PLANNING FOR HEAD INJURIES*

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Several factors in recent years have combined to arouse interest in future planning for the treatment of head injuries in this country. Peripheral hospitals are emphasizing the need for improved regional services based on the existing neurosurgical units or forming part of a more integrated plan for the accident services of the country as a whole.

The main concern is the rising accident rate. At a conservative estimate between 40,000 and 50,000 cases of head injuries require in-patient treatment in Great Britain every year. Apart from the large number of cases, head injuries now take high rank in the mortality from accidents of all kinds, and particularly from road accidents. Improved methods of treatment, the ready availability of antibiotics, and blood transfusion have lowered the mortality from other injuries, so that head injury now accounts for nearly three-quarters of all fatal road accidents. Surgeons realize that it is no longer possible, in busy centres at least, to commit themselves to take on accidents, including head injuries, as an appendage to the normal surgical working day. The surgery of trauma has become a major part of surgery of any general hospital and has to be arranged for accordingly.

The development of neurosurgery and the establishment of neurosurgical units has led to a more active management of the acute head injury. By the same token this specialization has led many general surgeons to seek transfer of head injuries to special centres. However, even when the surgeon is ready to continue treatment of these cases he may find himself handicapped by the limited resources of the building and of the nursing staff. The degree of observation and skilled nursing needed for the acute head injury may overstrain a nursing staff already taxed to the full by the ordinary surgical commitment of the hospital. Where there are large wards without adequate side-rooms, it becomes difficult and embarrassing at times to treat restless and confused patients. Neurosurgical units are now accustomed to receive frequent requests from other hospitals to take over the management of a patient with a head injury, not because of any particular surgical complication, but for the additional nursing facilities which it is hoped the centre may be able to provide.

Neurosurgical Units

Until recent years the neurosurgical units in the country, because of the smallness of their numbers and their primary concern with brain tumours and the like, were unable to take a major part in head injury work. Depending on circumstances, the amount they were able to do varied from very little to accepting, so far as possible, selected cases from the periphery, which in most instances meant certain complications such as

subacute subdural haematoma and cerebrospinal fluid rhinorrhoea. The majority of the complications which occurred in the first 48 hours after head injury remained in the care of the surgeons at the admitting hospital. In other areas, quite apart from shortage of beds, distance and transport were, and still can be, prohibitive factors. Thus, in the West Country, the distance from the nearest neurosurgical unit at Bristol may be over 150 miles, and in Scotland weather and roads combine to make transfer of patients hazardous during certain periods of the year.

In the last 10 years, however, neurosurgical units have entered much more into the management of head injuries, and, apart from the impetus given by the

FIG. 1.—Distribution of neurosurgical centres. The numbers refer to the neurosurgeons at each centre, those in London being grouped geographically.

factors mentioned earlier, there has been an increase in the number of neurosurgical units and of neurosurgeons. Fig. 1 shows the present neurosurgical distribution in the country on the background of density of population. It can be seen also where further units are required. These developments have led to a much more equitable division of neurosurgical work, so that with a few exceptions waiting-lists are now smaller, and the general impression is that units are able to accept more head injuries, although still, in most instances, with insufficient beds and staff to assume anything like a full regional service. In Oxford the position is no different,

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for with the limited number of beds in the neurosurgical unit it would not be possible to treat other than very selected cases. Fortunately, however, there has been another development in this hospital—that is, an accident service which deals with head injuries—and it may help in the discussion on planning for head injuries in the future to describe briefly our methods and experience.

Head Injury Service in Oxford

For our present purposes there are two features of interest about the accident service. One is that because of local circumstances all the accidents in the city of Oxford and environs are admitted to it. These include all the head injuries requiring admission to hospital. The second feature is that all the head injuries come under neurosurgical care, and it is thus possible to discuss a series of unselected head injuries provided with full neurosurgical cover and ancillary services from the outset.

There are no "head injury beds" as such. The accident service has one main ward, which contains 25 beds for male patients, together with a cubicled annexe of six beds, each equipped with suction and oxygen. This annexe has additional nursing staff, and to these beds are admitted patients of either sex who require resuscitation after injury or special care. Other beds are provided in one of the female wards and also in the children's ward, to give a total complement of 60 beds. (This arrangement would be improved further if all the accident service beds could be grouped together.) Unconscious patients are admitted to the annexe and, after the acute stage is over, go to the main wards, where the less severe head injuries are admitted direct.

From the point of view of head injury there are at least three major advantages of treatment within the compass of an accident service. The first advantage, and the main one, illustrates a basic tenet in planning for trauma—that is, the need to plan for patients who have sustained accidents, and not only for particular injuries. Modern accidents mean that there are patients with multiple injuries. A person may injure not only his head but his chest and femur as well. The Table shows

Other Injuries Sustained by 821 Patients with Head Injuries, All Direct Admissions. 269 Patients Sustained 383 Other Injuries, an Incidence of 32.7%

Injury	Total
Fractures	332
Face	107
Malar only	50
Nasal bones only	20
Maxillae	37
Upper limb	108
Clavicle	40
Shoulder	14
Humerus	6
Forearm and wrist	35
Hand	13
Lower limb	75
Pelvis	15
Femur	17
Knee	6
Leg	32
Foot	5
Spine	25
Body	15
Processes	10
Thorax	17
Ribs only	17
Chest (12 with rib fracture)	13
Abdomen	8
Spinal cord and peripheral nerves, without fracture	8
Eyes	7
Major facial lacerations and soft-tissue injuries	15

an analysis of a series of unselected head injuries where no less than 32% of patients had injuries elsewhere in addition. In the accident service at Oxford, although every patient admitted is under the immediate care of one of the orthopaedic surgeons or the neurosurgeon, there is also available a 24-hour service from the chest, dental, and plastic units, and from the general surgeons

for abdominal injuries. Within such a system the priorities for the treatment of patients with multiple injuries can be readily arranged and appropriate treatment given. Special units are here to stay, but in treating trauma the closest liaison must be maintained. The incidence of multiple injuries is rising, and these cases now play a not inconsiderable part in the mortality rate after head injury.

The second advantage of an accident service is that a ward devoted solely to accidents brings with it an elasticity in bed occupancy not met with in any other department. The turnover is considerable, and with the very varying demands it is much easier to arrange for emergencies.

A third advantage of treating head injuries within an accident service came to light when a large number of these cases were treated. It was found that the

FIG. 2.—Mortality rate of closed head injury in a consecutive series of 4,000 cases. Oxford, 1948-57.

uncomplicated head injury did well in the atmosphere of a general accident ward and that such a ward, with its majority of young patients who, apart from their injuries, were otherwise healthy and full of life, was the right atmosphere in which a patient after cerebral concussion could gain confidence for the future. For these cases it compared favourably with the more sombre atmosphere of a neurosurgical ward. In planning one tends to concentrate on the severe cases, but it should not be overlooked that with head injuries one is dealing with a condition which should have at least a 90% chance of survival. Moreover, 80% of the patients have less severe degrees of head injury, and most of them may be expected, with adequate care and rehabilitation, to return to their previous work with little or no disability. Indeed, from an economic standpoint these latter patients are the more important.

The results of management of 4,000 consecutive head injuries within the accident service in the years 1948 to 1957 are summarized in Fig. 2. There was an average mortality rate of about 5%.

Regional Service

In addition to treating all head injuries admitted directly from the immediate area, a regional service has also been developed. Surgeons at other hospitals in the region discuss management over the telephone or request transfer of selected patients. Where transfer is

not appropriate, a neurosurgeon has gone to the hospital, but with the ready communication in this region transfer has in most cases been the better solution. Where there is a real urgency patients can reach this hospital quickly and be operated on at once if need be. A small operation trolley is ready night and day, so that exploration can be immediate. In this way over 500 patients with major head injuries in the region have been transferred over the past 10 years. In about one-third of the cases the reasons for transfer were suspected cerebral compression, which was proved in just over half of them; compound fractures of the skull accounted for one-third; and major head injuries with special features for the remaining third. An analysis of the first 250 patients so transferred showed a mortality rate in this major group of only 12.2%.

These figures demonstrate again what was shown in war injuries, that as a group head-injury patients travel well. Their aftercare is often as important as any emergency operation required; moreover, in some patients the full range of ancillary investigations may be needed for their treatment. There are therefore cogent reasons for advising transfer of a patient to the centre, wherever this is practicable, if the maximum benefit is to result from skilled help. For treatment to be effective a decision to transfer has to be made sooner rather than later, beds have to be available, and the hospitals must have ambulances at immediate call. Advice on the care of the unconscious patient during transport, and in particular the management of the airway, has been described elsewhere.

In the past few years we have investigated, in conjunction with the Army neurosurgical unit at Wheatley, Oxfordshire, the possibilities of a helicopter service for head injuries. It is possible to transfer unconscious patients safely with full nursing attendance and care, including the availability of oxygen and suction. Several patients have now been transferred by helicopter from all parts of the country, and it is surely a part solution for selected cases otherwise isolated from a main centre. I understand that the present cost is about £40 an hour.

Training

Grouping of head injuries at special centres or accident services provides opportunities for undergraduate and postgraduate teaching. The junior housemen attached to the accident service at Oxford take their turn in looking after head-injury cases and gain experience in their management. Students during their dressership on the service have a series of teaching rounds on head injuries. Most encouragingly, in recent years consultant surgeons from other hospitals in the region, by arrangement with the Regional Hospital Board and the Board of Governors, have joined the unit at Oxford for varying periods to gain further experience for the management of head injuries in their own hospitals. This arrangement has also improved the liaison between surgeons at the centre and at the periphery, an invaluable factor when dealing with emergencies and deciding on the wisdom or otherwise of transferring patients.

Discussion

From these observations it seems permissible to draw a few conclusions. There would appear to be a good case to plan head injuries as a regional service based

on the neurosurgical unit within or in close association with a major accident service. We will shortly be reaching the time when with some modest adjustments it will be possible for neurosurgical units to take on, in addition to their present commitments, the management of the severer head injuries in their regions, along the lines that have been set out. It must be possible for the peripheral hospitals to transfer quickly and efficiently patients about whom they are worried, and, in order to keep the system running, to receive them back as soon as any specialist treatment or observation is finished. There may also be advantages if a few neurosurgical units in the country could admit all head injuries in their immediate area, both for training purposes and in order to obtain a better overall picture of management and progress. Certainly postgraduate facilities should be arranged for surgeons and nurses from peripheral hospitals, and it should also be noted that visits from the centre to the periphery will help to cement the liaison that is essential.

It should be noted that the regional arrangements would apply to selected cases. There are several reasons why it is not only impracticable but undesirable that all head injuries should be transferred to special centres throughout the country. 80% of these patients will, with ordinary surgical supervision and nursing management, make an uninterrupted recovery. To transfer such patients is not only unnecessary but extremely expensive, both to the Health Service and to the relatives and friends who have to travel long distances to see them. Moreover, the speed of their recovery may be hindered by their being so far from home. It is also clear that some patients would suffer by a routine policy of transfer. For example, some of those with multiple injuries are unsuitable for transfer. No one soon after an accident can fully assess with accuracy all the injuries sustained by a patient, and major injuries to other parts of the body may easily be overlooked, particularly in the setting of a major head injury. A policy of early routine transfer would certainly include some patients who would be better rested, treated for shock, and fully evaluated. There is also the occasional case of rapid cerebral compression, where operation to be effective at all has to be immediate. That there are contraindications to transfer is not to suggest that they apply to many cases, for they do not; but their existence emphasizes that any planning must take cognizance of the fact that arrangements have to be made for the treatment of a group of patients who of necessity must remain and be treated at the area hospital. Moreover, nursing of the unconscious patient should not of itself be a reason for his transfer to a neurosurgical or head injury unit.

Arrangements for dealing with accidents in any particular locality will rightly depend on local circumstances, but the present haphazard scheme of admitting accidents to any hospital in the county and city is uneconomic and inefficient. Not every hospital can be equipped with the 24-hour nursing and resident medical staff to cope properly with accidents. What is needed is an arrangement in each area to decide where major accidents—and these will include major head injuries—should be concentrated. At these designated hospitals there should be an organization for accident work which would include not only the staff and equipment but surgical wards and side wards with facilities for nursing the unconscious patient and those

requiring resuscitation. These hospitals would work in close co-operation with the special units—chest, plastic, neurosurgical—in the region, which should if possible be grouped together, and thus provide complete accident cover.

It has been suggested that the treatment of head injuries could be planned by opening up numerous "sub-areas" of neurosurgery, where a lone neurosurgeon with limited facilities would work. This suggestion still ignores the simple fact that accidents go to the nearest hospital, and, although it is essential that in the future this scheme should be streamlined further and hospitals be selected for major accident work, any organization must take into account the treatment of patients in hospitals to which they are first admitted. Specialist services, and particularly those of neurosurgery, are far better concentrated, and it is wiser to have several neurosurgeons in one centre with full ancillary services, providing between them an efficient 24-hour service, than to have individuals distributed throughout a region.

The peripheral hospitals, however, are not concerned only with the treatment and disposal of cases of major head injury. How essential is it to admit patients with minor degrees of concussion to hospital? And can beds be saved in this way? Our experience is that this work, although undramatic, is most valuable. To admit patients with minor degrees of concussion allows one to diagnose early the case that develops such a complication as an extradural clot, and this period of observation can also be properly used to determine the pattern and speed of the patient's subsequent progress. A short rehabilitation programme during the two or three days' observation is a major factor in the prevention of the post-concussional syndrome. It has for some years been our policy to follow up nearly all our patients until they have become symptom-free and have returned to work. It has been found that the number of cases of post-concussional syndrome arising among the in-patients is very small, but many more examples are seen in patients who, because of the mildness of their injury, have not been admitted to hospital. Quite apart from the surgical potentialities, the admission of these patients, short of wasting beds, results in a very considerable economic saving to the country in weeks off work and helps to restore them to health more quickly.

Finally, one should reiterate that head injuries constitute only one facet of the accident services of this country. A good deal has been heard lately of the need to plan for occasional national disasters such as railway accidents, but a more urgent problem is the treatment of the hundreds of daily accidents on our roads and in our homes.

Both problems can be solved if in every region an efficient accident service is planned, based on area hospitals, each having an accident service that serves also a group of smaller peripheral hospitals with which they work in concert. Special units would be grouped around a main accident service at the centre. Once such a system is established, it can deal with most situations. In the Radcliffe we had experience of this at the time of the Didcot rail disaster in 1955. It was found quite possible to provide additional beds in the hospital quickly by sending some patients home and transferring others. Thus it required no alteration in the system of the accident service to deal with the 54 casualties

admitted. A week-end road disaster in which 10 or more people are involved and arrive in hospital together is unhappily a common occurrence in all major hospitals, and a plan that deals with this quickly and efficiently can be readily expanded. Better hospital facilities are required, but much can be done by harnessing our existing resources. A good deal of what is required at this stage can come from organization within the profession.

THE CARDIAC MURMUR IN RELATION TO SYMPTOMS IN THE NEWBORN

BY

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During the first few hours of life a cardiac murmur is often heard in the newborn baby. The murmur increases in intensity towards the end of systole, sometimes continuing through the second sound. It has been attributed to blood flow through a persistent ductus arteriosus (Burnard, 1958). This paper describes the relationship between the presence of this murmur, a previous history of asphyxia, and the maturity and the clinical condition of the baby. Both asphyxia and dyspnoea were associated with a higher incidence of the murmur, particularly in premature infants.

Materials and Methods

Murmurs were identified by auscultation and recorded with a phonocardiograph as previously described (Burnard, 1958). Asphyxia was regarded as being present when there was a delay of three minutes or more in establishing normal breathing after birth, or, in a few instances, when there was severe foetal distress (even though normal breathing began within three minutes of delivery).

The mature babies were nursed in cots at a room temperature of approximately 70° F. (21.1° C.); extra warmth was applied in a bassinet heated with electric light bulbs. Blood pressure was measured with a 1-in. (2.5-cm.) cuff, both by palpation and the flush method. The premature babies were nursed in incubators that were maintained at 85° F. (29.5° C.) for babies over 4½ lb. (2,040 g.) and 90° F. (32.2° C.) for those weighing less, and were supplied with oxygen in varying concentrations.

Dyspnoea here refers to rates above 40 per minute in full-term and 50 in premature babies who have been at rest for a minute or longer, as well as to grunting laboured breathing, even though the rate is no higher than 40. A respiratory rate of 40 a minute is normal for healthy infants (Smith, 1951); and Miller and Conklin (1955) point out that the same is true after the first hour in premature babies when they are well. There is a subjective element in the clinical assessment of dyspnoea, and it was found difficult to draw a sharp line between respiratory embarrassment and normal breathing as a baby recovered.

Mature and Healthy Babies

In 69 normal babies who were nursed in their cots, without extra warmth, the crescendo systolic murmur developed in 4 (6%) between two and six hours after birth. Twenty-two babies were kept warm as described