Motor racing

K. K. EATON, L.R.C.P., L.R.C.S., L.R.F.P.S.
Andover

MOTOR racing is a popular and fast-growing sport in Britain as elsewhere. The three largest motor racing clubs have a membership between them of some 23,000 of whom about 40 per cent are active participants. Every weekend from March till October there are in the region of five major race meetings, at which approximately 80 drivers take part. In addition there are perhaps a dozen or more sprint or hill climb meetings with the same number of competitors. The term motor racing may also justifiably be applied to the many autocross and rallycross events which take place each weekend, and may also number in the region of a dozen. Thus it may be seen that in the region of 2,300 persons compete each weekend in some form of motor sporting activity, supported by about the same number of officials, and watched by 15,000–20,000 spectators.

A hazardous sport of this complexity must clearly have a competent organization. The Royal Automobile Club's Motor Sport Division is the parent body that licences circuits for use, and clubs and drivers to race, and any infringements of their rules are likely to lead to penalties up to disqualification for life.

At each meeting the senior officials are stewards, one appointed by the RAC and one or more by the organizing club. They are responsible among other things for the overall safety of the day's activities and may call the racing to a halt if required. The clerk of the course is the general organizer. At intervals round the track officials are posted to assist in the event of accident. At each post arranged at 100–200 yards intervals are: (1) An observer and his assistant who watch the cars as they race to ensure that they remain safe and to make sure that they are safely and responsibly driven. The observers also organize the team at each marshalling point. (2) Course marshals, who are present to assist any car or driver in difficulties. (3) Flag marshals who give internationally-agreed signs of information or obstruction to the drivers; blue, stationary or waved, indicating the presence of another car, yellow, stationary or waved, indicating danger or red and yellow indicating the presence of spilled oil on the track. (4) Fire marshals who may these days be wearing aluminised asbestos suits enabling them to spend up to 60 seconds actually working in a petrol fire. In addition to these officials ambulances manned by St John's first aiders are stationed at regular intervals round the circuit as are fire engines. The medical staff consists of doctors of whom one in overall charge is situated in the race control building and the others are based on marshalling points at strategic points round the circuit.

Other than as spectators, doctors are most likely to come in contact with motor racing when a patient presents himself seeking a medical certificate of fitness to race. The certificate is issued by the RAC Motor Sport Division, 31, Belgrave Square, London S.W.1. They will supply copies to any doctor on request, but it is usual for the applicant to bring the form with him. The BMA do not have a formally recommended fee for performing this examination, but a spokesman recently suggested to me that the same fee as they recommend for the HGV examination, namely £4 10s. 6d. would be appropriate. Clearly for this sport a comprehensive examination is required. There is space on one side of the form for a brief medical history and a form of consent by the would-be driver giving permission for his medical history to be divulged to the RAC.

The medical examination comprises a check on cardiovascular function, which includes blood pressure, and next a survey of the skeletal system for free and controlled movement of upper and lower limbs. A particular check of any arthritis or previously fracture-damaged joints should be made and the muscular power and co-ordination tested. If muscular power is lacking this may not be an absolute disbarment. One driver known to me competes with a complete flaccid paresis of both lower limbs following anterior poliomyelitis. He wears irons on both lower limbs, and has been given his medical certificate by the RAC medical panel. Amateur racing drivers may wish to continue driving to a considerable age. Several well-known drivers currently competing are in their sixties or seventies, and the question of Parkinsonism or spastic limb paralysis after strokes may enter into discussion. The next section to which attention should be paid is the visual function. A racing driver must have good visual accuity, no field defects and good co-ordination. He may easily be required to react from studying his instruments three feet away to an incident requiring sharp braking at 150 yards. At 140 mph in a large racing saloon car it could take this distance to stop by applying the brakes. When driving fast round a corner he may need the whole of his field of vision to react to another car out of control on the same corner. A specific search therefore should be made for field defects such as tunnel vision or hemianopias; lack of visual accuity in one eye is not necessarily going to exclude an applicant if his visual field is good. One well-known club hill climb driver has vision only in one eye. This may lead to co-ordination difficulties in judging distances if it is a recently acquired defect, but those who have it a long time always seem able to judge distances by monocular vision. This candidate was also given his licence by the RAC medical panel. Colour vision should be normal for red, blue and yellow, but green need not be perceived. In this respect automobile racing is different from the requirements of motorcycle racing where yellow-green colour-blindness is not acceptable, but red–green colour vision is not required. The form concludes by enquiring if there is any physical or mental condition which in the opinion of the examiners could deter the applicant from motor racing. Obviously any degree of mental abnormality, particularly psychopathic personality, or aggressive tendencies should debar a candidate from competition. Personality changes after head injury may be a reason for advising an experienced driver to retire from competition. The danger of deliberately ramming a car at speeds of over a 100 miles an hour are such that discretion by the examining doctor is far better than valour. The maximum number killed by a racing car was 65 at Le Mans in 1955, under rather extraordinary circumstances. In this a crash into a densely-packed crowd was followed by an explosion of a large capacity petrol tank which was surrounded by magnesium alloy bodywork. The speed was approaching 170 mph. Modern precautions on race track and car design should obviate recurrence of an accident on this scale.

There is an alternative to rejection of the applicant if any doubt exists. The RAC operate a panel of doctors who are experienced in assessing the capabilities of disabled drivers in relation to racing. A driver who is refused a medical certificate by the examining doctor may appeal to this medical panel which may licence him to drive if they think fit. The detailed rules issued for guidance are available on page 28 of the current *Year Book*.

Finally I should like to discuss some of the recent hazards of motor racing and instance the treatment undertaken and the changes made to help to prevent their recurrence. Fire is a perpetual hazard in a racing car. In theory it should also be so in road traffic accidents, and I am puzzled as to why cars catch fire so infrequently in collisions on the road. However, in a racing car the driver is usually closer to the fuel tanks, which may contain aviation spirit or even (in hill climbing, sprints or drag racing) fuels containing nitromethane which in addition to giving toxic combustion products is highly

explosive. Alcohol which burns but is less likely to explode is unfortunately less used to-day. In addition the fuel tank capacity is greater. A modern grand prix car contains tankage for over 250 miles, and consumes fuel at the rate of around 2–3 miles per gallon at racing speeds. Even a small saloon car such as a Mini may consume fuel at the rate of 8–12 mpg when highly tuned and running at racing speeds. Light magnesium alloys and large section tyres will burn well once ignited, and glass fibre bodywork is also combustible. Thus a fire in a racing car, once started, will be fierce and prolonged.

There have been a number of accidents where the car is over-turned and the driver is trapped or has a head injury in addition. The burns thus sustained are usually fatal, and the accidents to the late Archie Scott Brown at Spa in 1957, and the late Lorenzo Bandini in 1967 at Monaco spring to mind. The latter accident in particular prompted considerable thought and some research on preventitive treatment, with the following results. (1) The drivers now wear special overalls of a Dupont nylon material "Nomex" over a similar layer of long sleeved pants and vests, and Nomex socks and gloves. This material will neither burn nor support combustion, and will give a driver some 20 seconds in a petrol fire before his body is burned. In addition he wears a combination of a Nomex face-mask and possibly an all-in-one crash helmet which prevents flames reaching his face and causing inhalation burns of the respiratory tree for the same period of time. (2) The fuel system now contains fuel in special rubber bags which will not easily rupture on collision, and are self sealing when the fuel meets the outside of the tank. Fuel pipe lines are similarly protected. The cars may carry (in some races are required to carry) a built-in fire extinguishing system activated by heat or by collision. In the event that these built-in precautions do not prevent a fire the marshalling requirements have been stepped up, and firemen with aluminized asbestos suits supplement the fire marshals equipped with both foam and carbon dioxide extinguishers. Clearly if a fire can be extinguished promptly the problem of extraction of the driver is lessened, as the car can then be righted if necessary. Heavy shears, bolt cutters and hydraulic body jacks are available if required to extract an injured driver. The medical officers and the incident officers work together on an occasion like this.

When a driver is injured as a result of a crash the observer in charge of the nearest post calls race control who despatch the nearest medical officer and the incident officer. The diagnosis of the nature of the injuries is often far from clear, and if it is not possible to move the car well clear of the track it is urgent to extract the driver. However, basically the principle is to diagnose the probable injuries erring if in doubt on the side of caution, and assuming that internal injuries may well be present if the driver has hit the car with his body. The clothing is not disturbed unless necessary until the driver is out of the car, although if practicable the crash helmet may be removed. It is sometimes possible to apply plastic inflatable splints to limbs before the driver is removed. Under the guidance of the doctor the patient is then removed from the car by cutting it off him and is then loaded into an ambulance at the side of the track. Thereafter a fuller examination is made and the decision is taken as to whether to remove him to the circuit's medical room for dressings and initial or definitive treatment, or to direct him immediately to the nearest district hospital. Occasionally burns or head injuries may be referred directly to specialized units if this is convenient, but generally the policy is to refer the patient to the nearest full district hospital if inpatient treatment is going to be required, without attempting at the track side to decide on the severity of the lesions. As a matter of courtesy the nearest district hospital is always notified where racing will take place, before the meeting starts, so that they are warned in advance. The policy at the track side is changing over the years and new trends are towards speedy transfer rather than attempting to do ambitious procedures before transfer of the patient. For example setting up an intravenous infusion may cause temporary improvement which has been lost by the time the patient reaches hospital.

The hazard of head injury remains potentially as great as it ever has been, but current precautions are reducing its incidence. Until as late as 1951 it was permissible to drive without a crash helmet, and many grand prix drivers favoured a linen cap which gave no protection whatsoever. Over the years the head protection requirements have been increased steadily. Now drivers are required to have a crash helmet to BSI 1869 or 2495. These must give full temple protection. One, the Bell Star, now is giving increased facial protection by having a chin bar built in and a facial visor incorporated; in doing so it has become heavier and possibly increases the risk of cervical spine injuries due to whiplash. The likelihood of this, however, is diminished by virtue of the semi-recumbent posture adopted by racing drivers where the driver has his head already almost fully flexed on to his chest and has a head rest behind him thus restricting the range of possible head movement. In addition even in open cars the wearing of safety harness is now widespread (under American rules it is sometimes mandatory). The type of harness used differs from the 'full' harness sometimes worn on the road in that an additional pair of straps pass round the perineum and prevent the driver in his recumbent position 'telescoping' into the car in a head-on collision. With such precautions in an open racing car, I have examined a driver after an accident at about 100–120 mph in which the vehicle overturned, and found no signs of any physical injury.

Fractures have always been associated with injuries in motor racing and still are found in most accidents in which injury takes place. Lower limb fractures, femoral shaft, 'bumper' fractures of tibia and fibula or Pott's fractures are most common. In severe lateral impacts pelvic fractures may be seen, but these are more common in motor cycle racing. Chest fractures are becoming rarer since the almost universal adoption of full racing harness. However under racing stresses mountings may break and the car may be driven in upon its occupant. To prevent this steel anti-roll hoops are often fitted, especially to saloon cars so that the general shape is retained. Without them the modified saloon or road-going sports car is possibly the most dangerous vehicle on the track. Single-seater racing cars are constructed either with a chassis of welded, small diameter, steel tubes, a 'space frame' or a box section steel or aluminium sheeting, a 'monocoque' construction. The monocoque in a collision is infinitely the stronger (although it is more expensive to repair) and medically it is to be favoured. Unfortunately, since it costs more to make and repair, it is consequently less favoured by constructors of cheaper formula racing cars—the very vehicles likely to be driven by the less experienced drivers who may be more liable to have a crash. Although seat harness reduces incidence of limb fractures, especially telescoping injuries in open wheelers, this is a field in which above all we have furthest to go in improving the safety of the sport.

Summary

A brief account is given of the nature and organization of motor racing and the medicine that goes with it. The scheme of examination for fitness to drive is described.

Some of the hazards when accidents causing injury are experienced are instanced. Motor racing gives the doctor an opportunity to see all the hazards of road traffic accidents, including those that he may not meet on the roads for another decade. Unlike horse-racing medicine, however, he may obtain an excellent view of the sport whilst performing his duties.

Acknowledgements

The author wishes to thank Mr Geoffrey Branson, chief medical officer BARC and Dr T. W. I. Lovel for help and criticism in preparing this article.

REFERENCES

Henderson, Michael (1968). *Motor Racing in Safety*. London. Patrick Stephens Ltd.
RAC. (1970). *Motor Sport Year Book and Fixture List*. London.