

## THE MANAGEMENT OF CHEST INJURIES

The alarming toll of road accidents has belatedly led to attempts to review the organization and methods of treatment of the victims of this age of speed. It has not been fully appreciated how many people die untreated from injuries to the chest, and indeed in many cases the damage is only recognized after death.

Most automobile accidents produce multiple injuries of which the most obvious concern the limbs and head, particularly if the victim is a pedestrian or a passenger who has been flung clear. Crush injuries which include severe deceleration effects are more likely to involve the chest and abdomen. The classic injuries which affect the car driver in a head-on collision result from him being flung forward against the steering-wheel with the head crashing down on the dashboard and the legs broken by the general "concertinaing" effect. Chest injuries involving the passenger tend to come from a more lateral impact.

The significant chest injury is one in which multiple fractures occur anteriorly and posteriorly to produce a functionally loose segment of the chest wall, "*le volet mobile*" of the French. This "flail" or "stove-in" chest has the same effect as an open pneumothorax in producing paradoxical movement. But with severe injuries it is not only the physiological effects of the paradox that are dangerous, it is the danger of retained blood and secretions in the bronchial tree that, if not removed, lead to atelectasis and wet lung. A patient can drown in his own secretions without the severity of the condition being realized. The cough reflex is never effective enough to keep the lungs clear.

Shock, pain, and other injuries such as concussion will all depress respiratory exchange and tend to produce a state of hypoxia and CO<sub>2</sub> retention. Wet lung adds a further load to ventilation, but the severity of the condition may not be recognized clinically.

The patient is often quiet and without cyanosis owing to shock that leads to a low cardiac output and vasoconstriction. Respiratory insufficiency in which both hypoxia and increasing CO<sub>2</sub> retention steadily develop produces vasodilatation with which the cardiovascular system cannot compete.

It is not only failure of respiratory function but circulatory failure as well. This silent anoxia, whose only sign may be a lilac tinge, can be

recognized by arterial oxygen and CO<sub>2</sub> estimation, but the facilities for this are few and far between.

In recent months there have been a number of occasions on which some uniformity of opinion obtained as regards the treatment of these injuries. The Thoracic Surgeons of Great Britain, the Thoracic Society, and the 62nd French Congress of Surgery have discussed the problem and indicated how unsatisfactory is the overall handling of victims of road accidents.

Many of the earlier discussions centred on methods of fixing the loose chest wall segment without emphasizing the importance of early treatment. Barrett (1960) has outlined a scheme of treatment for which there is general agreement. The first objective is to ensure that there is a clear airway and some temporary stabilization of too extensive a *volet mobile*. The next stage is to ensure some method of maintaining adequate ventilation and to remove air and/or blood from the pleural cavity. When this stage is reached a more definitive exploration and examination of the patient's injuries becomes practicable. The chest takes priority until control of respiration is established, and this highlights the importance of a well-trained anaesthetist in every accident unit.

On the roadside it is impossible to make an assessment of the patient's injuries. He may be unconscious, with blood and dirt over his face and mouth. A clear airway and, at the earliest possible moment, an endotracheal tube ensures adequate ventilation and allows aspiration of secretions from the bronchi. At a later stage the question of a tracheostomy to give better control and to permit prolonged positive pressure ventilation can be considered, and where the facilities are available this approach is becoming increasingly popular.

One additional advantage of positive pressure ventilation is that it can be used to "splint" the loose segment in its inspiratory position.

Fixation of the *volet mobile* has been the subject of numerous communications, and, apart from the internal splinting just mentioned, there are two methods that can be employed. In the one external traction or splinting is achieved through the agency of screws, clips, or wires in or round the ribs. Two or three towel clips placed round the ribs and pulled on by a weight over a pulley is a relatively simple and satisfactory measure.

The other method involves a thoracotomy through which the broken rib ends are wired together or fixed by intramedullary pegs. At the same time an effective pleural toilet can be performed, but in general this method should be reserved for patients in whom a major intra-thoracic or diaphragmatic injury is suspected. The anatomical result is not always as satisfactory as anticipated and the procedure is not one to be undertaken in patients with severe multiple injuries.

Once the patient's respiratory function has been assured the restoration of function has to be considered. But this may be subject to other considerations, such as limb fractures. Ideally, active movements and inspiratory breathing exercises are indicated, the loose segment becoming sufficiently firm in two weeks to prevent its permanent depression.

The whole emphasis of treatment rests on the first few hours in a severe case, and it is regrettable that the thoracic surgeon or anaesthetist rarely sees the patient within the first 24 to 48 hours. Their advice is usually sought to improve the pleural or chest wall deformity at a later date.

The whole organization of accident services is being discussed with particular emphasis on high-velocity injuries, and it is to be hoped that the importance of treatment in the first few hours will not be overlooked and that ambulance services will have the advice and help on the roadside of someone who is best qualified to keep patients alive until the correct line of treatment is determined. The anaesthetist appears to be the

appropriate person to take charge of the casualty until the various priorities of injury are sorted out, and if there is a chest injury he can maintain control of ventilation during the period of danger.

The prevention of casualties is a matter of national importance. Numerous studies have been made on the physics of "crash" injuries, notably by Kulowski (1960). Certain measures have been advocated to minimize the effects of trauma, and of these one can instance Cairns' (1946) studies leading to the crash helmet for motor-cyclists and the use of safety belts in aeroplanes. There is evidence to suggest that safety belts and straps in motor-cars will prevent certain forms of injuries that might otherwise be lethal (Bothwell, 1960), but automobile manufacturers in this country do not consider it economical or necessary to provide these elementary precautions as part of their standard fittings. Nor would it appear that the design of motor-cars or motor-cycles has as yet been influenced by the researches and reports issued by the Ministry of Transport (1960).

Perhaps the public conscience may still act belatedly in insisting that action should be taken to reduce the toll of the road.

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#### REFERENCES

- Barrett, N. R. (1960). *Lancet*, 1, 293.  
 Bothwell, P. W. (1960). *Ibid.*, 2, 807.  
 Cairns, Sir H. (1946). *Brit. med. J.*, 2, 322.  
 Kulowski, J. (1960). *Crash Injuries*. Thomas, Springfield, Illinois; Blackwell, Oxford.  
 Ministry of Transport (1960). *Road Accidents, 1959*. H.M.S.O., London.