

Evaluation of CT scanned Multiple Injured in peacetime and Ile Ife-Modakeke Communal War

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Abstract

Background: Computed Tomography Scan (CT scan) is effective in delineating soft tissue and bony injuries. The multiply injured in peacetime and communal war who had CT scan in the sub-Saharan Africa has not been evaluated.

Objective: To evaluate the comparative study of CT scanned patients with multiple injuries in peacetime and during Ile-Ife/Modakeke communal war (IMCW).

Patients and Methods: A prospective study of the IMCW multiply injured that required CT Scan between 14th August, 1997 and June 2000 was embarked upon at a University Teaching Hospital setting. A 3 years consecutive peacetime multiply injured patients who needed CT scan were compared with the IMCW patients. The Injury Severity Score was used to assess the severity of injuries in both groups. Descriptive data analyzed with SPSS version 11.0.

Results: A total of forty three peacetime multiple injured (PMI) patients and thirty IMCW patients required CT scan. The main cause of multiple injuries in peacetime was road traffic injury 83.3% as compared to the gunshot 90% and explosive blast (10%) injuries during the communal war. A total of 77.2% and 89.2% of limb fractures were of Gustillo Anderson type III in the IMCW and PMI groups respectively. The distribution of CT scan findings and surgical treatment differs in the two groups of patients. There were 16.3% mortality and mean duration of hospital stay of 35 days \pm 17.2 in the PMI group. 71.4% of PMI group's mortality died of pulmonary embolism and 28.6% from sepsis. However, the mean duration of IMCW patient's hospital stay was 21 days \pm 7.6 and 3.3% mortality from multiple organ failure

Conclusion: We have applied the Injury Severity Score to communal war multiple injuries. A striking difference existed among the CT scanned PMI and IMCW patients. This could be used to prognosticate outcome of the multiply traumatized treatment awaiting CT scanning.

INTRODUCTION

Information acquired by Computerized tomography scan (CT Scan) concerning bony fragments and destruction, dural tear, spinal cord and nerve root compression, ocular and neural damage often directly influenced the surgical management ¹. Advantages of CT scan include accurate delineation of in-driven bony and metallic fragments, the relation of hematomas to the missile tract and detection of brain abscesses ².

To imagine that the first decade of the 21st century will be free of armed conflict is unfortunately an unrealistic dream ³

. In addition, road traffic injuries are a major cause for concern and are believed to be reaching pandemic proportions. Thousands of those wounded would have to be treated often in countries with limited resources available for providing adequate surgical care and rehabilitation ⁴. Gunshot trauma remains a significant cause of morbidity, mortality and socioeconomic burden with 115,000 missile injuries and as many as 40,000 deaths recorded annually ⁵. The cultural landscape of society cannot be assessed completely without the acknowledgment of gunshot injuries ⁶ and particularly relevant to traumatologist is the knowledge that the extremities are the most commonly struck areas of

the body ⁷.

Ile-Ife and Modakeke are two neighboring Nigerian communities that have coexisted together in the last 300 years with intermittent low level crisis ⁸. During the latest Ile-Ife/ Modakeke Communal War (IMCW) low and high velocity weapons were used among the two communities as seen at the Obafemi Awolowo University Teaching Hospital Complex (OAUTHC) Ile Ife, Nigeria. We are not aware of any report on the comparison of CT scanned multiply injured in communal war and peacetime in the sub-Saharan Africa. The present comparative study of CT scanned multiple injured war victims and the peacetime multiple injured patients is essential in trauma care. The research question was that there is a difference between the two groups of patients.

PATIENTS AND METHODS

All patients were triaged at the emergency and accident unit to sort out who will require further specialized investigation after clinical examination and plain radiographs assessment. Any patient with multiple injuries whose diagnosis and surgical management decision will depend on precise localization and delineation of the extent of traumas had CT scan. It was deemed appropriate if it led to an immediate change in a patient's management. A repeat CT scan was done within 24 hours and 7days. We conducted a prospective study on all multiply injured patients from the IMCW between 14th August 1997 and 10th June 2000 that required CT scan at OAUTHC, Ile-Ife, Nigeria. All the injured warriors and civilians from farm settlements, villages, and towns who presented at OAUTHC were included.

A 3years consecutive Peacetime Multiply Injured (PMI) patient who had CT scan were compared with the IMCW patients. Patient's informed consent and the institution's ethical research committee approval for the study were obtained.

In this study multiple injuries are defined using the Abbreviated Injury Scale Revision of 1985 ⁹, as simultaneous injuries of at least two out of four organ systems (the head and the neck, the thorax, the abdomen, and the limbs); at least one of the injuries directly threatens the patient's life (primary injury), while the others (secondary injuries) make the functioning of the afflicted system more difficult. The term penetrating injury as used here refers to injuries that resulted into skin integrity disruption which may not get to open body cavities. The Injury Severity Score ¹⁰ was used to

assess the severity of injuries in both groups of patient's. Patients with limb injuries were classified using mangled extremity severity scoring (MESS) while those with ocular injuries were classified using the Ocular Trauma Classification Group. ^{11,12}

The clinical information documented on each patients include patients' age, sex, occupation, mode of transportation to hospital, the interval between injury and hospital presentation/dead, hours of the day, causes of injury that require CT scan, treatment provided (fluid infusion, blood transfusion and antibiotics), number of specialists who participated in each patient's care and pattern of CT Scan findings. The clinical photographs of some of the intra operative retrieved missiles were documented. All mortality cases had post mortem analysis. The patients were followed up for 48 months.

Data Analysis: The data obtained was analyzed using descriptive method on SPSS version 11.0 computer software for windows. The p value was derived from the Chi square test or Fisher's exact test for the categorical variables. The Wilcoxon rank-sum test was used for the continuous variables. The alpha error level was taken as p value < 0.05.

RESULTS

A total of forty three peacetime multiple injured (PMI) patients (males=31, females=12, m: f=2.6:1) and thirty IMCW patients required CT scan. The thirty multiple injured patients (4.5%) of the IMCW victims were made up of 28 males, 2 females with male to female ratio 14:1. The removal of IMCW victims for treatment was promptly done by relatives and friends using taxi cab, buses and Lorries. At the peacetime, the multiple injured were mainly transferred to the hospital by the Nigerian Police Force (NPF) and Federal Road Safety Corps (FRSC) while the neighbors' of armed robbery attack and assaulted victims brought them for treatment. The age distribution and causes of injuries that necessitated CT scan in IMCW and PMI patients are shown in table 1 and figure 1 respectively.

Figure 1

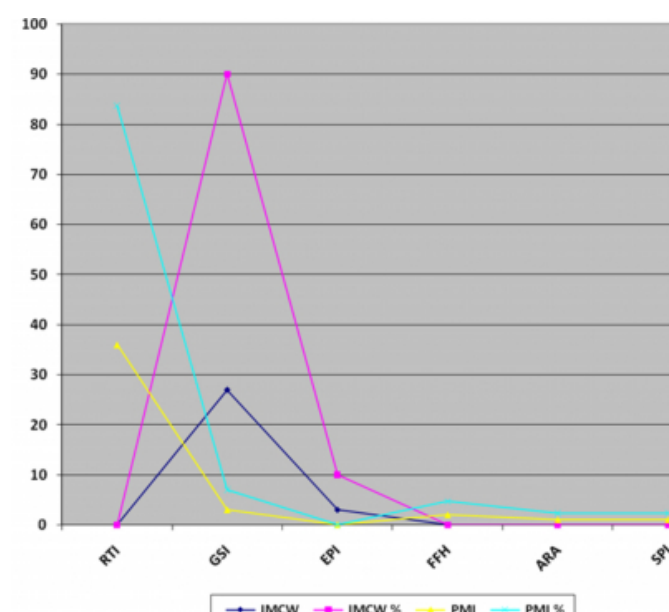
Table 1: The age distribution of IMCW and PMI patients who had CT scan.

AGE(Years)	IMCW Patients	%	PMI Patients	%
11-20	5	16.8	6	13.9
21-30	13	43.3	20	46.6
31-40	7	23.3	11	25.6
41-50	4	13.3	3	7.0
51-60	1	3.3	2	4.6
61-70	0	0.0	1	2.3
TOTAL	30	100.0	43	100.0

IMCW= Ile Ife Modakeke Communal War; PMI = Peacetime Multiply Injured

Figure 2

Figure 1: The causes of Injuries that necessitated CT scan in IMCW and PMI patients.



N.B.
RTI=Road Traffic Injury, GSI=Gunshot Injury, EPI=Explosive Blast Injury, FFH=Fall From Height
ARA=Armed Robbery Attack, SPI=Sport Injury

he road traffic injury 36(83.7%) was the main cause of multiple injuries in peacetime as compared to the gunshot (90%) and explosive blast (10%) injuries in the communal war. A patient of the IMCW with gunshot injury also presented with temporal lobe epilepsy. The source of the injuries in the IMCW was penetrating in nature from direct gunshot bullets or pellets, stray bullets, stone missiles, wooden planks, assault and gun burner as the people were fleeing away from the war zones. However, peacetime multiple injuries are generally caused by blunt deforming objects. The comparative clinical features of the PMI and IMCW patient's groups are shown in Table 3.

Figure 3

Table 3: Comparative Clinical features of IMCW and PMI patients that had CT Scan

Features	IMCW (n=30)			PMI (n=43)			Statistical significance P value
	No's of patients	%	Mean \pm SD	No's of patients	%	Mean \pm SD	
Age (years)							p>0.05
Injury Severity Score(ISS)							
All patients			26.2 \pm 9.1			25.4 \pm 9.9	p>0.05
Mortality			38.1 \pm 5.8			36.3 \pm 7.2	p>0.05
Survivors			23.4 \pm 6.7			18.5 \pm 6.1	P<0.002
T ¹ /24hrs fluid infusion			5.6 \pm 1.4			3.3 \pm 1.0	P<0.001
T ¹ /24hrs blood transfusion			4.8 \pm 2.2			4.4 \pm 1.9	P>0.05
Number of participating specialists in treatment			3.3 \pm 1.1			2.9 \pm 1.3	P>0.05
Sex							
Male	28	93.3		31	72.1		P<0.001
Female	2	6.7		12	27.9		
Timing of surgical operation							
Emergency(<6hrs)	25	83.3		16	37.2		P<0.001
Non emergency(>6hrs)	5	16.7		27	62.8		
Intravenous fluid required	30	100.0		43	100.0		P=0.05
Antibiotics required	30	100.0		29	67.4		P<0.001
Blood transfusion required	26	86.7		17	39.5		P<0.000
Duration from injury to death							
<24hrs	0	0.0		0.0	0.0		P<0.05
24hr-7days	1	100.0		0.0	0.0		
>1 week	0	0.0		7.0	100.0		

The patterns of the main findings on the CT scan differ in the two groups of the patients. Cerebral edema 18 (60.0%), intraocular gun pellets/ ruptured globe 7 (23.3%) mandible fracture 6 (20%) and cerebral hemisphere pellets 5 (16.7%) predominate brain, head and neck report of IMCW patients. Subdural hematoma 29 (67.4%), haemoperitoneum 19(44.2%) and depressed skull fracture 7 (16.3%) were seen in the PMI patients. The head and neck was reported normal in 10% and 4.7% of the IMCW and PMI respectively. The combinations of affected organ systems are shown in Table 2.

Figure 4

Table 2: Pattern of organ systems involvement that required CT scan.

Organ system	IMCW Patients	%	PMI Patients	%
Head + limbs	0.0	0.0	31	72.1
Head + chest	1.0	3.3	2	4.7
Head +Chest+ limbs	16.0	53.4	1	2.3
Head + abdomen	0.0	0.0	1	2.3
Head + abdomen + limbs	1.0	3.3	1	2.3
Chest + limbs	1.0	3.3	4	9.3
Chest + abdomen + limbs	9.0	30.0	2	4.7
Chest + abdomen	0.0	0.0	1	2.3
Abdomen + limbs	2	6.7	0	0.0

IMCW= Ile Ife Modakeke Communal War
PMI = Peacetime Multiply Injured

A combined head and limb injuries 31(72.1%) were seen in the PMI group and head, chest and limb injuries 16(53.4%) and chest /abdomen 9(30.0%) among the IMCW patients.

The chest and abdominal CT of PMI patients revealed mainly pneumothorax 24(55.8%), atelectasis 21 (48.8%), haemoperitoneum 17(39.5%) as compared to the IMCW with mediastinal shift 5(16.7%), peri hilar lung contusion 4(13.3%) and three each of Para pulmonary artery pellet and peritoneal hematomas (10%). The CT scan of the musculoskeletal system and the spine of IMCW patients shows Para spinal pellet 4 (13.3%, C7,T1 ,T2, L1 levels), intra articular knee and elbow joint pellet 3 (10%) and femoral neck fracture dislocation 2 (6.7%). Limb fractures was documented in 37(86.0%) and 22 (73.3%) of the PMI and IMCW patients respectively. The open limb fractures in the PMI group were Gustillo Anderson type I=9, type II=7, type IIIA=11, IIIB=,13 IIIC= 9 and in the IMCW patients were Gustillo Anderson type I=11, type II=8, type IIIA=8, IIIB=6, IIIC=3. A total of 77.2% and 89.2% of the fractures were of type III in the IMCW and PMI groups respectively. Figure 2, 3 and 4 illustrated the typical CT scan findings in the multiply injured patients.

Figure 5

Figure 2: CT scans intracranial foreign body in Multiple Injuries.

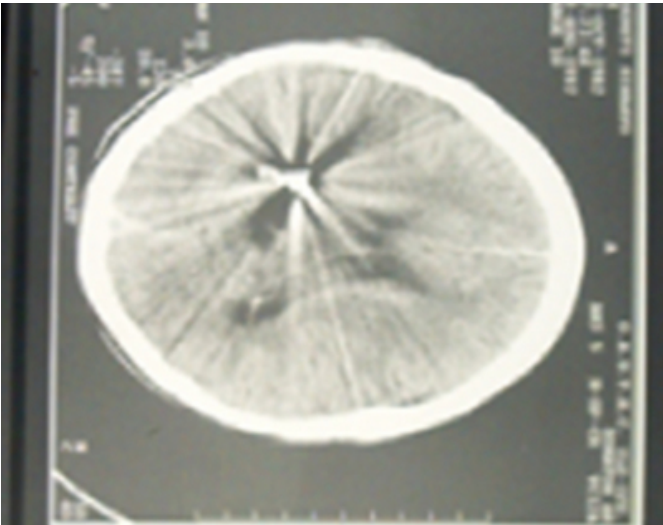


Figure 6

Figure 3: CT scans Para vertebral pellet and fracture in Multiple Injuries



Figure 7

Figure 4: CT scan intraocular gunshot in IMCW



The main surgical treatment pattern among the two groups differs from each other. Exploratory laparotomy15 (34.8%), limb amputation/and disarticulation 9 (20.9%), thoracostomy 8(18.6%) and burr hole/elevation of the skull bone 20 (46.5%) were performed for the PMI patients. In the IMCW group, hip hemiarthroplasty 2(4.7%), open arthrotomy 3(10%), enucleation 7(23.3%), repair of corneal laceration 9 (29.7%), craniotomy 6 (19.8%), limb amputation 3(10%) and each of laminectomy and Caldwell-Luc debridement (3.3%) were documented. Among the twelve IMCW patients

(40%) with penetrating ocular injury three had medical treatment for ocular contusion injuries. Post amputation stump care, prosthesis fittings, psychotherapy, physical therapy and occupational therapy were provided for the patients. All the amputees had a change of their job. The patients that had hemiarthroplasty are walking without aids and satisfactory Harris hip score. All the enucleated eyes had pellets and bullets lodged within them. Those who had corneal repair had low vision i.e. Visual acuity (VA) < 6/18 to C F. Five patients with ocular contusion injury had VA better than 6/18. Two patients received artificial globe implantation after six weeks of surgery.

The PMI patients had mean duration of hospital stay of 35 days +/-17.2 and 7(16.3%) mortality. 71.4% of PMI patient's mortality died of pulmonary embolism and the remaining 28.6% from sepsis. However, the mean duration of IMCW patient's hospital stay was 21 days +/-7.6 and 3.3% mortality from multiple organ failure. The difference in the two group mortality was not statistically significant. The patients follow up in the past years was difficult after one year due to high default rate.

DISCUSSION

The major hazard in the care of any multiple injured patient remains the undiagnosed/ or under diagnosed injury which does not receive any or only inadequate treatment¹³. Most injuries were obscured using plain radiograph only. Computerized tomography is emerging as the most important diagnostic tool in addition to conventional radiological examinations^{12,13} in multiple traumas.

The Injury Severity Score (ISS) has been applied in missile wounds¹⁴, explosive inflicted injuries¹⁵ and penetrating injuries in general¹⁶. We have applied the Injury Severity Score to communal war multiply injured assessment. Baker (1974) and Copes (1988) noted earlier that with an equal injury severity expressed in ISS, the hospital mortality depend also on the patient's age^{10,16}. In table 1, the age difference was not significant among the IMCW and PMI patients. The patients in both groups suffered equally severe injuries as shown in Table 3. The difference in the mortality among our subjects could not be due to the difference in the injury severity and age of the patients thus making it possible to compare the IMCW and PMI group. There was a preponderance of male sex in the IMCW who required CT scan. This finding is similar to earlier reports^{17,18,19}. The IMCW wounded patients are mostly young and middle aged male warriors/ persons injured in the guerrilla warfare where

villages and towns came under attack like those reported by Splavski et al²⁰. All the injured patients were primarily civilians who had no training in the handling of firearms. This accounted for their severe injuries that required CT Scanning. In the PMI group many females were involved due to commercial activities unlike the IMCW group where men were major warriors.

The IMCW patients with multiple war injuries received more intravenous colloid fluid infusion in the 1st 24hours and blood transfusion than those having PMI. This was due to the difference in pattern of injury sustained. The multiply injured Ile Modakeke Communal War patients had penetrating gunshot injuries associated with hemorrhage and rapid onset hypovolaemic shock associated with aggressive approach in volume replacement. The routine administration of antibiotics to war patients has been established²¹. The PMI group of patients had a higher proportion with head injuries and bleeding from limb fracture open to early first aids control by the NPF and FRSC staff.

About 73.3% of IMCW patients were scanned within twenty –four hours post injuries compared with 54% reported by Besenski et al²². The removal of IMCW victims for treatment by relatives and friends was prompt in majority of the cases probably accounting for part of the overall low mortality recorded for those who had CT scan as compared to the PMI group. This is in agreement with reports from a previous study which has shown that traumatized patients who are transported by the emergency medical system do experience a higher mortality than their counterparts transported by non emergency medical system means such as friends, relatives, or bystanders²³. It has been estimated that for every 10minutes of delay in definitive treatment, survival for certain types of injuries decreases by 10%, suggesting that a prolonged injury-to-treatment interval is deleterious especially in severely injured.²⁴

The CT scan precise localization of gun pellets and other foreign bodies lodged in the eyes, knee, abdomen, and pleural space aided early surgical diagnosis and management of multiply injured patients. This is considered in our opinion to be the most important factor in the recorded low IMCW mortality adjudged from their injury magnitude. The causes of injuries which require CT scan are consistent with the studies from the Croatian war²⁰. The outcome of late recognition of the patient injuries and foreign bodies in war and peacetime multiple injured patients are well known in the literature^{17,18,19,20,21,22,25}.

The care of the spinal injured patients can be very specialized with special equipment like CT scanner needed²⁶. The spine was more involved in the IMCW group and none was found among the PMI patients. Anatomical evaluation of roots and spinal cord lesions were more difficult when CT scan is not available²⁷. CT scan revealed depressed fracture, brain contusion, extra and intra cerebral hematomas, and diffuses axonal injuries²⁵. The availability of a CT scanner for use in military medicine as in IMCW and PMI may further reduce the mortality and morbidity due to cranial injuries²⁷.

We found a considerable difference in the duration of time between injury and operation in the two groups. The surgical operations on the IMCW patients were performed urgently 25(83.3%) and 27(62.8%) in the PMI group after delay. It was due to association of high priority of surgery for war injuries from the general principle that injuries are treated during the first 6 hours, in addition to established criteria of urgent care for penetrating injuries. The time needed to call specialists together, absence of a visible wound, unclear clinical feature, necessity for diagnostic testing and inadequate finance may account for delay seen in the PMI patients operation. The concern of trauma surgeons not wanting to cause unnecessary operative trauma while attending to PMI patients is equally important factor for delay treatment.

Ocular injury is a major cause of morbidity and blindness among IMCW victims which were not commonly seen in the PMI group. A sudden blindness in the active young patient is depressive socio-economically. Rehabilitation with artificial globe improves patient's psychosocial mood. Protective glasses and helmets should be worn by individuals participating in wars since they could be shielded from certain injuries.^{18,28,29}

The mortality in the IMCW occurred in the 1st week of injury while those of PMI were recorded after the 1st week of injury. The post CT scan mortality may be reduced by early recognition and preventing the cause of post traumatic organ failure in IMCW and thromboembolic prophylaxis for the PMI group. Symptomatic epilepsy can occur after a penetrating head injury without direct injury to the brain tissue by a missile as described by Treib et al,³⁰. Epilepsy is a frequent consequence after missile wounds of the brain³⁰. Orthopedic surgeons, Ophthalmologist, and Neurosurgeon must consider this possibility when handling war veterans presenting with seizures.

Dr Chapin (1913) view that it is unwise to emphasize the financial or monetary side of public health by placing a money value on life^{30,31} is essential especially in IMCW and PMI. The cost of CT Scanning promised to be paid by the Nigerian government enhanced the easy accessibility of the financially poor IMCW patients to this vital diagnostic tool. The PMI patients personally paid for their CT scan. The IMCW and PMI patients follow up was difficult similar to previous study³² because most of our patients were living in the rural farm land, villages and towns consequently their addresses post war were unknown. It may also be related to their low level of postwar and peacetime injury complications.

CONCLUSION

Absence of multiple injuries in peacetime and communal war may be better thing to ensure. We have applied the Injury Severity Score to communal war multiply injured assessment. The IMCW patients received more intravenous colloid fluid infusion in the 1st 24 hours than those having PMI. The spine was involved in the IMCW group and none was found among the PMI patients. The surgical operations on the IMCW patients were performed urgently, 83.3% and delayed in 62.8% of the PMI group. Ocular injury was a major cause of blindness among IMCW patients which were not commonly seen in the PMI group. The mortality in the IMCW occurred in the 1st week of injury while those of PMI were recorded after the 1st week of injury. The post CT scan mortality may be reduced by early recognition and preventing the cause of post traumatic organ failure in IMCW and thromboembolic prophylaxis provided for the PMI patients. A striking difference existed among the CT scanned PMI and IMCW patients. These could be used to prognosticate outcome of the multiply traumatized treatment awaiting CT scanning.

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