Cyclists

There were 120 cyclists (94 males, 26 females). As with motorists, no inference can be drawn from the high incidence of males, as the sex ratio of a normal cross-section of cyclists is not known. The age grouping shows a marked predominance of cases (52, or 44%) occurring between the years 10 and 24.

Injuries.—Injuries to cyclists were comparatively light: 11% of all cases were classified as severe, the lowest proportion of any group (Table I). There were two deaths, both from head injuries. One explanation of the lightness of the injuries suffered by this group may be that cyclists tend to fall off their bicycles rather than to crash into other fast-moving vehicles. Of individual injuries one feature was the greater proportion of upper limbs involved compared with lower limbs (70% of all injuries in this group) (Table IV). A possible explanation is that cyclists often come off their bicycles by going over their handlebars, and put out their hands to protect themselves, whereas motor-cyclists, moving so much faster, do not have time to do this.

Pedestrians

Of the 91 pedestrians 57 were males and 34 females. At first sight it would seem that male pedestrians are more careless than females; but the ratio of accidents between the sexes is reasonable in view of the fact that there are more men working outside the home than women; and from observance of the various means of transport it is possible to form the opinion that men are more at risk as pedestrians than women. It is, however, unsafe to do more than speculate on the evidence to hand in view of the comparatively few cases involved.

Most cases occurred at the two extremes of life. There was a heavy toll of children, no fewer than 20 of the 91 cases occurring in the five-year period comprising the ages of 3 and 7. There was a similar trend in the older age groups, 28 being 65 or over.

The greater incidence in the advanced age groups is even more obvious when the number of accidents is related to the very much reduced number surviving in those groups.

Injuries.—The relative severity of the injuries to pedestrians compared with the other groups is the outstanding feature—33% received severe or fatal injuries (Table I). This is a very high proportion when it is realized that every road-accident patient brought into the hospital during the period under review has been included, no matter how trivial the injuries. It was noticeable that there was a bigger proportion of lower-limb injuries than in any other group—32 upper to 59 lower limbs, or a ratio of 1 to 1.8. When the severe cases are considered this is more obvious still. Of the 18 cases 14 had severe lower-limb lesions only, and a further case classified +++ sustained, in addition to a very severe head injury, a central dislocation of the right hip. So 15 out of 18 (83%) severe pedestrian injuries involved the lower limbs, whereas there was only one serious upper-limb lesion.

Miscellaneous

The vehicles in this category are subdivided as lorries, 28 cases; omnibuses, 15; motor-vans, 6; wheel-chair, 1; farm trailer, 1; vehicle not known, 5. These numbers are all too small for detailed analysis, but one or two points of interest are worth noting.

Lorries.—Of the 28 cases in this series, no fewer than 21 (75%) were passengers, and 15 of these came in without the driver, 5 being in one lorry. Two more drivers came in with their passengers. As it must be more common for lorry drivers than car drivers to travel alone, it appears that lorry passengers are even more vulnerable than passengers in cars. Possibly, this is due to the increased vulnerability of people travelling in the body of an open lorry. There were 12 known instances of this practice in the series, and there may have been others.

Omnibuses.—All 15 cases were passengers. Of these, 9 came from the only bus crash in which the occupants were hurt. Five of the remaining 6 were adults who were injured while boarding or alighting. Points that arise therefore are: (a) Only one accident to a bus in the whole series caused casualties among those travelling in it, which suggests that buses are a very safe form of transport. This does not, of course, include other road users injured by buses. (b) Many injuries in buses occur when boarding or alighting from a moving vehicle.

Motor-vans.—Of the 6 cases involved only one was a driver; this again emphasizes the increased risk to the passenger.

Summary

Of the 717 road-accident injuries attended at one hospital over a two-year period the principal findings were: motor-cyclists comprised the largest number of cases and, with pedestrians, the greatest number of severe injuries and deaths; by far the largest single cause of death was head injury; in motor-cyclists the right side was injured more often than the left; in motorists knee injuries were common and passengers appeared to be more vulnerable than drivers; cyclists tended to sustain injury to their upper limbs more than did other groups; pedestrians tended to have leg injuries; most pedestrian cases occurred at the two extremes of life; in all groups males predominated over females.

Our thanks are due to Mr. H. H. Langston and Mr. J. S. Ellis, orthopaedic surgeons, Winchester Group of Hospitals, for their encouragement; to the various members of the surgical staff for permission to quote their cases; to the staff of the Medical Records Office of the Royal Hampshire County Hospital, Winchester; to Miss E. M. Street for typing the manuscript and tables; to the Chief Constable of Hampshire for help in the completion of records. We are most grateful also for the helpful advice and criticism given us by Mr. B. Benjamin.

DASHBOARD FRACTURE OF PATELLA

BY

I. S. SMILLIE, O.B.E., Ch.M., F.R.C.S.Ed.
F.R.F.P.S.*Surgeon in Charge, Eastern Region (Scotland)*
Orthopaedic Service

The purpose of this article is to draw attention to the potentially disabling injury of the knee-joint commonly sustained by the driver or front-seat passenger of a motor-car involved in a collision. The outstanding feature of the injury, which is produced by impact of the knee with the dashboard, is a fracture of the patella. It will be shown, however, that this particular fracture of the patella differs in mechanism, pathogenesis, and prognosis from that produced by lesser forms of direct or indirect violence. Furthermore, and in so far as it is related to automobile design and equipment, this injury is preventable.

Mechanism of Injury

The form of the fracture is determined by the height of the dashboard and the length of the limb: a central transverse or a comminuted fracture involving the entire bone occurs if the patella is driven against the flat face of the board; a comminuted fracture of the inferior pole in the direction from above downwards and backwards if the lower pole strikes the free edge; and a comminuted fracture of the superior pole in the direction from below upwards and backwards if the knee is driven under the free edge.

In addition to the fracture which results from the direct violence, in a large proportion of cases there is wide separation of the fragments, with extensive tearing of the medial and lateral expansions. The injury thus combines the features of fracture by direct and indirect violence. It is of interest to speculate on the mechanism of the so-called indirect violence. It is probable that the victim braces the quadriceps to meet the impact and, the fracture having occurred, the contracting muscle tears the expansions. On the other hand, there was some evidence that division of the patella, having thrown the quadriceps out of action, permitted extreme flexion of the joint in the follow-through of the impact. In one case the driver sprang out of the car unaware that he had fractured his patella, and the knee collapsed beneath him when he attempted to cross the road.

In relation to the torn expansions, it is to be noted that the greater the damage the less may be the subsequent swelling of the joint. The overlying soft tissues are thickened by contusion, but synovial effusion and haemorrhage escape through the rent in the capsule into the tissue planes of the leg.

In the present series there were 25 fractures in 22 patients, five of whom were women. The right side was involved on eleven occasions, the left on eight; and in three patients, two of whom were women, the injury was bilateral.

The sites and types of fracture were: comminuted superior pole, 1; transverse central, 6; comminuted entire bone, 2; comminuted inferior pole, 13; lateral marginal, 3.

Complications

In ordinary circumstances fracture of the patella is an isolated injury: treatment and final result are seldom determined by general or local complications. When local complications do exist, as in the unfortunate combination with fracture of the shaft of the femur, the difficulties of treatment and the effect on the final result are well known. In the dashboard fracture, complications are the rule rather than the exception.

General Complications.—Head, thoracic, or extremity injuries of a degree of severity which endanger life may preclude any form of treatment or take precedence in such a manner as to influence the final result. Five were Service cases, of which no records were available. In only three of the remaining 17 were associated injuries described as trivial. Fourteen patients incurred 23 injuries:—Head and neck: fracture of skull, 1; concussion, 3; fracture of mandible, 1; fracture of cervical spine, 1; laceration of face, 7. Chest: fracture of sternum, 1; fracture of ribs, 1; Arm: fracture of ulna, 2; one of which was compound; fracture of metacarpals, 1; dislocation of metacarpophalangeal joint, 1. Leg: fracture of tibia, 3; two of which were compound; wound of other knee-joint, 1. In two of these patients the complicating injuries were such that no treatment of the patella was possible; in three, these injuries delayed treatment from one to four weeks; and in the remaining nine treatment was uninfluenced.

Local Complications.—In the fracture of the inferior third, which is the commonest variety, the smaller fragment is crushed between the edge of the dashboard and the femoral condyles, with consequent contusion of the intervening soft tissues. The injury to the overlying skin varies between an abrasion and a wound exposing the femoral condyles. A superficial abrasion, however, situated at a site normally subject to pressure, is no indication of the severity of the underlying contusion of tendon, expansions, fat pad, synovial membrane, and even femoral condyles, which have such a profound influence on the final result.

In four of the Service fractures the state of the skin was unknown. Of the remaining 21, 5 were compound and 10 showed abrasions worthy of record. In 14 instances, in addition to the fracture, the lateral expansions were torn and the fragments widely separated. In four cases, all simple injuries, special features were depressed fractures of the articular cartilage of the inferior aspect of the femoral condyles.

Treatment

The treatment adopted followed current practice: fractures without displacement in which the extensor mechanism was intact were treated by conservative means (3); central transverse fractures without comminution where accurate anatomical reduction was possible, by internal fixation by screw (1); fractures of upper or lower thirds with comminution, by excision of the smaller fragments and suture of the tendon to the remaining fragment (10); where the whole bone was comminuted, all fragments were excised and the extensor apparatus was repaired (2); lateral marginal fractures were treated conservatively (1), or by excision of a displaced fragment (2).

The remaining six fractures received primary treatment elsewhere (4) or no treatment (2), and are not included.

In operating, it is important to remember that the violence involved is greater than that normally encountered in a fracture of the patella. The contusion and consequent devitalization of the deep layers of the skin, of the underlying soft tissue, and of the expansions immediately adjacent to the fracture indicate danger from sepsis; and immediate operation may be indicated in the presence of a potentially infective skin abrasion. For the same reason the removal of skin sutures may have to be deferred. Unless the knee is flexed in the course of operation the injury to the inferior aspect of the articular surface of the femur may pass unnoticed.

Results of Treatment

As might be expected, the results are related to the violence of the injury and the presence of complications. (1) The lesser injuries in which only immobilization was indicated secured a full return of function. (2) A patient aged 54, with a transverse fracture, treated by internal fixation, attained bony union and a painless knee but only 35 degrees of flexion. (3) In the polar fractures with comminution, results in terms of flexion varied between 65 degrees and full movement. Six patients failed to attain 90 degrees, one had 90 degrees, and only one had full movement. Recovery in these cases was slow, being characterized by delayed healing of the wound and brawny thickening in the anterior capsule, which in some instances lasted for many weeks. It is clear that the loss of flexion is due to dense fibrosis in the contused soft tissue. (4) Of the two patients with fractures necessitating excision of the entire bone, one secured full flexion, the other 45 degrees. It was of interest, in reviewing a case with bilateral fractures—one treated by total excision and the other by reduction and internal fixation—that the patient, aged 54, persistently referred to the knee in which the patella had been retained as her “good knee,” despite the fact that the range of movement was only 35 degrees, 10 degrees less than that from which the patella had been excised. (5) All patients with lateral marginal fractures made a complete recovery.

Of the two patients with fractures which received no treatment on account of life-endangering complications, one attained 70 degrees flexion, the other 35 degrees. The four fractures which received primary treatment elsewhere were all transverse central in type, and all had been subjected to operative reduction and suture with wire or other material: one, a compound fracture treated by wiring, became infected and resulted in ankylosis; one attained union with 55 degrees flexion; and in two there was non-union. Of the latter, one had an extension lag with instability and 100 degrees of painful flexion; he refused further treatment. The other was subjected to a second operation at which both fragments were excised; in the final result 85 degrees flexion was secured.

The records of this series of dashboard fractures suggest that the results of treatment are poor and below average for fractures of the patella in general. The features concerned are: (1) The nature of the injury, which has already been described. The position is perhaps over-simplified by the statement that the ordinary fracture is an injury of the

extensor apparatus, whereas the dashboard fracture is less an injury of the extensor apparatus than a violent contusion of the components of the knee-joint. (2) Absence of appropriate primary treatment: The demands of complicating life-endangering injuries often dictate the nature and timing of treatment. (3) Age of the patient. Apart from the Service patients, whose average age was 25 years, the youngest of this series was 32 and the oldest 66, the average being 45. The age of the patient in a gross injury of the knee-joint influences the result; the only perfect result of a comminuted fracture of the lower pole occurred in the youngest patient.

Discussion

The road accident problem of Britain is largely that of collision between car and pedestrian or cyclist; the American problem is of collision between car and car (*Autocar*, 1949). The fracture which has been described has been recognized for many years as a clinical entity in America, and, according to Ferciot (1939), is being encountered with increasing frequency. Most orthopaedic surgeons will confirm a similar tendency in this country.

The injury has been named "dashboard" fracture; but it can be produced by impact with any rigid projection, such as glove-tray, umbrella handle hand-brake, and radio set or heater controls which oppose the front seat; and the victim of a collision who escapes with nothing more than a fracture of the patella is fortunate. The knee injury, however, is often only one of multiple injuries sustained in a similar manner; but it is the well-defined mode of production which is important, for it serves to illustrate a mechanism of injury in automobile accidents which merits serious consideration.

The orthopaedic surgeon called upon to treat the results of collisions at all hours of the day and night may be excused if he shows a professional interest in certain features of automobile engineering which have received little attention from the industry and none from the public. It should be possible to prevent, or at least to modify in degree, the variety of injuries produced by violent contact with the dashboard, windscreen, and steering wheel; suggestions to this effect have come from the profession in the past (Ferciot, 1939; Woodward, 1948). There is something wrong with a design which produces in the same patient a bilateral fracture of the patella with the edge of the dashboard and a bilateral compound fracture of the upper third of the tibia with the sharp edge of the glove-tray located immediately below.

Must the dashboard be rigid? Need it be studded with projecting knobs, switches, and glass-faced dials to break the teeth and disfigure the face of a child when the driver brakes in an emergency? Can it not be sprung or hydraulically mounted, padded with rubber of suitable consistency, and generally made less dangerous? Is the rigid glass windscreen which produced head or facial injuries in half the patients of this series essential? Is a plastic windscreen which ejects on contact, said by Woodward (1948) to be fitted to one make of American car, impracticable? If the steering column can be made adjustable for angle and length, and the wheel to absorb road shocks, could they not also absorb a blow from the chest rather than inflict fractures of sternum and ribs and grave injuries on the vital underlying structures? Is the compulsory fitting of safety-belts a fantastic idea; or is it just a matter of time?

These are but a few of the many possibilities which suggest themselves in the course of investigating the causes and complications of a particular injury. Such safety measures could have no effect on the incidence of road accidents; but they could exert a favourable influence on morbidity and residual disability.

Summary

The mechanism of injury in dashboard fractures of the patella is described.

Twenty-five fractures are reviewed in regard to type, complications, treatment, and result.

The difference between "dashboard" and "ordinary" fractures is stressed.

Suggestions are advanced for the protection of the front-seat occupants of a car from dashboard fractures and associated injuries of similar mechanism.

REFERENCES

- Autocar*, 1949, April 15, p. 340.
Ferciot, C. F. (1939). *Amer. J. Surg.*, 44, 139.
Woodward, F. D. (1948). *J. Amer. med. Ass.*, 138, 627.

HEART FAILURE IN CHILDREN WITH ACTIVE RHEUMATIC CARDITIS

BY

GERALD THOMAS, M.B., M.R.C.P.

Physician and Deputy Director, Special Unit for Juvenile Rheumatism, Canadian Red Cross Memorial Hospital, Taplow

Heart failure is generally regarded as not uncommon in children with rheumatic carditis, and it is accepted as important evidence that that carditis is active (Bland and Jones, 1951). Differing views have been expressed on the efficacy of digitalis in its treatment. Thus Schwartz and Schwedel (1930) found no response in 12 cases, whereas Sutton and Wyckoff (1931) noted improvement in all their 22 cases. In the more recent series of Walsh and Sprague (1941) there was a beneficial effect in 15 cases but no response in 20.

In our experience at Taplow, heart failure in rheumatic carditis has been uncommon, but it has usually responded well to digitalis. The differences between our findings and those of others may be due to the distinction we make between pericardial effusion and heart failure: abnormal signs may easily be attributed to heart failure, whereas they are in fact due to effusion. The distinction may be difficult, for in both conditions there may be dyspnoea with reduced vital capacity, increased jugular venous pressure, and enlargement of the liver. Furthermore, pericardial friction may not be heard in effusion, the electrocardiogram may be normal, and the radiological appearances may be similar to those of dilatation. The question is of more than academic interest, however, for the prognosis of effusion is better than that of failure: of 23 patients with effusion and no evidence of failure seen here during the last four years, four died; of seven with failure, three died.

The diagnosis of effusion was confirmed in 11 out of 23 cases: by aspiration of fluid in one, by radiography after the passage of a catheter (Wood, 1951) in six, and at necropsy in four. These 11 cases and the remaining 12 of the pericardial effusion group presented a single complex of clinical and radiological signs. The seven cases showing failure presented another and different complex, and the absence of fresh pericardial effusion was confirmed at necropsy in three. The object of this paper is to delineate the two complexes of signs which characterized these two groups, according to the classical method for the definition of clinical syndromes.

Salient Features of Pericardial Effusion

The clinical and radiological signs of rheumatic pericardial effusion have been described previously (Thomas,