

Clinical Surgery

ACCIDENT SURGERY

CONSULTANT EDITORS

CHARLES ROB AND RODNEY SMITH

CLINICAL SURGERY—3

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Edited by

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Abdomen and Rectum and Anus

Accident Surgery

Ear, Nose and Throat

The Eye

Fractures and Dislocations

General Principles and Breast

Genito-urinary System

Gynaecology and Obstetrics

The Hand

Head and Neck

Neurosurgery

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Plastic Surgery

Thorax

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PREFACE

A friend of ours, commenting the other day on the changing pattern of disease, referred to the virtual disappearance of tuberculosis from the operating lists in his hospital and reflected that cancer would perhaps within a few years similarly disappear. "But", he added "the surgeon won't starve. There'll always be trauma". Yes indeed, as the pace of life quickens surgical progress may well mean that man is getting better at treating trauma, but he seems to be making very little progress in discovering how to prevent it. In the new hospitals now being built ample provision for a comprehensive accident service is acknowledged to be an absolute necessity.

Who, though, in these departments of trauma should look after the patients? The day is long past when the task could be left to the most recently appointed surgeon to the staff of a hospital, who as "casualty surgeon" dealt with in-patient and out-patient trauma until retirement of a senior led to promotion to better things. Gone too are the days when traumatic surgery seemed in danger of becoming an offshoot of orthopaedic surgery. Broken bones must be treated correctly, but if a patient has a fractured femur and a visceral injury it is the latter which is the more likely to kill him.

An individual injured patient may require an abdominal operation, or a thoracotomy, or a craniotomy. He may present a problem in orthopaedics or plastic surgery or urology or he may have multiple injuries each one complex in its own way. He may be burnt as well as injured. He may well have in addition to the problem of the injuries themselves the problems of blood loss or electrolyte disturbance. No one surgeon can be expected to acquire the technical expertise necessary to cope with the more complicated injuries in all of these many specialties. Surgeons working in a department of traumatic surgery must form a team and between them provide what no single surgeon can hope to provide.

This volume is planned to emphasize the co-operative effort essential to the running of an efficient accident service. Thus, although individual problems in the treatment of the injured patient are covered by surgeons having a special interest and experience in each, a full description is also given of the problem posed by the patient with multiple injuries and a chapter is included on the organization of the accident service itself.

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CHARLES ROB
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CHAPTER 1

ORGANIZATION OF AN ACCIDENT SERVICE

PETER R. FRENCH

INTRODUCTION

Throughout the world the toll of human life and limb due to accidents is steadily increasing. Nowhere is this more notable or provides a more urgent problem than in the United Kingdom, with its densely populated areas and advancing mechanization. The problem is one which affects all walks of life and all age groups and its seriousness can only be judged by comparison with other causes of death or morbidity. Trauma now closely follows cardiovascular disease and cancer as a cause of loss of working years in adult manhood in Great Britain.

The subject has received the attention of the medical profession as a whole since the earlier part of this century, and that of the British Orthopaedic Association more particularly during the last 40 years. The most recent and most important recommendations have been those of the Accident Services Review Committee of Great Britain and Ireland which was set up by the Royal College of Surgeons following the Memorandum on Accident Services published by the B.O.A. in 1959 (Interim report, 1961); and of the Sub-Committee of the Standing Medical Advisory Committee (1962) of the Central Health Services Council. The implementation of the recommendations of these two bodies will be an essential part of combating the problem on a national scale. Clearly, a great deal of regional planning has still to be done. The major difficulty is that it is impossible to provide a plan which is applicable to all situations in the country. The aggregation of heavy industry in a city such as Birmingham allows of the feasibility of having an "Accident Hospital". This is not possible in a widely spread metropolis, and London produces its own special problems. The country districts again must be considered separately in view of the greater distances to be covered, transport difficulties and varying weather conditions. However, certain overriding principles can be laid down and these must be put into force soon in the face of a situation of increasing gravity. It is proposed, therefore, to deal with the organization of a service to treat accidents and emergencies on general lines, beginning with an outline of the present problems and difficulties. More particular reference will then be made to the requirements and construction of an accident department.

PRESENT PROBLEMS AND DEFICIENCIES

ACCIDENT RATE

The main causes of the increasing numbers of accidents are (1) the rapid increase in the numbers of high speed vehicles on the roads; (2) the increasing numbers of the working population involved in industry; (3) the advancing

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age of the population; and (4) the extension of mechanical devices in the home, and more complicated machinery in industry and agriculture.

From a national and industrial point of view, the accident rate in men and women of working age is of prime importance and the bulk of accidents occur on the roads or in industry. An excessively large number of accidents occur in the home, however, and these are largely in children and old people. The latter throw an enormous additional burden on the accident services and the Health Service in general because of the duration of their stay in hospital and their rehabilitation. The total number of road casualties in 1962 was 341,696 of which 6,709 were killed; the greater proportion of these were in working age groups, and the number of men far exceeded that of women. The 1960 figures show that men in the decade from 20–30 years have more than twice as many fatal and serious road accidents than in any other decade of life. In the same year the deaths due to accidents, violence and poisoning totalled 23,120 of which nearly a third occurred in accidents on the roads and a further third in accidents in the home.

DEFICIENCIES IN EXISTING SERVICES

At present, up and down the country, too many small, inadequately staffed and poorly equipped departments are being obliged to deal with accidents of increasing complexity. The high speed of road travel and the nature of machinery in the home and in industry are producing emergencies of a kind with which the smaller hospitals were never designed to cope. Moreover, in many places there is a complete lack of regional organization to provide for local needs, and many of the existing “casualty” departments are staffed by doctors and ancillary personnel who are relatively untrained in dealing with these problems. Because of this, the seriously injured have often to be moved from the hospital to which they are first taken, and the minor injuries take longer than they need to return to work.

Perhaps the biggest single bar to the efficient treatment of accidents is the present “casualty” department. As has been pointed out (Fry, 1960) the casualty department usually runs a general practitioner service, and the “casual” attendant provides well over 50 per cent of the work of the department. This is sometimes inevitable in an urban hospital in which people work at a distance from their homes and which may have a large migrant population. The general practitioner service, however, should be curtailed to the minimum and should not be dealt with in accident departments. The word “casualty” should be abolished in civilian life as applied to a department, a doctor or a patient. The renaming of the casualty department as an “accident and emergency department” would in itself discourage a number of the casual attenders. Because of the nature of the work of most existing casualty departments, the medical staffing is often of a junior and inexperienced level. The more senior surgeons who are on call in case of accidents or emergencies are usually involved in other routine duties in the hospital and therefore not sufficiently readily available when an accident arrives.

METHODS TO BE CONSIDERED OF COMBATING ACCIDENTS

There are four main lines along which the problems associated with the treatment of accidents in general must be approached; first, prevention;

PRESENT PROBLEMS AND DEFICIENCIES

secondly, the proper training of surgeons and ancillary personnel; thirdly, the regional planning of "accident and emergency" centres; and fourthly, the building of suitable departments in those centres. The main concern here is to deal more comprehensively with the third and fourth groups, but the first and second are no less important and must be considered briefly.

Prevention

The great majority of accidents can be prevented, which is another way of saying that the human element is of prime importance. There is no doubt that if the public as a whole could be induced to take more care there would be very few accidents. This, however, is only part of the problem, because, as people become tired, their liability to accidents on the road or at work increases. Also certain people are more accident prone than others, and provision cannot always be made to place such people in situations where they will not have accidents. However, much can be done by training the public in the proper use of machinery on the roads, in industry and in the home; this at the moment is being effected by voluntary organizations and more should be done on a national scale.

Roads and traffic.—As far as road traffic accidents are concerned, improvements should be aimed at in four obvious directions; first, the roads themselves, secondly, the vehicles, thirdly, the driver and fourthly, the pedestrians. The construction of new and better roads cuts down accident rates considerably; the accident rate on the M1 is very appreciably less than on the A5 for an equivalent number of vehicles passing. Where it is not practicable to build a new road or refashion an old one, the speed should be restricted. There are very few places in the British Isles, except the new motorways, where completely unrestricted speed is justifiable. The three-lane road, that is those having two traffic lanes and a centre passing lane common to both, should be abolished. The design of the motor car in the small and medium range should be altered to provide greater safety; tubular steel reinforcement of the body would prevent the concertina effect on impact, and the replacement of "dashboards" and panels by thick sorbo rubber and provision of telescoping steering columns would lessen the danger to driver and passenger; seat belts should be obligatory in all but convertible models. Old cars can be rendered safer by annual testing. It is difficult to make the driver of a vehicle more responsible or more considerate in his behaviour on the road, but a stricter driving test and more rigid enforcement of the Highway Code would do much to help in this direction. Last, but by no means least, the non-driving public must be educated or controlled in its pedestrian habits. More subways are required for busy thoroughfares and the correct use of pedestrian crossings and traffic lights should be taught.

Industrial machinery.—Concerning the use of machines in industry, suffice it to say that safety precautions require more strict enforcement, and in many cases need to be made more practicable. When using the sort of equipment which cannot be made reasonably safe, working hours ought to be curtailed to limit accidents due to fatigue.

Home accidents.—These are in many ways the most difficult to predict or prevent. The greater safety of fires of all sorts, washing and drying machinery,

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stairways and floor coverings still require improvement. However, the majority of accidents at home occur at an age when the control of the locomotor system is inadequate, in the very young and the very old. For these two groups the only safeguard is more careful supervision; children need to be put into day nurseries if the parents are too busy to look after them; and more provision in the way of homes or flatlets with resident nursing supervision is needed in the care of the aged.

Training of medical staff and ancillary personnel

A generation of doctors has qualified since World War II provided enforced tuition in traumatic surgery. As the results of trauma make up an ever increasing proportion of medical and surgical practice in civilian life, it is important that the principles of the treatment of trauma should be taught more intensively in the undergraduate training programme. At present the amount of time spent on fractures and casualty work in most teaching hospitals is pathetically small. In the organization of an accident service, general practitioners will take an increasing part in the treatment of more minor injuries and in the follow-up of more serious ones; it is therefore desirable that they should have a firmer grounding in the subject before qualifying. In the postgraduate training of a surgeon, the inclusion of a period of experience in trauma in registrar and senior registrar years is no less important, even if the chosen branch of surgery does not eventually involve much emergency work. All branches of surgery are likely to be involved from time to time, and the necessity for training dental surgeons in faciomaxillary work must be included in this. As the majority of accidents involve the locomotor system, trauma surgery must primarily come into the province of the orthopaedic surgeon. The training of an orthopaedic surgeon, therefore, must include some time in studying the work of thoracic, plastic, faciomaxillary and neurosurgeons. The idea, however, of the appointment of surgeons concentrating on accident work to the exclusion of all else is not recommended as a general rule, although there will clearly be some who find complete satisfaction in this field of surgery.

Of the ancillary personnel, those for whom special training in accident work is of most vital importance are the ambulance staff. Except in situations where a "flying squad" equipped with medically qualified persons is justified, the ambulance staff have to carry out first-aid measures, and on them falls the responsibility of choosing the proper centre to which to take a particular patient. The training of these people is therefore particularly necessary, and a definite programme should be laid down, including hospital work, to enable them to reach a reasonable standard of proficiency.

REGIONAL ORGANIZATION OF ACCIDENT SERVICES

The planning of a comprehensive service to provide treatment for accidents at all times of the day and night is a most complex problem. The differing needs of various parts of the country make it impossible to lay down a plan which would suit all circumstances; and, indeed, the exact requirements of each area have yet to be ascertained, in terms of numbers and types of accidents to be expected. However, certain overriding principles can be set

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out, and each region can adjust its planning to suit local needs. The regional hospital boards should carry out surveys in their regions to assess the extent of local demands, and then make plans, in conjunction with the teaching hospitals, as to the most suitable situations for accident centres and their size. It will be particularly important in country districts to make sure that there is co-operation at regional boundaries so that emergencies near a boundary will be taken to the nearest suitable centre.

ACCIDENT CENTRES AND THEIR SIZE

The British Orthopaedic Association have recommended that the country should be divided into accident service areas and that probably the ideal population for one of these areas would be 1,500,000; this, of course, is dependent to some extent on geographical considerations. The organization of accident centres within the accident area would be directed towards siting the centres at convenient hospitals serving a suitable head of population. It is considered that 35 beds per 100,000 population is an average requirement, but this will vary somewhat according to the needs of local industry. From the point of view of providing a 24-hour service the accident centre should not have less than 50 beds, as this would be uneconomical in the provision of medical staff. On the other hand, a centre having more than 150 beds would probably prove unwieldy. Thus, the hospital to choose for an accident centre is one serving a population of between 150,000 and 500,000. There is no doubt that an accident centre should be housed in a general hospital rather than a specialized one, but certain special injuries require treatment which is not economically provided on a 24-hour basis in every general hospital. It is therefore suggested that there should be three levels of hospitals dealing with accidents, the central unit, the general hospital accident unit and peripheral hospitals.

THE CENTRAL UNIT

At the highest level there should be a central unit, which can co-ordinate the accident services of the area: and besides taking all accidents in its immediate vicinity, it would provide for the treatment of special injuries in the area. These include neurosurgical, burns and other plastic problems, maxillo-facial and thoracic injuries. These complicated and often multiple problems would ideally be taken straight to the central unit, or may be sent there later for definitive treatment. The central unit, moreover, should be prepared to provide consultant opinion to any of the accident centres in its area. However, it is unlikely that all the specialties can be housed in one hospital and the special injury may therefore have to be sent to the appropriate unit. The central unit would conveniently, where possible, be attached to a teaching hospital and would therefore be able to provide training at undergraduate and postgraduate levels. It should also co-ordinate the training of ambulance personnel in the area and should assist the Civil Defence and other local authorities in educating the public in the prevention of accidents.

ACCIDENT UNIT SITED IN A GENERAL HOSPITAL

The accident unit is sited in a general hospital serving a population between 150,000 and 500,000. Thus in an accident area of 1,500,000 there

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would probably be between 4 and 6 accident units, having between 50 and 150 beds according to the population to be served and the nature of industry and highways in the area. It is important that the current bed occupancy should be not more than 75 per cent so that it is always possible to admit the victims of two or three road accidents at any time. To prevent beds becoming blocked, they must only be used for emergency purposes, and once the emergency is past the patients are transferred to the departmental beds of the speciality concerned. Thus, the orthopaedic problems, which provide the majority of the long-stay cases resulting from trauma, would be transferred to orthopaedic beds in the same hospital or to an orthopaedic hospital. The patient should not be taken to an orthopaedic hospital as an emergency. The difficult problems from the point of view of disposal are (a) the head injuries with prolonged unconsciousness, (b) the spinal injuries with paraplegia and (c) the elderly who live alone or where relations refuse to have them home again. It is an essential part of the organization of the accident unit that provision be made for patients in these three categories to be taken care of outside the unit itself.

PERIPHERAL HOSPITALS

Peripheral hospitals are those which have not the facilities, or do not warrant the staff, to deal with accidents and emergencies on a 24-hour basis. Such hospitals will deal with minor injuries and those patients who arrive at hospital otherwise than by ambulance. These so-called "minor" injuries, besides providing the numerical majority of the results of trauma, produce a great amount of disability in terms of loss of working hours, although they do not necessarily occupy many hospital beds. The treatment, therefore, of this class of emergency requires no less high a level of skill and attention if undue disability is to be avoided. As the minor injuries in the peripheral hospitals and clinics will be dealt with largely by general practitioners, casualty officers and house surgeons, it is all the more important that adequate training in traumatology should be provided at undergraduate teaching hospitals. It is also essential that the principles of first aid should be taught in country districts and to key personnel in industry. Perhaps the most important group of injuries commonly classed as "minor" is that of the injured hand, on the proper treatment of which depends the ability of the patient to return to his original occupation. In this type of injury it is very necessary for the doctor in charge to have a sound judgment of his own limitations and to send the patient to the nearest accident unit for more expert treatment at an early stage. Thus, there must be a close link between the peripheral hospitals and the accident units and, while the general practitioners organize their own rota for duty in dealing with accidents, the larger units will ensure that they are properly supplied with the essential equipment to do so adequately.

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The organization of an accident and emergency department will be considered on three particular lines, first, the building itself, secondly, the equipment and thirdly, the staff.

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BUILDING

It is clearly not always possible to provide new buildings for the reception of accidents, nor is it profitable at present to do so as there are widely differing conceptions as to the sort of building required. It is, therefore, often necessary to modify existing buildings. The average "casualty" department is designed, and mostly used, for dealing with "casual" patients and walking injuries with occasional stretcher cases. The first requirement, then, is the separation of the casual patients from the severely injured, and adequate accommodation made for the reception of the latter.

In considering the main requirements for building an accident department or modifying existing buildings, certain basic needs can be put forward and the building can be adjusted to suit local conditions.

General considerations for reception

The first and most important consideration is that the casual patients and those with minor injuries should not interfere with the arrival and prompt treatment of the more seriously injured and other emergencies arriving by ambulance. This presupposes a separate entrance and special reception area for all stretcher cases. There is clearly no discrimination on arrival between accidents and other emergencies, as the ambulance personnel are not expected to make a diagnosis. All seriously ill and severely injured patients are therefore taken to the same resuscitation area for preliminary examination and emergency treatment. The resuscitation room must be situated next to the reception area so that there is the least possible delay between leaving the ambulance and the beginning of emergency treatment. This room can be divided into cubicles to separate one patient from another and male from female, or children from adults. Radiological facilities must be provided in the resuscitation room either by portable machines or by an x-ray bay off the main room, so that x-rays may be taken without moving the patient more than a few yards or shifting him off the trolley. Ideally there should be a separate space for those patients with septic wounds but this is not usually possible in the resuscitation room, nor is it usually possible to subdivide clean from septic cases before they enter the resuscitation room.

Conveniently near to the reception area for ambulance cases should be sited the separate reception area and waiting space for minor injuries, to avoid undue duplication of staff. Here it may be necessary to divide male from female patients and to provide separate accommodation for children; this depends upon how much privacy it is possible to provide for patients in the department. It is certainly desirable to have a separate waiting room for children. It is not usually necessary to have separate accommodation for new and "old" patients, as patients returning for second and third visits can be told to come at off-peak periods. A proportion of patients returning after their first visit will be directed to particular clinics, for example fracture or septic hand clinics. While all new patients must be seen by a doctor and a large proportion require treatment by him, at subsequent visits only about one in every four requires medical treatment. A further important consideration is the provision of adequate space for recovery from treatment, including minor operations whether with or without anaesthesia. If space permits, there should

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be a small short-stay ward attached to the emergency department where the serious injuries can be supervised while recovering from their emergency treatment, and where patients arriving at night can be dealt with without disturbing a main ward.

Accommodation required

With these general considerations in mind, the requirements in terms of rooms within the accident and emergency department can be defined. The actual space given to each part of the service will vary according to local needs and it is desirable, before building or rebuilding the department, to have a precise quantitative analysis of the work to be undertaken. It must be remembered that a number of hospitals which now receive serious emergencies will no longer do so, and therefore the analysis will have to be done on a regional basis to ascertain the work to be undertaken by a particular accident unit.

The accommodation required is as follows:

(1) Entrance for stretchers leading directly through a small reception area with a bay for trolleys.

(2) Resuscitation room; this should be sufficiently large for the reception and emergency treatment of at least four seriously ill or injured patients at one time.

(3) Entrance and reception area for walking patients. This may well include space for transport personnel.

(4) Examination rooms, which should also have all the equipment for treatment by a nurse. It is thought (Department of Health for Scotland, 1961) that "multi-purpose" rooms in which a doctor can examine the patient whether walking, in a wheelchair or on a trolley, write the notes and examine x-rays provides speed and flexibility for the doctor's work and privacy for the patient. The patient can then remain in the same room for treatment by a nurse, which three-quarters of the patients will require, while the doctor can move on to another room. This probably does not increase the amount of walking done by the doctor, and, as the doctor can move faster than most of the patients, leads to greater efficiency. This arrangement also means that male and female, children and adults can be dealt with in the same part of the department.

(5) Waiting space must be adequate for patients and relatives while waiting to be seen and, if requiring transport, while waiting to go home. It will also be required by patients waiting the return of their x-rays or for the application of plaster of Paris. There must be separate waiting space for children and their accompanying adults. Lavatories are to be provided off the waiting areas.

(6) Operating theatre requirements depend on the distance from the emergency department to the main operating theatre suite. The accident centre requires its own major operating theatre and it must be decided in planning whether to have separate staff for a theatre in the emergency department, or to have the special theatre in the main theatre suite. Apart from the theatre for major accidents, the emergency department requires two theatres for minor operations, one for clean cases and one for septic cases. Practically all

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treatment that needs to be performed by a doctor himself is done in one of the operating theatres where he can work unhampered in reasonable conditions. Each operating theatre must have its own sluice, scrubbing-up room, anaesthetic room and waiting space.

(7) The plaster room should be of sufficient size and adequately equipped for the reduction of fractures under general anaesthesia. It is usually convenient to have the fracture clinic in close association with the emergency department so that the same plaster room can be used by both.

(8) A recovery room can conveniently be shared by the minor operating theatres and the plaster room. This requires its own sluice and lavatories.

(9) A short-stay ward should be attached to the emergency department for those patients whose length of stay does not warrant admission to the main wards of the accident unit, and for emergencies arriving at night to save disturbance in the main wards. This can be used as an observation ward for head injuries of doubtful severity and for patients with drug overdosages. This ward requires its own sluice, lavatories, bathrooms and kitchen.

In addition to the accommodation mentioned above, arrangements must be made for the staff which includes duty rooms, and sitting rooms, changing rooms, lavatories and wash rooms for medical and nursing staff, clerical staff and porters. Additional space is required for storage, medical records and cleaning equipment.

Siting of accident and emergency department

Clearly, the situation of the accident and emergency department must be such that it is easily accessible to ambulances and other forms of transport. There must also be easy access to other departments in the hospital to which patients from this department are likely to be referred. The most important of these is the x-ray department, and if the main x-ray department is some distance away or is on a different level, the emergency department should have its own x-ray department. There should be an easy internal route to the main wards of the accident unit and these must be near to the major operating theatre of that unit. Ideally, this theatre is next to the resuscitation room, with wards adjoining; in this case the short-stay ward can be a side ward off one of the main wards, which would obviate the provision of separate service rooms. The main working space, preferably a number of "multi-purpose" examination and treatment rooms, should be so grouped as to avoid unnecessary perambulation for patients and staff and be within easy reach of the waiting spaces. The theatre suites and resuscitation room must be so situated that they cannot be used as thoroughfares.

As the reorganization of the accident services makes the requirements of an individual accident unit difficult to predict, and also the number of accidents is steadily increasing, the emergency department should be constructed so as to be capable of expansion.

Communications

Simple and efficient communications are essential to the smooth running of the department. The outside information of the utmost usefulness is advanced warning by police or ambulance drivers of serious accidents,

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particularly in respect of the number of seriously injured patients to be expected. This will allow time for adequate space to be made available and for medical staff to be in readiness. Inside the department, a signalling system may be necessary for the porter at the entrance to inform the necessary staff when a stretcher-borne patient arrives. Such warning is not usually required for walking or chair-borne patients, but in their case, the receptionist must be in communication with the nursing staff for a steady supply of patients to the examination rooms to be maintained. In cases of emergency both the porter at the entrance and the receptionist must be able to call on a nurse for assistance at a moment's notice. In the working area, there must be some local convention by means of which the nurse and doctor can tell which room is vacant and which occupied by a patient, and what state of examination or treatment the patient is in. An open door to a room might signify a state of emptiness, while a folder or treatment card in a slot on the door shows that the patient is waiting to be examined. The nursing staff should then inform the receptionist when the room is again vacant. Above all, the internal communications must be simple, and, if possible, quiet; systems of lights being better than buzzers or bells.

Sequence of movements in department

In order to plan the relative position of various parts of the department an analysis must be made, on a regional basis, not only of the numbers of patients likely to be seen per day, but also what proportion of patients require a given part of the service. It is also desirable to know which sequences of movements in the department are the most common, so that these sequences can be facilitated and time saved; for instance, the commonest ancillary service to be used is the x-ray department, and therefore the route from the examination room to the x-ray department must be made as simple and short as possible. This seems to be particularly important for the return journey, as very often the patient is accompanied by a nurse on the way to the x-ray department, but has to find his own way back.

The most usual sequence for the patient to follow is that after registering at the reception desk, he is directed to an examination room, and, if this is a "multi-purpose" room, treated in the same room; after treatment, he is allowed home and advised to return to the same department for review or further treatment. This sequence accounted for about 45 per cent of new patients in a survey done by the Sub-Committee of the Standing Medical Advisory Committee (1962). This survey comprised 104,660 new patients seen in one week in 789 hospitals in England and Wales in 1960. It is of interest to note that in this survey only 25,861 patients came through a general practitioner, whereas over twice that number arrived of their own volition: this indicates a large proportion of "casual" patients which it is hoped to diminish in an accident service. Nearly 10 per cent of the total arrived by ambulance, and almost the same percentage required in-patient treatment.

In another series analysed by the Department of Health for Scotland (1961) 4,000 patients attending one hospital over a 10-week period were considered. For this survey, the serious injuries amounted to about 10 per cent. Children aged under 15 years accounted for 30 per cent of the total, a

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somewhat larger proportion than in the former series. It was found that 39 per cent of the new patients were sent for an x-ray examination. Seventy per cent of patients required treatment in the emergency department, and these were made up of 45 per cent who were treated by a nurse, 17 per cent requiring suturing of wounds, 5 per cent had plaster of Paris applied, and 2 per cent needed more extensive treatment in the operating theatre. In-patient treatment was required by 9 per cent, 3 per cent were referred to out-patient clinics other than orthopaedic and fracture clinics, 45 per cent were discharged after one visit and 38 per cent were told to return to the department; the latter figure includes those returning to the fracture clinic and orthopaedic out-patients. The proportion of "old" patients to new in this series was thus 1.2 to 1. Of patients returning for a further visit 38 per cent were discharged after being seen by the doctor without requiring any more treatment.

Accommodation per volume of patients

In the latter survey it was possible to estimate fairly accurately the proportion of patients with various injuries, together with the pattern of events which was likely to ensue after they had entered the department. The difficulty arises in planning a department in a hospital chosen for an accident centre, which has not only to cope with its own known turnover of emergencies but also a share of the patients from surrounding smaller hospitals. The accommodation required can however be estimated with a certain degree of accuracy by knowing the absolute number of patients to be dealt with, the number of hours in the day during which the majority are likely to attend and the proportion of the various types of injuries. If, to this information, is added the number of patients arriving at peak hours and the numbers and seniority of staff available, much more precise planning becomes possible. The busiest time in most departments seems to be between 9 a.m. and midday, but this is partly accounted for by the fact that it is usually organized for most staff to be available at that time and a large proportion of old patients are therefore told to return then. In many places there is a second peak in the late afternoon, and serious injuries on the roads often occur at this time during the homeward rush. If the peak hours for new patients in a given locality can be assessed with some accuracy, the "old" patients can be told to come back at "off-peak" times. On an average, a given doctor can see $2\frac{1}{2}$ "old" patients in the time it takes him to see one new one, but the time varies considerably between doctors, and the more senior the doctor the smaller the proportion of old patients. The department should be planned to deal with the numbers that usually arrive at peak periods, and if occasionally the expected peak is exceeded it is reasonable to make non-urgent cases wait while more serious injuries are dealt with and treated.

If the recommended "multi-purpose" examination-cum-treatment room is adopted, the number of rooms required can be assessed when the ratio of new patients to old and the number of doctors in attendance is known, together with the total number of patients arriving during the 3-hour peak period. On the lines of the general considerations discussed above the Department of Health for Scotland (1961) has suggested the following type of estimation. The average time for a doctor to see a new patient is 8 minutes and