CLINICAL PRACTICE

# Gunshot Injuries in Enugu: The challenges of our time.

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## ABSTRACT

*Gunshot injuries (GSI) are very common in time of war. However, the incidence of gunshot injuries are on the increase in civilian practice almost approaching an epidemic level. A six-year retrospective study of treated cases of gunshot injuries at National Orthopaedic Hospital, Enugu (NOHE) was done.*

*There were 77 patients with 73(94.81%) males and 4(5.19%) females giving a male to female ratio of 18.25:1. The mean age was 34.58± 8.72, range 4 months to 68 years with an average time of presention being 1.70days. Majorities of the injuries sustained were mainly from low velocity guns. Seventy-one patients with shooting occurring mostly at close range in 66 patients. Most shootings were done on highways.*

*Lower extremities were involved in 32 victims. Analysis of the anatomical structures showed that there were 81 injuries in 71 patients with the bone mostly affected. Sixteen patients had associated injuries.*

*Majorities of gunshot injuries in our environment are from armed robbery attacks with traders as the most of their victims. Pretrauma centre treatment was grossly inadequate and this calls for a review of training programmes of medical schools in our country as well as the continuing education programme. Ways of prevention and improved management are recommended and discussed*

**KEYWORDS:** *Gunshot injuries; Pattern; Treatment; Outcome.*

## INTRODUCTION

Gunshot injuries (GSI) are very common in time of war. It has often been said that those who seek experience in GSI management must be prepared to go to theatres of war. It is common knowledge that these injuries abound all over the world where there are or have been human conflicts be it war or acts of terrorism. The incidence of GSI are on the increase in civilian practice and almost approaching an epidemic level in some parts of the world including Nigeria[1,2]. NOHE is a regional trauma centre serving former Eastern Nigeria, Edo, Delta and Benue States; some neighbouring West African countries like Cameroon, The Republics of Benin, Chad and Niger. This leaves us with an approximate population of twenty million users.

Furthermore, the challenges posed by these not too familiar injuries are quite enormous and we believe that our experience is worth sharing. The aim of this study therefore is to examine the pattern of injuries in our environment and various factors responsible for the upsurge, assess the treatment given and its outcome as well as proffer solutions to the problems based on our experience.

## PATIENTS AND METHOD

The records of patients with GSI seen at NOHE between January 1, 1992 to January 1, 1998 (six years) were reviewed retrospectively. The sex, age, occupation, circumstances of injury, type of gun used, number of shots, range of shooting, anatomical injury, associated injury, pretrauma centre treatment, time of presentation, emergency and definitive treatment given, length of hospital stay, outcome and complications were analysed. Medical notes with incomplete data were excluded from the study.

## RESULTS

### General Data

There were 77 patients with 73(94.81%) males and 4(5.19%) females giving a male: female ratio of 18.25:1. The mean age was 34.68 with a standard deviation of 8.72. The range was 4 months-68 years. The average time of presenting to us was 1.70 days with a range of 02-28 days.

### Occupation at Risk

An assessment of occupation at risk showed that 27(35.06%) patients were traders while the remaining distribution was as shown in Table I.

### Circumstances of Shooting

An assessment of circumstances of shooting showed armed robbery to involve 60(77.93%) patients while others were as shown in Table II.

### Types of Guns used

Seventy-one(92.21%) patients were shot with low velocity guns while 6(7.79%) patients were shot with high velocity guns (rifle). The types of the low velocity guns used are as follows: shotgun 32(45.07%), pistol 31(43.66%), locally made guns 6(8.45%), double-barrel 7(9.86%), revolver 1(1.41%). Sixty-six (85.71%) patients were shot at close range i.e. <100 metres while 11(14.29%)

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patients were shot from a distance.

TABLE I: High Risk Group N =77

| Occupation | Number | Percentage |
|---|---|---|
| Traders | 27 | 35.06 |
| Students | 10 | 12.99 |
| Policemen and security agents | 9 | 11.69 |
| Drivers, mechanics and allied professionals | 9 | 11.69 |
| Civil servants, pensioners and priests | 6 | 7.79 |
| Applicants and apprentices | 5 | 6.49 |
| Infants | 4 | 5.19 |
| Bankers | 3 | 3.90 |
| Farmers | 3 | 3.90 |
| Housewives | 1 | 1.30 |
| TOTAL | 77 | 100 |

TABLE II: Circumstances of Shooting

| Circumstances | No | Percentage |
|---|---|---|
| Armed robbery | 60 | 77.92 |
| Accidental discharge(self-inflicted) | 7 | 9.09 |
| Police (while effecting arrest) | 6 | 7.79 |
| Communal clashes | 2 | 2.60 |
| Assassins | 1 | 1.30 |
| Secret cult activities | 1 | 1.30 |
| Total | 77 | 100 |

## Anatomcal Sites Involved

Thirty-two(41.56%) patients were shot in the lower extremities. Other sites involved are as in Table III.

TABLE III: Anatomical site involved (N=77)

| Site | Number | Percentage |
|---|---|---|
| Lower extremities | 32 | 41.56 |
| Upper extremities | 26 | 32.47 |
| Head and neck | 12 | 15.58 |
| Abdomen | 5 | 6.49 |
| Trunk | 3 | 3.90 |
| TOTAL | 77 | 100 |

## Anatomical Structures Injured

An analysis of structures injured showed that there were 81 injuries with the following distribution. Soft tissue injuries only (i.e. muscle, skin and appendages) 25(30.86%); fractures: femoral 15(18.52%), humeral 8(9.88%), skull (including maxilla and mandible) 7(8.64%), tibia/fibula 5(6.17%), hand bones 5(6.17%), foot bones 4(4.94%) and shoulder joints 4(4.94%). Neural injuries occurred in 5(6.17%) patients with the following distribution: mandibular N.1(1.23%), sciatic N. I(1.23%), ulna N. 1(1.23%) and brachial plexus 2 (2.21%). Other are traumatic amputations of the hands and feet 2(2.47%) and vascular injuries 1(1.23%).

## Associated Injuries

Sixteen (20.80%) patients had associated injuries. The distribution was as in Table IV.

TABLE IV: Associated injuries other than the primary gunshot injuries N=16(20.80%)

| Injuries | Number | Percentage |
|---|---|---|
| Soft tissue injuries (buttocks, legs, upper limbs and jaws) | 4 | 5.20 |
| Head injuries | 3 | 3.90 |
| Blunt face injury | 3 | 3.90 |
| Blunt abdominal injury | 2 | 2.60 |
| Testicular avulsion | 1 | 1.30 |
| Flash burns | 1 | 1.30 |
| Eye injury | 1 | 1.30 |
| Matchet cut (involving various parts of the body) | 1 | 1.30 |
| TOTAL | 16 | 20.80 |

## Pretrauma Centre Treatment

Thirty-four (44.16%) patients had treatment elsewhere before coming to us. Fourteen(41.18%) patients were initially treated at specialist hospitals while 19(55.88%) were seen in general hospitals before arrival. One (2.94%) patient was seen by the traditional bone setter.

## Pretrauma Centre Treatment Assessment

An assessment of the treatment given before arrival showed that for those who went to specialist hospitals, treatment given was adequate in 13(38.24%) patients and inadequate in 1(2.94%) patient. For those who went to general and private hospitals 19(55.88%) patients were inadequately treated while only 1(2.94%) patient was adequately treated.

### Errors of Treatment

There were errors of treatment in 20(25.97%) patients and the errors were shown in Table V.

**TABLE V: Errors of Treatment N=20(25.97%)**

| Errors | Number | Percentage |
|---|---|---|
| Suturing of wounds with little or no debridement | 10 | 12.99 |
| Immediate attempt at fragments | 6 | 7.79 |
| No debridement at all with very poor dressing | 2 | 2.60 |
| Poor resuscitation(giving less than 1 litre of 5% Dextrose) | 2 | 2.60 |
| **TOTAL** | **20** | **25.97** |

### Emergency Treatment Given

Ninety-four emergency treatments were carried out with the following distribution: wound debridement, toileting, fasciotomy with or without suturing 45(47.87%); resuscitation (with normal saline or blood transfusion when indicated) 30(31.91%); fracture stabilisation using external fixators, POP, scotchcast, K-wire or Steinmann pin insertion 15(15.96%); inspection of wound, removal of sutures and dressing only 11(1.70%); laparotomy 2(2.13%); guillotine amputation 1(1.06%).

### Definitive Treatment Given

Fourty-one definitive procedures were carried out with the following distribution: Wound coverage 20(48.78%), secondary suturing 6(14.63%), delayed primary suturing 5(12.20%), splitskin graft 5(12.20%), flapcover 3(7.32%) and Wolfe graft 1(12.44%). Conservative management with POP application 6(14.63%), open reduction, plating and bone grafting 3(7.32%) was also done. The remaining procedures included laparatomy 3(7.32%), interdental wiring 2(4.88%), foreign body extraction 2(4.88%), K-wire fixation of digits 1(2.44%), tendon repair 1(2.44%), sequestrectomy 1(2.44%), amputation and refashioning 1(2.44%) and vascular repair 1(2.44%).

### Complications

There were 31 complications from these GSI. These include: wound infection, dehiscence, scars and contracture 8(25.81%); nerve palsy and paraesthesia 7(2.58%); stiff joint, digits and ankylosis 6(19.35%); non-union of fracture 2(6.45%); pressure symptoms from pellets 2(6.45%). One (3.23%) of each of the following complications was also seen: anxiety over migrated subcutaneous pellets, recurrent fits, femoral artery pseudoaneurysm, delayed haemoptysis from chest trauma, Volkmann ischaemic contracture and chronic osteomyelitis.

### Mortality

Five patients (6.50%) died from the causes shown in Table VI.

**TABLE VI: Mortality N=5(6.50%)**

| Cause of death (summary) | | |
|---|---|---|
| 1.Poor resuscitation- patients were in haemorrhagic shock. No attempts at resuscitation were made, rather their wounds were sutured in a peripheral hospital. | 2 | 2.60% |
| 2.Sepsis-due to infected comminuted compound fracture - sutured under local anaesthesia in casualty ward at a general hospital. | 1 | 1.30% |
| 3.Electrolyte imbalance- post laparatomy patient who was not adequately rehydrated. | 1 | 1.30% |
| 4.Gangrene of the lower limb- following badly treated compound fracture by the native doctors. | 1 | 1.30% |
| **TOTAL** | **5** | **6.50%** |

## DISCUSSION

GSI present serious problems, which may lead to death or serious disability. Our demographic analysis showed an even higher preponderance of male to female when compared with findings of Ofiaeli[2] who carried out a similar study in a semi-urban Nigerian population. In times of warfare, this could be easily explained as more men are involved in warfare than women. Men by nature are most exposed to forces of violence and this could explain the case here. Our mean age of 34.59±8.72 also tallied with that of his group.

Our analysis of the occupation involved showed that traders constituted the highest group at risk and the circumstances of shooting showed that many victims especially the traders were attacked by armed robbers. Ofiaeli[2] demonstrated in his study that 91% of the armed robbery attack were on highways. Our findings also confirmed this. Traders are in the bad habit of traveling with a huge amount of cash (sometimes up to twenty million naira). Government should promulgate a law prohibiting massive cash movements as the Nigerian traders have consistently refused to make use of the Nigerian banking facilities.

Though injuries due to secret cult activities in our series were as low as 1.30 percent, efforts should be directed at discouraging this as there is no clear dividing line between armed robbery and cultism. The attempt by the Nigerian Police to reintroduce patrols on the Federal highways is a welcome development as most robberies took place on the highway.

Low velocity guns, especially shotguns, account for most of the weapons used. This is in consonant with the findings of Ofiaeli[2] who demonstrated a 52% use of shotguns. Rifles (high velocity weapons) accounted for up to 38% in his series and this he attributed to the present war in

Liberia which serves as a source of loose assault-type weapons in the West-African sub-region. This is at variance with our present and previous studies[3] where high velocity weapons had remained as low as 7.79%.

Lower extremities were mostly affected in our series. This is also in consonant with Ofiaeli's[2] finding and our previous report[3] where we attributed this phenomenon to the intent to demobilize victims. Ofieli however attributed his own situation to indiscriminate shooting aimed at scaring away citizens during armed robbery operations. Doge et al[4] had trunk, head and neck injuries more than that in the extremities.

There is no anatomical structure that is exempted from injuries. Bone, being the framework of the body, becomes the most vulnerable. Our policy of adhering to the strict principle of management of compound fractures accounted for our good results. Most fractures were managed conservatively after an initial wound debridement and toileting. Where stabilisation was needed, we had always preferred the external fixation method for obvious reasons. Though some authors[5] had advocated that wounds caused by low velocity missiles can be managed by standard surgical procedures, we had a different approach to it. All gunshot wounds, irrespective of the type, had an early exploration with thorough wound debridement. The wounds were often left open and later closed by either delayed primary or secondary closure.

Sixteen (20.80%) patients had associated injuries other than the primary GSI. Some of these injuries were severe enough to threaten life more than the primary injury. This calls for the need for total evaluation of patients on admission. Armed robbers and assailants often carry dangerous weapons other that guns and this could be used to inflict injuries on the victims. Victims could also sustain injuries while trying to escape as evidenced by two of our patients who sustained head and abdominal injuries while jumping from a two-storey building. The attending physician therefore must not allow himself to be carried away by the primary gun shot injuries.

Thirty-four (44.16%) patients had treatment elsewhere before arriving at our trauma centre. Assessment of treatment given showed that a lot of patients were inadequately treated especially those who went to non-specialist centres. This is a reflection of the health status and medical education in the country. For one to be adequately equipped to manage these injuries, the principles of ballistics must be understood. Most tissues absorb the energy ($KE=1/2\ mv2$) released by the bullet and this is what causes the damage and not the presence of a bullet per se. However, these bullets at times can cause pressure symptoms or erosion of major vessels. Abscess formation could also result, but these complications take quite sometime to develop. We are also aware that systemic lead toxicity (plumbism) can develop and has been reported[10,11]. Plumbism is common with bullets in joints where the synovial fluid acts as a dissolution agent as well as pellets deposition in a large surface with adequate blood supply[10,11]. Presence of bullets in large joints can also cause mechanical problems with its attendant osteoarthritic complications[12,13]. This, however, does not justify the routine search for bullets during the primary treatment. Errors of treatment ranged from poor resuscitation to suturing of wounds with little or no debridement. Most practitioners outside the specialist centers do lack the knowledge of the principles of management of injured patient especially in the case of GSI.

Many a times ignorance has led to deliberate attempts being made to extract bullets leaving life threatening problems unattended to. Attempts at bullet extraction are rampant in our society and should be discouraged. Apart from absolute or relative indications for exploration and extraction of bullet, no attempt should be made in that direction as further damage could be done, moreso as this bullet exercise with time with little or no problem. However, these bullets could be extracted in future if the need arises but definitely not at the time of injury except it is absolutely indicated.

There is no substitution for wound debridement, toileting and fasciotomy. In fact the traditional approach to the surgery of gun shot wounds is based on the treatment of wounds caused by rifle or machine-gun bullets and large shell fragments of the first world war[6]. Michael Owen-smith[7] had stated that "Surgeons and their patients have had to learn the hard way that these injuries require a different form of treatment. The correct treatment has been known since world war I and the principles have not changed much since world war II, about 40 years ago. Regrettably, at the beginning of every minor or major war, there is still widespread ignorance about these methods". We cannot but agree with him that the principles have not changed and therefore one should stick to it.

Our method of fracture stabilization as stated earlier is external fixation. Attempts at internal fixation are fraught with danger especially where bone has been comminutely shattered. Where a doctor is not familiar with application of external fixator devices, a POP back slab will suffice. However, non-united fractures could be plated and bone grafted.

Our method of wound coverage ranged from secondary suturing to split skin graft, Wolfe graft and flapcover. Attempt at initial closure of wound is dangerous, for not only is one incubating anaerobic organisms especially in high velocity injuries, the patient also stand a chance of

developing acute compartment syndrome in the extremities.

Our series were not without complications: there were 31 complications out of the 81 anatomical structures damaged representing 38.27%. These complications could be minimised if anticipated and attended to in good time. For example one does not have to wait for a wound or fracture to heal before attending to nerve palsies and stiff joints. Fractures could be plated in optimum time to reduce the incidences of non-union.

We had a mortality rate of 6.50% which is similar to Ofiaeli's[2] findings. The reasons for this low mortality are: First, most of our patients were hit with low velocity weapons. When high velocity weapon is used mortality is usually four to five times higher[3]. Secondly, extremities were worst hit in our series. Thirdly, vital organs were not mainly affected. Finally, there was minimum delay of surgery in our group. These factors in general contributed to our low mortality rate. As a matter of fact our patient died from poor resuscitation, sepsis, electrolyte imbalance and gas gangrene. These are all correctable errors and could be redressed with continuing education of doctors and review of medical curriculum to deal with trauma situations since most frontline doctors are fresh medical graduates.

GSI will pose new challenges in our time as this incidence continues to rise. Since we cannot close our eyes to these facts, one would like to proffer solutions on both the preventive and treatment aspect. There is need for moral rearmament of the people through religious organisations and agencies such as the National Orientation Agency. We should begin to have a proper look at the youths especially the parenting and educational aspects. This may in future change the present societal values, which lay emphasis on wealth acquisition irrespective of its method. The police must be re-equipped morally, psychologically and financially to combat armed robbery. These, to our mind, might be the long and final solution to reduction of incidence of armed robbery and other violent crimes.

In conclusion, we have reviewed GSI in our environment. Most injuries result from armed robbery attacks, which should be stemmed down. Most of the victims were traders who are in bad habit of moving large amount of cash and this should be discouraged. Pretrauma centre treatment of this injury has not been adequate and we have therefore recommended re-education of our doctors and broadening of the medical curriculum to take care of ever increasing trauma cases. When these are done we are confident that we shall be in a position to face gunshot injuries which has posed new challenges in our time.

## ACKNOWLEDGMENT

We are grateful to the following: Consultant Surgeons in NOHE for granting us permission to review the case notes of their patients; the Medical Records Illustration Units of NOHE for their assistance with records and illustrations; Mr.C.C. Eze of GTZ/NOHE for Computer typesetting; and Miss Esther Arinze of Hilltop Clinics Enugu for typing the manuscripts diligently

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