Computed Tomography (CT) in civilian gunshot head injuries in Ibadan

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Summary

Background: **There is data on civilian gunshot injuries in Nigerians. The purpose of the study is to describe the Computed Tomography findings of civilian gunshot injuries (GSI) to the head in Ibadan, Nigeria.**

Method: **This is a retrospective study of Computed Tomography (CT) films and clinical records of 28 consecutive civilian gunshot injuries to the head from 1996 to 1999.**

Results: **The gunshot injuries to the head were mostly armed robbery related. Though there was a steady annual increase of civilian gunshot injuries during the study period, a low CT Scan frequency (0.61%) was recorded. The following CT findings were present in all the patients; bullet fragments, intraparenchymal haemorrhage, vault fractures and soft tissue swelling. The resting position of the bullets showed a predilection for the parietal lobe (32.1%) and the most common fracture site was also the parietal bone (42.8%).**

Conclusion: **CT findings simplified the management of civilian gunshot injuries to the head in the patients studied by demonstrating the exact pathology sequel to the injury. Despite important constraints, CT remains a cost effective means of managing GSI to the head.**

Keywords: ***Gunshot, Head injury, Computed Tomography***

Résumé

II s'agit des donnees sur des civils atteints des blessures par balle au Nigéria. L'objet de cet étude est de décrire les résultats de la tomographie Calculée des civils atteints de blessures par balle dans la tête à Ibadan. Nigeria.

Méthodes: C'est une étude rétrospective de la Tomographie Claculée (CT) cinema et dossiers cliniques de 28 civils consécutifs atteints des blessures par balle dans la tête de 1996 a 1999.

Resultats: Les blessures par belle dans la tête étaient principalement liées au vol à main armée. Quoiqu'il ait une augumentation continue annuelle des cas des blessures par balle chez dez civils pendant la periode de cet étude, on a noté une frequence de 0, 61% de CT Scan tres bas. Les résultats de CT suivants ont été remarqués chez tous les *patients:*- morceau de balle, hémorragie intraparenchymal, fractures de saut et tuméfaction de tissu mou, lieu d'abri des balles a indiqué une prédilection pour le lobe pariétal (32, 1%) et le siege le plus concerné de la fracture également l'os pariétal (42, 8%).

Conclusion: Les résultats à travers le CT ont simplifie la prise en charge des blessures par balle dans les têtes des civils chez des patients étudiés tout en donnant une demonstration pratique du fonctionnement de la pathologie exacte suite à la blessure. En dépit des restriction/constraints considerables, CT demeure un moyen rentable de la prise en charge de GSI dans la tête.

Introduction

There is substantial evidence of a steady increase of gunshot injuries (GSI) among the civilian population in Nigeria.[1,2,3] This is sequel to the incessant armed robbery attacks, ethnic conflicts as well as campus cult activities.[1,2,3]

Previous studies of gunshot injuries from U. C. H. were among the military population during the hostilities of the Nigerian Civil War and preceded the advent of CT.[4,5,6] A recent study on civilian gunshot injuries to the head in Nigeria dealt with ocular complications.[7] This retrospective study will review literature, present the demographic data and describe the CT findings in the 28 cases of civilian GSI to the head over a four-year period.

Materials and method

All the consecutive patients who had cranial CT scans done consequent to gunshot injuries to the head during a four-year period 1996 - 1999 were included in the study. The CT scans were done in the CT suite of the Department of Radiology, University College Hospital, Ibadan using a General Electric CT 9000 scanner.

The CT examination provided serial axial images from the base of the skull to the vertex at 10mm interval. Coronal images were done in ten patients who appeared to have orbital involvement. Intravenous contrast medium was not given in order to avoid misinterpretation and reduce further complications from its administration. Three patients with multiple injuries had additional CT scans of the chest and abdomen to evaluate suspected injuries in these other areas.

Demographic and clinical data were extracted from the patient's case notes.

Results

From a total of about 4,608 cranial CT scans done in the CT suite during the stipulated 4-year period, only 28 (0.61%) were done for gunshot injuries to the head. Figure 1 shows an annual steady increase of GSI to the head over the same time frame. All the patients except one were males. The only non Nigerian in the study was a Lebanese. Their ages ranged from 17 to 68 years (mean = 36.6years). All the 28 GSI were inflicted by others and they were brought in unconscious. Glasgow coma scale ranged from 3 to 7 with a mean of 5. The time interval from gunshot injury to the CT scan examination was variable. None of the patients had a scan within 24 hours of injury. Fifty percent of cases had CT scan done within the first week of injury, 6 (21.4%) were done two weeks after injuries. In 8 (28.6%) this information was not provided.

Metallic fragments were visualized as areas of hyperdensities, lodged either intraosseously (fig. 2), or within the brain parenchyma (fig 3). In 14.4%, the bullet fragments were found in both intraosseus and brain parenchyma. Computed Tomographic images demonstrated these metallic bullets in varying sizes and shapes. More than two intraparenchymal bullet fragments were noted in 10 (35.7%).

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Table 1 Age and sex distribution of gunshot injuries to the head

Age groups (Yrs)	Sex Male	Female	Total No (%)
0 -9	-	-	-
10 - 19	1	-	1 (3.6)
20 - 29	6	-	6 (21.4)
30 - 39	11	-	11 (39.3)
40 - 49	5	1	6 (21.4)
50 - 59	3	-	3 (10.7)
60 - 69	1	-	1 (3.6)
Total	27	1	28(100)

Table 2 Circumstances and incidence of gunshots

Circumstances of gunshot	Number	%
Armed robbery victims	14	50
Stray bullets from conflicts	9	32.1
Accidental gunshots (Armed robbery related)	5	17.9
Total	28	100.00

Table 3 Spectrum of CT findings and incidence in the 28 gunshot head injuries

CT findings	Number	%
Location of Bullet fragments		
Intra parenchymal	20	66.6
Parietal lobe	9	32.1
Frontal lobe	6	21.4
Temporal lobe	3	10.7
Occipital lobe	2	7.1
Intraosseus	6	21.4
Both intraparenchymal and intraosseous	4	14.4
Vault fracture	40	64.3
Parietal bone	12	42.8
Frontal bone	9	32.1
Occipital bone	5	17.9
Temporal bone	6	21.4
Parasinus bone	5	17.9
Orbital bone	3	10.7
Cerebral/Parenchymal haemorrhage	28	100
Soft tissue swelling	28	100
Cerebral oedema	10	35.7
Intrasinus haemorrhage	5	17.9
Intraventricular haemorrhage	4	14.3

N.B Bullet fragments were noted in multiple sites in 19 (67.9%) cases while fractures were seen in multiple sites in 15(53.6%)

Figure 3. The resting positions of these bullets as demonstrated by the CT images are shown in Table 3. The highest incidence (32.1%), was noted in the parietal lobe.

Skull fractures were common in all cases and were also comminuted. The parietal bone recorded the highest of 42.8%. The fractures were demonstrated in multiple sites in 53.6%. Intracranial bony fragments were found in 6 (21.4%).

Parenchymal haemorrhage like metallic bullets and fractures were seeen in all the cases. In 18 (64.3%), parenchymal haemorrhage was demonstrated in the acute phase as an area of hyperdensity within the brain substance and outlined in the vicinity of the bullets. In these 64.3% though haemorrhages appeared hyperdense like bullets, they were characterized by much lower densities, corresponding to that of fresh blood. Hypodense (chronic) parenchymal haemorrhages were found in 10 (35.7%). Additional intra-

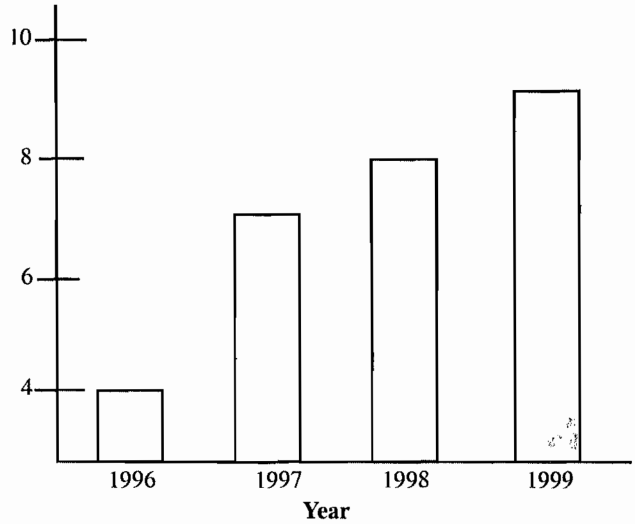

Fig. 1 *Bar chart showing the annual incidence of gunshot injuries over a four year period.*

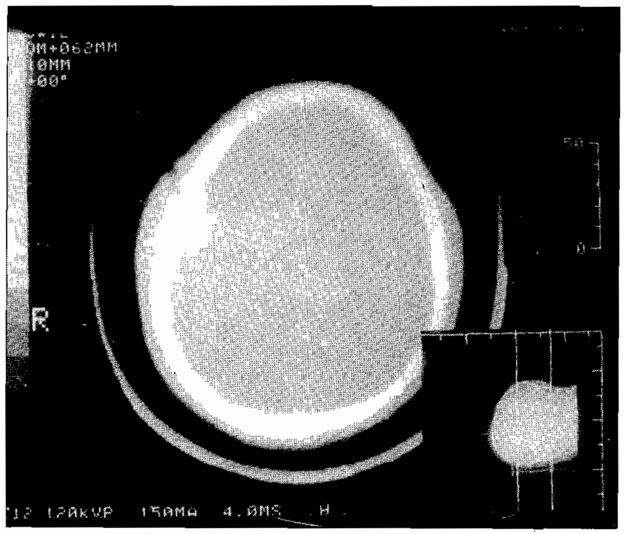

Fig. 2 *Non contrast enhanced axial Brain CT scan (Bony window) showing lodgement of bullet in the right fronto - parietal bone. Note the associated comminuted vault fracture.*

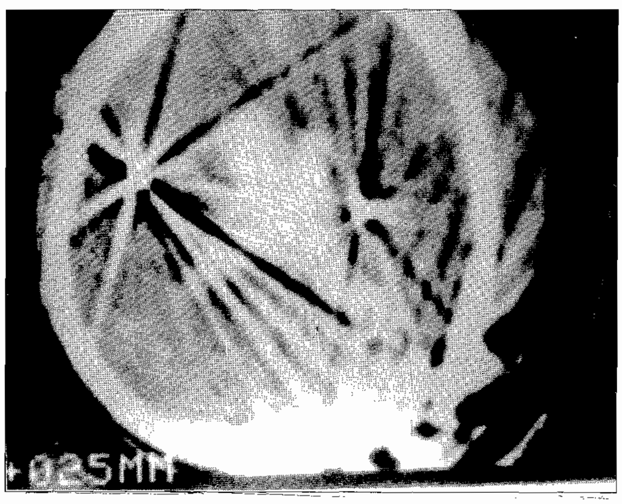

Fig. 3 *Non contrast enhanced axial Brain CT showing soft tissue swelling on the left multiple metallic shrapnels (bullets) are present within the brain parenchyma. They are seen casting streaky artefacts over the brain thereby degrading the quality of the image and making detailed intracranial evaluation difficult. Associated intraventricular haemorrhage is demonstrated centrally in the background.*

ventricular haemorrhage was reported in 14.3% (Table 3) and were reported in the cases with multiple intracranial bullets (fig. 3). This type of haemorrhage was diagnosed by the replacement of the usual hypodense cerebrospinal fluid with hyperdense fresh blood.

Cerebral Oedema was observed in 10 (35.7%) it was found peripheral to the brain insult i.e. the bullet and the intraparenchymal haemorrhage especially in the acute phase. Radiological diagnosis was made easy by their characteristic hypodense appearance and associated local mass effect.

Soft tissue swelling was common to all. In 18 (64.3%) with entry and exist wounds, soft tissue swelling was bilateral. Associated subcutaneous emphysema was present in the outline soft tissue swelling 28.6%. They were demonstrated as linear and/or circular hypodensities within the soft tissue.

Discussion

Though the study shows a low scan frequency (0.61%) in the four-year period under study, fig.1 shows a steady annual increase of GS. This apparent low frequency can be attributed to the dearth of facilities and poor reporting when compared with more advanced countries where available facilities ensure prompt transfer, admission and patient management.[8] In countries like America, firearms injuries are usually due to homicides, suicides and assault,[8] but here in Nigeria, these gunshot injuries were mostly armed robbery related (Table 2) a recent trend, aggravated by the plaguing, poor socio economic factors.[10,11] Our male: female ratio is in agreement with other reports locally and internationally where the ratio ranges between 5:1 and 9:1.[3,9,10]

The average duration before CT scan examination was 15.8 days. This is a rather long post injury scan time and maybe due to the following; the restricted availability of CT Scan facility during the study period which necessitated long distance travels to get a CT scan done and timely requests which were delayed because of the prohibitive cost of the procedure. A single scan costs about N25,000. which at the time of the study was three times the monthly minimum wage in the public service.

In this study, metallic bullet fragmens were the most common CT findings and they were housed mostly by the brain parenchyma. (Table 3). We observed one or two bullet fragments in the 18(64.3%) cases who had entry and exist wounds which is in agreement with the ballistic dynamics of gunshot injuries described by previous authors.[12,13] The bullets characterised by high metallic density (1000HU) and above, resulted in streaky artefacts that were projected over the brain, a known pitfall of CT.[14] In 19(67.9%) these multiple bullet fragments in the brain substance produced artefacts which practically degraded the quality of the image (fig. 3) From our study no part of the head was immuned to the bullets (Table 3.)

The gunshots injuries were always associated with fractures that were found to be communited. They were better outlined using the bony window, which is able to detect depressed fractures and also distinguished between intracranial bone and bullet fragment, a diagnosis made without an invasive surgery, acceptably, an added asset of CT imaging.

The density of the intraparenchymal haemorrhage as described by the same author,[15] is a useful parameter in estimating the age of the haemorrhage. It therefore gave a rough estimation of prescan injury time in our patients who could not provide this information.

Conclusion

Although our study reiterates the increasing incidence of civilian gunshot injuries especially to the head. It points to a low scan frequency in the patients.

It has emphasized the value of CT in demonstrating the precise pathology sequel to the injury. The advantage of the bony window in the evaluation of these CT images is also notable. The authors recommend CT scans in the management of gunshot injuries to the head despite important constraint to its ready and uniform access.

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