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CASE REPORT

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A charred body inside a burning car with a garden hose connected to the exhaust pipe: Post-mortem self-immolation, a complex or a complicated suicide after the ingestion of alcohol? The importance of an interdisciplinary approach

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Abstract

The analysis of charred bodies represents a serious challenge for forensic pathologists, and an interdisciplinary approach is often the only way to determine the cause and manner of death. We present an unusual case in which the charred body of a 61-year-old man was found inside his burning vehicle. In order to determine cause and manner of death, an interdisciplinary team was employed, with experts in forensic pathology, forensic radiology, toxicology and fire investigations. Post-mortem computed tomography, autopsy and toxicology ruled out the presence of trauma injury and detected signs of vital exposure to fire and blood alcohol levels. On the other hand, according to fire investigations, the fire started inside the car and partially burned fragments of a garden hose were found along the right side of the car. A suicide could therefore be hypothesized, with the man having attempted to poison himself with the car's exhaust fumes and having set the car on fire. The death was consistent with a complicated suicide in which the victim, in a state of reduced capability, accidentally set his car on fire and was unable to escape. The hypothesis of a complex suicide, with the car having been set deliberately on fire, could not, however, be ruled out.

KEYWORDS

autopsy, carbon monoxide poisoning, complex suicide, complicated suicide, fire-related death, forensic pathology

Highlights

- An interdisciplinary approach is recommended in evaluating charred bodies.
- This method involves experts from different fields working together as a team.
- A suicide in which more than one suicide method is involved is termed "complex suicide."
- Complicated suicides are the result of an unintentional trauma following a failed suicide attempt.
- In some cases, a clear differentiation between complex and complicated suicide is impossible.

1 | INTRODUCTION

Complex suicides are an infrequent type of suicide in which more than one method is employed, and those involving self-immolation are even more unusual. [1, 2]

The term "complicated suicides" refers to those suicides in which death is the result of a fatal, unintentional trauma following a failed suicide attempt and they are even rarer. [3]

The term "post-mortem self-immolation" indicates those cases of complex suicides in which a first method of suicide causes the death of the victim and is followed by self-immolation aimed exclusively at destroying the mortal remains of the deceased. [4]

An "interdisciplinary approach" involves experts from different academic fields working jointly in order to address a common issue. In particular, the team makes use of a language that is clear to every person involved and of a research method that combines both their knowledge and perspectives.

This paper illustrates an unusual suicide in which a man initially attempted to kill himself by inhaling exhaust gases from a car but, according to the fire investigation, a fire subsequently broke out inside the car while the subject was still alive.

By means of an interdisciplinary approach involving a forensic pathologist, a forensic radiologist, a toxicologist and fire and police investigators, the discussion focuses on an attempt to determine whether the car was set on fire intentionally (a complex suicide) or accidentally (a complicated suicide).

2 | CASE REPORT

A police patrol noticed a burning car parked on a gravel road in the country at around 10.30 p.m. one night in November. Once the fire had been extinguished, a charred body was found inside the vehicle: it was lying in a supine position, attached to and apparently inseparable from what remained of the burnt vehicle seat.

Police investigations revealed that the owner of the car was a 61-year-old man with a history of unspecified psychiatric disorders and previous suicide attempts. Analysis of DNA extracted from the femur confirmed the identification of the deceased. The victim had been last seen alive at around 8.45 p.m., when he took leave of his partner, without taking his copy of the house keys. It was further discovered that the man was a smoker and that he had purchased a garden hose a few days earlier at a local hardware store.

On-site fire investigation revealed partially burned fragments of a garden hose along the right side of the car, one end of which was found inserted into the exhaust pipe, with the other end near the front hinge of the right-side door (Figure 1A,B).

FIGURE 1 (A–D) Death scene investigation: The car after the fire had been extinguished, with the pieces of garden hose (yellow arrows) (A, B); the fragments of spirits bottles (C, D) found inside the cabin.

The vehicle was in a severely burned state, with the windshield and the windows missing, making it impossible to ascertain whether the ignition was on or off. Various portions of flat glass reasonably attributable to the missing windows were found inside the cabin in the form of melted material (glass transition starts at 600°C). [5]

Furthermore, glass fragments were found between the two front seats and behind the passenger seat, as a consequence of the fire. Those fragments can be associated with bottles of ethanol-based liquids with a high alcohol content (such as vodka and whisky) (Figure 1C,D).

The engine compartment showed the effects of secondary thermal action and the oxidation of metal parts, though the effects of destruction and consumption were not as severe as those found inside the car. [6]

Fire investigators ascertained that the fire had started in the front of the cabin on the driver's side before spreading to the rear seat, engine compartment and then the outside of the vehicle.

It was likely that flammable vapors emanating from the spirits on the car seats and mats acted as an accelerant, as did the carbon monoxide conveyed into the passenger compartment by the hose connected to the exhaust. The gap in the passenger-side window to let the hose in provided ventilation and an oxygen supply, leading to a rapid increase in temperature.

Post-mortem computed tomography (PMCT) was performed prior to autopsy. No vertebral fractures or metallic foreign objects were observed.

At autopsy, the degree of destruction of the corpse corresponded to level 3 on the Crow-Glassman scale: the skull was still present but the identity of the victim could not be discerned and significant portions of the arms and legs were missing. [7] Heat-related injuries such as fissures involving mainly the outer table of the calvarium, skin splits, rupture of the abdominal wall and prolapse of the partially charred intestinal loops were noted. No signs of ante-mortem injuries were observed.

Soot particles in the trachea and the bronchi, mucous in the airways, thermal damage to the mucosa and pulmonary edema were present. (Figure 2). Other pathologic findings included slight coronary atherosclerosis.

Toxicological exams highlighted a blood alcohol concentration (BAC) of 0.16 gm% and a carboxyhemoglobin (COHb) concentration of 45%.

3 | DISCUSSION

The determination of the cause and manner of death in bodies recovered from burned-out motor vehicles represents a significant challenge for the forensic pathologist, especially when the incident occurs in little-frequented locations. Accordingly, a hypothesis of homicide with subsequent destruction of the corpse must always be considered and an interdisciplinary approach is highly recommended. [8]

3.1 | A suicide involving CO intoxication with vital exposure to fire

In the present case, the absence of significant ante- and peri-mortem trauma and the presence of potentially lethal COHb levels clearly pointed toward the inhalation of combustion products as the cause of death. [9]

These findings, in association with the psychiatric background of the deceased and the presence of the garden hose, were indicative of a suicide.

However, the determination of the cause of death could not be solely based on the COHb levels and it was essential to establish whether the victim was alive or not when the body was exposed to the fire.

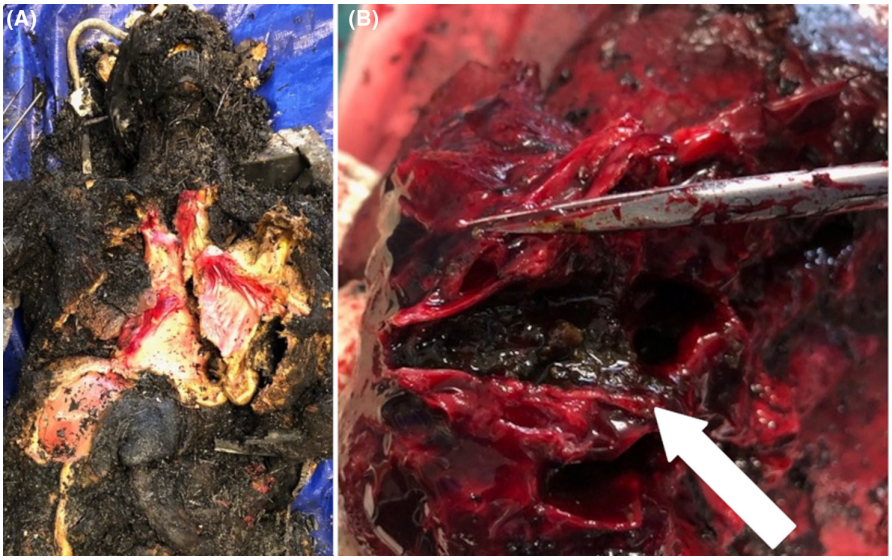

FIGURE 2 (A, B) Autopsy findings: The charred body (A) and soot in the bronchi (white arrow) (B).

The presence of thermal damage to the respiratory mucosa and soot particles in the airways below the glottis was consistent with vital exposure to fire, so a hypothesis of post-mortem self-immolation subsequent to CO poisoning could be ruled out. [10]

With what appeared to be melted window glass and the extensive destruction of the interior, fire investigators declared that temperatures of at least 600°C had been reached. It is well known that temperatures over 150° may be responsible for loss of consciousness, with clothing starting to burn at 225°C and pyrolysis occurring at temperatures between 500 and 600°C. [10]

Therefore, it was highly likely that the victim was still alive when the fire started and that it played a contributory role in his death.

Finally, the advanced stage of destruction of the car led to another critical issue: as it was not possible to determine whether the engine was on or off, the possibility of an accident also had to be considered. In this case, the CO could have been the result of an accidental fire inside the vehicle, even if the hose was a clear indication of suicidal intentions. However, the use of an interdisciplinary method allowed to rule out the hypothesis of a car accident.

Unlike carbon monoxide poisoning, death from burns is particularly painful and violent, and BAC was not suggestive of confusion, stupor or coma. The victim would have therefore been able to leave the car in order to escape. Furthermore, large amounts of CO are typically the result of a smoldering fire. [11]

Therefore, if a fire had broken out inside the vehicle, the man, although intent on committing suicide with the exhaust fumes, would have likely been able to get out of the vehicle.

3.2 | Deliberate or accidental? Complex versus complicated suicide

The use of a hosepipe to connect the exhaust pipe to the car's interior was clearly intentional. However, it was essential to determine whether the fire had been started on purpose or by accident, in order to categorize the suicide as complex or complicated.

Detected BAC (0.16 gm%) is associated with a condition of excitement or stimulation, characterized by unpredictability and behavioral changes, decreased inhibition and sensory response, poor judgment, increased motor reaction time, impaired memory and a lack of muscle coordination. [11]

Moreover, people under the influence of alcohol are more likely to start a fire by mistake and then find it more difficult to escape. [12]

On the other hand, COHb (at concentrations of 30%–40%) can cause impaired vision, abnormal dexterity, weakness, mental confusion and fainting. Moreover, its effect can synergically act with ethanol abuse, causing respiratory impairment and aggravating hypoxemia, with the result that lower levels of COHb could still cause death. [13]

Finally, with regard to the use of fire accelerants, flammable liquids (including spirits) are more frequently observed in suicides and homicides, whereas cigarettes and lighters are more often associated with accidental fires. [14]

In conclusion, there seem to be two ways of explaining the chronological sequence of events and the intention of the victim.

If we interpret this as a complex suicide, the victim connected the exhaust pipe to the cabin with the garden hose, sat in the car,

TABLE 1 Complex suicides involving self-immolation and occurring in cars, complicated suicide involving fire and the current case.

No.	Reference	Type of suicide	Sex and age (years)	Psychiatric condition and PSA	Suicide methods	Unintentional fatal trauma	Other data
1	[15]	Complex suicide inside a car	M 48	Negative No PSA	Stab wound drugs self-burning	-	COHb saturation = 43.6% TBSA = 100% Soot deposits BAC = negative
2	[15]	Complex suicide inside a car	F 32	Negative No PSA	Wrist cut self-burning (fire accelerant: "cocktail")	-	COHb saturation = 75% Soot deposits TBSA = 10% BAC = 0.03 gm%
3	[16]	Complicated suicide	M 60	DNP	Self-immolation	Stab injury by glass fragments (as a consequence of a fall against a glass door)	COHb saturation = 20% Soot deposits TBSA = 65% BAC = negative
4	[17]	Complicated suicide inside a car	M 53	Paranoid disorder No PSA	Gunshot to the mouth	Accidental CO poisoning and burns (fire as a result of engine overheating)	COHb saturation = 40% Soot deposits TBSA = 55–60% BAC = DNP
5	Current case	Complicated or complex suicide inside a car[a]	M 61	2 PSA (medicine ingestion)	Inhalation of exhaust fumes	CO poisoning, smoke inhalation and burns	COHb saturation = 45% Soot deposits TBSA = 100% BAC = 0.16 gm%

Abbreviations: BAC, blood alcohol concentration; DNP, data not provided; F, female; M, male; PSA, previous suicide attempts; TBSA, total burned surface area.

[a]In the current case the hypothesis of a complicated suicide was more likely, but a complex suicide could not be ruled out beyond any reasonable doubt.

spilt spirits on seats and mats and ignited them, with the resulting fire spreading throughout the car's interior.

If, on the other hand, we interpret it as a complicated suicide, the victim intended to end his life by carbon monoxide poisoning. However, his movements were severely impaired by the combined effects of alcohol and the high levels of carbon monoxide in the car, and unintentionally spilt spirits on the driver's seat and accidentally caused a fire.

The latter hypothesis appears to be more likely, but a deliberate act of fire setting could not be ruled out beyond any reasonable doubt.

Although suicides by inhalation of exhaust fumes are frequent and well documented, only two complex and two complicated suicides occurring in cars and involving fire are reported in the literature. [15–17] They have been summarized in Table 1, together with the current case.

4 | CONCLUDING REMARKS

The present case highlights the importance that an interdisciplinary approach can have in dealing with complex cases, in particular in the analysis of charred corpses: the coordinated efforts and expertise can allow access to significant information otherwise unavailable to the forensic pathologist, contributing to the ascertainment of the cause and manner of death.

Another crucial point is the differentiation between complex and complicated suicide: although the definition of the two events is clear, this case shows that, on the one hand, it is not always possible to establish beyond any reasonable doubt the actual nature of a suicide involving different types of injuries; on the other hand, the use of an interdisciplinary method made it possible to establish that the hypothesis of an accident was improbable.

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

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