HEAD INJURIES—II

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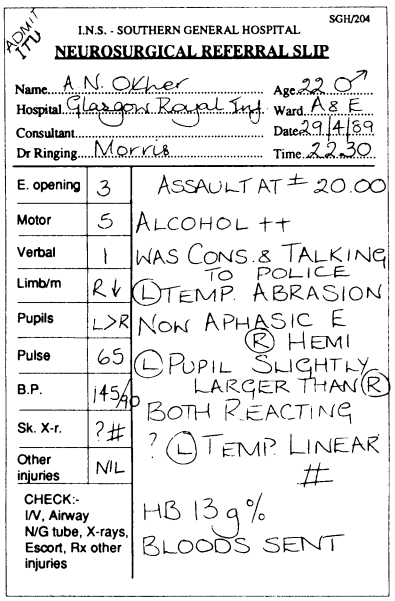
Hospital admission

Example of a head injury warning card

(Accident and emergency department tel)

This person has recently sustained a head injury and should be kept under regular observation every two hours for the first 24 hours. The person should be asked to tell you his or her name, where he or she is, the year, and who you are and should show you that he or she can move all four limbs normally. If asleep you should awaken the person to do these tests. If the person develops any of the following problems he or she should be brought back to hospital without delay:

(1) Drowsiness or excessive sleepiness
(2) Confusion or disorientation
(3) Severe headaches, vomiting, or fever
(4) Weakness of any limbs or double vision
(5) Convulsion, seizure, or passing out
(6) Discharge of blood or fluid from ears or nose

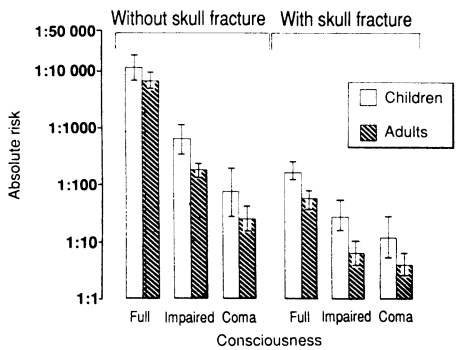

I.N.S. - SOUTHERN GENERAL HOSPITAL SGH/204

NEUROSURGICAL REFERRAL SLIP

ADMIT ITU

Name A.N. Other Age 22 ♂
Hospital Glasgow Royal Inf. Ward A & E
Consultant Date 29/4/89
Dr Ringing Morris Time 22.30

E. opening	3	ASSAULT AT ± 20.00
Motor	5	ALCOHOL ++
Verbal	1	WAS CONS. & TALKING TO POLICE
Limb/m	R↓	(L) TEMP. ABRASION
Pupils	L>R	NON APHASIC E (R) HEMI
Pulse	65	(L) PUPIL SLIGHTLY LARGER THAN (R)
B.P.	145/90	BOTH REACTING
Sk. X-r.	?#	? (L) TEMP. LINEAR #
Other injuries	NIL	
CHECK:- I/V, Airway N/G tube, X-rays, Escort, Rx other injuries		HB 13 g% BLOODS SENT



Absolute risk of death in patients with head injury.

The following list of indications for admission of patients with head injuries should be displayed in accident and emergency departments.

- Confusion or any other depression of consciousness at the time of the examination
- Skull fracture
- Neurological symptoms or signs, or both
- Difficulty in assessing the patient—for example, because of ingestion of alcohol, epilepsy, or other medical conditions that cloud consciousness; children are also difficult to assess
- Lack of a responsible adult to supervise the patient and other social problems.

Brief amnesia after trauma with full recovery is not necessarily an indication for admission.

If the patient is to be observed outside hospital he or she should be discharged with a head injury "warning card" into the care of a responsible person.

The aims of hospital admission are to provide optimal conditions for recovery of the brain and to detect complications before they cause further secondary brain damage. The mainstay of admission is therefore neurological observation, which should be hourly for at least the first 24 hours.

Consultation with a neurosurgeon

A group of British neurosurgeons formulated the following list of indications for consultation with a neurosurgeon and computed tomography in patients with head injuries.

(1) Fractured skull with confusion or worse impairment of consciousness, focal neurological signs, fits, or any other neurological symptoms or signs.

(2) Coma continuing after resuscitation, even if there is no skull fracture (coma is defined as not obeying commands, not speaking, not opening eyes—that is, a Glasgow coma score ≤8).

(3) Deterioration in level of consciousness or development of other neurological signs.

(4) Confusion or other neurological disturbance persisting for more than six to eight hours even without skull fracture.

(5) Compound depressed fractures of the vault of the skull.

(6) Suspected fracture of the base of the skull—causing leakage of cerebrospinal fluid, orbital haematoma, or retromastoid haematoma—or other penetrating injury (for example, gunshot wounds).

Patients in categories 1-3 should be referred urgently. In all cases the diagnosis and initial treatment of serious extracranial injury takes priority over transfer to the nearest neurosurgical unit.

Computed tomography

Increasing numbers of accident and emergency departments have access to emergency computed tomography for patients with head injuries, but the interpretation of the computed tomogram is often difficult—for example, features of raised intracranial pressure can be missed by the untrained observer. It is preferable for computed tomography to be performed under the control of a neurosurgeon or neuroradiologist.

Drugs in acute head injury

Antibiotics in head injury

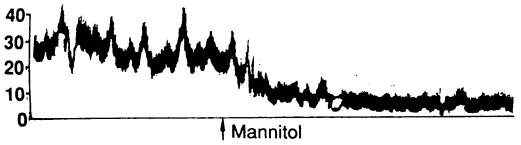
Indications

Basal fracture
Compound vault fracture
Suspected or proven meningitis

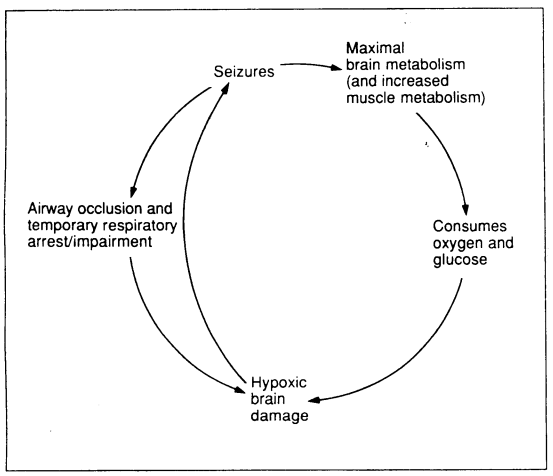
Suitable agents

Benzylpenicillin 1 million units intravenously every six hours for seven days or phenoxymethylpenicillin orally 500 mg every six hours (children 10-20 mg/kg/day)

For patients with penicillin allergy give oral co-trimoxazole 960 mg twice daily



The effect of mannitol in a patient with raised intracranial pressure after severe focal brain injury.



The consequences of uncontrolled seizures.

Sedation and analgesia

Sedation and analgesia for patients with head injuries are often a problem; they may be in pain and nauseous as a result of their injury, yet strong opiate analgesics and drugs with respiratory depressant effects must be avoided as they may cause iatrogenic deterioration in conscious level and respiratory depression. For adults give paracetamol 250-500 mg every six hours or dihydrocodeine preparations such as DF118 or Co-codamol one to two tablets every four to six hours. If given parenterally DF118, 30 mg every six hours is usually safe and effective. Give metoclopramide 10 mg up to every eight hours for nausea intravenously or orally. For children paracetamol suspension 125-250 mg every six hours is suitable.

Antibiotics

Avoid using antibiotics prophylactically except in the cases described in the box.

Mannitol

Mannitol is a powerful osmotic diuretic and may be life saving, but it carries dangers. It should be used, in consultation with a neurosurgeon, to "buy time" while the patient is prepared for transfer to the nearest neurosurgical centre. Give 0·5-1 g/kg as a bolus over 10-30 minutes. (Usually 250-400 ml of a 20% solution for adults.)

Steroids

Several trials have shown no benefit from steroids, even at high doses.

Management of seizures

Seizures within the first week carry a low risk of future epilepsy but may cause severe hypoxic brain damage. Prevent further seizures with phenytoin as a loading dose of a 250 mg bolus given intravenously over 10 minutes (ideally with electrocardiography) followed by an intravenous infusion of 250-500 mg over four hours. Thereafter give 100 mg every eight hours intravenously or orally.

If seizures persist after phenytoin loading give clonazepam 0·25 mg intravenously incrementally after each seizure. Be prepared to ventilate the patient in an intensive care unit. Intravenous diazepam 5-10 mg may be used if seizures still persist but may cause respiratory depression.

Restlessness

In patients with head injury restlessness is often a warning sign, and restless patients should not be sedated without excluding hypoxia, hypotension, metabolic derangement, a full bladder, or pain due to other injuries. The "checklist" for secondary deterioration described below should be considered before sedation is prescribed.

Secondary deterioration in conscious level

Effect of hypotension and hypoxia on patients' outcome after acute head injury

	Outcome	
	Dead/ vegetative/ severely disabled	Moderate disability, good recovery
Both hypoxia and hypotension	6	
Hypoxia only	11	7
Hypotension only	1	1
Neither hypoxia nor hypotension	11	38

$\chi^2=14{\cdot}72$; $p<0{\cdot}005$.

If deterioration in conscious level is apparent the following possibilities should be investigated.

Hypoxia—Check arterial blood gas tensions, respiratory rate, and chest radiographs. Start treatment with oxygen.

Ischaemia—Check pulse, blood pressure, electrocardiogram, and full blood count, particularly if there has been a substantial delay between the patient sustaining the head injury and assessment. Exclude intra-abdominal bleeding.

Metabolic derangement—Exclude dehydration and check urea, electrolyte, and blood glucose concentrations.

Missed intracranial haematoma—If hypoxia, ischaemia, and metabolic derangement have been excluded refer the patient for computed tomography.

Seizures—Seizures may not have been witnessed. Control them with drugs. If the conscious level has not returned to its previous level within one hour consult the neurosurgeon.

Guide to siting of exploratory burr holes

(1) Give 0·5 g/kg of 20% mannitol solution intravenously over 15 minutes while the theatre is prepared

(2) Perform the procedure with the patient intubated and under general anaesthesia. Blood should be cross matched and an intravenous line (preferably plus a central venous line) established

(3) Shave, prepare, and drape the patient for "whole head" access

(4) Place the first burr hole adjacent to the fracture, ipsilateral to the first pupil to dilate or, in the absence of a fracture, in the temporal region (2·5 cm above the zygoma and 2·5 cm behind the zygomaticofrontal ridge)

(5) If an extradural clot is found enlarge the hole, following the clot

(6) If the underlying dura is blue and tense enlarge the burr hole to 5-8 cm in diameter and open the dura and evacuate as much clot as possible. Seek neurosurgical advice

(7) If no clot is seen beneath the dura make frontal and parietal burr holes ipsilateral to the first dilated pupil

(8) If no haematoma is found needling the brain is unlikely to be useful. Close the burr holes and refer the patient to the neurosurgical centre

Meningitis—If meningitis is suspected first obtain a computed tomogram to exclude the presence of a haematoma, which may cause neck stiffness. Start treatment with high doses of antibiotics immediately. Lumbar puncture should be performed only after computed tomography has excluded raised intracranial pressure. (Appropriate antibiotic treatment is intravenous penicillin 5 million units every six hours and intravenous chloramphenicol 1-2 g every six hours.)

Exploratory burr holes

The use of exploratory burr holes in modern management of head injury is extremely limited. Even experienced neurosurgeons miss one third of intracranial haematomas and may initiate bleeding and worsen brain damage. Use of burr holes may be indicated if a capable surgeon is available and a previously alert patient rapidly deteriorates and develops a fixed dilated pupil that is ipsilateral to a skull fracture and in patients whose transfer to a neurosurgical centre is likely to take two hours or more.

Interhospital transfer

Checklist for interhospital transfer

- *Airway with cervical spine control*—Use an endotracheal tube or Guedel airway if appropriate with a hard or soft collar. Give oxygen by a mask or T piece
- *Breathing*—Use an Ambu bag and appropriate connectors or portable ventilator (for example, oxylog)
- *Circulation*—Once intravenous infusion is established give plasma Hartmann's solution or Ringer's solution if hypotension develops
- *Dysfunction of central nervous system*—Send details of conscious level and central nervous system findings at base hospital with patient
- *Ensure* documents and radiographs are sent with patient

The events associated with interhospital transfer are a potent cause of avoidable mortality and morbidity after head injury. Problems are caused by:

- Delay in arranging transfer
- Inadequate resuscitation before transfer
- Inadequate preparation for the journey
- Inadequate care during the ambulance journey.

Patients with hypovolaemia who have not been fully resuscitated may become profoundly hypotensive during an ambulance journey. Patients in a coma should be accompanied by a doctor who has the experience and equipment necessary to carry out intubation and ventilation during the journey.

Outcome after severe head injury

Outcome at six months after head injury related to age, best coma score, and best pupil reaction at 24 hours after injury

	Dead or vegetative (%)	Moderate disability or good recovery (%)
Age:		
0-29	39	50
30-59	49	34
⩾60	81	11
Coma score:		
3-5	84	11
6-7	56	29
8-10	28	58
11-15	16	72
Pupils:		
Both fixed	86	6
One or both reacting	16	72

The main determinants of outcome are coma scale score at admission, age, pupillary state, raised intracranial pressure, and the presence of hypoxia or ischaemia. About 40% of patients who are in a coma after initial resuscitation and beyond six hours after injury will die. Prognosis should not be estimated too soon because resuscitation and stabilisation may dramatically improve the patient's conscious level.

Late sequelae

Neurological recovery after severe injuries takes about two years but is most rapid within the first six months. Mental disabilities are far more important for the patient and his or her family than physical impairment. Personality changes, poor motivation, impaired memory and concentration, and lack of emotional restraint are the most common of these. They often cause difficulty with schooling, employment, and family relationships, and patients should be advised against returning to school or employment too soon after a head injury. Psychometric testing often discloses unsuspected difficulties and allows more directed rehabilitation to be formulated.

Moderate and severe deficits in patients with head injuries. Figures are percentages of patients

	Degree of overall disability	
	Moderate	Severe
Physical handicap		22
Cognitive impairment	8	78
Personality change	18	89

Common physical sequelae include ataxia, hemiparesis, speech disorders, cranial nerve palsies such as anosmia, unilateral blindness, diplopia, unilateral deafness, and tinnitus. Seizures occur in from 4% to 40% of patients, depending on the nature of the initial injury, focal injuries being more epileptogenic.

Symptoms after minor head injury

Proportion (%) of patients with certain neurological symptoms after trauma

	At discharge	At one year
Headache	36	18
Dizziness	17	14
Depression	8	18

In a third of patients with minor head injury symptoms such as headache, dizziness, irritability, poor concentration, tinnitus, poor balance, fatigue, depression, and intolerance of alcohol will persist for more than six months. Many of these "postconcussional" symptoms are due to mild diffuse axonal injury, which occur in patients who have been unconscious for only a few minutes and who may have electrophysiological and neuropsychological abnormalities. The symptoms usually subside spontaneously; depression and anxiety may lead to their persistence but malingering is rare. When the symptoms begin only after an appreciable interval psychological factors are likely to be more important.

Specific treatment for postconscussional symptoms is lacking. In the early stages reassurance that severe brain damage has not occurred is important, but patients should not resume activity too rapidly: if the patient has difficulty in coping anxiety and depression may be provoked and lead to perpetuation of symptoms. Psycotherapeutic support is appropriate, but the value of more formal psychological rehabilitation is not proved. Analgesics are appropriate in the early stages, but the smaller their effect the greater the need for a psychological approach.

The illustrations were prepared by Mr Derek Virtue, medical illustration department, *BMJ*.

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The ABC of Major Trauma has been edited by Mr David Skinner, FRCS; Mr Peter Driscoll, FRCS; and Mr Richard Earlam, FRCS.

Letter from . . . Moscow

The cost of change

G E Falkowski

Studying the anatomy of the heart some years ago I came across a beautiful book entitled *Anatomie des Herzens* written by Julius Tandler in 1912. I learnt from this book that the crista supraventricularis, a band of muscle in the right ventricle, had been given its name by a French anatomist called Wolff as far back as 1781. I imagined him sitting there in some anatomy theatre or small room lit by candles studying hearts. He probably neither realised nor cared about what was going on in the world outside his laboratory. The material for his studies was obviously available in any quantity desired. The situation here today strikes me as being somewhat similar. The "winter of our discontent" is over but only in the seasonal sense.

Every day begins with news of trouble. Trouble everywhere, far and near. Almost every day brings news of people, mostly young people with perfectly sound hearts, being killed in some part of the Soviet Union. No state of war has been declared yet the sense of something tragic and unpredictable going on is felt everywhere. The newspapers and other mass media are full of reports of a disturbing nature—economic, ecological, and political. The harsh antagonistic attitude of people towards one another is felt at every contact, whether you stand in a queue for food or talk to the relatives of a patient. You encounter disbelief, suspicion, and distrust. Too much has been lost and practically nothing gained so far.

In this situation nobody talks or writes about medicine and its urgent needs. Every once in a while you read about terrible conditions in hospitals, lack of medicines, lack of qualified staff, and unhygienic conditions. You feel it in everyday work when all of a sudden something just disappears—oxygenators, catheters, blood, solutions, drugs. You never know what you will have or not have tomorrow. For ecological reasons some 15 factories producing vitally essential drugs, including antibiotics and antiseptics, are being closed down. So it is not exactly correct to say there is no talk about medicine. There are no answers to the questions raised. It seems that nobody can find a solution to the problems facing us today, at this moment in the history of our country, where medicine has never been a priority. Even in the inaugural speech of our first president not a word was said about the health of the people who are to perform the herculean task now facing the country or, rather, for whose sake it is going to be performed.

On 12 December 1989 Andrei Sakharov, the conscience of our time, died. There were hundreds of obituaries and hundreds of tributes to the memory of the great man. Five hundred thousand people stood for

Bakulev Institute of Cardiovascular Surgery, Moscow
G E Falkowski, MD, *professor of paediatric cardiovascular surgery*

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