Cranial Computed Tomographic Findings in Head-Injured Patients during Communal/ Ethno-Religious Crises: Jos Experience

Charles Chibunna Ani, Stephen Daniel Pam, John Ekedigwe, Samson Omini Paulinus
Department of Radiology, Jos University Teaching Hospital, Jos, Nigeria

Correspondence: Dr. Charles Chibunna Ani, Department of Radiology, Jos University Teaching Hospital, Jos, Nigeria.
E-mail: dranicharles@yahoo.com

ABSTRACT

Background: Communal/ethno-religious crises have been on the increase in many parts of the world with attendant morbidity and mortality. Assailants often target the head of their victim, intent on causing mortal harm. Computed Tomography is effective in demonstrating soft tissue and bony injuries. Our experience in North Central Nigeria underscores the relevance of documentation of imaging findings on patients who presented following such crises. **Objective:** To profile the findings on cranial Computed Tomography scan of patients with head injury during communal/ethno-religious crisis in North Central Nigeria. **Materials and Methods:** Retrospective and prospective evaluation of cranial Computed Tomography scans conducted on 43 victims of communal/ethno-religious crisis between January 2010 and March 2012 was carried out in the Computed Tomography suite of the Radiology Department in a tertiary hospital in North Central Nigeria. **Results:** Of the 43 patients, 37 were male and 6 were female (male: female ratio of 6:1). The ages of the patients ranged from <1 year to 80 years. The mean age of the patients was 36.7 years (±14.7). Abnormal findings were seen in 37 patients (86.1%) while 6 patients (13.9%) had normal scans. The most common Computed Tomography scan findings were intra-cerebral contusion (51.1%), skull fracture (48.8%), and subdural hematoma (23.2%). Head injury was inflicted mostly with machete cut. **Conclusion:** Inevitable head trauma during communal/ethno-religious crisis justifies the use of Computed Tomography scan in investigating the nature of head injury in affected victims as well as provides an invaluable guide for their prompt management.

Key words: Communal/Ethno-religious crisis; computed tomography; head injury

Introduction

The past decade has witnessed a recurrence of communal/ethno-religious crises in north-central Nigeria. Attendant to this are morbidity, mortality, and loss of property; with a wide range of negative implications to the economy. Assailants often target the head of their victim intent on inflicting mortal harm. Various weapons have been used in the assault and include knives, clubs, machetes, guns—local or Dane guns and sub-machine guns, and more recently, improvised explosive devices (IEDs). Those with head injury are brought to the radiology suite for a valuable Computed Tomography (CT) scan of the head.

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CT scan is the radiological investigation of choice for diagnosing the presence and extent of brain parenchymal injuries and cranial vault fractures in the setting of an assault, comparative to plain radiography and Magnetic Resonance Imaging.[1-3] The CT scanogram is a good compliment in assessing fractures and metallic foreign bodies following assault.

The recurrence of sectarian crisis in our environment and the availability of a CT scan for investigating the head-injured prompted the interest in the study. This paper reports on the imaging findings on 43 of such victims who had cranial CT scan done during the period under review.

Materials and Methods

The list of all the victims of communal crises between January 2010 and January 2012 who required a CT scan was obtained from the records in our department. The CT imaging records of those that had cranial CT scan were retrieved and retrospectively evaluated. Cranial CT scan of victims of subsequent crises were evaluated in a prospective study and added to the data. Images evaluated were the native non-contrast axial slices and complimenting scanograms. All images were evaluated by Consultant Radiologists (of at least 6 years' experience). GE Bright Speed 4 Slice CT scanner was used for the study. The protocol used contiguous axial 2.5 mm sections for the skull base including the petrous temporal bones and 5 mm sections for the rest of the cranium up to the vertex. The images were then viewed in brain and bone windows with multi-planar reconstructions in coronal and sagittal planes. The findings were carefully recorded. Additional information documented included age, gender, and assault object which were obtained from retrieved clinical notes in the cases for retrospective study and from the patients themselves or their relatives prospectively.

The results were presented numerically and in tabular forms.

Results

Cranial CT scans of 43 victims were reviewed. Thirty-seven of these were male and 6 were female (male: female ratio of 6:1). The ages of the patients ranged from < 1 year to 80 years. The mean age of the patients was 36.7 years (±14.7). Abnormal CT finding were seen in 37 patients (86.1%) while a normal scan was seen in 6 patients (13.9%). The most common CT scan findings were soft tissue swelling, skull fracture, intra-cerebral contusion, and subdural hematoma.

These were seen often in combination depending on the assault weapon. Machete attacks had skull fractures with accompanying cerebral contusion. The contusions (22; 51.1%) were demonstrated as areas of mixed hyper and hypo densities within brain parenchyma. The skull fractures (21; 48%), assessed using bone window, involved the posterior parietal and vertical aspects of the cranium in 16 (76%) of the victims. In 2 (12.5%) of these patients with machete attack, intra-cranial bony fragments were observed. Soft tissue swelling (28; 65.1%) and emphysema (12; 27.9%) were seen in assaults with machetes, club as well as with gunshot injuries of the local or dane gun and IEDs where the pellets or shrapnels were lodged extra-cranially within the scalp.

Sub-machine gun injuries defined by the shape of the densities of their pellets caused more extensive intra-cranial damage in the form of cerebral laceration, contusion, hematoma, intra-ventricular hemorrhage and aeroceles with traceable trajectory in the brain substance leading from their entry points. The entry points of the pellets were mostly facial (5/8; 62.5%). However, no cranial exit points were observed and the pellets were found lodged in the brain parenchyma of these patients, some exhibiting streak artifacts. Subdural hematomas (10;23.2%) were found in the victims of IEDs, machete, and club attacks while subarachnoid hemorrhage (5;11.6%) were associated with the more penetrating gunshot injuries. No epidural hematomas were observed in the 43 patients studied. CT findings were not remarkable in six of the patients (13.9%).

Discussion

Communal clashes with ethnic and religious coloration have inundated our region of the country in recent years gradually escalating since 2001. Morbidity and mortality attendant to such crises have often been as a result of head injuries sustained by individuals and these head injured cut across the age-groups including the extremes of life.

Prior to the availability of the CT scanner in our center, the head injured victims of these crises have been evaluated essentially by clinical methods with plain skull radiography being the only available radiologic investigation. Objective demonstration of site and size of immediate or evolving intra-cranial events was not possible. Surgically removable foreign bodies could not be traced if they were not radio-opaque. Many lives that could have been saved were lost. With the availability of CT, however, decisions on surgery or conservative management are a lot quicker. Sagittal, coronal, and 3D reconstruction with volume rendering component of acquired CT images can now be done and have added to make assessment and surgical intervention easier. Prognosticative index has also increased.

Many studies were done on CT findings in head trauma from other causes, especially following road traffic accidents (RTA).[4-6] But there is paucity of data on CT findings in head trauma from assault and of such during communal or sectarian conflicts. This may not be unconnected to the global peace initiatives being more vigorously pursued by the United Nation and its agencies with resultant reduction in such conflicts around the world.

In our institution, CT scan is a relatively costly investigation. A cranial CT scan cost about N35,000 (215 USD). Thus, making it unaffordable to most of the victims; who fall within the brackets of low income earners. Nevertheless in such crises situations, the cost of acquiring a CT scan and indeed other investigations and treatment is often borne by the government or charitable organizations as has been our experience.

Significantly, more males in their youth (peak age-group: 31–40 years) fall victims of such communal crises resulting in head injury [Table 1]. Our results are consistent with various studies that show that the peak incidence of head trauma was seen in the most productive years of life. Bharti *et al.*[7] reported that males were predominantly involved with head injuries and this was more with the younger age group. The male-to-female ratio of 6:1 in this study compares well with that observed in other studies with CT on head trauma.[8,9] In our African set-up, the males are indeed naturally expected to perform protective and defensive roles in the community with the youthful ones being in the front lines in the situation of communal conflict. The youngest victim observed in this study was 9 months old while the oldest was 80 years. These vulnerable groups are often left at the mercy of rampaging assailants, being unable to escape or defend themselves.

Skull fractures were found in 21 of the 43 study subjects [Table 2]. They were multiple and involved more of the posterior parietal and vertical aspects of the cranium: 16/21 (76%). This perhaps suggests that these victims may have been "fleeing" while they were attacked. In a prospective study of 91 assault victims with head injury, Chattopadhyay and Tripathi[10] found multiple fractures in 69.3% of the victims involving the frontal, parietal, and temporal bones of the skull and inferred that multiple fractures arising from assault with a blunt weapon indicated the degree of force applied to the head. They also postulated that fracture of the occipital bone being the thickest cranial bone would require a considerably great amount of force, hence its least involvement. Adeyinka *et al.*[5] found the temporal bone to be the most commonly fractured bone while Obajimi *et al.*[6] observed more fractures of the parieto-facial areas in their studies.However, these studies were specific for findings on CT following RTA and civilian gunshot head injuries, respectively.

Table 1: Age distribution of patients

Age range (years)	No. of patients	Percentage %
1-10	2	4.7
11-20	1	2.3
21-30	12	27.9
31-40	15	34.9
41-50	10	23
51-60	0	0
>6o	3	6.9

Table 2 : Cranial computed tomography (CT) findings

CT Finding	No. of cases	Percentage (%)
Soft tissue swelling	28	65.1
Skull fracture	21	48.0
Epidural Hematoma	0	0.0
Subdural Hematoma	10	23.2
Subarachnoid Hemorrhage	5	11.6
Intracerebral Contusion	22	51.1
Intracerebral Hematoma	4	9.3
Intraventricular Hemorrhage	4	9.3
Cerebellar Contusion	0	0.0
Intracranial Foreign body	7	16.3
Aerocele	7	16.3
Midline Shift	4	9.3
Scalp Emphysema	12	27.9
Normal	6	14.0

Eight victims had gunshot head injuries. In this study, while the entry points of the pellets were mostly facial, we did not encounter any cranial exit points, the dense foreign bodies coming to rest in the brain parenchyma of these patients, some exhibiting streak artifacts. This is consistent with majority of the gunshot victims (6/8; 75%) being attacked with local guns with low ballistic velocities. It also suggests that the few victims of higher velocity submachine gun attacks may have been shot from a distance with considerable attenuation of their velocities before impacting the cranium.[11] On the other hand, victims with more devastating cranial injuries from submachine gunshots may have expired before reaching our facility and could not be part of the study. Machetes and clubs were the most common assault weapons (16; 37.2% and 11; 25.6%, respectively) among the victims, corroborating the apparent low level of sophistication and the civilian nature of these communal/ethno-religious conflicts [Table 3].

Cerebral contusions seen in 22 (51.1%) of the patients accompanied skull fractures and were observed ipsilateral to these fractures. They were associated with machete and club attacks as well as with the gunshot injuries of the local gun and IED attacks. Heterogenous areas of hyperdensities mixed with normal or hypodense areas were often surrounded by low density areas depicting cerebral edema. Brain parenchymal contusions are often associated with head injury.

According to Macpherson and Jennet[12], the occurrence of cerebral contusion in head trauma varied from 30% to 40%. In a study by Ohaegbulam *et al.*[9], cerebral contusion and brain edema were the most common CT findings in head injured patients (30.7%). In four (9.3%) individuals from our findings, the edema was enough to cause mass effect and shift of the midline to the contralateral side. The cerebellum was spared of any axial lesions in all the images assessed.

While we observed subdural hematoma in 10 of the victims (23.2%), there was no finding of epidural collection in any of the 43 patients. Our inability to find any epidurals may be in conformity with the finding that the skull fractures on the victims were on the postero-parietal and vertical parts of the cranium. It is known that small vertex epidural hematomas pose a diagnostic dilemma even on coronal reconstructed views.[13] Small epidural collections may also have been possibly missed on axial sections due to volume averaging with adjacent cranium.[14]

Table 3: Computed tomography findings against assaulting agents

	Soft tissue swelling	Skull fracture	Subdural hematoma	Subarachnoid hemorrhage	Intracerebral contusion	Intracerebral hematoma	Intraventricular hemorrhage	Cerebellar contusion	Intracranial foreign body	Extracranial foreign body	Aerocele	Midline shift	Scalp emphyssema
Machine gunshot	+	+		+	+	+	+		+		+	+	
Dane/local gunshot	+	+		+	+				+	+	+	+	+
Matchet	+	+	+	+	+	+	+	+	+			+	+
Club	+	+	+		+								+
IED	+	+	+		+				+	+	+		+
Knife	+												

IED=Improvised explosive device

Figure 1: Scanograms of a patient assaulted with Jackknife

Subarachnoid and intra-ventricular hemorrhage were seen in 5 (11.6%) and 4 (9.3%) of the victims, respectively. They were associated with firearm injuries and are perhaps also an indicator of the severity of the force of impact on the cranium and its content.[10] Also associated with firearms are metallic artefacts, constituting intra-cranial foreign bodies and aeroceles following on the trajectory of the penetrating gun pellets or scattered within an area of brain contusion. These have been previously reported as frequent findings on CT following gunshot head injury.[6]

CT was not remarkable in six of the patients (13.9%). This finding was not unexpected in crises situation where there would be patients in whom it was pertinent to do a CT scan to exclude head injury especially in the event of the cost of acquiring one being already taken care of. These included victims with facial blood stains and/or lacerations or who were brought alongside other head injured patients. One victim had a jack knife impaled through the right temporal area with the cranial CT scan revealing a normal cranium and its content. [Figure 1]

Blunt attack of mild to moderate force to the head and face as with a club may also lead to diffuse axonal injury with the finding of an apparently normal CT scan. Repeat CT scan of the victims which may have revealed earlier missed diagnosis or later events and progression was not routinely done or followed up in this study. The outcome of events was however not within the objectives of this study.

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