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Computerised tomography of intracranial subdural haematoma in Ibadan

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Summary
The high mortality and morbidity associated with intra-cranial subdural hematoma(SDH), has declined significantly with the introduction of Computerised Tomography(CT) for the evaluation of the brain in suspected cases. One hundred patients with CT-diagnosed SDH at the Radiology department of the University College Hospital,Ibadan between January 1999 and December 2000 were reviewed. The mean age was 47.4 years. The most frequent cause of SDH was head injury 61(61%). The observed CT appearances of SDH included 66(66%) of chronic (hypodense), 30(30%) of acute (hyperdense) and 4(4%) of acute-en-chronic(mixed density) lesions. There were more unilateral 83(83%) lesions than bilateral 17(17%). The lesions were right-sided in 45(45%) cases and left-sided in 38(38%). A total of 169 lesions were detected as some patients had multiple sites, however, the parietal 78(46.2%) and frontal 64(37.9%) lobes were mostly affected. We conclude that brain CT scan offers the advantage of prompt determination and precise anatomical localization of SDH, which significantly aids management.

Keywords : *Subdural hematoma, computerised tomography, brain, hypodense, hyperdense*

Résumé
L'élévation de la souffrance et la mortalité associés a l'hematome subdural intracraniere (SDH) s'est réduit significativement avec l'introduction de la tonographie computarisée (CT) pour evaluation des cas cerebral suspectés. Cent patients ayant le CT-diagnotiques SDH au departement de radiologie du centre Universiatire Hospitalier d 'Ibadan au Nigéria entre janvier 1999 a decembre 2000 étaient révue. La moyenne d'age était de 47.4 ans . La cause plus fréquente du SDH était les blessures de la tete 61(61%). L'apparence du CT observée du SDH inclus 66(66%) cas chronique (hyperdense), 30 (30%) (hypodense) et4 (4%) des lésions acute (densité mixe). Ils y avaient plus de lésion unilatérale (83%) que bilatérale(38%). Un total de 169 lésions étaient detectées et certain patients avaient des taches multiples . Cependant , les lobes parietal 78 (46%) et frontal 64 (37.9%) étaient plus affectés. Nous avons conclu que le CT-scan du cerveau offers un adavantage de determination precise et une precise localisation anatomique du SDH qui aide significativement le management.

Introduction

Computed Tomographic (CT) appearances of Subdural hematoma (SDH), have been extensively studied by various authors, over two decades, in the developed part of the world [1,2,3]. SDH may present in a variable, and sometimes confusing manner. The CT is a relatively rapid and non-invasive means of making an accurate diagnosis [4] In the cases reported by Forbes [5] who had surgery, 73(96%) patients with SDH were found as predicted by CT. CT data is obtained more easily and more rapidly than with angiography [5]. The precise localization of SDH achievable with CT enhances prompt treatment and reduces the time for surgery, as well as morbidity and mortality.

In Nigeria , CT was introduced into the clinical management of patients in 1990 and its increasing availability and accessibility has provided some data for our study. This retrospective study reviews the CT findings in 100 patients at Ibadan with CT-diagnosed SDH over a period of two consecutive years.

Clinical materials and methods

This is a retrospective study. The materials consist of the CT films and the available clinical records of 100 patients with CT diagnosis of SDH within a period of two consecutive years (January 1999 to December 2000) at the University College Hospital Ibadan, Nigeria.The scans were done on a GE 9800 series scanner. The CT protocols include axial slices of the brain ,obtained at 10mm intervals from the skull base to the vertex. Pre and post contrast slices were done, except in cases of acute SDH where only the pre-contrast study was done. The CT radiological patterns were assessed and classified as follows:

SDH is a lesion with a concave medial border immediately subjacent to the cranial vault , spreading over the surface of the cerebral hemisphere(described as concavoconvex).
Chronic Subdural Hematoma (Hypodense): the lesion shows an attenuation coefficient lower than that of normal brain tissue. Acute Subdural Hematoma (Hyperdense): the lesion shows an attenuation coefficient higher than that of normal brain tissue. Acute-en-Chronic Subdural Hematoma (Mixed density): the lesion shows a combination of low and high attenuation coefficients. Mass Effect: A shift, compression or effacement of the adjacent cerebral tissue and the ventricles.

Results

The patients' ages ranged from 0.33 to 90 years with a mean of 47.4 years. There were 74 males and 26 females , with a male : female ratio of 2.8:1. The sex and age distribution patterns are shown in table 1,while Fig 1 is a graphical

Fig 1:Graphical Representation of SDH on CT.

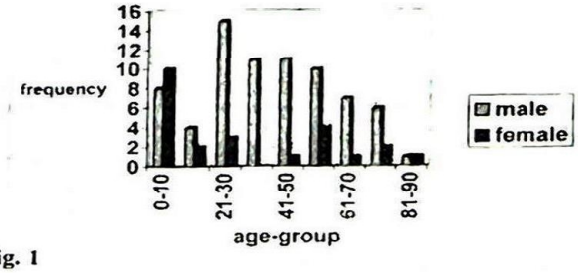

Fig. 1

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representation (histogram) of the age distribution pattern. 82% of the patients were in the 1st to 6th decades of life.

Table 1: Age-sex distribution pattern of SDH on CT Scan

Age-group	Males	Females	Total
<10	8	10	18
11 - 20	4	2	6
21 - 30	15	3	18
31 - 40	12	2	14
41 - 50	11	1	12
51 - 60	10	4	14
61 - 70	7	1	8
71 - 80	6	2	8
81 - 90	1	1	2
Total	74	26	100

Table 2 shows the clinical indications for the brain CT scan study. Head injury was highest on the list with 61% followed by post surgical cases (17%).Cerebrovascular accidents(CVA), hypertension and infection were 8%, 2% and 2% respectively. A group of non-specific symptoms(others) made up 10% of the series.

Table 2: Clinical indications in patients with CT-diagnosed SDH

Indications	Total
Head injury	61 (61%)
Post surgery	17 (17%)
CVA	8 (8%)
Hypertension	2 (2%)
Infection	2 (2%)
Others	10 (10%)
Total	100 (100%)

The distribution pattern of the 3-types of SDH observed is shown in Table 3A. There were more cases of chronic SDH (66%) compared to the acute (30%) and acute-on-chronic (4%) SDHs respectively ..More unilateral (83%) lesions were observed than bilateral (17%), with predominantly right-sided (45%) than the left (38%).

Table 3A: Pattern of intra-cranial SDH on CT scan

Types of SDH	Unilateral		Bilateral	Total
	Right	Left		
Chronic	29(29%)	23(23%)	14(14%)	66(66%)
Acute	13(13%)	14(14%)	3(3%)	30(30%)
Acute-on-chronic	3(3%)	1(1%)	0(0%)	4(4%)
Total	45(45%)	38(38%)	17(17%)	100(100%)

The anatomical sites distribution pattern of the SDH is shown in Table 3B, while Fig 2 is the graphical (Pie-Chart) representation. Most of the SDH occurred at the parietal lobe (46.2%), compared to the frontal (37.9%), temporal (11.8%) and occipital (4.1%) lobes respectively. Other findings, in addition to SDH were observed in 32 cases. These include fractures (11), vault defects in post-surgical cases (7), intra-cranial haemorrhage (13) and hydrocephalus (1).

Fig. 2:Graphical Representation of Anatomical Sites of SDH on Brain C/T

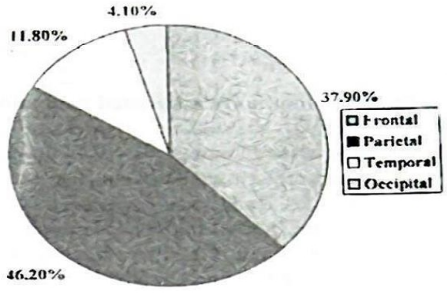

Fig. 2:

Table 3B: Anatomical sites of SDH on brain CT scan

Sites	Total
F	64 (37.9%)
P	78 (46.2%)
T	20 (11.8%)
O	7 (4.1%)
Total	*169 (100%)

Key:
F = Frontal
P = Parietal
T = Temporal
O = Occipital
**Some patients had multiple sites*

Discussion

Computerised Tomography Scan remains a valuable tool for the diagnosis and care of patients with suspected cranial pathology because of its safety, speed and ability to allow visualization of the entire intra-cranial space [4]. The use of CT in the diagnosis of SDH has improved efficiency and consistency of diagnosis with less than 4% of false positive diagnosis at surgery [5] There has been a remarkable increase in the number of SDH diagnosed with CT in this hospital when compared with the pre – CT era. In 1967, Odeku and Idowu [6] recorded only 25 cases over a 9 – year period, and angiography was required for diagnosis in 16(64%) of these patients. In this study, 100 cases of SDH were diagnosed by CT alone within a 2-year period. A male to female ratio of 2.8: 1 was observed in this study. Similar ratios for SDHs have been reported by other authors [7,8] but a much higher ratio of 7.3 to 1 was previously recorded at Ibadan[6] and this could have been due to the small sample size of patients used. Most of the patients in this study were in the first three decades of life. This age group, particularly the male sex , is mostly susceptible to road traffic accident (RTA), the most frequent cause of head injury, and the commonest clinical indication in this study.

Odeku *et al* [6] and Amendola [7], separately recorded 6 cases each of SDH , which had no specific predisposing factors. This study recorded 12 cases with no clearly defined predisposing factor. Amnesia in the elderly patient or classification of a previous traumatic episode as trivial and thus, not reportable are possible explanations in these patients.

SDHS may appear hyperdense, hypodense or isodense and mixed density on CT. These patterns , with the exception of isodense lesions , were recorded in this study. The change in CT density pattern from hyperdense to hypodense with time is similar to the evolution of extravasated blood anywhere in the body. This follows a general rule which is related to the presence of the protein component of the hemoglobin molecule [8,9]. The radiodensity of the SDH is expected to decline between 7 and 28 days, thus converting an initially hyperdense lesion on CT to an isodense and later hypodense collection after one month. Occasionally, discrepancies occur between the clinical and CT classification of SDH.This may be due to difficulty in obtaining precise clinical information on the initial traumatic event, especially where the patient has an altered state of consciousness.

Isodense SDHs with attenuation coefficient similar to that of surrounding brain, may present a diagnostic problem. This may partly explain the low frequency of isodense SDH diagnosed by CT in the study period. Amendola and Ostrum [7] described two radiological signs on the pre-contrast CT scans to alert the radiologist to this problem. These are (i) a mass effect with a shift of midline structures and/or unilateral compression of the ventricular system ,while in bilateral cases, the midline shift was always away from the side with the larger collection. (ii) Unilateral effacement of cortical sulci over the brain convexity more notable in patients over 60years of age. There are conflicting reports on the value of contrast-enhanced CT scans in SDH. Tsai et al 10 using a continuous infusion of contrast medium were able to outline the subdural membrane in all 29 cases of isodense SDH studied while Forbes *et al* 5 recorded no additional valuable information with contrast enhancement in patients with acute head trauma in whom initial pre-contrast CT scans were negative for SDH. However, in the non-trauma patients, contrast medium is helpful in excluding other pathologies. The infusion technique may thus be employed in suspected cases of isodense SDH as it appears to give a higher rate of enhancement when compared to the more conventional method of bolus injection.

All the forms of SDH are associated with alterations in ventricular structure such as ventricular displacement, deformity and compression [5,7,10] but these have often been reported in acute hyperdense SDHs [5]. In this study, these ventricular changes were noted to be absent in minimal SDHs. which forms majority of the cases recorded. Four of the patients in this study had SDHs with mixed densities on CT. The hyperdense portion was always in the more dependent portion with the hypodense area above and a horizontal fluid-fluid level in between (Fig 3). Tsai *et al* [10] recorded similar findings of mixed density SDHs and he proposed two theories for these cases namely (i) fresh bleeding within the subdural membrane or within the sac of an old hematoma and (ii) SDH in different stages of organization.

Most of the SDHs in this study were seen in the frontal and parietal regions, over the convexities. This is in agreement with the sites of SDHs in patients reported by Amendola and Ostrum [7]. Majority of the recorded cases in this study were predominantly right-sided lesions, but no concrete reasons can be adduced for this. A previous study of SDH in Ibadan had recorded more left-sided lesions. The literature reviewed also showed no consistent predilection for a particular side. All the SDHs showed concave margins adjacent to the brain parenchyma. In those with post-contrast CT scans, a characteristic linear area of enhancement along the medial boundary of the collection was demonstrated. This finding has also been documented by many authors [7,10,11]. Calcification of the SDH margin or of the hematoma is known to occur [12] but only after a long period. Majority (78%) of the patients studied had post-traumatic and post-surgical SDHs and the CT scans were requested early, within a mean of weeks and a median of 2 weeks after onset of symptoms. Calcification is unlikely to have occurred at this time and was absent in all our patients. In favor of CT scan as an investigative modality was the fact that other positive findings were noted in addition to the SDH in 32 of our cases. These included vault fractures, hydrocephalus, intra-cerebral, epidural and intra-ventricular hemorrhages

CT is invaluable in making the decision between surgical evacuation and conservative management of SDH. Significant SDH to warrant surgery must be seen on two or more tomographic slices. However, if massive ventricular displacement is demonstrated, the number of slices is irrelevant as surgery is always indicated in such cases [5]. In long-standing SDH there is the possibility that no clinical benefit may be achieved from surgical evacuation as the chronic pressure may have caused irreparable damage beyond mere removal of the fluid mass or restricting membrane [6].

Conclusion

The advent of CT scan has remarkably improved the diagnostic accuracy of SDHs in our environment. More invasive investigative modalities are totally avoidable. CT Scan findings confirm the age, location and extent of the SDH as well as its effect on the brain parenchyma and ventricles. Other complications precipitating the SDH are also easily demonstrated at the same CT examination. Chronic, right-sided unilateral SDHs were mostly seen , while head injury was the commonest primary incident. Males were more affected than females.

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