Legal Medicine 24 (2017) 63–66

Contents lists available at ScienceDirect

Legal Medicine

journal homepage: www.elsevier.com/locate/legalmed

Case Report

Traffic accident or dumping? – Striking results of a traffic accident reconstruction

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ARTICLE INFO

Article history:
Received 26 August 2016
Received in revised form 4 November 2016
Accepted 7 November 2016
Available online 8 December 2016

Keywords:
Traffic accident
Dumping
Reconstruction
Pedestrian

ABSTRACT

An atypical traffic accident scenario should be investigated directly at the crash site from all concerned professions, especially police men, forensic pathologists and technical experts, to get a personal overview and impression of the situation and the opportunity for interdisciplinary discussion.

We present the rare case of a fatal traffic accident on a German motorway which was initially thought to be an accidental discovery of dumping a corpse. Based on autopsy findings, the technical investigation and the accident reconstruction, this case was solved as a spectacular form of a collision between a pedestrian and a bonnet-front car, which was not described elsewhere in scientific literature to the best of our knowledge.

The pedestrian was hit in an upright body position, was lifted up by the car, smashed the windscreen and flew over the car with several body rotations. His flight curve ends directly at the roof of the car during brake processing, where the body touched the roof, smashed the rear-window and landed in the trunk.

Based on the technical investigation, the driver of the car was not able to hide the accident. However, the pedestrian could have avoided the collision if he did not cross the motorway on foot.

1. Introduction

More and more modern motor vehicles are equipped with several safety-features for drivers and passengers like seat belts, airbags, crush zones, etc [1]. It's clearly evident that by the use of such safety-systems fewer drivers and passengers have been killed in accidents. However, there are still fatal traffic accidents with approx. 1.25 million victims in the whole world per year [2]. In Germany in 2014, 28.500 people had a collision in a car, or were hit by one, and about 3.000 people died [3].

In every fatal case, forensic pathologists as well as technical engineers have to be involved in the investigation proceedings to state or rule out personal or technical failure as the cause of the accident in question and to document all personal injuries and vehicle damages to reconstruct the accident.

An atypical accident scenario should be investigated directly at the crash site from all concerned professions, especially police men, forensic pathologists and technical experts to get a personal overview and impression of the situation and the opportunity for interdisciplinary discussion. This would often be an important opportunity to give early, valuable clues for criminological investigations in cases of hidden crimes.

Here, we present the rare case of a fatal traffic accident on a German motorway which was initially thought to be an accidental discovery of dumping a corpse. Based on autopsy findings and the technical investigation, this case was solved as a spectacular form of a collision between a pedestrian and a car.

2. Case report

A driver of a bonnet-front Skoda Octavia was driving at night on a German motorway. He suddenly recognized something big on the roadside and immediately braked. In this moment there was a collision with "something". The driver presumed it was an animal. He left his car to have a look, walked a short way back, saw no injured animal and wanted to secure the accident-site. A little later, the driver felt he was in a strange and bizarre situation. When he got back to his car, he didn't realize that the rear-window was broken at first. After opening the trunk to pick up the warning triangle the automatic light in the luggage compartment switched-on and manifested a cruel view. The motorist was

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http://dx.doi.org/10.1016/j.legalmed.2016.11.007
1344-6223/

looking upon a poly-traumatized and severely deformed male body (see Fig. 1).

He called the police. They were afraid of the possibility of a body dumping which was discovered accidentally. The person in the trunk was declared dead due to multiple heavy injuries by the emergency doctor. However, the police did not order a further forensic postmortem investigation as well as a technical investigation at the "crime scene". They immediately transported the dead corpse to the institute of legal medicine and the damaged car to a local car workshop.

3. Autopsy results

We investigated a 79-year old man, height 166 cm, weight 70 kg, in good nutritional condition. He was initially partly undressed, but clothed in dark-blue jogging pants, which showed material melting and paint abrasion especially on the outer edge of the left popliteal fossa corresponding to the color of the car.

A Messerer-like fracture (wedge-shape fracture) with the tip directed to the frontal inside of the left leg was found on the tibia just beneath the knee joint, associated with two massive lacerations of the skin. The left femur also had a complex fracture just above the knee joint. These injuries were interpreted as the point of initial impulse. In addition, there were dislocated fractures of the right tibia and fibula just above the ankle joint and a complex fracture of the right femur just above the knee joint as well. Furthermore, multiple hematomas on the lower and upper leg on both sides were shown.

The pelvis was massively destroyed on the left iliac crest and the pubic symphysis was broken with surrounding bleeding. Additionally, the spine was broken in its lower thoracic segment. The abdominal aorta showed intimal lacerations. There were multiple fractures to the bony thorax including all ribs, the right clavicle and the left scapula. Both lungs were collapsed after some dislocated rip-fragments pierced the lung tissues several times. The thoracic aorta had been completely ruptured between the aortic arch and the descending aorta with heavy bleeding in the surrounded tissue. In total, 450 ml of fresh and unclotted blood was collected from the thoracic cavities.

On the left side of the head and the left arm, there were multiple superficial lacerations of the skin as signs of sharp force due to glass splinters. The cervical medulla was injured associated to a dislocated fracture of the cervical spine between atlas and axis. This resulted in heavy subdural bleeding into the spinal cord.

Toxicological analysis showed a femoral blood alcohol concentration of 0.00 per mill and therapeutic concentrations of pantoprazole in the femoral blood.

The cause of death was a blunt polytrauma with only very short survival time. The mechanism of injury was typical for a collision of a pedestrian with a car, the manner of death was non-natural.

4. Technical investigation

At the time of accident, it was dark and there were dry conditions on the three-lane motorway (local speed limit 130 km per hour, kph). At the crash site a stopping distance of about 207 m could be measured via initial skid marks on the motorway at the collision point until the final position of the car marked by the police.

The investigation of the vehicle did not result in any objections. The tires showed tread depths up to 8 mm. The break-system, light-system and tire-pressure were functional. Additionally, it could be shown that the driver used low-beams during the time of accident, and even the high-beams were fully functional.

The right fender was completely destroyed, the right light-system pressed back into the engine-compartment and the windscreen was smashed at the right (see Fig. 2). There were several contact marks on the bonnet and the roof. The spoiler and the rear-window on the tailgate were destroyed (see Fig. 3).

5. Accident reconstruction

The victim of the accident wanted to cross the road from the right to the left side and was hit in an upright body position, both explainable because of the mainly left-sided located injuries on his body and the direction of the wedge-shape fracture on the left leg [4]. The pedestrian was lifted up by the car, smashed into the bonnet with the left side of his body and pelvis (broken left scapula, smashed left iliac crest and rib fractures, injuries of abdominal and thoracic organs), turned over head with heavy flection of the right side of his body (aggravation of the thoracic and abdominal injuries), dived with his head and neck into the windscreen (fracture of the cervical spine, cuts of skin on the head, cuts on the left arm) so he was accelerated almost to the car's speed. The impact energy was divided into lateral movement, deformation and rotation. Because the car didn't brake the next 0.2 s during reaction-time after collision, the car could overtake the pedestrian. Due to the moment arm between center of gravity and the impulse at the lower body of the pedestrian, the person was sent into several

Fig. 1. Initial position of the deceased in the trunk of the car leading to suspicion of a coincidentally detected body dumping transport by the police.

Fig. 2. Front-view of the car: The right front light is completely destroyed, the right fender and the right part of the hood are heavily damaged and the windscreen is smashed.

Fig. 3. Back-view of the car: The rear-window on the tailgate is completely destroyed.

body rotations. His flight curve ends directly at the roof during massive deceleration of the car, where he touched the roof aloft the c-pillar (with arm or leg), smashed the rear-window from outside and landed into the trunk. An aggravation of injuries and lacerations during this landing is probable.

After the initial heavy breaking process the driver steered his car into the emergency lane, crossed the driveway and stopped at the end of the acceleration strip 207 m after collision (for an overview of the accident situation from bird's-eye view please find Supplementary Material). Fig. 4 shows a sequence picture beginning at the impact with about 120 kph until the "diving" into the trunk at a car's speed of around 75 kph about 48 m after the initial collision (please find the animated presentation attached as electronic Supplementary Material). The reconstruction of the accident phases was done with PC-Crash (version 10.1.0.14a, Linz, Austria), using a complex multibody simulation model for accident reconstruction.

A collision speed of about 120 kph, which was determined by a standard formula for calculation, the stopping distance of 207 m and a reaction-time of about 1.1 s (basic reaction until braking begins plus penalty for the situation at night) could be worked out for the moment before the driver began to brake. Additionally, the collision speed was estimated with an analysis of the injuries by using the wrap around distance of the pedestrian's impact on the windscreen. Previous analyses showed that a minimum collision speed of 70 kph is necessary for the pedestrian to reach the front edge of the roof. In this case the person had the first contact on the end of the roof, so the collision speed had to be much higher, approximately 100 kph. Otherwise, speeds higher than 130 kph would result in a non-parabolic flight, too much distance between the car and the person, and a possible dismemberment of the body. Therefore, the person couldn't reach the back of the car during breaking process.

Based on the normal walking speed of 8 kph, the pedestrian was entering the right lane approx. 1 s before the collision. At this time the driver was traveling at about 120 kph and was nearly 33 m away. This was the latest point to brake and avoid the accident, which could have only been possible with a speed lower than 55 kph. Therefore, the driver was not able to hide the accident. The pedestrian could have avoided the collision if he had followed the general rule that it is forbidden to enter or cross the motorway without a vehicle. Afterwards the man was identified as a resident at a senior home just a few kilometers away. He suffered from the early stages of dementia and had been missing since the evening before.

6. Discussion

To the best of our knowledge, no comparable traffic accidents are described in scientific literature, which was the reason behind preparing the case report to share with forensic colleagues. Of course, there are case reports of other, but no less spectacular results of traffic accident reconstructions [5].

The severity of the injuries, the damages to the car and the end position of the pedestrian inside the trunk could be matched in total with the introduced accident reconstruction. There were no other signs of injuries except those explainable by the traffic accident and clear signs of vital reactions for the accident-related bone injuries. Therefore, a postmortem transportation could be ruled out with certainty after autopsy. From our point of view, this statement would even be possible directly at the motorway and emphasize the necessity of medicolegal investigation at the crash site for every questionable traffic accident with lethal outcome in combination with a sufficient accident recording by technical engineers.

Here, the policemen first thought it was an accidentally detected transfer of a corpse for dumping. A typical kind of dumping is to transport the corpse away from the real crime-scene with the risk of being caught because of the enormous stress level of the offenders [6]. There are also case reports of sealing the corpse with bricks or dumping them in walls [7,8].

There are a few rules-of-thumb to estimate the impact velocity during pedestrian-car collisions from known or absent injuries [9] and to assess a minimal speed of the car at the collision moment from the grade of damage [10]. Therefore, interdisciplinary teamwork is necessary to match all autopsy results with the damages to the car in every accident case. However, all physical laws perfectly correlated with the presented case, so that the velocity of the car of about 120 kph, the primary impact of the bonnet-front

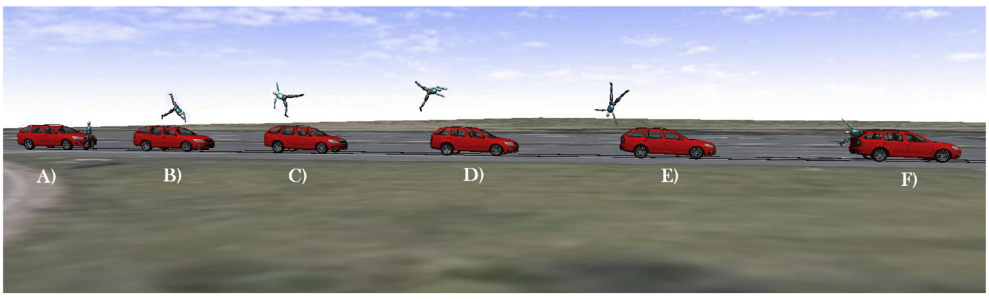

Fig. 4. Sequence picture in synopsis of the interdisciplinary results of the accident reconstruction (PC-Crash® Ver. 10.1.0.14a) as a cutout of the whole braking distance: A) Initial collision between the car and the pedestrian. B)–E) Flight curve of the pedestrian while the car overtakes him. F) The pedestrian smashed the rear-window 48 m after the initial contact during the braking process of the car. – Please find attached supplementary video file online.

car against a pedestrian in an upright body position, the parabolic and rotating flight of the pedestrian straight over the car, and the directly after collision intensive braking phase matched so exactly that the person smashed back into the trunk, which could be visualized in an impressive way by using technical software.

However, if all these variables and conditions come together again, similar traffic accidents may occur in the future, but are hardly conceivable with motor vehicles other than bonnet-front cars, e.g. flat-front vehicles like SUVs or vans. These vehicles have a modified front and the pedestrian center of gravity is lower than the front of the car so that the person will be pushed back onto the road during the braking phase leading to rolling traumatism and were not lifted up [1,11].

Conflict of interest

The authors declare that they have no competing interest.

Acknowledgments

We want to thank the public prosecution office for the access to the complete investigation file and their approval for publishing the case report.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.legalmed.2016.11.007.

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