

Fatal visit to the dentist

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Abstract A 23-year-old woman was mortally afraid of dental interventions and decided to have her four wisdom teeth removed by outpatient surgery under endotracheal anaesthesia. According to the files, the patient was categorized as ASA I and Mallampati II, and surgery was considered an elective routine intervention. Soon after initiation of anaesthesia, O₂ saturation and blood pressure dropped, and the young woman died shortly afterwards in spite of immediate resuscitation measures. At first, an allergic reaction to succinylcholine, which had been administered as a muscle relaxant, was suspected. Autopsy and histological examination showed haemorrhagic pulmonary oedema and a defined lesion in the midportion of the oesophageal mucosa in spite of correct placement of the endotracheal breathing tube. Ultimately, misintubation into the oesophagus, which had not been noticed at first, was determined as cause of death.

Keywords Anaesthetic incident · General anaesthesia · Misintubation · Succinylcholine · Death · Anaphylactic shock · Haemorrhagic pulmonary oedema · CD117 · Giemsa

Introduction

Deaths related to anaesthesia are difficult medico-legal cases, especially if they occur during elective surgical interventions in patients without major risk factors. Apart from death due to the surgical procedure death as a result of anaesthesia must also be taken into consideration. However, it is also possible that there is a chronological, but no causal relation between death and the medical procedure [18]. Risks are not only involved in general anaesthesia, but serious incidents even leading to a patient's death can also occur during regional anaesthesia [11]. Although reports on deaths caused by anaesthesia alone are rare, numerous complications, e.g. reactions to administered drugs, bronchoconstriction and aspiration, can occur even if anaesthesia is performed correctly. Medical malpractice is another risk factor: For example, Knobelsdorff et al. reported on a 4-year-old boy who died during surgery for phimosis after an experienced anaesthesiologist had administered 500 ml of a 40 % glucose solution via a peripheral intravenous line [25].

Nowadays, anaesthesia is increasingly used also in dental practice. Especially in children undergoing more complex procedures, dental treatment under general anaesthesia plays an important role and is more comfortable for patient and doctor than sedation [23]. In adult patients with dental anxiety, the situation is similar. However, according to American studies, both sedation and general anaesthesia at the dentist's office are not without risks [14], which are at least partly attributable to inadequate monitoring of the patients [3]. In the literature, there is a report about a 35-year-old man who died from malignant hyperthermia after the administration of succinylcholine during general anaesthesia in the dentist's office [20]. Although the antidote dantrolene was already known at that time, it was not administered.

Medico-legal literature does not contain any reports on fatal anaesthesia accidents due to misintubation during a

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surgical intervention. In the case presented here, this caused the death of a young woman during dental treatment. Accidental oesophageal misintubation is a frequent incident that is easily detected and corrected thanks to the modern technical equipment available today [8]. Severe consequences are rare. According to a study from Thailand, the rate of oesophageal misintubations was 5.2:10,000 in 2003 [4]. These occurred primarily in children, emergency surgery and rapid sequence induction. They were generally noticed and corrected in time. Only one patient suffered persistent brain damage.

Case report

Situation prior to the incident and findings at the scene

A 23-year-old woman, who was mortally afraid of dental treatment and had a history of circulatory collapse, decided to have her wisdom teeth extracted under endotracheal anaesthesia. According to the medical file, this was considered an elective routine intervention in a patient categorized as ASA I and Mallampati II. Both the ECG and the blood tests performed before surgery were unremarkable. Previous operations under general anaesthesia had been carried out without complications. Soon after initiation of anaesthesia by using propofol, remifentanyl and succinylcholine. O₂ saturation and blood pressure dropped, and shortly afterwards, the young woman died in spite of the resuscitation measures taken. In his report, the emergency doctor on duty stated “initiation of anaesthesia with propofol/ultiva, relaxation with succinylcholine. First, bronchospasm, finally, cardiocirculatory arrest. No evidence of malignant hyperthermia. Suspected reaction to succinylcholine.”

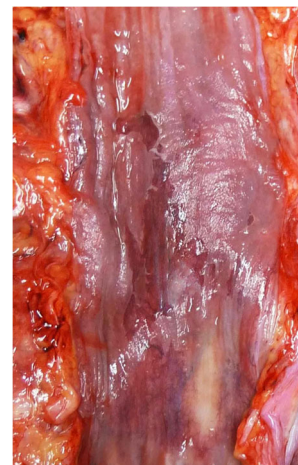
Technical check of the anaesthesia equipment

The anaesthesia equipment was confiscated and technically checked by the manufacturer in collaboration with the Würzburg University Hospital of Anaesthesiology. The check did not raise any doubts as to the correct operation of the device. Capnometry measuring the carbon dioxide content in the exhaled breath was not used in the operation under review.

Autopsy findings

Autopsy of the woman (height 166 cm and weight 90 kg) showed blood congestion and overhydration of the internal organs as well as enlargement of the spleen. In the oesophageal mucosa, a defined lesion located 19 cm from the tip of the tongue was found (Fig. 1). In the soft tissue between the oesophagus and the trachea, a discreet haemorrhage was discernible at the same level. The breathing

Fig. 1 Defined lesion of the oesophageal mucosa in its mid portion 19 cm from the tip of the tongue



tube was correctly positioned in the trachea; there were no bleedings in the tracheal mucous membrane. There was no pathological connection such as a fistula between the trachea and the oesophagus, and there was no remarkable hyperextension of the stomach and the small intestine.

Histology

In addition to HE staining, we performed CD117 staining to visualize the mast cell membrane and Giemsa staining to visualize the granules contained in the mast cells for histological assessment whether there had been an allergic reaction to any of the drugs used [10, 22, 24]. Moreover, PAS, tryptase and CD25 staining were performed. However, neither an increased number nor degranulation of the mast cells was detected in the pulmonary tissue, although haemorrhagic oedema was discernible in the lungs (Fig. 2). Histological examination of the macroscopically visible lesion of the oesophageal mucosa showed concomitant minor bleeding, cell necrosis and leukocyte migration. There were no signs of incipient wound healing however (Figs. 3 and 4).

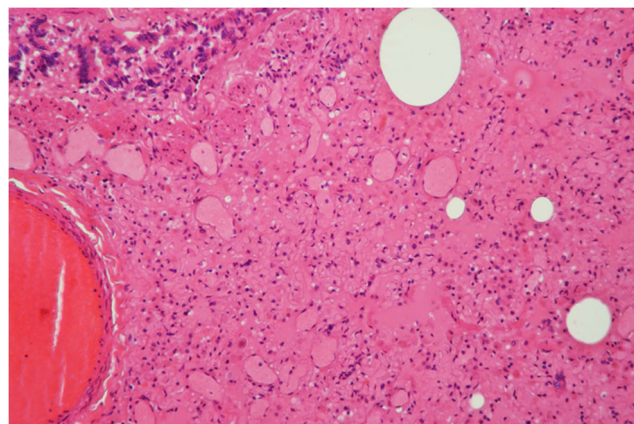


Fig. 2 Haemorrhagic pulmonary oedema

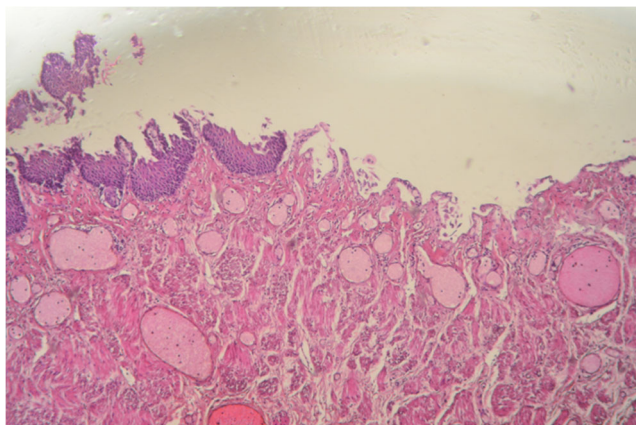


Fig. 3 Histological view of the macroscopically visible lesion of the oesophageal mucosa, overview

Laboratory tests

In the blood gas analysis performed during the resuscitation efforts, pO_2 was 56 mmHg and pCO_2 was 54 mmHg.

In the blood sample taken during autopsy 93 h after death, a slightly elevated total IgE value of 113 kU/l (normal range <100 kU/l) as well as a markedly increased tryptase concentration of 49 g/l (normal range <11.4 g/l) were determined. Apart from evidence of the propofol used for initiating anaesthesia, chemical and toxicological investigations including a blood alcohol concentration test were negative.

Further investigations

Later, it was found that death had been caused by the initially unnoticed misintubation into the oesophagus. The anaesthesiologist had neither used a capnometer to check the CO_2 content of the exhaled breath nor did he check the proper placement of the tube by laryngoscopy. The misintubation

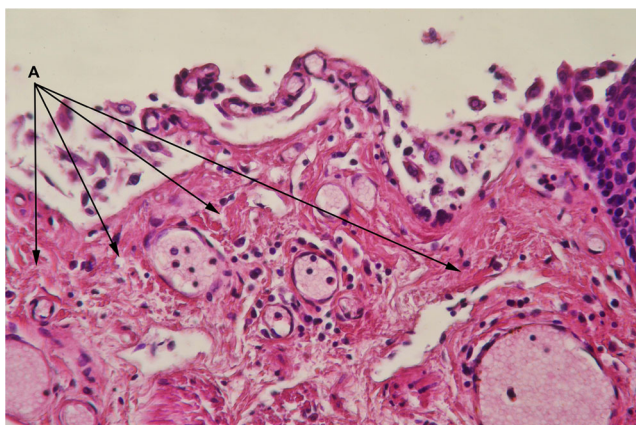


Fig. 4 Histological view of the macroscopically visible lesion of the oesophageal mucosa with concomitant minor bleeding (A), cell necrosis (A) and leukocyte migration (in the middle of the picture). No signs of incipient wound healing

was finally detected and corrected by a colleague called in before the arrival of the emergency doctor, who made a statement to the police only after being summoned by the prosecutor as a witness. The colleague was called in several minutes after the circulation of the patient started to break down. He needed some minutes to get to the dentist. Having arrived, he first checked the technical equipment because the anaesthesiologist claimed that the intubation was okay. As the colleague found nothing that could have explained the patient's problems, he had a look for the breathing tube and determined it in the oesophagus. As there is no documentation of the second intubation, the duration of misintubation can only be estimated.

Discussion

After misintubation into the oesophagus, the resulting oxygen deficiency caused a consecutive drop of pO_2 and an increase of pCO_2 , as CO_2 could not be exhaled any more. As no capnometer had been connected to the system, it was not noticed that the exhaled breath did not contain CO_2 . The increase in pCO_2 also remained undetected.

At the time of the autopsy, no information about the misintubation was available. An allergic reaction to succinylcholine used as a muscle relaxant (or another drug) was therefore suspected at first, as also assumed by the emergency doctor. However, there was no histological evidence of an increased number of mast cells or their degranulation in the pulmonary tissue, as observed in other fatal anaphylactic reactions [10, 22, 24]. The medical file did not give any clue to malignant hyperthermia, and the autopsy findings did not suggest an anaphylactic shock either. At best, the elevated tryptase concentration in the deceased's blood could have been a sign that an allergic reaction had taken place [1, 6, 7, 16, 17, 21, 24, 26]. On the other hand, Randall et al. advised caution to use an elevated tryptase level alone as a diagnostic criterion of anaphylaxis, as elevated tryptase levels are also found in deaths not related to anaphylaxis [19]. Histologically, haemorrhagic pulmonary oedema was determined, which was regarded as caused by asphyxia and evidence of death by protracted suffocation [2, 5, 9, 12, 13, 15]. The lesion of the oesophageal mucosa was localized approximately at the site of the final position of the tube after an assumed misintubation. The small haemorrhages histologically visible and the incipient leukocyte migration suggested that the injury had occurred while the patient was still alive. However, as there were no signs of incipient wound healing, the injury appeared to be of recent origin. Thus, the assumption seemed plausible that the injury was sustained shortly before death, and that it was caused by mechanical traumatization. Finally, misintubation into the oesophagus was discussed as the potential cause of death. Due to the

results of the medico-legal investigations, numerous witnesses were summoned for interrogation in the course of which the colleague called in before the emergency doctor finally reported that he had found the breathing tube in the oesophagus.

The responsible anaesthesiologist was sentenced to 1 year and 9 months imprisonment on probation and payment of 20,000 EUR to “Doctors without Borders” for manslaughter through culpable negligence. Adequate monitoring would have saved the life of the young woman. During the medico-legal visit to the scene, the treatment team had voiced the suspicion that death had occurred due to drug intolerance, although they knew about the misintubation.

The presented case illustrates the role of legal medicine as an important component in investigation proceedings for unclear deaths.

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