

## Postmortem “delivery” in a pregnant fire victim

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Received: 1 February 2008 / Accepted: 28 March 2008 / Published online: 27 May 2008  
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**Abstract** A 23-year-old woman traveling in the front passenger seat of a car was killed in a traffic accident involving two rear-end collisions. After the second rear-end collision, the car caught fire. While the driver could be rescued, the pregnant passenger remained inside the car. After the fire had been extinguished, a charred body was found in a pugilistic attitude with an exposed abdominal cavity and a ruptured anterior wall of the gravid uterus. Between the woman’s legs, an almost unburned fetus was found with body measurements corresponding to a gestational age of 28 weeks. The placenta had remained inside the uterine cavity and was still connected with the fetus via the umbilical cord. In conclusion, the rupture of the pregnant uterus with expulsion of the fetus had to be considered a secondary event due to the initial heating and subsequent shrinking of the uterine wall.

**Keywords** Rear-end collision · Car fire · Charred body · Uterus rupture · Heat · Postmortem “delivery”

### Introduction

In the medicolegal assessment of burned bodies, the following essential questions have to be answered: (1) identity of the victim, (2) exposure to heat and/or fire fumes before or after death, (3) cause and manner of death, (4)

contributing factors (e.g., alcohol, drugs), and (5) course of events [2, 6, 10, 11].

In severely burned fire victims, the heat-related changes must be differentiated from any mechanical trauma sustained before the fire began. In most cases, the effects of heat on the body continue beyond death, consequently, the destruction and consumption by the fire is mainly of postmortem origin. This is true both for external and internal findings such as skin splitting, pugilistic attitude, loss of soft tissues, exposure of body cavities, shrinking of organs, heat fractures, and thermal hematoma in the extradural space.

Generally, the position of the uterus lying deep inside the small pelvis protects it from the effects of heat such as searing and charring for a long time. In advanced stages of pregnancy, when the corpus and fundus occupy a large portion of the abdominal cavity, the situation is, however, different: After the abdominal wall is (partly) burned away, the enlarged and softened uterus is directly exposed to the heat of the flames.

Recently, we had to investigate the death of a pregnant woman who was killed on the front passenger seat of a car in a traffic accident followed by a car fire. When recovering the charred corpse, the 37-cm-long fetus was found almost unburned outside the mother’s body. By describing this exceptional observation, we would like to draw the forensic pathologists’ attention to the possible occurrence of “postmortem delivery” in fire deaths of pregnant women.

### Case history

A traffic accident happened at night on a four-lane highway, in which a 23-year-old woman in the front passenger seat of a Volkswagen Polo suffered fatal injuries. The car was

Dedicated to Prof. Dr. med. Gunther Geserick on the occasion of his 70th birthday.

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driving on the right lane of the dry road at a speed of about 100 km/h when a Ford Mondeo passenger car approaching it from behind on the same lane collided with the rear end at a velocity about 40 km/h higher than that of the Volkswagen Polo, thus accelerating it in the direction of travel and flinging it diagonally to the right. The Volkswagen hit the right guardrail, was deflected to the left, and finally came to a stop in the left hand lane. The driver briefly talked to his pregnant passenger who told him that she was uninjured.

A few seconds later, another passenger car (Daimler Chrysler SLK) collided with the left rear corner of the Volkswagen Polo standing diagonally on the highway at a speed of 110–120 km/h. Due to this impact, the Polo returned to its original direction of travel, touched the guardrail on the median strip, and rolled on for another 25 m. This second rear-end collision damaged the fuel pipe of the Volkswagen Polo, and when metal construction parts of the car scraped along the road surface, the resulting sparks ignited the escaping gasoline, and the car caught fire.

While the driver could be rescued alive by helpers, the restrained woman in the front passenger seat remained in the burning car. After the fire had been extinguished (Fig. 1), a severely charred body with an exposed abdominal cavity was found in the front passenger seat area. The back rest of the seat was tilted backward. In the footwell between the legs of the body, a largely unburned fetus was found still connected to the ruptured uterus and the placenta in it via the umbilical cord (Fig. 2).

The driver of the Ford Mondeo, who had caused the collision because of his delayed reaction, was highly intoxicated. He was given a suspended sentence of 1 year and 9 months for negligent homicide. The female driver of the Daimler Chrysler, who was not under the influence of alcohol, was accused of having noticed the car standing on the highway without lights too late because she had been



**Fig. 1** Final position of the burned out Volkswagen Polo before recovery of the killed accident victim, who is still in the front passenger seat (arrow). On the right-hand side of the picture, the car causing the second rear-end collision (Daimler Chrysler SLK)

driving too fast to react adequately. She was sentenced to a fine.

### Autopsy findings

Autopsy revealed a charred body of an obese woman with a body length of 169 cm and a residual body mass of 97 kg. The extremities showed a “pugilistic attitude,” the arms were shortened, and the hands were partly consumed by the fire. The skin and large parts of the subcutis were missing from the front of the trunk. The skin of the buttocks and the rear of the thighs had remained and become leathery with a yellowish-brown to brownish-black discoloration. The soft tissue of the head was almost completely burnt away. The right thoracic and the abdominal cavities were exposed. Identity was confirmed by dental comparison.

The skull cap showed heat-related fractures of the outer table. Between the skull cap and the dura, a thin-layered heat hematoma was localized in the left parietal region. The brain had an elevated consistency and a cooked appearance. The extremities had fractured due to the effect of the heat. The surface of the exposed intestinal loops was charred.

The uterus protruded from the gap in the abdominal wall, was superficially charred, and was 18 cm long and 15 cm wide. On the front of the corpus uteri, there was a tear-like, 10-cm-long opening without bleeding in the wound margins. In the cavity of the uterus with an adherent placenta



**Fig. 2** Scene with the charred body in the front passenger seat. The skin has been consumed by the fire, the abdominal cavity is exposed, and the uterus (arrows) is shrunken and ruptured. The unburned umbilical cord is hanging out of the cavity of the uterus, and the largely unburned fetus (arrowheads) is lying between the legs

(15 cm in diameter, 15 mm thick), no thermal damage was observed. The umbilical cord with central insertion into the placenta protruded from the ruptured uterus.

When dissecting the soft tissues of the back, extensive blunt traumatization was found along the thoracic and lumbar spine. The skin and subcutaneous layer were avulsed from the underlying fascia with contusions and crush damage to the fatty tissue (so-called *décollement*). The vertebral column was completely severed at the level of the ninth and tenth thoracic vertebrae. The descending part of the thoracic aorta was ruptured above the diaphragm, and from there, massive bleeding had occurred into the two thoracic cavities (1.6 l in total). Further traumatic findings included ruptures of the liver and spleen, dorsal fractures of the left third to eighth ribs, disruption of the left sacroiliac joint, and fractures of the right pubic bone.

In the larynx, the trachea, and the bronchi, no soot deposits were found; the same applied to the esophagus and the stomach. The mucosa of the trachea was reddened but did not show any heat damage such as edematous swelling or vesicular detachment [7]. The CO-Hb concentration in the corpse blood was measured as 7%, and the test for ethanol was negative. In the pulmonary sections stained with Fat Red 7B, no “smoker cells” could be found.

The male fetus was 37 cm long with a crown-rump length of 25 cm, a body mass of 1,100 g, and a head circumference of 26 cm (corresponding to a gestational age of about 28 weeks). The umbilical cord was 44 cm long, pale grayish-red in color, jelly-like in consistency, and showed no heat-related damage. The skin revealed soot blackening of varying intensity, especially on the head and limbs (Fig. 3). There was patchy detachment of the epidermis due to the effect of heat (“skin slippage”), and the exposed corium was parched brownish red. No fluid-filled burn blisters or full-thickness burns were found.

Flotation tests of the lungs and gastrointestinal tract of the fetus produced negative results. The lungs were dark, small, and liver-like in appearance. No deformities and no pathological alterations of the fetal organs were found.

## Discussion

The reconstruction of traffic accidents has always been an important task in legal medicine [15, 19]. In the reported case, a pregnant woman in the third trimester suffered a traumatic rupture of the aorta as a passenger in a rear-end car collision. When the car caught fire after the collision, severe fire burns occurred with extensive charring, heat flexure of the limbs, and extensive consumption of the soft tissues with subsequent exposure of abdominal organs including the pregnant uterus, which was considerably shrunken and split on its anterior wall. Through this gap in



**Fig. 3** Anterior aspect of the male fetus with very small thermal damage and zones of soot blackening

the corpus uteri, the fetus, which did not show any major heat damage itself, was expelled postmortem but remained connected with the placenta inside the uterus cavity via the umbilical cord. The autopsy of the fetus did not give any indications of a separate existence outside the mother’s body.

The phenomenon of a “postmortem delivery” is a rare finding in putrefied bodies of pregnant women. Bacterial gas formation with a consecutive increase in the intra-abdominal pressure may cause the uterus to prolapse and evert so that the fetus is expelled and placed between its mother’s legs [8, 13, 14, 18]. A probably unique kind of agonal delivery was recently reported by Behera et al. where a 23-year-old woman committed suicide by hanging after her contractions had started and delivered a healthy baby without any medical assistance while suspended [1].

With regard to the mother, in our case, the results suggested peracute death due to internal exsanguination after traumatic rupture of the aorta. The rear-end collision at a speed of 110–120 km/h against the motionless small car in which the victim was sitting produced a characteristic pattern of injuries: extensive soft-tissue traumatization on the back of the trunk, dorsal serial rib fractures in combination with severance of the spine, fractures of the pelvis, ruptures of the liver and spleen, and rupture of the thoracic aorta. This injury pattern is typical of fatally



wounded vehicle occupants after rear-end collisions with a change in velocity ( $\Delta v$ ) above 60 km/h [12].

The car fire, which started immediately after the collision causing the fatal outcome, did not produce any signs of soot inhalation discernible at autopsy or histological evidence of an inhalation of fire fumes. The CO-Hb concentration of 7% was in a range not uncommon in smokers. However, in the present case, there were no indications that the victim was a smoker. As already noted by Saukko and Knight [16], in a rapid flash gasoline fire, there are often low or even absent carboxyhemoglobin levels, which makes the diagnosis of being alive during the fire difficult. Especially in peracute deaths, signs of vitality are usually sparse. Among these fatalities, there is one subgroup consisting of car passengers showing severe traumatization due to the preceding accidents [20].

The relationship between the duration of the fire and the degree of thermal damage has been observed and documented in corpses undergoing cremation [3, 4, 9]. In modern crematories, the temperature is comparable to that in car fires. In bodies retrieved from burned-out vehicles, the extent of heat changes is usually more pronounced than in bodies recovered from house fires [4, 5]. The degree of consumption by the fire depends both on the temperature and in particular on the duration of exposure to flames.

According to our experience gained in cremations, the course of destruction follows a chronological order: Even after about 10 min, heat flexures of the limbs (“pugilistic attitude”) can be seen, after 20 min, the calvaria is free from any soft tissue, and fissures of the outer table appear, and after approximately 30 min, the body cavities become visible [3, 4]. With respect to our case, this time frame of about 30 min roughly corresponds to the interval between onset and extinction of the car fire.

One major effect of thermal trauma is shrinkage of the soft tissues and organs due to dehydration and protein denaturation causing a considerable reduction in size. The affected organs become firm, hardened, and assume a cooked appearance, or, if directly exposed to flames, the surface is charred. The same applied to the uterus of the burned traffic victim in our case: Its dimensions were significantly smaller than in normal pregnant women at the end of the seventh lunar month (physiological height of the fundus three finger’s width above the navel), and the uppermost layer of the unprotected anterior wall was charred.

Heat-related ruptures of interior organs are usually attributed to a raised gas pressure inside casing anatomical structures, induced by vaporization of body fluids or the fluid contents of hollow organs such as the stomach or the bowels. This mechanism is said to be partly responsible for tears of the abdominal wall and of the gastrointestinal tract [17]. Another reason is the loss of tissue elasticity as a consequence of dehydration and protein denaturation. In the

presented case, only the surface of the corpus uteri was charred, whereas at greater depths, the myometrium and the margins of the gaping tear turned out to be moist (uncooked) and red colored (not brownish-pale). This normal-looking appearance of the tissues also applied to the jelly-like consistency of the umbilical cord and placenta, which had remained inside the cavum uteri. The discrepancy between charring of the surface and undamaged appearance in deeper lying structures is typical of exposure to very high temperatures.

The extruded fetus did not show full-thickness burns or charring but only some patchy detachments of the epidermis. Considering the almost unburned condition of the body of the fetus, an exposure to flames does not seem plausible. The constellation of findings rather suggests that the fetus had been protected against heat by the insulating effect of the uterus wall and the amniotic fluid as long as it remained inside the intact womb. When the uterus ruptured and the fetus was expelled, the car fire had obviously already been extinguished so that further burning did not take place. It is therefore fair to assume that the uterus tear occurred only during the cooling of the body, particularly since the tissue exposed in the deeper areas of the split was unburned. A similar finding is seen in heat-related splitting of the skin [2]. The myometrium probably ruptured under the tension of the shrinking process, as the uterus content was hardly compressible and could not be expelled through the regular birth canal.

## Conclusion

Under special circumstances, a postmortem “delivery” may occur not only in putrefied bodies due to intra-abdominal gas pressure but also in fire deaths as a consequence of the thermal effects on the pregnant uterus.

**Acknowledgment** The authors thank Mr. Karl-Heinz Simon for the technical evaluation of the accident and for fruitful interdisciplinary discussion.

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