

Recent Advances in the Surgery of Trauma

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WITH 180 ILLUSTRATIONS



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Preface

MUCH attention has recently been focused on the surgery of trauma. The subject is vast, of increasing complexity, and coming to occupy an ever-larger proportion of surgical time and hospital resources. These seemed good reasons for adding this volume to the series of 'Recent Advances'.

The selection of the contents is the personal responsibility of the editor and I am well aware that some will look in vain for guidance on points which they will feel should have been included. The choice of subject matter is so wide that it is impossible to include everything. As far as practicable I have tried to concentrate on work not ordinarily the subject matter of standard textbooks. For example, general discussion of recent advances in the treatment of fractures has been omitted, whilst chapters on facial fractures and spinal injuries, which are not usually so fully covered in these works, are included. Developments in anaesthesia are covered in another volume of this Series.

A difficulty for contributors to a volume of this kind is to decide how recent an advance should be for it to merit inclusion in his chapter. If it is only to be read by other experts in his field nothing but the very latest work—perhaps only experimental work—qualifies; but if it is to be of use to those whose interests cover the whole range of the surgery of trauma some description of up-to-date practice must stand alongside the newest trends. I am grateful to the contributors for the blend which they have evolved since I asked them to attempt to interest the larger group.

To avoid disjointedness I have endeavoured to correlate individual styles of presentation so that the whole volume would read smoothly. It is a tribute to their indulgence that they have not objected to any modifications of phraseology I have made.

I wish also to record my indebtedness to Mrs. Gillian Crossley for much secretarial work and to Mr. Knightley and Mr. John Rivers of Messrs. J. & A. Churchill Ltd. for their untiring assistance and the help their experience has afforded me.

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CHAPTER 1

Organisation of an Accident Service

J. C. SCOTT

Introduction

THE history of the medical and social problems of the treatment of injuries is one of relative indifference from both the public and the authorities. All the compelling statistics which have been adduced in the last twenty-five years—in support of better organisation and treatment—if placed vertically would certainly reach into space. It is only in the last three or four years that the pressure of opinion has stimulated a serious demand for improvement. There is much to be learned about prevention and treatment, but the urgent problem is the improvement in organisation and methods in order to apply knowledge already available. Various interested bodies have recently devoted much time and effort in offering solutions to the problems involved (British Orthopaedic Association, Nuffield Provincial Hospitals Trust, Accident Services Review Committee). How practical their suggestions are, and how quickly they will be applied, remains to be seen.

The objects of the Accident Service organisation are to cater for all injuries *requiring hospital treatment*—to give them quick and efficient service—using all the modern methods available to return them to normal activity as quickly as possible. This means suitable (i) organisation; (ii) staff; (iii) accommodation; (iv) facilities for rehabilitation; (v) contact with ancillary and social services in regard to transport; (vi) facilities for undergraduate and post-graduate teaching, and (vii) enquiry into the many unsolved problems in prevention and treatment of injuries.

Organisation

The ease of organisation of an Accident Service is directly proportional to the concentration of the population to be served. In a country in which the population is so concentrated the difficulties are reduced to the minimum. A unit of population sufficient to command the services of all medical and surgical specialties should form the basis of the Accident Service organisation, and where this is confined to a radius of a few miles no difficulties arise. Where it is spread over many miles, bringing the highest standard of treatment to the patient at all times requires a more complicated organisation, more efficient transport arrangements, and a high standard of co-operation and sense of purpose on the part of all concerned. This applies

not only to the spectacular major injuries, but to the large number of minor injuries productive of so much unnecessary morbidity.

The population unit and geographical zone should be served from its centre by an Accident Service equipped to deal with all types of injuries at all hours of the day or night providing, in generous measure, all the facilities to be set out in succeeding paragraphs.

Where the spread of population makes it necessary, this central Accident Service should be supported by other units in appropriate centres throughout the area to be served. These may vary from well-equipped General Hospitals to small General Practitioner Units, according to local needs. In the General Hospitals there should be independent and fully-staffed Accident Service units dealing with all injuries to the locomotor system, and seeking assistance from the central Accident Service only in respect of the special injuries for which there is no local departmental organisation. The calls made upon the central Accident Service will vary with the volume of population, and the scope of the work undertaken at these peripheral units. Each person dealing with accidents should be doing so as part of an organised team. Elasticity is an essential feature of this type of organisation—to allow for the sudden bursts of serious and minor accidents which may appear.

Staff

The described basis of the organisation implies that in injuries requiring hospital treatment each medical and surgical specialty should deal with those in its own field. General practitioners should be encouraged to deal throughout with injuries which do not require hospital treatment, and by so doing would make their greatest contribution to this problem. The standard of medical education in this field should be improved, and the General Practitioner organisation should be such that in group practice one member of the firm is always available for this purpose.

The central Accident Service will need to be under the administrative direction of one individual. Because the majority of the patients suffer from fractures and extremity injuries it is logical that this individual should be an Orthopaedic Surgeon. He should be responsible for the general organisation, and for the treatment of the orthopaedic problems, but should not treat other types of injury.

A central Accident Service dealing with a local population of one-third of a million, and special problems such as head injuries from another one-third of a million, will require two maximum part-time Orthopaedic Surgeons, half-time Neurosurgeon, one-quarter time Plastic and Facio-Maxillary Surgeons, and part time assistance from other special departments—amounting to about 1 session per week. This type of unit will deal with approximately 200 out-patients per day. Resident staff for such a Unit

will be one Senior Registrar, two Registrars, four Senior House Officers, and one Registrar in Neurosurgery.

Staffing of the other Accident Service Units in the area will depend on local requirements. Proportionately greater Consultant 'cover' will be necessary in the General Hospitals, and a rota system in the General Practitioner Units, so that one person who is part of the team is always available.

It is essential that there should be Consultant opinion readily available at all times. The urgency of assessment and treatment of all major injuries can best be emphasised in this way. Three other essential members of the team are the Anaesthetist, the Radiologist and the Clinical Pathologist; without good services in these fields there can be no efficient management of injuries.

It is not possible to deal in any detail with the ancillary staff required. The need for secretarial staff, physiotherapists and occupational therapists is generally recognised, as is a 24-hour radiographic service. The extent of the clerical work involved is not appreciated, and the amount of time wasted by trained staff of all sorts in this direction should be reduced to a minimum.

Accommodation

There is considerable local variation in these requirements, and it is therefore impossible to set out in detail the accommodation necessary for the efficient management of an Accident Service. There are, however, certain functional requirements which should be borne in mind in the planning, and certain physical characteristics that should be common to all departments. Functional requirements are concerned with the fact that larger numbers of patients have to be dealt with daily, than in any other department. A small proportion of these (about 4 per cent) will require immediate resuscitation, and all the other life-saving adjuncts, such as oxygen, suction pressure and resuscitation to be immediately available. It is essential that the quantity and distribution of the accommodation should take these requirements into account, and provide for them separately. There should be a hospital entrance for the injured which is clearly labelled and easily accessible, and the severely injured should be immediately segregated from the rest. The registration and records should be adequately housed in the entrance to the block. The waiting space should be central and give access to the cubicles, treatment area, plaster room, X-ray and any other special services which are provided. If the facilities and staff are adequate a large waiting area will not be required. There should be a treatment area for fresh cuts, abrasions, burns and all wounds which require cleaning and dressing, but nothing more than one or two intradermal sutures. This should be laid out in a way that is most economic in the use of

nurses' and doctors' time. Curtains should provide the required privacy, and the whole area should be easily cleansible daily. Close to the treatment area should be the cubicles for examination. There should be a separate dressing station for infected wounds, and it may be possible to combine this with the septic theatre. There should be plenty of light and good ventilation everywhere. The waiting space should be comfortable and have a canteen. Steps should be taken to reduce noise.

A clean theatre, with pressure ventilation and good ancillary service is essential. Most of the work will be done under local anaesthesia, but a few patients after general anaesthetic will be allowed to go home, and some suitable recovery accommodation is necessary for those not being admitted.

Two good-sized plaster rooms are desirable, one *en suite* with the theatre and resuscitation room, and the other close to the waiting space. One can in this way be used as extended resuscitation space when this is required, as well as for immediate reduction of fractures. X-ray facilities, including fixed and portable sets should be available within the confines of the department. This is essential to avoid waste of time by patients and staff.

It is also advantageous to have the daily Fracture Clinic proceeding in the same area; this leads to ease of communication between all members of the staff, and reduces the need for duplication of services.

All patients with more than one injury should be admitted to the Accident Service. It is only by this means that delays in admitting patients, while busy residents argue about which is the more serious injury, can be avoided. Single injuries to be treated by other departments may be admitted either to the Accident Service or to the department concerned. This is a matter for local preference. In the Oxford Accident Service all injuries, except to eyes, are admitted to the Accident Service.

The beds for the patients requiring admission as a result should be located on the floors above the out-patient accommodation. About 35 beds will be required for each 100,000 of the population served. The proportion will be about half male and half female and children. This will depend upon there being provision of geriatric beds to which the elderly female patients can be transferred. Provision should be made so that some of the beds can be used for male, female or children as required.

A resuscitation/observation annex should be provided as part of the in-patient accommodation, with separate cubicles and all the facilities required for the management of severely injured and unconscious patients. Special cubicles will be required if the Accident Service is to be responsible for the treatment of burns.

A 'clean' theatre should be available at all times for in-patients, with all the necessary services—including anaesthetic room and plaster room. Efficient X-ray services are essential to the in-patient theatre/plaster room block. Clean dressing rooms should be provided either in the Wards or the theatre block, and there should be separate access to a 'dirty' theatre.

Rehabilitation

Facilities for rehabilitation are an essential part of the Accident Service. This magic word is much misused, and generally associated in the public mind with elaborate facilities. It should be thought of in terms of returning each patient to full physical, social and industrial recovery as quickly as possible. The doctor or nurse or physiotherapist having time to explain the implications of injury to the patient is an essential part of rehabilitation. The combination of apprehension and inadequate instruction often leads to much unnecessary delay in recovery. Time spent showing a patient how to walk in a plaster, how to use crutches, how to exercise a limb released from plaster, will speed their recovery, save visits to the Physiotherapy Department, and is collectively the best and simplest form of rehabilitation. This is by no means all that is required. The more seriously injured need also the physical means to aid recovery, and this includes a suitably equipped gymnasium, and a treatment pool. Most in-patient occupational therapy is diversional. This is not to be spurned as of no value in the patient's recovery; there are also those for whom it will form the basis for industrial retraining. The Almoner and other social workers should assist by bringing to bear all the organised social services available to help the patient and his family, and by so doing to impress upon him that the whole object is to reinstate him into his pre-accident position in society as quickly as possible, and that he must help in this process to the full extent of his ability.

A residential rehabilitation centre is of considerable value for a relatively small proportion of the seriously injured, and it should be possible, by suitable siting, to have one such unit available to serve two or three Accident Service zones.

Transport

In the organisation of the efficient management of injuries transport plays an important part. The present position is that emergency accident calls form a small and incidental part of the routine ambulance duties. They are said to make up rather less than 10 per cent of the total demands on the Ambulance Service. This being so, it is only to be expected that in general the speed and efficiency of ambulance service leaves much to be desired.

Ideally, specially designed ambulances, with crews trained in the management of severe injuries and the unconscious patient would be available to hurry to the scene of an accident, and there are many parts of the world where this service exists. It is neither practical nor necessary in this country. With an efficient radio-telephone link between ambulances and depot, and with so many ambulances on the road, it should always be possible by re-routing to get an ambulance to the scene of an accident before one is despatched from the Accident Centre. This means that all ambulance crews should be trained in the care of the injured, and emphasis should be placed

on the value and importance of their efforts. Radio-telephone links should be established between the ambulances and the Accident Centres, so that the driver can speak directly to the doctor on duty. He can obtain any advice needed, and also warn the Accident Service of what to expect.

Unnecessary moving and lifting of injured patients may be fatal, and all ambulances should be equipped with canvas stretchers which can be lifted direct to a suitable hospital trolley, thereby avoiding 'humping' the patient, and delaying the ambulance. Where distance and urgency create the demand, a suitable helicopter service should be readily available.

Teaching

If the standard of treatment of the injured is to be improved it is essential, as has already been pointed out, to put into effect in organisation and treatment things that have been readily possible and well known for many years. This should be the first step in any Accident Service organisation. Only when that is done will it be possible to tackle on a proper scale the problem of *advancement* of knowledge in regard to prevention and treatment.

It is most important that due thought and attention should be given to this aspect of the problem in the organisation of any Accident Service.

The central Accident Service should be equipped and staffed for undergraduate and post-graduate teaching. The latter should include regular meetings of all those working in the zone. The record system should include diagnostic indices for out-patients and in-patients, and all material translated to punch cards, so that it can be easily accessible. Much new work is necessary in relation to the chemical and physiological reaction of the different tissues of the body to injury, and both facilities and encouragement to do this work should be a *sine qua non* of any central Accident Service.

The Casualty Departments have always been the poor relation of the hospital service. They were not under the care of any senior medical staff, and were usually badly housed, often in basements. Their instruments consisted mainly of discards from the main theatres. This mentality remains to a considerable extent in many places. Only about half the departments in the country at present have even nominal supervision. This is one of the biggest problems to be overcome in organising an Accident Service. It must be taken right out of this sort of setting, dissociated from other medical and surgical emergencies and, above all, relieved of the casual general practitioner work which should not find its way to the General Hospital, and which has been largely responsible for the present state of many Casualty Departments.

CHAPTER 2

Prevention of Accidents in the Home

C. A. BOUCHER

DURING the last 10 years there have been 75,433 fatal accidents in the homes of Great Britain; more than 10,000 children have died in this way, most of them being under 5 years of age. Over this decade an average of 20 persons have died every day from a home accident. It would be reassuring to believe that, with the increasing publicity and the greater awareness of the hazards, the position would be improving; in fact there has been a steady increase each year in the number of fatalities, particularly from accidental poisoning, from falls and from burns; fatalities from scalds and electrical accidents have shown little change. Only in regard to suffocation has there been any marked improvement, and this may be due to more accurate certification.

The pattern of home accidents varies little from year to year. Fatalities predominantly concern the young and the old, for two-thirds involve infants and elderly people over 75 years of age; males are more often the victims until middle age, but in the later years females predominate. The trend has been towards an increasing proportion of these fatalities in the elderly and an improvement regarding children. When, however, all home accidents are considered, fatal and non-fatal, the picture is rather different; perhaps half affect children, particularly those in their earliest years, while accidents to the elderly are less frequent than might be expected but potentially more serious.

Causes and Incidence

The causes of fatal home accidents are shown in Table I, p. 8.

Home accidents are not notifiable, and thus their incidence can only be based on a study of the many local surveys that have been made. These suggest that perhaps a million home accidents occur in Britain every year requiring medical treatment for the injuries sustained. Many will be trivial but some produce considerable strain on the hospital services; it is not unusual, for example, to find many beds in the orthopaedic wards occupied by elderly patients with fractures of the neck of the femur.

Home accidents, particularly burns and scalds, have their highest incidence during the winter months. MacQueen, (1960) in a carefully conducted survey in Aberdeen, found that Monday proved the greatest day of risk

TABLE I

FATAL ACCIDENTS IN HOMES AND RESIDENTIAL
INSTITUTIONS IN GREAT BRITAIN, 1960

	Ages in years						Total
	0-4	5-14	15-44	45-64	65-74	75+	
Poisoning: solids and liquids	29	1	85	213	52	23	403 (5.0%)
Poisoning: Gases and vapours	9	16	140	267	224	499	1,155 (14.3%)
Falls	50	15	63	333	718	3,620	4,799 (59.2%)
Burns	77	44	71	113	104	258	677 (8.3%)
Scalds	26	1	3	11	13	25	79 (1.0%)
Electric current	2	2	18	17	4	3	46 (0.6%)
Suffocation	439	8	33	73	25	29	607 (7.5%)
Drowning	20	3	8	21	7	10	69 (0.9%)
Other accidents	108	40	60	42	27	43	320 (3.9%)
Total	760 (9.4%)	130 (1.6%)	481 (5.3%)	1,090 (13.4%)	1,174 (14.5%)	4,510 (55.7%)	8,145

for women, old people of both sexes, and girls of pre-school age, while Saturday proved the most dangerous day for school children and for men; the general picture suggested that the times of greatest danger are 'towards the end of periods of maximum activity', and there may be an association with fatigue. He was satisfied that certain families were accident prone. There are undoubtedly regional variations in mortality; males show a relatively high rate in the North of England and in Wales, and for both sexes there seems to be a definite fall in mortality rate from Scotland through the North of England and the Midlands, to the South.

Children are naturally curious and adventurous, and a survey in Edinburgh (Seiler *et al.*, 1954) showed that 40 per cent of the patients who were known to have needed hospital treatment for home accidents were under five years of age. Most burns and scalds in children must surely be preventable, and this assumes vital importance when one thinks of the physical suffering which they endured and of the mental scars which may have persisted. It is salutary to remember that in many instances of poisoning the child had access to medicines prescribed for adults in the household. The accident rate is high in old people, and increases with age. In a survey of living conditions of old people in Wolverhampton (Sheldon, 1948) there was constant reference to accidents, and an analysis of injuries in aged patients admitted to the Birmingham Accident Hospital revealed that more than half were of domestic origin (Fisher, 1955). Fatigue, forgetfulness accompanied by such physiological changes as failing vision, diminished hearing and sense of smell, muscular weakness and unco-ordinated movements are factors predisposing to accidents.

It is customary to attribute the cause of a domestic accident to some

unsatisfactory feature in the design of the home or to some fault in an appliance, and only rarely to human failing. There is also the complacent attitude which maintains that 'an accident cannot happen to me'. Usually there is a multiplicity of factors. The home may be of poor design, but more often neglected maintenance proves responsible. There may be ignorance of dangers that exist, fecklessness or gross misuse of appliances that were once safe. Tempest (1956), in a survey of domestic burns and scalds in Wales, found that most of them were preventable; he questioned the parents, doctors, medical students and nurses, about the 'Fireguards Act', flammability of clothing materials and the liability to prosecution in certain cases, and was dismayed to find widespread ignorance. Illness or disability will always render the individual more vulnerable, as will physical or mental tiredness. Nevertheless sensible domestic planning and discipline will do much to reduce the risk.

Burns and Scalds

About 800 deaths occur every year from burns and scalds in the home, most of the victims being children and old people. In spite of the publicity

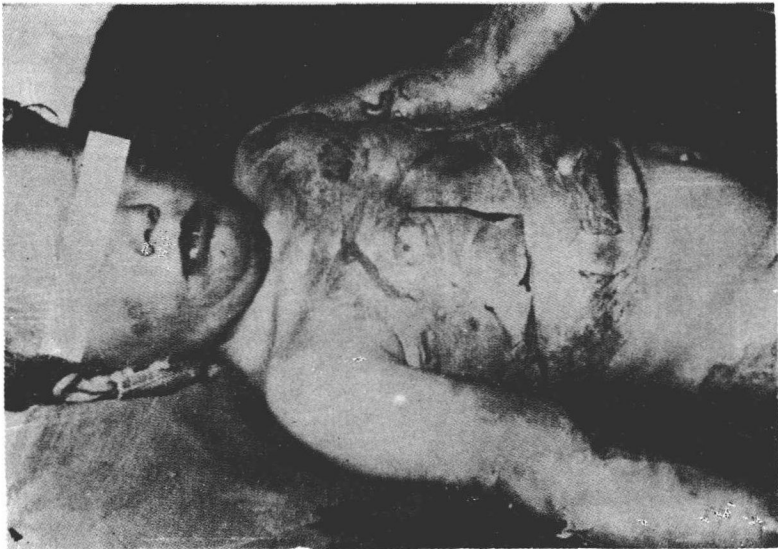


FIG. 1. A.B., aged 3, spilled pan of hot milk over chest.

given to this danger and in spite of the progress in modern surgical techniques, including transfusions and early skin grafting, this annual toll has altered little over the last decade. It is estimated that perhaps 50,000 people receive hospital treatment for burns and scalds each year, including 15,000



FIG. 2 (a). The extensive full thickness burns on the back and buttocks of this six year old occurred when his shirt caught fire from the naked flames of a gas heater.

FIG. 2(b). 18 days later dead collagen could be seen lying still partly adherent to early granulations. (Photographs from the Burns Unit, Birmingham Accident Hospital, Crown copyright).

who require hospital admission. The mortality varies in direct proportion to the area of the body burnt, and the risk of death increases with age. Half of the burns admitted to hospital result from clothes catching fire, and these account for four-fifths of the deaths; the nightdress, dress and shirt are most commonly the garments first ignited, while cotton materials, including flannelette and winceyette, or rayon are the materials usually involved. The open coal fire remains the greatest single menace and while this form of heating persists the danger can only be lessened by the use of fireguards, flame-resistant clothing materials and the substitution of close-fitting for flowing garments, (pyjamas for nightdresses). Scalds have a much lower death rate than burns but the incidence is little different, and the degree of disfigurement or disablement may be equally severe. Very young children are usually the victims and the most serious injuries result from falls into containers of hot water left on the floor or into baths into which the hot water has been drawn first. Overcrowding is a contributory factor and the kitchen is the most dangerous room, for here are found such hazards as the saucepan containing boiling water or fat, and the dangling flex from the electric kettle.

Falls

Falls account for about 60 per cent of all fatal home accidents and most affect elderly people, particularly women; three-quarters of the victims are aged 75 years or more. Sheldon (1960) made a study of 500 falls, of which 171 were truly accidental. The stairs were responsible for one-third, and he found that the most frequent cause lay in missing the last step, or the last group of steps, in the belief that the bottom had been reached. He also referred to the dangers of inadequate illumination. Sheldon concluded that the fundamental fact underlying the liability to fall in old people was a decrease in the number of healthy nerve cells available for control of posture and gait, but it was not known whether this atrophy was a direct result of the ageing process or whether it was based on ischaemia. The Royal Society for the Prevention of Accidents has produced a useful pamphlet* which recommends structural and personal measures to reduce the risk of falls in the home.

Poisoning

During the last decade there has been a considerable increase in the number of cases of accidental poisoning, particularly in the middle-aged and older age groups. Some of these accidents have resulted from careless storage of corrosive and other poisonous liquids. Heasman (1961) estimated that there are approximately 8,000 cases of poisoning annually among children seen

* 'How to Avoid Falls' (Ref. HS/L/18), 1959, price 6d.