

CASE REPORT

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A dangerous design for a mountain bike

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Abstract The case of a man's death as a consequence of an accident with a mountain bike was examined. Despite only slight external injuries, a general examination revealed the existence of a rupture of the diaphragm which was the ultimate cause of death. The discussion reconstructs the way the accident occurred and briefly analyses the consequences of safety design in two-wheeled vehicles.

Keywords Diaphragm rupture · Mountain bike · Traffic safety

Introduction

Today's level of vehicle safety has been achieved thanks to the contribution of studies of accident victims presenting either injury or death.

The use of mountain bikes, either for their specific application or as an urban or road vehicle, has undergone enormous growth in the last few years. Like all means of transport, the use of such bikes involves certain hazards and a study of the injuries derived from accidents with them should be taken into account in order to increase the level of safety they offer.

In the few bibliographical references found on this subject, some studies [1, 2, 3] deal with health-related problems occurring following the reiterated use of mountain bikes, whereas others [4, 5, 6, 7] describe consequences of a greater importance.

The work of Nehoda and Hochleitner [4] makes an express reference to the fact that the cause of lesions is of special importance when accessories such as "bar ends" are added to the vehicles. Nevertheless the present case shows how the original design of the bicycle was already potentially dangerous.

Case report

A 39-year-old athletic man with no known pre-existing pathology, 153 cm in height and weighing 60 kg, rode his mountain bike 3 times a week. On one of these occasions, when riding down a slight slope on a cold winter day, he suddenly fell. According to eyewitnesses who saw the accident from a distance of about 200 m, the bike, estimated to be travelling at 20–30 km/h, seemed to stop suddenly and the cyclist flew over the handlebars. When the witnesses approached, they observed that although the man presented no obvious external injuries, he had difficulty breathing. Despite their efforts, the man died before the ambulance arrived.

During the subsequent autopsy, the external examination only showed abrasions on the palms of both hands and two contusions located over the knee area. Neither the cranium, including its contents, nor the neck showed any sign of injury. When the thoracic and abdominal cavities were opened, a diaphragm rupture affecting the costal diaphragm and the central tendon was observed, with the crura unaffected. As a consequence of the rupture, the abdominal viscera had been drawn up into the thoracic cavity, giving rise to a cardiopulmonary compression that was finally the cause of death. In the remaining thoracic and abdominal viscera, no injuries were found. The sternum and ribs were also uninjured.

Discussion

The external injuries presented by the victim were by no means indicative of the dramatic extent of the internal injury produced by the fall. Diaphragm ruptures frequently occur in traffic accidents accompanied by other injuries, although there are frequent cases of this type of injury due to blunt trauma.

The absence of visceral injuries was of particular note, since the literature on similar types of mechanical injury contains frequent references to hepatic or pancreatic trauma [8, 9, 10].

In view of the fact that no other vehicles had been involved in the accident, the bicycle itself was examined with the aim of finding an explanation for the injury leading to the man's death.

It was a vehicle to which no accessories had been added. The pedals had no foot restraints, leaving the feet free and there were no suspension or shock absorption



Fig. 1 Vehicle involved in case report

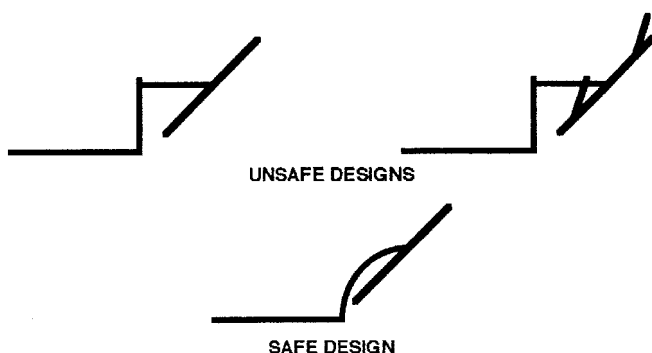


Fig. 2 Levels of design safeness

systems present. Figure 1 shows the details of the handlebars and the way they are connected to the frame. The structure presents a hazardous design that could conceivably be highly dangerous. A technical examination of the rest of the bicycle showed that a complete blockage of the braking system on the front wheel had been produced.

Using these data, the accident was reconstructed as follows: following the sudden braking of the front wheel, the cyclist was thrown forward, his upper abdominal area hitting against the handlebars in an upward direction, provoking the diaphragm rupture. The cyclist fell over the handlebars and hit both knees, causing the bruises. He used his extended hands and arms to protect himself as he hit the ground. The absence of further external lesions in the area receiving the impact can be explained by the fact that he was wearing sufficient clothing to protect himself against the cold, a thermal corset and a double weather-proof cycling suit.

To deduce the cause of the lesion mechanism, in addition to eyewitness accounts, the following determining elements were taken into consideration: the first was that there was no other structure capable of producing the compression, the bicycle had no accessories on the handlebars as was the case according to Nehoda and Hochleitner [4] displayed in Fig. 2. The second was that to attribute the lesion to the end of a set of conventional handlebars a sharp turn would have had to have been made using both hands, permitting the ends to contact the affected body area. In this case, the fall would have been on the man's side and consequently his external injuries would have been significantly different.

It is safe to say that if the handlebars had been connected to the frame using a curved instead of a sharp element, the accident could have been no more than another cyclist's mishap producing only slight injuries.

The existence of a hazardous structure on a bicycle may have potentially fatal results, turning a common mishap, as is fortunately the case in the majority of occurrences, into a fatal accident. The replacement or modification of this part, as Fig. 2 shows, may make the bicycle somewhat more expensive, but it is an investment in cyclist safety that should definitely be considered.

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