

## DEATH CAUSED BY AIRBAG IN VEHICLE

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### ABSTRACT

**Introduction:** This is a case of death of a bus driver, caused by an activated airbag during a frontal collision with a large truck which suddenly intersected the driver's path. **Materials and methods:** Inspection of the accident scene. Full forensic examination. **Case Presentation:** During the inspection of the scene it is found that the bus collided square in the middle part of the back of the truck (type "TIR"). The trajectory of the bus to the point of impact is well-defined by brake tracks. The front of the bus is "tucked" under the chassis of the truck and due to the "diving" of the front section during an active halting. Thus contact with the edge of the chassis is made with respect to the bus in the area between the front bumper and the windshield wipers. During the deformation of the bus, the steering wheel approaches the driver's seat, pressing against the driver's abdomen. The airbag unfolds at about 1/3 of its full volume. The remainder was still pleated under the torn decorative cover. The driver is overweight with a large gut. The autopsy revealed discrete bruises on the skin of the anterior abdominal wall, extensive traumatic tearing between the fatty apron of the anterior abdominal wall and underlying muscle, the presence of 2900 ml of blood filling the abdominal cavity, a torn inferior vena cava, mural torn abdominal cavity, and blood loss of the entire body. **Discussion:** The cause of death was acute traumatic blood loss from a life-incompatible rupture of the inferior vena cava, under the influence of hard-hitting kinetic energy from the opening of the airbag. Several overlapping factors have led to the fatal **results:** 1) Three cables activating the airbag are located in the bumper of the car, on the presumption that it is the most protruding part, hence it deforms first. In this case the bumper deformed last; 2) In the process of the cabin's deformation, the steering wheel was recessed into the seat and thus pins the driver back. Only then is the airbag activated, "exploding" in the abdomen of the victim; 3) The driver's large gut further increased the density of contact with the wheel. In practice, the anterior abdominal wall prevented the airbag from opening fully. **Conclusion:** This case is a demonstrative example of how the protection system of the car, due to mechanical imperfections, can cause death rather than save lives.

**Key words:** *airbag; laceration of the inferior vena cava*

### INTRODUCTION:

Airbags are devices that serve to protect the passenger from collisions. Other such devices are the seat belts. The airbags are filled with gas bags built into the steering wheel, instrument panel, doors, ceiling beams or car seats; they rapidly open in case of a frontal or side impact. They are operated by crash and deformation sensors and react rapidly with inflation to protect the body of the driver from serious injury in a possible crash.

Since 1950, when the German gentleman, Walter Linderer, and American, John Hedrick registered the first patents, and to this day, engineers all around the world are constantly trying to improve the integrated security system in the vehicle compartment and the airbags as part of it (9). The airbags provide a softened and wider contact surface, which is far less traumatic than a dashboard, steering wheel, windshield, or the other parts of the interior of the vehicle (4, 5). Modern airbag systems are activated automatically, regulated by a number of built-in sensors that take into

account: 1) the size and weight of the driver, 2) seat position, 3) the presence or lack of a seat belt, 4) impact force, etc. This is the perfect model for anyone seeking modern developments (3, 6).

This is how airbags work:

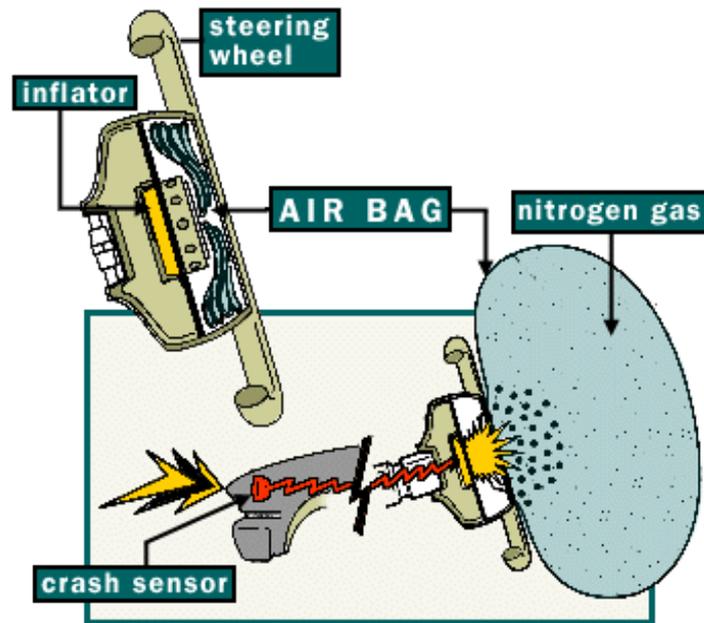


Figure 1. Airbag device.

In the vehicle body are sensors that react to a strong enough electric impulse to the detonator casing located at the base of the folded airbag. A swift chemical reaction occurs, in which an explosion releases large amounts of nitrogen, filling a pleated bag of strong textile fabric hidden under a decorative cover.

Numerous technological imperfections of airbags have been demonstrated in practice. Often they have serious and sometimes fatal consequences (2, 10, 11). One problem that arises is related to where the airbag will hit the passenger (7). The best scenario is when the contact is made with the thorax and the head simultaneously. The most frequent causes of accidents related to airbags occur if the contact is isolated at the head and neck (8).

The present case of death caused by an activated airbag is more unusual and curious (12). The fatal outcome is due to coincidence and overlapping of many unfortunate factors.

This and similar cases of death caused by airbags (1) rightfully lead the public and researchers to move away from the question of "How to protect people from their own risky behaviour?", to "Do we drive our cars installed with a "bomb" disguised as "survival equipment?". The prospect of being killed by a balloon opened at 240 km/h imperatively necessitates a search for better technological solutions.

## MATERIALS AND METHODS

To determine the cause and mechanism of death from a technical and medical point of view, a detailed examination of the scene was carried out, as well as a careful external and internal examination of the body, such as chemical and forensic analyses. All data were analyzed and compared.

## CASE PRESENTATION

This case is about a 52-year-old bus driver, who was killed on the spot following a collision with the back of a large truck (type "TIR"). The crash takes place while the truck attempts to make a U-turn on the road in a dense fog. During the inspection of the scene it is found that the front of the

bus was "tucked" in the middle of the back of the truck. The trajectory of the bus back to the site of collision is outlined by brake tracks with a length of 60-70 meters. The point of contact of the bus to the chassis of the truck is between the armour and the base of the windshield wipers, and dashboard with the steering wheel is pushed back to the seats.

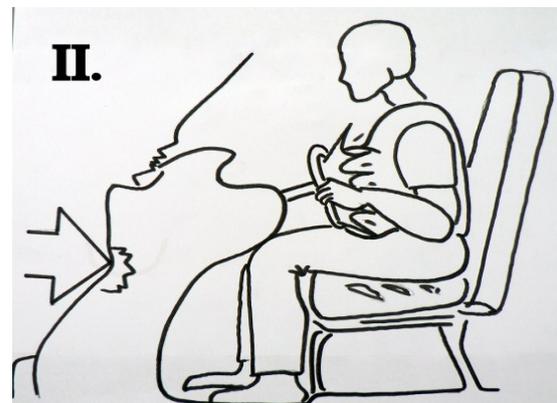
The driver was removed from the cabin before the arrival of investigators. His body was found lying on a stretcher on the road. The Emergency team only affirmed the death. We did not receive certain information as to whether the seat belt of the dead was in place.

The decorative cover of the airbag was found open. The airbag itself was unfolded to about one third of its entire volume. The remainder was found in its original factory-manufactured condition in the body of the wheel.

Visual inspection of the body revealed that the deceased has a highly typical physique - pronounced obesity and abdominal distension, with a prominent gut.



**Figure 2.** Schematic representation of the position of the driver before the impact.

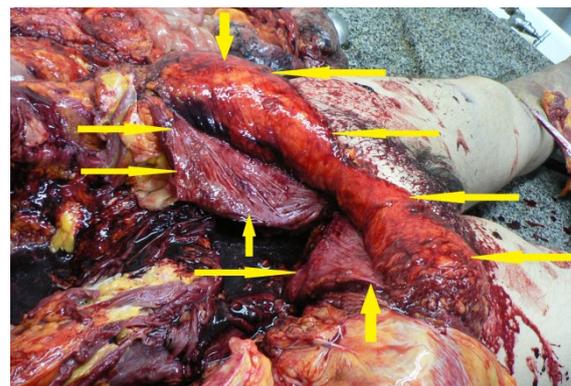


**Figure 3.** Schematic representation of the position of the driver during the collision.

On the skin of the anterior abdominal wall were found discrete pale blue diffuse bruises distributed in a roughly shaped circle on the edge of the abdomen.



**Figure 4.** Bruises of the anterior abdominal wall.



**Figure 5.** Decollement traumatique of the anterior abdominal wall.

During the internal viewing of the body it is found that the fat layer of the anterior abdominal wall delaminated from the underlying muscle, and created a soft tissue pocket full of blood and crushed fat (also called a "decollement traumatique"), a traumatic rupture of the peritoneal back wall, a corresponding traumatic rupture of the inferior vena cava, right-sided retroperitoneal bleeding, bruising of the mesentery of the colon and small intestine in the same place, an effusion of

2800 ml of blood in the abdominal cavity, an isolated fracture of the sternum, and blood loss of the entire body. In addition, it was established that the driver suffered from disease and disability - advanced liver cirrhosis, splenomegaly, generalized atherosclerosis, ischemic heart disease, and a hypertensive heart. Forensic chemical tests of blood and urine showed no alcohol or other psychoactive substances.

### **DISCUSSION**

The driver's death was caused by massive blood loss resulting from a traumatic rupture of the inferior vena cava, as part of the morphological complex of the covered abdominal trauma.

A comparison of the morphological autopsy findings with data from the inspection of the scene suggests that the internal abdominal trauma is due to the explosive action of the airbag which opened too late, preceded by close contact between the anterior abdominal wall of the patient and the facade of the wheel.

There are several factors which lead to the fatal outcome. Firstly, the sensors, which provide the momentum to open the airbag located in the bumper of the car on the presumption that it is the protruding part and the quickest to deform upon impact. This technological solution has proved unfortunate, since in this case the armour is not impacted directly by the collision with the truck and was deformed later. Before the opening of the airbag, due to the deformation of the vehicle, the steering wheel recesses into the seat and thus pins the driver back. Only then the airbag is triggered, "exploding" onto the abdomen of the victim. The imbalances constituting the driver's physique had already determined the very limited spatial possibilities between the backrest and the steering wheel - practically his entire torso occupies this space, simultaneously touching the seat and the steering wheel. In practice the anterior abdominal wall prevented the airbag from fully opening.

### **CONCLUSION**

In a standard situation, in a frontal collision of a bus with primary contact of the bumper and a driver with a normal build, the airbag would open in time and make contact with the chest and face of the driver, protecting him from serious injury. This case is demonstrative of how the protection system of the car, due to mechanical imperfections and failure to account for the physical characteristics of the driver, can cause death rather than save their life.

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