: Comparison between in detecting intracerebral airocele

Intracerebral Airocele	CT		Skull X Ray	
	Frequency	Percent	Frequency	Percent
	11	100%	9	81.8%

Table 6: Comparison in detecting intracerebral bullet and shrapnel

Intracerebral Bullet and Shrapnel	CT		Skull X Ray	
	Frequency	Percent%	Frequency	Percent%
	2	100%	2	100%

DISCUSSION

Head injuries are most common in male, 216 patients (86%), (Table1) than female, 34 patients (14%). This is because the males usually travel to perform their works and they are more active than females, who stay almost at home and this matches with Adekoya *et al.* [6] who motioned that in a recent report from the US CDC showed that death from TBI was 3- 4 times more common for males versus females; specifically, males were 2.3-times more likely to have sustained injury by motor vehicle crash, 2.5-times more likely to have a TBI secondary to falls and 6.0-times more likely to be injured via firearms.

According to age, this study showed that about 55pateints (22%) were less than 15 year this was differ with Dietrich AM *et al.* [7] and Homer CJ *et al.* [8]. They found that, clinical criteria for scanning of children with head injury have been less reliable than those for adults, particularly for children younger than

age 2, for this reason, more liberal use of CT scanning has been suggested for pediatric patients.

This matches with Haydel *et al*. [9], who said that all head injury patients over 60 years of age should undergo imaging and according to the Canadian CT head rules, anyone over 65 years of age is at high risk for needing neurosurgical intervention, which is also matches with Stiell IG *et al*. [10, 11] and Schutzman SA *et al*. [12], they have also shown a high incidence of intracranial injuries among infants who had no signs or symptoms, suggesting that imaging should be pursued more aggressively in younger children.

The CT scan detected all cases (77 cases) of the linear fractures of the skull (100%), and the skull x-ray detected 76 cases (98.7%), regarding to depressed fractures, the CT scan detected all cases (59 cases) of the (100%), and the skull x-ray detected 56 cases (94.9%). When we look to compound fractures, we found that the CT scan detected all cases (23 cases) of them (100%), and the skull X-ray detected also 23 cases (100%). Referring to fractures base of the skull we found that the CT scan detected all cases (12 cases) of the fractures of the base of the skull (100%), and the skull X-ray did not detected the fractures of the base of the skull efficiently. For fractures vault of the skull, t he CT scan detected 2 cases of the fractures of the vault of the skull (28.6%), and the skull X-ray detected all cases (7 cases) (100%). About multiple fractures of the skull, t he CT scan detected all cases (6 cases) of the multiple fractures of the skull (100%), and the skull x-ray detected 4 cases (66.7%). These finding were matches with Gruen P [13] and Zee CS *et al*. [14], they found that, depending on the location, size, and type of fracture, fractures may need to be surgically repaired to relieve or prevent CSF leakage. Although plain films of the skull may detect fractures, CT is the imaging modality of choice (Fig. 3). Open skull fractures depressed more than the full thickness of the skull should be surgically elevated.

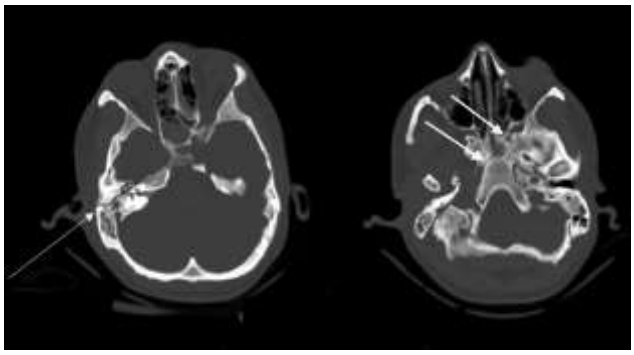

Fig. 3: CT scan of 35-year-old male with recent motor vehicle accident demonstrating longitudinal fracture of the right petrous bone (thin arrow) that extends into the skull base (thick arrow)

The CT scan detected all cases (20 cases) of the acute and the chronic subdural haemorrhage (100%), and the skull x-ray detected 5 cases of the chronic subdural hematomas (25%). With concerning to extradural haemorrhage, the CT scan detected all cases (39 cases) of the extradural haemorrhage (100%), and the skull x-ray did not detect it. According to the intracerebral haemorrhage and intracerebral haemorrahagic contusions, the CT scan detected all cases (67 cases) of the intracerebral haemorrhage (100%) and (54 cases) of the intracerebral haemorrahagic contusions (100%) respectively and the skull x-ray did not detect it. Which is matches with Seeram Eucli, [5] who said that, CT scan is highly sensitive in the diagnosis of the intracerebral haemorrhage because it has a high resolution, also it matches with Gutman MB *et al*. [15], they found that, subdural hematomas (Fig. 4) are also relatively common (10–20% of patients with head trauma) and are associated with high mortality (50–85%). Also matches with Bakshi R *et al*. [16], they found that Epidural hematomas are relatively uncommon (1–4% of head trauma patients) and are often associated with skull fractures. Whereas intraventricular hemorrhages are also uncommon (2.8%), they can be associated with significant morbidity and mortality.

Fig. 4: CT of an 87-year-old female status post fall showing a large subdural hematoma along the left cerebral convexity with significant midline shift and effacement of the left lateral ventricle.

In this study there is no difference between the conventional skull x-ray and the CT scanning at detecting the intracerebral bullet and shrapnel and this matches with Kim PE *et al*. [17] with the rising prevalence of firearms injuries, it is increasingly common to find foreign bodies in the head. Depending on their size and velocity, foreign bodies can cause damage by several mechanisms: direct laceration, shock-wave transmission (pulsations that emanate from the front of a projectile), and cavitation (the motion of the foreign body creates a suction force in its path).

CONCLUSION

Most of the head injuries were caused by road traffic accidents (RTA) (158 cases – 63.2%). No difference between the CT scanning and the conventional skull x-ray in demonstrating the linear

fractures of the skull (100% to 98.7%). The conventional skull x-ray is capable to diagnose the depressed fractures of the skull as equal to the CT scanning does (100% CT- 94.9% skull x-ray). The conventional skull x-ray is sensitive to detect the compound fractures of the skull as well as the CT scanning (100% CT – 100% skull X-ray).

RECOMMENDATIONS

Traumatic patients with no neurological symptoms should do skull x-ray for assurance. Traumatic patients with neurological symptoms should be directed to do CT scan examination firstly, and it should be done as quickly as possible. All the governmental hospitals should be provided by CT scanning machines. The CT scan for the head injured patients should be done free, or with less cost.

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