An Unusual Case of Carbon Monoxide Poisoning

N. G. FLANAGAN, MB, ChB, MRC Path, MRCP, DCP, DMJ  
Consultant in Pathology

D. G. WOOTTON, CChem, MRIC, FIMLS  
Medical Technical Officer

G. SMITH, MB, ChB, FFARCS  
Senior Specialist in Anaesthetics

D. K. GOFF, MB, BS, MRCPath  
Senior Specialist in Pathology

Royal Air Force Institute of Pathology and Tropical Medicine, Halton, Aylesbury, Bucks.

SUMMARY

A case of suicidal carbon monoxide poisoning by car exhaust inhalation is described. It is unusual in that the subject at the beginning of the incident switched on a cassette tape recorder and recorded his dying sounds. The circumstances of the death were reconstructed experimentally and a correlation between the recorded sounds and experimental concentrations of carbon monoxide in the vehicle has been obtained.

CASE REPORT

The subject was a 36 year old married British Service-man who was separated from his wife and was serving in Germany. He had started an association with a girl some 16 years his junior about one month previously and apparently had become deeply involved. At 11pm on the evening in question the girl told him that she wanted to end the relationship. He was seen shortly afterwards by a friend of the girl who described him as being in a highly emotional state. He stayed with this friend until 1am and left saying that he was going to commit suicide. His comments were not taken seriously.

At 5am on the following morning he was found dead by a game warden in his car in a nearby wood. He was in the driver's seat, sitting upright, with his head leaning backwards. The engine was still running. A rubber hose-pipe was attached to the exhaust and passed through the nearside rear window of the car. The open end of this pipe was in the centre of the rear seat. A tape recorder had been placed on the front passenger seat and was switched on. A note indicating his intention to commit suicide and a will were found in his jacket pocket.

The tape was played through and lasted for 60 minutes. The first sounds heard on the tape were those made by the subject switching on the recorder. A few seconds later he was heard to settle in his seat and start the car engine. For the next 17 minutes a variety of sounds were heard which are described in detail below. After this time there were no other sounds although the tape remained live. No spoken words were heard at any time.

Examination of his medical records showed him to have been in excellent physical condition during his 13 years in the Services.

POST MORTEM FINDINGS

The gross findings were typical of classical carbon monoxide poisoning and the histology supported a diagnosis of asphyxia due to this. There were no other abnormal features. No evidence of vomiting was found on the clothing, on gross autopsy examination or on histology. The carboxyhaemoglobin level was 70 per cent saturation. A full toxicological screen for drugs and alcohol was negative.

RECONSTRUCTION OF INCIDENT

In view of the unusual information obtained from the tape recording a reconstruction of the incident was performed. Although the actual car used could not be tested for administrative reasons, a car of the same make and model and comparable state of tune was obtained. A test was carried out when the air temperature and weather conditions were similar to that of the night in question.
A Mark II Austin 850cc motor car was warmed up by running for several minutes before the start of the test. A rubber hose was fastened to the exhaust pipe with towels and the open end passed through the nearside rear window. The window was plugged with towels and tape in a similar manner to that found in the original vehicle. The inner end of the tube was placed in the centre of the rear seat.

LABORATORY INVESTIGATIONS

A sample tube was positioned at head height above the driver's seat and passed out between the car body and the door. The outer end of the sample tube was fitted with a rubber septum so that the gas mixture inside of the vehicle could be sampled with the aid of a large disposable syringe fitted with a narrow gauge needle.

Samples were taken before the car was started and at 30 second intervals over the next 20 minutes. After fully ventilating the car the experiment was repeated several hours later, this time sampling at minute intervals. All samples were obtained with a 20 ml syringe which was twice filled, the first volume which was equal to that of the dead space in the sample tube was discarded. The syringe was sealed by inserting the needle into a rubber bung.

The samples were analyzed on a Perkin Elmer F11 gas chromatograph fitted with a hot wire detector. A two metre column packed with molecular sieve 5A was used at an oven temperature of 100°C with helium as the carrier gas at 30 mls per minute.

FINDINGS

The concentration of carbon monoxide increased steadily with time reaching 5 per cent saturation at 20 minutes. Figure 1 shows the
Table I: Interpretation of recorded sounds compared with carbon monoxide saturation in test vehicle

| Time from switching on engine (mins) | % CO saturation | Interpretation of recorded sounds |
|-------------------------------------|----------------|-----------------------------------|
| 1                                   | 0.2            | Nil                               |
| 2                                   | 0.5            | Unintelligible vocalization with moaning, whimpering and occasional coughing. |
| 3                                   | 0.75           | Vigorous coughing and retching. |
| 4                                   | 0.1            | Suggestion of inspiratory obstruction with laryngeal stridor. |
| 5                                   | 1.5            | Severe coughing. Expiratory wheeze develops. Marked inspiratory stridor. |
| 6                                   | 1.7            | Coughing gradually lessens in intensity. Respiration becomes shallow and respiratory rate increases. |
| 7                                   | 2.2            | Intermittent periods of apnoea. Otherwise shallow regular respiration. Rate slowing. |
| 9                                   | 2.5            | Inspiratory stridor ceases. Respiratory rate now 6 per minute. |
| 11                                  | 2.7            | Prolonged expiratory phase. Definite change in pattern to comatose/stuporose type. |
| 13                                  | 3.7            | Respiratory frequency 3 per minute. Slight expiratory wheeze. Last sound heard at approximately 20 minutes tape running time. |
| 17                                  | over 4         | Essentials apnoeic gasping from about 17 minutes, similar in type to the severe neonatal apnoea pattern. |

levels of carbon monoxide reached in the car during this 20 minutes.

The recording was played repeatedly to a team of experienced anaesthetists who felt that although interpretation on the basis of sounds alone was clearly difficult, a time-table of likely events could be suggested. This is summarized in Table I.

DISCUSSION

The tape recording by the subject of his death provided a unique opportunity to obtain further information on the problem of carbon monoxide intoxication. We can find no reference in the literature to a comparable case. He had regular routine medical examinations during his Service career and was regarded as physically fit. No explanation has been forthcoming for his making this recording or for the intriguing fact that he did not choose to say anything on it. A summary of our interpretation of the sounds is as follows:

a. Rapidly progressing hypoxia complicated by the development of laryngeal stridor and bronchospasm. This would be the most easily explained by the aspiration of vomit but, as mentioned above, no evidence of this could be found. Direct laryngeal irritation by the gas is a likely factor.

b. Progressive loss of control of upper airway patency from about 5 minutes, probably with the tongue flopping back to intermittently occlude the upper airway.

c. Depression of respiratory drive from about 6½ minutes with, probably, loss of protective laryngeal reflex at about 9 minutes presumably due to depression of vagal motor nuclei.

d. Essentially apnoeic gasping from about 17 minutes, similar in type to the severe neonatal asphyxia pattern.

It is difficult to decide at what stage the situation became irretrievable but certainly at about 6 to 7 minutes there is evidence of rapid downhill progress. Although the exact time of death cannot be established the incident provides very good evidence for the survival time that might be expected in such circumstances.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the help and advice given by Group Captain F. R. Jones, Squadron Leader J. Christie, Squadron Leader A. Adam, and would like to thank the Director General of Medical Services for permission to publish.