patient is justified in taking his own life. But it's not justified for a patient to involve a whole host of health services just to bring her husband to heel.

DR. WELLS: Should the doctor provide the wherewithal?

DR. ELITHORN: It's the doctor's responsibility to evaluate the risk of suicide. If I prescribe barbiturates for a patient, then I'm evaluating the risk. If that patient then allows the barbiturates to become available to a teenager, that's a different and important issue. I think that a ban on drugs creates addiction. No normal teenager would become addicted.

DR. WELLS: I challenge that. Experience in Ipswich has shown that six youngsters from normal middle-class families have become addicted.

DR. ELITHORN: The incidence of neurosis in the community is 8-10%—so that these six youngsters just represent what would be expected.

DR. WELLS: Boyd at the Middlesex Hospital has shown that adolescents like barbiturates: they abolish problems, and teenagers like the "buzz" after injection. More youngsters die from barbiturates than any other drug.

CHAIRMAN: Dr. Wells, are you pursuing all hypnotics or just the barbiturates?

DR. WELLS: No, the aim is to achieve an overall responsible attitude towards prescribing.

DR. ELITHORN: You're saying "you can't get responsible prescribing without a ban." You don't consider the quality of life of your patients and you haven't proved that they can do without barbiturates.

DR. WELLS: I have to live with my patients, I've followed them all up and I'd know if they'd suffered because of the change in our prescribing habits.

DR. ELITHORN: You and I see different patients. I see the patients who daren't go back to their G.P. and complain.

CHAIRMAN: Is Dr. Wells entitled to say this on the basis of this experience without a double-blind random trial, Dr. Galloway?

DR. GALLOWAY: Yes: his experience in the general practice situation is valuable—that many patients can do without barbiturates. Equally important in all this is that doctors should be made aware of the indications for barbiturates, or the contraindications . . .

CHAIRMAN: . . . which are?

DR. GALLOWAY: Liver disease, renal disease, obstructive lung disease, mental instability, porphyria, and extremes of age—and, thirdly, the doctor should be aware of the mode of action and the side effects of barbiturates.

DR. ELITHORN: We mustn't forget that the personality of the prescribing doctor is important. Dr. Wells may underestimate what he has achieved by force of personality which other doctors might not be able to. Some patients may get benefit from hypnotics although they don't realize that they need them. Drugs are artificial, but so is civilization: to deny patients drugs because they are drugs is illogical and inhuman.

DR. WELLS: Doctors are unlikely to do this, as it goes against their ethics and training.

DR. GALLOWAY: Dr. Wells has never suggested that this should be done: he's merely pointed out that there are alternatives to the barbiturates, and that once weaned off hypnotics many patients are found to be able to sleep without them.

CHAIRMAN: Would we agree that the dispensing of barbiturates could be tightened up—for instance, put on a schedule?

DR. ELITHORN: Yes, there should be more penalties for people who misuse them, and I believe that the doctor who overprescribes recklessly should be punished: a lot of the trouble has been caused by a few rogue doctors. But an increasing number of regulations about what to prescribe would be destructive.

DR. GALLOWAY: A real tightening up would reduce the potential for addiction and drug abuse. What we are trying to aim at is rational prescribing, in which both the doctor and his patient are aware of the value of the drug as well as its potential for abuse. If we can reduce the side effects for the patient and complications for the doctor, so much the better. There seems to me to be a number of hypnotic drugs on the market which, though not necessarily equipotent with barbiturates, are adequate for most circumstances.

Surgery of Violence

The Tower of London Bomb Explosion

KEITH TUCKER,   ALAN LETTIN

Summary

After the detonation of a bomb in the Tower of London 37 people were brought to St. Bartholomew's Hospital. The explosion caused numerous severe injuries of a type rarely seen in peacetime.

Introduction

During the past few years St. Bartholomew's Hospital, situated

Princess Alexandria Hospital, Harlow, Essex CM20 1QX
KEITH TUCKER, F.R.C.S., Senior Orthopaedic Registrar
St. Bartholomew's Hospital, London EC1A 7BE
ALAN LETTIN, M.S., F.R.C.S., Consultant Orthopaedic Surgeon

within the City of London, has received many civilian casualties resulting from letter bombs, a car bomb, and more recently from the explosion of what was probably a "carrier bag" bomb detonated inside the Tower of London. This has presented unfamiliar problems for the rescue services, the accident and emergency department, and the individual doctor.

Each of these explosions has produced its own pattern of injuries. The Old Bailey car bomb caused 160 casualties, most of whose injuries were caused by flying glass and metal and not directly by the blast, which was easily dissipated in the open air. On that occasion 19 patients were admitted to hospital, but only four had severe injuries.[1] The explosion within the confines of the Tower of London injured fewer people, but these injuries were generally much more severe. This bomb contained 10 lb (4·5 kg) of explosive and it had been placed alongside the wooden carriage of a 50 cwt (2500 kg) 18th century bronze cannon in the armoury of the White Tower. The room, which measured 68 ft (21 m) long 28 ft (8·5 m) wide and 20 ft (6 m) high, had stone

walls 15 ft (4·5 m) thick. The casualties were grouped around the cannon, and their injuries were caused by "blast," fragments of wood, stone, and metal or by being thrown against the floor and walls. The gun carriage was destroyed and the cannon thrown to the floor.

Thirty-seven people were injured and 19 required admission to hospital; of these, 10 (27%) had severe multiple injuries. One patient died. The injuries and the numbers of patients sustaining them were as follows: Fractured skull 2, injuries to the facial skeleton 2, fractures of other bones 10, abdominal injuries 2, lung injuries 2, injuries to skin and integument 20, burns 10, eye injuries 4, ear injuries 22.

Organization

The first casualties arrived at the hospital within 20 minutes of the explosion through a traffic-free clearway established by the police. On arrival previously prepared and similarly numbered emergency record cards, pathology and x-ray request forms, and observation charts were attached to each patient with an identification bracelet.

As soon as the magnitude of the disaster became apparent all available medical, nursing, and ancillary staff were summoned to the receiving area. Sufficient medical staff were available to allow one doctor to devote his whole attention to the examination and documentation of a single patient, initiating resuscitation, antibiotic therapy, and antitetanus prophylaxis. This initial assessment was complicated by the fact that many of the patients had been deafened and some spoke no English.

A consultant general surgeon and a consultant orthopaedic surgeon, guided by this initial assessment, reviewed each patient and determined further treatment. Anaesthetists were on hand to help with respiratory and major resuscitation problems, and a pathologist was present in the receiving area organizing supplies of blood for transfusion.

Though a mobile medical team was dispatched to the Tower, as in the Old Bailey incident, its presence was superfluous. The injured had not been trapped, and there were sufficient ambulances to transfer them all to hospital without the need for any preliminary assessment of treatment.

Seven fully staffed main operating theatres were available within one hour of the first casualties arriving at the hospital, four by curtailing operating lists already in progress. This relieved the surgeons in charge of the difficult task of establishing any degree of priority in the treatment of the seven most severely injured patients. In the operating theatres these patients came under an appropriate surgical team headed by a consultant, senior registrar, or registrar. Two consultant plastic surgeons, a consultant neurosurgeon, and a consultant faciomaxillary surgeon were incorporated in the teams requiring their specialist skills. Further resuscitation and assessment of each patient took place in the relative calm of the anaesthetic room before and after induction of anaesthesia. Most of the x-ray films which were required were taken at this stage. The consultants in charge visited each operating theatre after their initial duties in the emergency department were completed to advise on policy and co-ordinate the overall management. All patients had been transferred from the receiving area within two hours of the first arrival.

Inquiries from the police, the press, the public, and relatives were dealt with by the senior administrative staff, as recommended by Caro and Irving.[1]

Treatment

The immediate surgical treatment was restricted to repairing vital organs and wound toilet. This was accomplished in nearly all patients within 12 hours of the explosion. One patient was observed overnight for signs of visceral damage before his simple wounds were attended to. Initial antibiotic therapy,

consisting of penicillin to combat potential clostridial infections and an antibiotic effective against a broad spectrum of other organisms, was continued until wounds had healed.

OPEN WOUNDS

Seventeen patients had multiple extensive contaminated wounds containing wood, splinters, stone, metal, and clothing. The larger wounds were obvious but often it was not until the superficial debris had been gently removed with a scrubbing brush that smaller penetrating wounds were found. The classical treatment for wounds of this nature was followed.

After liberal cleansing with Savlon (cetrimide) all flayed skin and the wound edges were excised down to the deep fascia. Contaminated and devitalized fat, fascia, and muscle were removed to expose healthy tissues. Small areas of discolouration remaining on the skin after the initial "scrubbing" were often the entry wounds of surprisingly large pieces of debris, and these were carefully treated in the same way. Some 300 small pieces of wood were removed from one patient alone.

All but five wounds, including an amputation, were left open for later closure. The dorsum of a hand which had been degloved was partially covered with Thiersch grafts. A clean incised facial wound, a compound comminuted fracture of the skull sustained in falling, and a contamined leg wound were sutured, the latter under local anaesthetic. It is significant that this leg wound subsequently became infected and broke down before healing by granulation.

All the wounds were inspected under general anaesthetic between the fifth and seventh days after the incident. Most were clean and suitable for closure, but in addition seven patients required multiple Thiersch grafts. The amputation was closed with drainage.

The severe blast injuries of both calves sustained by one patient were heavily infected and necrotic, resulting in septicaemia and renal failure. Further exploration disclosed more debris and a more extensive debridement was carried out, which resulted in immediate improvement of the patient's condition. Two weeks later the wounds were grafted, but healing eventually occurred by granulation. With the exception of this patient and three other local infections all wounds had healed within three weeks of the explosion. The infection was predominantly Pseudomonas aeruginora (pyocyanea), and this was eradicated by topical application of acetic acid and exposure to a current of hot air from a hair dryer.

BURNS

Ten patients suffered flash burns to areas of uncovered skin. These were treated by exposure unless adjacent to open wounds. All healed without scarring, though two patients required plasma infusions more in keeping with full thickness loss. Burning clothing in two patients resulted in minor full thickness burns, for which grafting was unnecessary.

INTRA-ABDOMINAL INJURIES

Two children suffered intra-abdominal injuries. One was caused by a sliver of wood 18 in (45 cm) long penetrating the left flank and entering the cortex of the left kidney. The wood was removed, the kidney preserved, and the wound closed by delayed primary suture. The other child sustained a "closed" laceration of the left lobe of the liver. This was not suspected until three hours after the explosion. The laceration was sutured.

INJURIES TO CRANIUM AND FACIAL SKELETON

One patient sustained severe damage to the frontal lobes and brain stem associated with multiple compound facial fractures

and a compound comminuted fracture of the skull. After intubation and transfusion a tracheostomy was performed, but before her injuries could be treated she died.

An 11-year-old boy sustained a compound comminuted fracture of the occipital and parietal bones when he was blown over. This injury was associated with cortical blindness and minor concussion, but it did not involve damage to the dura or venous sinuses. Immediate debridement and skin closure were performed. One week later the remaining fragments of bone were removed, and three months later the defect was closed with a tantalum plate. The cortical blindness has almost completely recovered.

A boy of 13 sustained a comminuted fracture of the mandible and maxillae. He also had facial burns and a few small lacerations. On the day of the incident the jaw was stabilized with wire and an airway maintained via a nasopharyngeal tube.

FRACTURES

There were 20 fractures of bones other than the skull and facial skeleton in ten patients. Except for an open fracture of the pubis the fractures were all confined to limb bones, and 10 were compound.

The fractures were initially treated conservatively with the exception of a fractured tibia and fibula associated with such severe vascular, nerve, and soft tissue damage that an amputation 3½ in (9 cm) below the knee joint had to be performed. Subsequent internal fixation was necessary in three patients. A very unstable simple supracondylar fracture of the humerus associated with a radial nerve palsy was treated by open reduction and internal fixation three weeks after the incident. The radial nerve palsy has partially recovered, but unfortunately myositis ossificans has developed.

A compound fracture of the right tibia and fibula with extensive anterior skin loss which required Thiersch grafts was the only fracture showing no evidence of union at 10 weeks. After the skin had completely healed this was plated and grafted with autogenous cancellous bone through a posterior approach.

One boy had a severely mutilated hand in which there were compound fractures of the three ulnar metacarpals and fractures of the little and ring fingers. The little finger was amputated on the day of the incident. A week later the wound was sufficiently clean for the metacarpal fractures to be stabilized with Kirschner wires and the hand to be covered with a pedicle graft from the anterior abdominal wall.

JOINTS

Two patients sustained open injuries to the ankle joint. In both patients the joint was initially cleaned, the capsule closed, and the overlying skin left open. Neither joint became infected.

LUNGS

Chest x-ray films showed evidence of contusion of the lower lobes of the right lung in two children. Fortunately neither patient developed "blast lung syndrome," and from this standpoint their clinical condition was always satisfactory. Serial x-ray films have shown that the changes have resolved. No other chest injuries were detected.

EAR INJURIES

Twenty-two patients with ear injuries suffered deafness, tinnitus, pain, and bleeding from the external meatus. There were 16 perforated ear drums in 12 patients. Audiograms showed varying degrees of sensorineural damage in 21 patients.

The initial treatment was always conservative. Local treatment was prohibited unless there were large pieces of debris in the

meatus. The patients were instructed not to allow their ears to get wet. Eight perforated drums healed spontaneously, and four myringoplasties have so far been performed, of which three were successful. Serial audiograms have shown varying degrees of recovery in those patients with sensorienural damage, but in only two (both children) has recovery been complete. One patient complained of total deafness, for which no organic cause could be found, and his hearing suddenly returned spontaneously a few days after the explosion. No damage to the inner ear causing leakage of fluid from the cochlear was detected.

EYE INJURIES

Four patients received eye injuries which would have necessitated hospital admission in their own right. One boy suffered a laceration of the left cornea, which required suturing, and multiple intraocular and intracorneal foreign bodies were detected in the right eye (probably cordite). The sight in the left eye is now satisfactory, but the right eye will be permanently damaged, and the right lens has been removed for post-traumatic cataract. Three patients had corneal abrasions, which responded rapidly to traditional conservative therapy.

MENTAL ILLNESS

Only four patients complained of psychiatric symptoms. For three weeks one woman experienced a severe exacerbation of her previous depression and anxiety neurosis. Another patient had similar milder symptoms. One man suffered from recurrent nightmares and agoraphobia on leaving hospital three months after the explosion. Another patient, referred to above, suffered from hysterical deafness.

These symptoms all improved with reassurance and tranquilizers.

FURTHER FOLLOW-UP

In all, 47 surgical procedures were undertaken on the day of the explosion and over subsequent weeks. Eight patients were in hospital for more than three months.

Follow-up is by no means complete, and it is hoped that further recovery will take place in those patients who still have symptoms. Many patients have returned to their own countries and further assessment of results is difficult.

Conclusions

The multiplicity and variety of injuries caused by an explosion may be considerable. Many doctors, nurses, and ancillary staff with the specialist skills of a large hospital are required to give adequate treatment to so many patients simultaneously. These skills and facilities are not readily available in every hospital, and this should be considered by the rescue services when they are evacuating a disaster area. A traffic-free route can usually be created through the most crowded streets to a major hospital by the police.

The initial assessment of each patient can be difficult and time-consuming, and preferably should not be carried out at the site of the explosion. Mobile teams are required only when casualties are trapped or where transport facilities are limited, delaying transfer to hospital. We agree with Boyd[3] that rapid evacuation of casualties to a large centre without any form of immediate treatment is to be preferred.

The classical precepts of radical débridement and delayed primary or secondary suture must be rigorously adhered to in the treatment of open wounds if complications are to be avoided. The frequency of serious ear and eye injuries after an explosion makes it imperative that the injured are all examined by an ophthalmologist and ear specialist at the earliest opportunity.

We are indebted to the members of the consultant staff of the hospital under whose care the casualties were admitted and to those others who treated them for their permission to publish this article. We are particularly grateful to Messrs. M. A. Bedford, R. J. McNab Jones, and D. Winstock, who advised us on the details and management of the injuries peculiar to their respective specialties.

References

[1] Caro, D., and Irving, M., Lancet, 1973, 1, 1433.
[2] Edwards, H. C., Recent Advances in Surgery, 3rd edn., p. 3. London, Churchill, 1948.
[3] Boyd, N. A., Annals of the Royal College of Surgeons of England, 1975, 56, 15.

Hospital Topics

Analysis of Services Available for Total Joint Replacement Surgery

J. R. W. MORRIS

Summary

The use of total joint replacement surgery has been growing in a manner which is poorly understood. This growth is more likely to be limited by saturation of the available medical services than by a limit to the number of people who could benefit from the treatment. Present indications are that services will be saturated in 1974 or 1975, after which 4600 extra people a year will go on to the waiting lists if demand continues as at present. Stability can then be achieved by either raising the clinical criteria for surgical treatment or making about 300 extra orthopaedic beds available each year, buffered from the demands of acute trauma admissions.

Introduction

After the introduction of any new form of treatment there are inevitably questions as to whether the treatment is clearing a backlog of disease or whether the scale of treatment is expanding to satisfy demand. There is no truly objective measure of the factors controlling the rapid growth in the use of total joint replacements, but the current limits to the growth of total joint replacement surgery can be identified. All the figures quoted here are taken directly or derived from four widely available source documents[1-4] and relate only to England.

Work Load Statistics

In 1972 there were 393 000 admissions to orthopaedic and traumatic beds. The ratio of acute to elective, or "hot" to "cold," orthopaedic beds is nowhere published, but the rate at which people pass through the orthopaedic waiting lists and become by definition non-acute admissions can be estimated. In 1972 there were 137 000 non-acute orthopaedic admissions and 23 000 people were admitted for arthroplasties of all sorts, this being the most detailed division of operational codings on the waiting list data tables. Thus, in 1972 non-acute admissions were 35% of all orthopaedic and traumatic admissions and arthroplasties represented 6% of all such admissions. These figures begin to emphasize the dominance of acute, traumatic admissions.

Oxford Orthopaedic Engineering Centre, University of Oxford, Oxford OX3 7LD

J. R. W. MORRIS, B.SC., D.PHIL., Research Officer

Since the determinants of actual service load are given more by bed occupancy than by crude numbers of admissions it is necessary to know the total number of beds available and the mean lengths of stay for different categories of patient. There was an average occupancy of 80% for the 20 000 traumatic and orthopaedic beds available in 1973, and the mean length of stay for all traumatic and orthopaedic admissions was 15 days. For non-acute admissions the average length of stay was 17 days, and for all arthroplasties, 70% of which were total hip replacements, the figure went up to 29 days—almost twice the average for all admissions.

Hence, 2 330 000 bed-days were used for non-acute orthopaedics, and 670 000 bed-days were used for arthroplasties. That is, 29% of all elective orthopaedic beds were occupied by patients undergoing total hip replacements. This last estimate agrees well with spot samples of orthopaedic practices.

Trends

A careful estimate based on a variety of sources showed that the number of total joint replacements increased by about 40% from 1972 to 1974—a rate of 18% a year. The actual figure will not be known until 1976, when the Report on Hospital Inpatient Enquiry for 1974 is published. The number of orthopaedic and traumatic beds available actually fell during the year up to 31 December 1973, though the fall was not large and the general pattern is for the number of beds to remain steady at around 20 000. Combining these figures with those given previously a forecast for 1975 can be made. Total joint replacements could represent 23% of all non-acute orthopaedic admissions and such patients could occupy 40% of all elective orthopaedic beds. If these forecasts are not fulfilled then the medical services for joint replacement surgery will already have become saturated, and many would say that this is certainly the case.

The only types of orthopaedic bed which are buffered from the priority requirements of acute admissions are those in specialist hospitals and private wards. The number of total joint replacements performed privately is unknown since these are not included in the inpatient inquiry report. Almost all further increases in the number of total joint replacements will have to occur in specialist orthopaedic hospitals and private beds.

The current waiting list of 12 000 for total joint replacements could increase by about 40% a year once service saturation is reached, probably within the next year. This is the amount by which, by all indications, the number of suitable candidates will initially exceed the number of admissions. In 1973 total joint replacements already had the longest median waiting time— 16 weeks—of any operative procedure, including tonsillectomy.