Current Practice

Emergency Management of Head Injuries

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Unfortunately nothing can be done to reverse damage already sustained by an injured brain, but if the injury has not been an essentially lethal one emergency attention to ensure respiratory efficiency, to control severe haemorrhage, and to maintain an adequate circulation will prevent further brain damage from hypoxia. Attention to the head itself is not, therefore, usually the prime consideration when the injury has been a severe one.

First Things First

The fundamentals of resuscitation are liable to be forgotten ; for the alarming appearance and noisy breathing of someone bloody and unconscious from a road accident, lying in the road or being trundled through the doors of an accident-room or surgery, can be enough to send even the most level-headed rushing first to the pupils and even to the tendon and plantar reflexes. An injured brain that is not getting a sufficient quantity of oxygenated blood will become increasingly and perhaps irreparably damaged from that cause alone: "Anoxaemia," runs the aphorism, "not only stops the machine, but wrecks the machinery."

Respiration

Occasionally the head injury is actually witnessed, and one is hard put to say whether the patient is dead or merely stunned. Give mouth-to-mouth artificial respiration until it is certain that the patient is breathing, and then turn him over into the almost-prone position—and keep him there until the cough and swallowing reflexes return or until it is clear that his airway requires more drastic attention, such as the passage of an endotracheal tube or a tracheostomy. In the almost-prone position blood, vomitus, and secretions will flow out of the mouth instead of down the trachea. It seems extraordinary now that as little as 10 years ago first-aid manuals should have been recommending that the head be elevated—a presumed increase in intracranial pressure being considered more dangerous than obvious respiratory embarrassment. Stertorous breathing was then regarded as an accepted sign of deep coma ; now it is an ominous noise to be overcome as soon as possible.

Morphine should never be given: it may aggravate any existing respiratory insufficiency ; it makes the later assessment of the true level of consciousness difficult or impossible ; and it constricts the pupils, which are needed as important and naturally functioning indicators.

Circulation

Haemorrhage from the scalp may be arrested with a firm pad and a crêpe bandage and by suturing the wound. Surgical shock is rare when the injuries are confined to the head, unless there has been severe blood loss, and the cause should always be sought elsewhere, especially in the chest, abdomen, femurs, and pelvis. Adequate blood replacement should be given as soon as possible.

Assessing the Head Injury

By the time these most urgent matters have been attended to the effects of the head injury may not seem so serious ; indeed there may have already been an improvement in the level of consciousness. The next task is to establish important "base-lines" so that it will be possible to say later with confidence whether the patient's condition is better, worse, or the same. Since others may well be responsible for subsequent observations and treatment, it is essential that careful and concise notes should be recorded in English that anyone can understand. The three base-lines to be established concern the *level of consciousness*, *neurological signs* (with particular reference to the pupils), and the *vital functions* indicated by pulse-rate, arterial blood-pressure, and respiration-rate.

Level of Consciousness

An accurate picture of such a complicated matter as someone else's consciousness may be conveniently conveyed by recording the answers to such questions as the following: Is the patient rational and correctly orientated in time and place? Is he alert, drowsy, or comatose? Can he be roused to respond to verbal commands, to tactile stimulation, or only to painful stimuli? In what way does he respond? Vocally? With natural movements or with abnormal ones, such as the extensor activity of the limbs seen in "decerebrate rigidity"?

If an early assessment is made in this way it is usually a relatively simple matter to say later whether spontaneous improvement is occurring or whether some complication, such as extradural haemorrhage, is causing deepening unconsciousness.

Neurological Signs

No great expertise is necessary here, but the more accurate and comprehensive the neurological examination the more useful is the assessment. The two important examinations are those of the pupils and of cerebral hemisphere function.

The Pupils.—At the earliest possible moment it should be noted if the pupils are equal, and whether each reacts to light from a bright torch (in strong daylight the eyes may be temporarily covered and then suddenly exposed to the light). In cases of severe injury to the head or to the orbit, one or both pupils may have been immediately or rapidly rendered inactive owing either to damage to the optic nerve or to paralysis of the pupillary constrictor mechanism. It is the *progressive dilatation* later of first one pupil and then the other that is so important in the diagnosis of middle meningeal (extradural) haemorrhage: unless the clot can be evacuated before both pupils have become fixed and dilated useful recovery is unlikely.

Cerebral Hemisphere Function.—The objective here is to detect whether or not there is evidence of lateralized contusion to one cerebral hemisphere producing hemiparesis, hemianaesthesia, hemianopia, or, if the left (dominant) side is affected, dysphasia. If no such signs are present at the initial examination and they appear later they may be due to clot-compression of the appropriate area of the brain on the opposite side, especially if accompanied by a dilating pupil, also on the side opposite to the hemiparesis, and by a slowing pulse and a rising systolic blood-pressure.

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Pulse, Blood-pressure, and Respiration

The initial readings on the patient's chart are usually more important for the detection of shock from associated injuries than for information about intracranial damage. When shock has been remedied a watch must be kept for any tendency towards *progressive* bradycardia, systolic hypertension, and slowing of the respiratory rate, for cerebral compression is usually accompanied, although not always in the earlier stages, by one, two, or sometimes all of these signs. If they appear, prompt reference should be made again to the level of consciousness, the pupils, and the neurological state.

The temperature should also be taken regularly to make sure that there is no tendency to hyperpyrexia: if this occurs energetic cooling measures should be instituted to prevent the possibility of further brain damage from the very high fever which may sometimes develop.

Scalp Wounds and Skull X-rays

The wound may now be dealt with, but if the patient is in hospital it is a good practice to x-ray the skull first. In this way it is possible to discover a compound depressed fracture aseptically, and to make a more comprehensive assessment than is possible by external exploration through the wound. If x-ray films are not taken such a fracture may be overlooked, especially if the mobility of the scalp is such that the depression does not immediately underlie the wound.

Skull x-ray films provide other important information which may put one on the alert for complications. If a fracture-line crosses the course of the middle meningeal artery, the possibility of bleeding from this vessel should be particularly borne in mind. If the paranasal air sinuses, the middle-ear, or the mastoid air-cells are affected by comminuted fracturing, or if air is seen inside the cranial cavity, cerebrospinal fluid rhinorrhoea and otorrhoea should be watched for and meningitis anticipated. A centrally placed calcified pineal body provides fair reassurance that there is no sizable lateralized intracranial clot, whereas a pineal shift of more than 2 mm. laterally will suggest that there may be such a complication—but the antero-posterior projection that shows a calcified pineal gland must of course be a straight one.

Middle Meningeal (Extradural) Haemorrhage

The mortality from this complication is still very high, but there are three measures that can be taken to reduce it substantially. These are, first, to admit all cases of concussion to hospital for at least one night; secondly, to carry out half-hourly observations of the level of consciousness, the pupils, the pulse-rate, the systolic blood-pressure, and the respiration-rate to anticipate this complication; and, thirdly, to ensure that all hospitals admitting such cases have a member of the staff who is prepared and equipped to open the skull once the diagnosis has been made. The important thing is to release the compressing clot, after which there is likely—at least in Great Britain—to be a neurosurgeon not too far away who can give advice by telephone, or if necessary come to assist the doctor who has taken this first vital step in the operation.

The diagnosis is usually not difficult, particularly if the complication has been anticipated and specifically watched for. The first clue, in those patients who have not been comatose from the outset from severe brain damage, is the presence of a lucid or more usually only a relatively lucid interval between the injury and the onset of symptoms, which consist usually of increasing headache, vomiting, confusion, restlessness, and deepening unconsciousness.

On examination there is typically a boggy swelling in one temporal region; the pupil on the same side is dilating and reacts sluggishly or not at all to light, and there is usually bradycardia. There may also be a progressive rise in the

systolic blood-pressure, focal fits, and weakening of the limbs on the side opposite to the head injury and dilating pupil.

No time should then be lost on x-rays of the skull, but if these have been taken and a temporal fracture has been revealed a burr- or trephine-hole should be made adjacent to that fracture without delay. Otherwise the incision should be made vertically into the centre of the boggy swelling and the skull opened at that point. Meanwhile blood should have been grouped and quickly cross-matched, and if the patient's airway is not clear an endotracheal tube should be passed as a safeguard against respiratory obstruction during an operation performed under adverse conditions.

But nothing should hold up the drilling of the hole and the scooping or sucking out of as much of the compressing haematoma as possible. This is the life-saving step, and when it has been done there will be a breathing space when less pressing matters can be attended to. Even if there is brisk bleeding this will be externally and of less immediate danger to the patient. Those who are in the very least likely to have to do this operation are advised to familiarize themselves with its more detailed technique from a textbook of operative surgery and to perform the operation on a cadaver.

Compound Depressed Skull Fractures

Unless extradural haemorrhage is also suspected—and the two sometimes co-exist—there is no extreme urgency to excise a compound depressed fracture. With more important matters settled, the operation should be carried out within 12–18 hours of injury, and a textbook of operative surgery should be consulted for operative details by those who are not familiar with the procedure. If the dura mater has been penetrated I believe that a five-day course of prophylactic antibiotic treatment should be given, and at present prefer cloxacillin, 500 mg. six-hourly, combined with sulphadiazine, 2 g. *stat.*, followed by 1 g. four-hourly. Prophylaxis against tetanus should not be forgotten.

Care of the Unconscious Patient

The prime importance of the airway has already been stressed, and if this gives rise to any concern at all or if there are serious fractures of the mandible it is best to carry out a tracheostomy. Otherwise the patient should be nursed almost prone, with care that the unprotected eyes are not rubbed by sheets or towelling. The air passages should be kept clear of secretions by suction, positioning, and with the assistance of physiotherapy; regular turning from side to side assists this and prevents pressure sores.

Observation should be continued by the nursing staff, and the doctor should be informed of any suspicious changes in the condition of the patient. No sedation should be given; for restlessness is on balance better for the patient than inertness, provided that he does not damage himself by falling out of bed. The important subject of feeding does not really enter into the emergency treatment of these patients, because it is not normally necessary during the first 24 hours following the injury.

Conclusion

A closer attention to those bodily functions on which the brain is dependent, rather than to the brain itself, has in recent years resulted in the more effective treatment of head injuries. Provided that it is not being subjected to undue compression (which is only rarely present in the acute stage), to the effects of respiratory and circulatory inadequacy (which are more common), to hyperpyrexia, infection, and metabolic disorder, the injured brain requires no more than plenty of time to make what recovery it can; for, although brain-tissue lost from contusion, laceration, and infarction is irreparable, recovery of function through that which remains can be surprisingly effective.