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THE PATTERN OF COMPUTERISED TOMOGRAPHIC FINDINGS IN MODERATE AND SEVERE HEAD INJURIES IN ILE-IFE, NIGERIA

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ABSTRACT
Fifty-seven patients with moderate and severe head injuries between January 2001 and December 2001 had computerised tomographic (CT) scan of the head done at the Obafemi Awolowo University Teaching Hospitals Complex Ile- Ife, Nigeria. Forty patients (70%) were male while 17 (30%) were female, with a male to female ratio of 2.5: 1. The age range was from 1 to 71 years with a mean of 27.2years. The age groups mostly affected were those in the second and third decades of life. A retrospective study of the CT findings was carried out to determine the pattern of radiological presentation in these groups of patients. Fifty (>87%) patients showed abnormal CT findings based on the demonstration of skull fractures, intracranial hemorrhage, cerebral oedema, cerebral contusion, ventricular compression, midline shift, soft tissue swelling and pneumocephalus (aerocele). These findings were analysed and the various abnormalities were compared to the portion of the brain mostly affected in each case. The frontal and parietal regions of the brain were mostly affected both by fractures and by intracranial hemorrhages. Skull fractures were demonstrated in eighteen (32%) cases. These were frequently associated with intracranial hemorrhages particularly extradural hemorrhage (EDH) in 80% and subdural hemorrhage (SDH) in 33% of the cases. CT brain scan in moderate and severe head injuries is vital in the overall management of the patients and may be cost effective.

ABSTRAIT
Les patients de Fifty-seven présentant des dommages principaux modérés et graves entre janvier 2001 et décembre 2001 avaient informatisé le balayage (CT) tomographique de la tête faite aux hôpitaux d'enseignement d'université d'Obafemi Awolowo Ile- complexe Ife, Le Nigéria. Quarante patients (70%) étaient masculins tandis que 17 (30%) étaient femelles, avec un mâle au rapport femelle de 2.5 : 1. La gamme d'âge était de de 1 à 71 ans avec un moyen de 27.2years. Les catégories d'âge la plupart du temps affectées étaient ceux dans les deuxièmes et troisième décennies de la vie. Une étude rétrospective des résultats de CT a été effectuée pour déterminer le modèle de la présentation radiologique dans ces groupes de patients. Cinquante (> patients de 87%) ont montré des résultats anormaux de CT basés sur la démonstration des ruptures de crâne, hémorragie intra-crânienne, oedème cérébral, contusion cérébrale, compression ventriculaire, décalage de midline, gonflement de tissu et pneumocephalus doux (aerocele). Ces résultats ont été analysés et les diverses anomalies ont été comparées à la partie du cerveau la plupart du temps affecté

dans chaque cas. Les régions frontales et pariétales du cerveau ont été la plupart du temps affectées par des ruptures et par des hémorragies intra-crâniennes. Des ruptures de crâne ont été démontrées dans dix-huit cas (de 32%). Ceux-ci ont été fréquemment associés à l'hémorragie extradural intra-crânienne d'hémorragies en particulier (EDH) dans 80% et à l'hémorragie subdural (CSAD) dans 33% des caisses. Le balayage de cerveau de CT dans des dommages principaux modérés et graves est essentiel dans la gestion globale des patients et peut être rentable.

INTRODUCTION

Head injury has been described as the leading cause of death in individuals under the age of 30 years in the western world following trauma. Approximately 8% of all deaths in the United States can be attributed to injuries while nearly 50% of these deaths are from brain injury.[1] Traumatic head injury is also the neurological disorder with the highest incidence in the young population[2.] It is nearly three times as common in males as in females. The causes of head injury depend on the age group and the geographical location, though the commonest cause usually is motor vehicular accidents[1.]

CT scan of the brain remains the first diagnostic step in treating the emergency patient especially those with moderate to severe brain injury[2]. It is a rapid imaging examination done to determine the necessity for surgical intervention in order to save the patient's life [1,3.] It allows the visualization of the entire head showing both the bony and soft tissues with resolution of very small lesions that produce little or no mass effect. It can help to determine the nature and characteristics of intracranial lesions. Moreover, it is invaluable for the rational planning of surgical intervention.[4]

Where available, CT brain scan should be carried out in all patients with moderate to severe head injuries* and previous studies by many workers have shown that the severity of clinical symptoms in a patient has significant correlation with the CT findings[3, 5.] This is especially true for the degree of clouding of consciousness as well as with further prognosis.

This study however was carried out with the aim of studying the pattern of CT findings in patients with mild and severe head injury and relating these abnormalities to the portions of the skull and lobes of the brain.

* Moderate and severe head injuries have the Glasgow Coma Scale score of 9-12 and $\leq$ 8 respectively.

MATERIALS AND METHODS

All the 57 patient's records with moderate and severe head injury referred for brain CT scan at the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) Ile-Ife between January 2001 and December 2001 were reviewed. The patients with mild head injury (GCS 13-15) were excluded from the study. Data such as the age, sex, cause of injury and radiological findings were obtained from the CT films; duplicate radiologist reports as well as the patient's request cards. The abnormal findings noted on the CT films included: demonstration of skull fracture(s) in the calvarium or the skull base, presence of intracranial hemorrhage(s) which could be extradural (EDH); subdural (SDH); intracerebral (ICH); intraventricular (IVH) or subarachnoid (SAH). Other parameters noted included cerebral contusion, cerebral oedema, pneumocephalus (aerocele), ventricular (+/- cistern) compression/effacement, midline shift and soft tissue changes (haematoma/subcutaneous emphysema).

The locations of these different lesions, in relation to the skull bone and the lobes of

the brain were noted and analysed.

RESULTS

During the period under review, 57 patients with moderate and severe head injuries had brain CT scan done. The age ranges between 1 and 71 years (mean age was 27.2 ± 17.057 yrs S.D). The male to female ratio was 2.5:1. Forty-three (75%) patients were below the age of 40 years (Table 1) with the peaks in the second and third decades of life. Only 3 (5.2%) patients were 60 years and above (figure 1).

The causes of injury in these patients were road traffic accident (RTA) 53(90%); falls 1(1.8%); assault 3(5.4%) and gunshot 1(1.8%).

Fifty (87%) of the patients had abnormal CT findings while seven (13%) showed grossly normal findings. Table II summarises the CT findings.

21 (42%) patients had skull fractures with 18(36%) involving the calvarium and 3(6%) affecting the base of the skull.7 (38.9%) of the fractures were comminuted; 5(27.8%) depressed and 6(33.8%) were linear. Intracranial haemorrhages were demonstrated in a large number of these patients. EDH was seen in 7(14%) of cases; SDH 18 (36%); ICH 24 (48%); IVH 3(6%); and SAH 2(4%). Thirty-seven (74%) showed evidence of cerebral oedema with 10(28%) of these having no other abnormal finding. Cerebral contusion was seen in 27(54%) cases. Ventricular compression and midline shift were found in 27(54%) and 18(36%) of the cases reviewed, respectively. 4(8%) cases of pneumocephalus (aerocele) were identified. Soft tissue changes in the form of scalp swelling, haematoma or subcutaneous emphysema was demonstrated in 13(26%) cases.

The locations of some of the CT findings in relation to the skull bone and different lobes of the brain were as shown in Table III. Over 66% of the skull fractures were located in the frontal and parietal regions. EDH were localised to the frontal and parietal regions in 90% while SDH and ICH affected the frontal and parietal lobes of the brain in 78.6% and 58.3% respectively.

Skull fractures were found to be more commonly associated with EDH (80%) than SDH (33%) in this study.

DISCUSSION

Head injury is a universal problem affecting relatively young people in general and the male sex in particular.[1, 2, 6.] This study showed that over 75% of the patients sent for CT brain following head injury were below the age of 40years. Only 5.2% were above 60years. Elesha et al[6] reported 44% for patients between 22 and 40 years. A steady decline was also noted after the age of 40 years. The high incidence of head injury in the young population is not unexpected as this group of the population is usually very active and adventurous, and therefore more involved in accidents. Those above the age of 60 years are rather less mobile and therefore unlikely to get involved in road traffic accidents, the major cause of head injuries. However falls are common in this age group. The male to female ratio of 2.5: 1 is in agreement with many of the earlier reports[1, 7.]

Road traffic accidents (RTA) accounted for 90% of the cases. This proportion is rather high compared with some of the earlier studies. This may be due to the fact that only moderate and severe head injuries are considered in this study. Grossman identified RTA as the cause of head injury in 49% among Black and White Americans[8.] However, considering the recent influx of motor vehicles and motorbikes into our country coupled with poor road/car maintenance as well as increase in the number of inexperienced drivers on our roads, the occurrence of RTAs has increased. The culture of not using the seat belts and the crash helmet add to the severity of the

injury. Also, most patients referred for brain CT scan following head injury are usually those with moderate and severe head injuries. Such injuries are usually caused by automobile accidents and rarely by falls. Other causes of injury in this study were falls (1.8%), assault (5.4%) and gunshot (1.8%). Mild head injuries, which more commonly result from falls, assaults and sports, are usually not an indication for brain CT scan. Mohanty et al[9] in their study of 348 patients with mild head injury following trauma, noted that only 12 had abnormal CT findings with no neurological deficit or sequelae and all of them had an uneventful hospital discharge without readmission. Hence, they concluded that routine CT scan in mild head injured patients is an inefficient use of personnel and equipment.

Fifty (87%) patients had abnormal CT findings in this review, further emphasizing the importance of CT scan in these groups of patients with moderate and severe head injuries. These abnormal findings included skull fractures, intracranial hemorrhages of different types, cerebral contusion, cerebral oedema and soft tissue changes. The most frequent lesion demonstrated was intracramal heamorrhage at various sites. This finding is similar to that of Elesha[6] where 69.18% of the parenchymal injury was due to intracranial hemorrhages. This can also be related to the severity of the head injury. 24 cases of intracerebral hemorrhage were seen, out of which 9(37%) were bihemispheric and 128(75%) were multiple. The 3 cases of intraventricular hemorrhage (IVH) seen were bilateral and they involved the lateral ventricles in all cases. It has been documented that CT findings such as bihemispheric injury and intraventricular blood or air were associated with a poor outcome [10, 11.] Even though, IVH is said to be frequently associated with ICH [12], only 3 cases of IVH were seen in this study despite the 24 cases of ICH detected. This could be due to the fact that IVH becomes isodense relatively more rapidly and may disappear completely within a week. Only 2 cases of SAH were identified in this study most likely due to the fact that, many of the cases were not referred for CT in the acute phase, as CT is poor at identifying SAH after 24 hours. The difficulty encountered sometimes in the detection of both IVH and SAH may be due to the small amount of blood in the two spaces.

Cerebral oedema was demonstrated in 37(74%) cases with 10(28%) of these having no other abnormality. A large proportion of the cerebral oedema is usually associated with intracranial haemorrhage.

The 4 cases of aerocele (pneumocephalus) were associated with basal skull fractures in keeping with earlier reports[13.] It is said to be a relatively benign complication of head injury, which usually resolves spontaneously. However, few cases of tension pneumocephalus have been reported in the literature, which may cause neurological symptoms, [13] and even death. Skuna et al reported 5 cases of subdural tension pneumocephalus following head injury. All the patients had basal skull fractures involving the paranasal sinuses or mastoid air cells with coexisting CSF leakages. Four of the patients clinically improved with conservative management while only 1 case needed surgical intervention.

Skull fractures were found to be more associated with extradural hemorrhage (80%) than subdural hemorrhage (33%) in this study. This is similar to the reports of studies done by Eric[14] and Markwalder[15.] Efforts should therefore be made to identify skull fractures once an extradural clot is seen and vice versa.

The different lesions demonstrated on CT in this study especially skull fractures and intracranial hemorrhages were

Table I: Age and sex distribution:

Age range	**Total No of cases**	**Male**	**Female**	**%**
0 - 9	8	7	1	14
10 19	13	6	7	23
20 29	14	9	5	24.5
30 39	8	6	2	14
40 49	7	6	1	12.5
50 59	4	3	1	7
60 - 69	2	2	0	3.5
≥ 70	1	1	0	1.7
TOTAL	**57**	**40**	**17**	**100**

Table II: Frequency table of the CT findings

CT Findings	**No. of Cases**	**%**
Normal	7	14
Skull fracture (a) Calvarium	18	36
(b) Base of the skull	3	6
Extradural hemorrhage (EDH)	7	14
Subdural hemorrhage (SDH)	18	36
Intracerebral hemorrhage (ICH)	24	48
Intraventricular hemorrhage (IVH)	3	6
Subarachnoid hemorrhage (SAH)	2	4
Cerebral oedema	37	74
Cerebral contusion	27	54
Midline shift	18	36
Ventricular/cistern compression	27	54
Pneumocephalus	2	4
Soft tissue changes (haematoma/emphysema)	13	26

Table III: Location of the common CT findings.

CT findings	**Frontal**	**Parietal**	**Temporal**	**Occipital**
Skull Fractures	5(21%)	11(45.8%	4(16.6%)	4(16.6%)
EDH	3(30%)	6(60%)	1(10%)	-
SDH	14(50%)	8(28.6%)	6(21.4%)	-
ICH	13(36.1%)	8(22.2%)	14(39%)	1(2.7%)

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