# ASPECTS OF MAJOR INJURY IN THE JOHANNESBURG AFRICAN— A REVIEW OF 300 CASES

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The non-European section of the Johannesburg Hospital has a surgical unit of 50 beds which accepts seriously injured patients, who are unfit to travel to Baragwanath Hospital some ten miles away. The onus of deciding whether the patient is *fit to travel* rests with the casualty officer. He has no facilities for resuscitation in his department, which functions almost entirely as a reference station. The surgical unit receives an average of 1 patient daily, who has been assaulted or injured in an accident and who is in imminent danger of losing his life. We wish to review the extent of injuries sustained by this group of patients and to discuss facets in their resuscitation, with particular reference to blood transfusion, osmotic diuresis, and ventilatory adjuvants. We wish to refer to the head injury problem in particular, and to discuss the aetiological factors of injury and some of the problems of rehabilitation.

In the 11 months 1 September 1962 to 31 July 1963, 300 patients were considered sufficiently ill to warrant admission and inclusion in this series. Owing to paucity of beds, the small resident staff and minimal theatre and ancillary facilities available, the criteria for admission have been most stringent. Many times patients were transported to Baragwanath with considerable trepidation. 'Not fit to travel' has implied either a deeply comatose patient or one in severe oligaemic shock, or marked respiratory embarrassment, or one who has been disembowelled.

Schrire[1] reviewed the management of the multiple injury patient at Groote Schuur Hospital, a hospital with diverse specialist units. Here only a general surgical unit is functioning, and it has been necessary to institute a friendly liaison with a host of consultants who have assisted with injuries falling in their province. The overall management of the patient has depended on the resident general surgical staff.

## STATISTICS

Of 300 patients 72 died. Head injury was the most common cause of death. At autopsy it was shown that 66% of these resulted from irreversible cerebral damage. The other deaths could not be attributed to a single causative factor but rather to a conglomerate of hypovolaemic shock, respiratory failure, fat embolism, renal failure and electrolyte disturbance (Table I).

TABLE I. ANALYSIS OF THE INJURIES TO 300 PATIENTS

| | Number | Deaths |
|---|---|---|
| 1. Head and Cord injuries | 123 | 50 |
| 2. Orthopaedic— | | |
| (*a*) Fractures | 80 | 4 |
| (*b*) Amputations | 10 | — |
| 3. Cardiac wounds | 15 | 3 |
| 4. Pulmonary | 84 | 6 |
| 5. Abdominal | 55 | 2 |
| 6. Vascular | 16 | 6 |
| 7. Plastic | 59 | — |
| 8. Maxillo-facial | 13 | — |
| 9. Genito-urinary | 16 | 1 |
| Total | 451 | 72 |

Of the 72 deaths, 12 occurred within one hour of admission to the ward and 19 died within 6 hours. There were 2 operative deaths, both attributable to head injury.

## CLINICAL ANNOTATIONS

### *The Cardiovascular Problem*

The key to the resuscitation of the severely injured patient is an accurate diagnosis of the cause of the circulatory failure,[2] and in all patients an immediate assessment of possible inadequate respiration was made, such as impaired venous return, blood loss—apparent or occult, and cardiac contusion. Then whole blood transfusion was liberally used. In 211 patients receiving blood transfusion 918 units of blood were used. 14 patients received over 15 units of blood. For clinical purposes we regarded 'irreversible shock' as an entity of under-transfusion.

Particularly in the group of patients who sustained vascular or cardiac injuries, we attempted to monitor central venous pressure (CVP) by the insertion of a wide-bore 8-inch polythene catheter into the cephalic or external jugular vein. A simple manometer has been attached to this by a Y-connection to assess the CVP. In the presence of a low blood pressure and low CVP, fluids were given rapidly, to restore the blood volume deficit. In three patients with stab wounds of the heart, a rise of CVP facilitated diagnosis of developing tamponade, well before a pulsus paradoxus or an elevated jugular venous pressure was noted. Of 15 patients with cardiac stab wounds, 4 were treated by thoracotomy because of the size and persistence of the flow from the pericardial sac. One of these died. Eleven were treated conservatively by single or multiple aspirations and two died within an hour of admission. Two patients who sustained cardiac stab wounds developed cerebral embolic catastrophes a few days after injury. Both were left with residual hemiplegias.

### *The Renal Problem*

In the first half of the series 10 patients demonstrated a serious degree of posttraumatic oliguria. Seven patients recovered on conservative measures; 3 died. Of the latter three, 2 patients showed a complete suppression of urine, although cystoscopy and retrograde pyelography were normal in both. One patient had a major head injury, the other a high cord transection and a fractured pelvis. At autopsy the kidneys showed minimal histological changes. The third patient died of respiratory and renal failure, following a femoral fracture, pelvic fracture, urethral rupture and multiple rib fractures. He represented a very complex fluid-balance problem (Fig. 1). In the latter half of the series it was decided to attempt reversal of the antidiuresis of an injury by the immediate administration of osmotic diuretics, to overcome the difficulties of diagnosis and management of posttraumatic oliguria. Initially, 90 G of Ureavert[r] in 1,000 ml. of 10% invert sugar were used; latterly 1,000 ml. of 10% mannitol has been given during an operation or after transfusion to those patients showing hypotension of any duration, who had received blood transfusion. This was necessary in 37 instances.

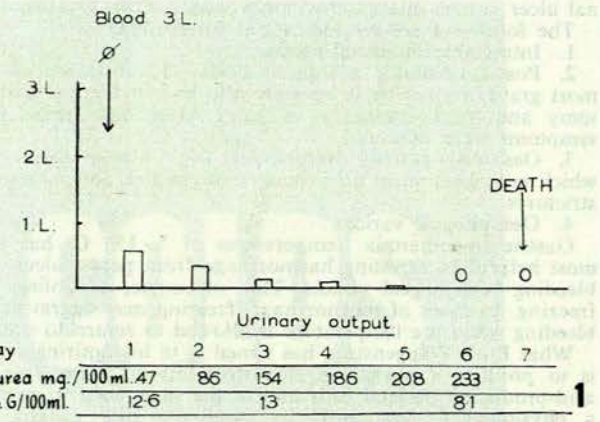


*Fig. 1.* Acute renal failure in a patient with multiple injuries including bladder and urethral ruptures.

Francis D. Moore[3] recently wrote:

'Whenever the question of mannitol prophylaxis of acute tubular necrosis is brought up, someone is apt to observe that "after all it doesn't do the patient any good just to have a lot of urine in a bottle—it only makes the surgeon feel good". This allegation has become a ceremonious platitude in the field. The large amount of urine in the bottle is indeed not there solely for the purpose of filling the bottle; it is there as evidence that glomerular filtration has been maintained at a high rate and that the mannitol-induced diuresis has occurred, both of them important features in the prevention of acute tubular necrosis when it is threatened by renal ischaemia and a load of nephrotoxic substances.'

We have found that in addition to the surmised prophylactic value of mannitol, it also facilitates subsequent fluid-balance management considerably. Electrolyte measurement and replacement must still be carefully followed, but the large volume of fluid which may now be given makes replacement easy. If further blood transfusion is required, it may now be given, but a blood transfusion given to an oliguric patient is a further load of pigment, acid, and potassium, and may cause further renal damage. In the patient with multiple injuries, second and third operative procedures in the few days after injury are often necessary and these too are made easier by the ability to manipulate large volumes of fluid.

*The high urinary flow rates* have also been of value in keeping catheters clear and reducing urinary-tract infection in those patients with cerebral, cord, bladder, or urethral injuries. Situations in which urea and mannitol yielded a large diuresis are illustrated in Figs. 2 and 3 probably preventing renal cortical necrosis (speculative, we admit), and facilitating further transfusion and re-operation.

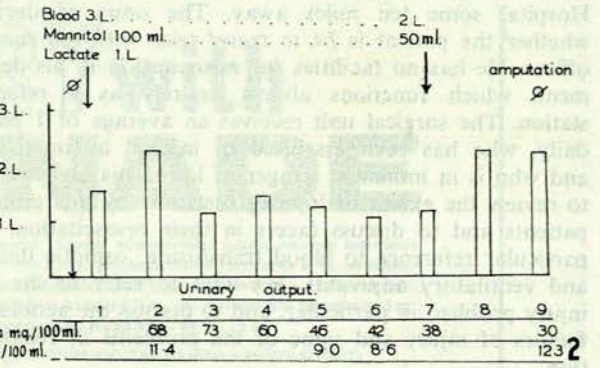


*Fig. 2.* Mannitol-induced diuresis facilitating late amputation of a 'dead' limb after venous gangrene had occurred following arterial grafting.

Of the 37 patients who received osmotic diuretics, 4 died, 2 as a result of associated head injuries, 1 of peritonitis and respiratory infection, and 1 of fat embolism with multiple

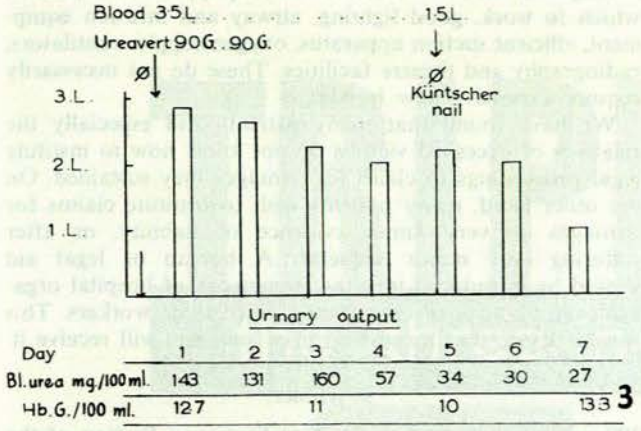


*Fig. 3.* Urea-induced diuresis facilitating retransfusion and re-operation in a patient with multiple injury.

fractures. No patient showed oliguria of any consequence. In most cases urinary volume exceeded 1,500 ml. in the 24 hours following injury.

*The hypovolaemic shock syndrome* is also associated with an accumulation of a hydrogen-iron load. This results from poor tissue perfusion and accumulation of organic anions, poor renal perfusion, and diminished hydrogen-iron excretion. This is often aggravated by diminished respiratory efficiency and respiratory acidosis, and finally augmented by the administration of large volumes of acid-citrate dextrose blood. Latterly, we have been administering mannitol dissolved in 1,000 ml. of one-sixth molar-lactate solution, to counteract the metabolic acidosis of shock. Merrill[4] stressed the role of early alkalinization in the prophylaxis of renal shutdown; 80 mEq. of lactate is sufficient to yield an alkaline urine. Many of our cases take unduly long to reach hospital, following assault or injury in the townships on the perimeter of the city, and as a result of prolonged hypotension they are all the more liable to renal failure. Every potential prophylactic weapon is therefore welcome, and we have not regretted making use of mannitol plus alkali infusion—a routine procedure in the shocked patient.

## THE RESPIRATORY PROBLEM

*Tracheostomy* was done in 51 of the 300 patients. Maloney and McDonald[5] have recently criticized the rationale for tracheostomy. They assert that most of the respiratory dead space is located below the carina, and is therefore not eliminated by a tracheostomy; that most of the secretions aspirated through a tracheostomy are salivary; and that airway resistance is increased by anything other than a clear large tracheostomy tube. Despite these criticisms we have found tracheostomy of value in patients with the following conditions, provided that stringent supervision of the management of the tracheostomy was maintained:

| | |
|---|---|
| Head injury | 29 |
| Tracheo-bronchial injury | 4 |
| Respiratory failure | 8 |
| Chest wall and diaphragmatic injury | 8 |
| Maxillo-facial injury | 2 |

*In patients with head injuries* presenting with obstruction of the airway, and in those unconscious after 24 hours, with a danger of respiratory infection, we have performed early rather than late tracheostomy. Tracheobronchial lavage has also been of value. Simenstad *et al.*[6] state that when tracheostomy and bronchoscopy have failed, and the clinical picture and radiograph show broncho-pneumonic change, quite dramatic results may be obtained by the use of 400 ml. of saline in 50 ml. quantities injected down the endotracheal or cuffed tracheostomy tube. This is coupled with re-aspiration and positive-pressure ventilation from a Boyle's machine or mechanical ventilator. Several patients with head injuries in status terminalis a few days after the injury, and a few in respiratory failure caused by atelectasis, were actively treated in this manner. All improved at this stage, and a few have made unexpected recoveries.

Recently, we had access to positive-pressure mechanical ventilators, and there is no doubt that the use of such a machine is essential in patients with a flail chest injury. Despite very gross lesions, recovery has been uneventful in 5 patients treated on ventilators, and in 3 others death was due to other injuries occurring in association with the damaged chest wall. **We suggest that any patient who sustains flail chest injury, caused by a steering wheel, in the country districts, should be treated by tracheostomy* and that intermittent-positive-pressure ventilation by hand be started, before he is transferred to a centre equipped with mechanical ventilators.**

Besides the flail chest injuries treated in this way, we have used the ventilator in 8 other patients with respiratory failure resulting from pathology in the upper abdomen, or respiratory infection, or head injury. Many more head-injury victims might have been afforded the chance of long-term assisted ventilation. The mechanical ventilator is essential equipment in a unit managing major traumatic injury.

## HEAD INJURIES

Of 300 admissions 117 sustained head injuries and 6 had spinal-cord lesions. Of these patients 47 recovered consciousness within 72 hours, and their head injury was usually coupled with a second lesion which warranted their admission. 47 patients of 68 with major head injuries died. All these deaths were attributable to cerebral laceration and intracerebral bleeding, and on no occasion was a death due to accumulation of extradural or subdural haematomata. 14 cerebral angiograms were done. Facilities for this procedure were limited, and the process was time-consuming. On 11 occasions exploratory burrholes were made without angiography and on 3 occasions subdural haematomata were evacuated. All the latter 3 patients developed symptoms after a few days of hospitalization. Two patients were submitted to radical decompression procedures following gross pick-axe wounds to the skull, and in those instances where burrholes were made for increased intracranial pressure, ventricular drainage was instituted. Despite this active management of head injuries, the results were disappointing. Of the entire group of patients with severe head injuries, only 3 may be classed as fully rehabilitated. The differential diagnosis of the cause of coma was often interesting. One patient with peri-orbital bruises was found to be in hypoglycaemic coma owing to a hepatic carcinoma. Two patients in deep coma with minimal clinical injuries died of hypothermia caused by severe exposure. Rectal temperatures were below 85°F in each of these instances. The diagnosis was suggested in each instance by marked bradycardia. Both died shortly after admission.

## AETIOLOGY AND PROPHYLAXIS

The 300 patients constituted 30% of the total number admitted to the unit in 11 months. However, their treatment constituted a far greater work load than did the elective surgical procedures; they placed a considerable strain on the resident staff and they encroached a great deal on space and time theoretically available for routine patient care.

*Man's inhumanity to man* still remains the major blight of the Johannesburg African. 201 patients were victims of assault. Most were stabbed or hit with blunt instruments, but 15 patients had bullet wounds. The latter were usually bag snatchers and other petty criminals who were dealt with rather summarily by gun-carrying citizens; but 2 were innocent bystanders at hold-ups, and one patient, a domestic servant, was shot through the abdomen when her employer's gun fell on to the floor from beneath the mattress, while she was making the bed. This source of violence both deliberate, calculated, spontaneous or acci-

*A cuffed endotracheal or tracheostomy tube should be inserted.

dental represents a burden to the entire community and not only the hospital services.

*Motor accidents* yielded 77 casualties. Most of these occurred at night, when the Black pedestrians are particularly invisible. Some form of illumination or reflectors for pedestrians may be worth considering.

*Trains*: Recently, it was stated[7] that 150 persons are killed annually on Reef train services. This series includes 12 victims of train tragedies. Of 10 amputations performed, 9 were caused by falls under trains. Three patients died of multiple injuries after being pushed off overcrowded coaches.

*Workmen* who sustained gross injury constitute the remaining 10 patients in this selective series. Most other injured patients covered by WCA were diverted to private practitioners, and only those in dire straits were admitted to the hospital unit.

**Of the 228 survivors 21 are unfit for employment, and of these many require permanent institutionalization. A further 30 are partially disabled and are fit only for sheltered employment. Since most of these patients were manual labourers, rehabilitation is not easily achieved. 72 patients are dead. Thus, of 300 patients, only 177 may be considered cured and fit for a return to normal living.**

## CONCLUSIONS

We feel that a concerted communal effort is required to investigate and reduce the incidence of traumatic injury to the Johannesburg African.

Accident units ready to deal with lesser injuries on the one hand and with major injuries on the other, would require better organization of hospital services. These services should be divorced from the routine, casual patient services. This would constitute better organization of hospital services for the accident victim, the 'cold' surgical patient and the hospital staff. Injuries can best be managed in an intensive care unit, equipped with space in which to work, good lighting, airway and infusion equipment, efficient suction apparatus, oxygen supply, ventilators, radiography and theatre facilities. These do not necessarily require expensive new buildings.

We have found that many patients and especially the relatives of deceased victims do not know how to institute legal proceedings to claim for damages they sustained. On the other hand, many patients wish to institute claims for damages on very flimsy evidence of liability, or after suffering only minor sequelae. A bureau of legal aid should be introduced into the framework of hospital organization, to work in cooperation with social workers. This would ensure that those who need succour, will receive it.

## SUMMARY

300 patients admitted to the Non-European Section of the General Hospital, Johannesburg, in 11 months, who sustained major injuries, rendering them unfit for travel, are discussed. The mortality was 24%, mainly caused by head injuries. Clinical annotations are made concerning cardiovascular, respiratory, renal and cerebral problems encountered in this series. Aetiological factors of injury are briefly considered, and the organization of a traumatic injury unit is mooted.

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