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DEATH IN DENTAL MEDICINE- LITERATURE DATA

Bianca Hanganu[1], Andreea Elena Bîrlescu[1,2], Andreea Alexandra Hleşcu[1,2*], Irina Smaranda Manoilescu[1,2], Simona Ionescu[2], Beatrice Gabriela Ioan[1,2]

"Grigore T. Popa" University of Medicine and Pharmacy, Iaşi, Romania
Institute of Legal Medicine, Iasi, Romania
**Corresponding author. E-mail: andreea.velnic@yahoo.com*
Authors had equal contribution to this article

Abstract

Death and emergencies in dental medicine are rare events, occurring most frequently during dental surgery. Their occurrence is favored by various patient-related factors, physician-related factors, procedures applied and medical instruments used by the dentists. In this article, the authors analyze the factors that can lead to major medical emergencies and death in the current dental practice and identify possible solutions to avoid and/or solve them according to the literature. The authors conclude that even if the incidence of emergencies and death in current dental practice is reduced, the dentist and the whole team in his/her office must recognize these incidents and treat them correctly.

Keywords: death, emergency, dentistry, patient, physician.

Introduction

Death in current dental practice is a rare event, but such fatality may occur under various circumstances. The most common emergencies occur during dental surgery, most often during conservative treatment and dentoalveolar surgery. A survey conducted in the UK and Scotland on a number of 1500 dentists, which tracked the prevalence, nature and results of dental emergencies over a 10-year period, showed that an emergency in dental practice appears on average for every 4.5 years practice in England and Wales and for every 3.6 years in Scotland, indicating that a dentist can experience 9-11 emergencies in a 40-year practice. The same study, comparing the number of emergencies and deaths reported by respondents with the total number of years of practice of all participants (8849 years), showed that death in general dental practice occurs once in 758 years in England and Wales and once in 464 in Scotland. None of the reported deaths in this study were due to anesthesia [1].

Emergencies and death in dental medicine are favored by various factors. Some of them belong to the patient, being represented by associated diseases, age or medication administered, which may interfere with dental treatments [2]. Other factors are related to the dentist, the medical instruments used and the medical procedures applied by him/her.

Even if the incidence of emergencies and death in current dental practice is reduced, the dentist and the whole team in his office must recognize these incidents and treat them properly [1,3].

I. Patient related factors

Most complications that occur during dental treatments which can also determine the patient's death, are favored by some of the previous illnesses they suffer from. In patients suffering from diseases

such as epilepsy, congestive heart failure and chronic obstructive pulmonary disease, unexpected sudden death may occur during dental treatments performed correctly [4] .

A study regarding death related to dental treatment performed by Reuter et al. in 2017 showed that age of the patient is in relation with the type of disease leading to death. Thus, for people under 26 years old the main causes of death were related to respiratory system; for people with the mean age of 47 years, infections were the main cause of death, while for people with mean age of 59 years the cardiovascular events come on the first place [5].

In addition, in a study of 1995 the authors showed that 3217 non-hospitalized persons aged 65 years were taking medication which could negatively influence their dental treatment [3].

I.1. Sudden cardiac arrest

Sudden cardiac arrest is a major medical emergency which may have various causes, such as: coronary heart disease or the physical stress that can be determined by a dental procedure. In some situations, the cause of sudden cardiac arrest remains unknown.

The procedure of removing one or more teeth and also hypoxia and hypercarbia can lead the patient to cardiac arrhythmias [6].

In order to avoid cardiac arrest due to myocardial infarction in the dental settings, a precise medical history should be carried out before any dental procedure; anxiety reduction is also very important in this context. The dentist should be aware that these patients might need supplemental myocardial oxygen supply and be prepared accordingly. In patients with pacemakers, the dental practitioner should avoid using the electrocautery and cavitron [7].

Patient survival and avoidance of neurological sequelae after a sudden cardiac arrest requires recognizing its premonitory signs and rapid intervention by initiating cardio-pulmonary resuscitation (CPR) maneuvers prior to the arrival of the emergency crew. For this purpose, it is necessary for the dental practitioners to receive basic life support training [8-10].

I.2. Congestive Heart Failure

Congestive heart failure is most commonly caused by hypertensive disease, cardiac valvular disease and coronary atherosclerotic heart disease, being one of the most common causes of death. Other diseases may cause congestive heart failure as well, such as: severe anemia, thyrotoxicosis, chronic obstructive lung disease, rheumatic fever, congenital heart disease, and pulmonary hypertension.

The physical and emotional stress associated with dental treatment could be detrimental to the patients suffering from cardiovascular diseases. Therefore, patients suffering from congestive heart failure need special attention during dental care. The dental practitioner on one hand should avoid using procedures that can stress the heart and on the other hand should control the pain, monitor blood pressure, and shorten the duration of the consultation. In the same time, the dental practitioner should take the necessary measures to prevent oral infections and periodontal disease that may also negatively influence the heart [6].

The medication taken by patients with congestive heart failure may cause on one hand negative side effects, such as orthostatic hypotension, xerostomia, and nausea and on the other hand they may interfere with the drugs used in dental treatment, which is why dentists need to know these aspects, to prevent them and to

intervene effectively in case of cardiac emergencies [11].

It is important to note that despite the fact that cardiovascular disease is a risk factor for accidents and even death in dental practice, oral health is essential for patients undergoing heart surgery for preventing infectious endocarditis [12].

I.3. Chronic Obstructive Pulmonary Disease

Chronic Obstructive Pulmonary Disease (COPD) is a disease of the airways, which includes chronic bronchitis and emphysema, characterized by an irreversible and gradual loss of respiratory function, which limit the inflow of air in lungs [13,14]. Therefore, in the dental surgery interventions in patients with COPD, it is essential that the dentist knows the respiratory reserve of the patients [15].

When dealing with patients with COPD and respiratory diseases in general, the dental practitioner must keep in mind the possibility of bacterial spreading in case of periodontal disease and also he/she should take care of the medication received by the patient which can impact the oral health and oral procedures and which should be avoided in the dental practice [14].

Given these particularities that may negatively interfere with dental treatments, the dentist should carefully assess the risk of providing appropriate and safe dental care in patients with moderate to severe COPD [16]. Therefore, it is necessary for the dental practitioner to know a thorough history of the patient, he/she should choose carefully the procedures applied and create ergonomic conditions that do not worsen the depression of the respiratory function of the patient [17]. An ergonomic aspect which should be considered, is the position in which the oral procedure is performed or the application of different oral devices such as the rubber dam [14]. In patients with advanced stage of COPD, in which the dorsal decubitus position may affect the breathing, the dental procedures may be performed with the patient sitting in upright position in the dental chair [18]. The rubber dam may lead to suffocation sensation in the patients with COPD, being necessary to adapt it for the patients to feel comfortable and safe [14].

The dental practitioner should avoid performing general anesthesia in patients with respiratory diseases such as asthma, bronchitis and chronic restrictive or obstructive pulmonary disease. Local anesthesia is the most reliable and safe option for these patients. Moreover, in the case of local anesthesia, the anesthetics should be carefully chosen (for instance, the sulfite anesthetics, such as epinephrine and levonordefin, can precipitate acute asthma attacks and allergic reactions which exacerbate respiratory distress) [19]. Taking into account all these aspects, even if dental procedures are performed under local anesthesia, the dentist should have a bronchodilator inhalator for an emergency situation caused the aggravation of the respiratory restriction [15].

In case of patient sedation, the barbiturates or narcotics, nitrous oxide and high flow rates of oxygen have a central respiratory depression effect, which will worsen the respiratory function of the patient [14]. Anticholinergic and antihistamine drugs should also be avoided in these patients because they alter trahobronchial secretion, which prevents airflow through the upper respiratory tract [14,16]. On the other hand, patients with COPD can use NSAIDs in anti-inflammatory doses, as these drugs stimulate

breathing through peripheral and central action and prevent bronchospasm [16,20].

As mentioned above, patients with respiratory diseases are particularly prone to lung infections. Bacteria from the oral cavity, especially in case of deficient oral health (e.g. periodontal disease) may spread to the lungs, leading to life-threatening infections [14].

I.4. Epilepsy

According to World Health Organization definition, ”epilepsy is a chronic disease, with different etiologies, recurring episodes of paroxysmal brain dysfunction being characteristic”. From a clinical perspective, epilepsy is characterized by recurrent seizures. Simple seizure can occur in persons without a specific cause; some studies suggest that up to 5% of the world' s population may have experienced a seizure at some point in their lives [21].

The medical literature data on the influence of epilepsy in dental care are scarce. Patients who suffer from epilepsy have special needs during dental treatment and increased attention is required regarding the drug interactions and the adverse effects of the drugs (such as bleeding, bone fragility and immune system depression), the occurrence of seizures, the oral cavity health, and the type of dentures which all can induce life-threatening complications. Generalized tonic–clonic seizures often cause minor oral injuries, such as tongue biting, but they may also determine tooth injuries and even maxillofacial trauma [22-24].

Patients who suffer from epilepsy can be safely treated in the general dental office, if the detailed medical history of the patient is taken and updated at each visit. The dental practitioner should take into account the seizure history when planning treatment and checkups for different procedures, so as to avoid the occurrence of a seizure during the dental treatment [25].

The light which is used during the dental procedure, may trigger a seizure if it is directed in the patient’s eyes. For that reason, some authors recommend the use of glasses with dark lens in order to avoid this situation [25,26], as well as focusing the light as much as possible on the mouth of the patient and not in his/her eyes [26].

For patients with epilepsy who need dentures, the preferred type are the fixed prosthesis, as for mobile type there is an increased risk for aspiration during the epileptic seizures [25]. Likewise, in order to avoid the aspiration, the dentures must be resistant to damage. If they broke during seizures, small pieces can enter the respiratory tract and cause obstruction, which can be life-threatening [26].

Antiepileptic medication has important side effects that need to be known by the dentist. Enzyme-inducing antiepileptic drugs (phenytoin, phenobarbital, carbamazepine) interfere with metabolism of vitamin D, therefore they can induce osteopenia and osteomalacia, which predispose to bone fractures [24]. Valproic acid can cause bone marrow suppression, which determines the decrease in platelets, having a negative effect on the healing process of the wounds, and also increases the postoperative bleeding and the risk of infections [27]. Likewise, long treatment with carbamazepine, can lead to excessive bleeding [25] so that increased attention is needed to avoid aspiration of blood. Given these issues, prior to performing any elective surgery on patients taking anti-epileptic drugs, laboratory tests such as: bleeding time, fibrinogen level, prothrombin time, partial thromboplastin time and von

Willebrand factor level, are necessary to assess the risk of peri- and postoperative bleeding [27].

On the other hand, some of the drugs prescribed by dentists may interfere with the metabolism of certain antiepileptic drugs. For instance, fluconazole (an antifungal agent) determines a clinically significant increase in phenytoin plasma concentration [28]. Clarithromycin increases the plasma concentration of carbamazepine; therefore a careful monitoring is required so as to avoid carbamazepine toxicity [29].

I.5. Anticoagulant therapy

In patients with anticoagulant therapy there are necessary local measures for bleeding control such as atraumatic surgical technique, compression or topical clotting agents, in order to prevent severe bleeding [5-7].

Reuter et al. reported that in people with warfarin therapy, stopping the drug administration couple of days before the extraction of a tooth may led to cerebrovascular accident [5].

II. Medical instruments and procedures

II. 1. Anaesthesia

Death is an extreme negative consequence of general anaesthesia in dental practice and it may occur particularly in people whose health condition is compromised by various diseases [30]. As Mortazavi et al. showed in their review the mortality rate associated with general anesthesia almost halved since the middle of the last century, i.e. from 6.2 per 1,000,000 in 1955 to 3 per 1,000,000 in 2012, the rate being similar in men and women [30].

Even though in the past decades local anesthesia is being more and more used, general anesthesia remains the best choice in patients who fear or feel pain and anxiety regarding dental treatment, as well as in children or adults who are difficult to cooperate with [31]. The main factors leading to death after anesthesia in children were related to the environment in which the procedure was performed, i.e. suboptimal conditions for assistance, monitoring of the patient and resuscitation equipment [30].

General anaesthesia raises important issues in terms of both morbidity and mortality [30]. Thus, it can influence the respiratory system, leading to respiratory difficulties; unrecognized and untreated vasovagal syncope and ventricular arrhythmias can determine cardiac arrest [6]. Death can also occur if the patient is not well monitored as a result of administering an overdose of a sedative drug, depression of the respiratory centers, anoxia or hypoxia [5].

II. 2. Infectious complications

Despite the correct aseptic measures taken by the dentists, infection can result from various dental procedures, such as teeth cleanings and fillings [32], water contamination [5] as well as tooth extractions and root canal treatments [32].

Dental infection can be localized to apex of the root or progress to soft and bony tissues surrounding the teeth. The following infectious complications are possible: abcess, fistula, phlegmon and cellulitis, odontogenic cysts, actinomycosis, craniofacial thrombophlebitis, osteitis and osteomyelitis, maxillary sinusitis, septicemia and local odontogenic infections [32].

As already showed previously, people with certain health conditions, such as heart disease, are more susceptible to bacterial infections (e.g endocarditis) from dental procedures, so a good oral hygiene to

improve gingival health is necessary to reduce the spreading of bacteria to the endocardium via blood vessels, while antibiotic prophylaxis before any invasive procedure is mandatory [7]. Infections can also spread to lungs, causing pneumonia; to maxillary sinus, causing sinusitis; to the bone, causing osteomyelitis; or can spread throughout the body, causing septicemia [5].

II. 3. Infrastructure and facilities

During his work, the dentist uses various instruments and equipment, which should be maintained according to the protocols. Medical technology advanced significantly in the last decades, this leading to a positive impact on the outcomes of the medical act and the health of patients [33]. Likewise, dental surgeon must supply the medical setting where he/she works with the appropriate infrastructure and facilities in accordance with the specific dental procedure that he/ she intends to perform as well as with specific drugs, oxygen and airway securing devices. More, every dental practitioner shall be prepared and specifically trained to adequately provide basic life-saving support for his/her patients in case of medical emergency.

II. 4. Other

Other situations that can lead to death are the obstruction of the airways as a result of hypersensitivity reaction and asthma attack, as well as swallowing or aspiration of vomitus or foreign bodies from the operatory field, such as cotton roll [5] and dental instruments, especially given the fact that the dental practitioner uses many small objects during his/her medical activity [14]. The anaphylactic reaction to dental medication is a dangerous and life threatening pathological condition which may determine the death of the patient if the dentist is not specifically trained to recognize these situations and to intervene promptly [5,34].

III. The dental practitioner

III. 1. Incorrect anamnesis

Anamnesis of a patient can provide important information to his/her dentist. A complete medical history is useful in formulating a diagnosis and providing medical care to the patient. In dentistry, taking the medical history is important in the detection of medical problems of patients. Before any dental treatment, the dentist must learn all the medical problems that could represent a risk for both the dentist and the patient during the treatment. In order to be able to collect relevant informations about the patient, which is important in therapeutic decisions and to prevent life-threatening situations, effective and proper communication between the dentist and the patient is essential, using the style best suited to each patient [35-37]. In the case of patients belonging to ethnic minorities, it may be useful to involve health mediators who act as cultural brokers in the context of the medical act [38]. Good communication with patients allows on the one hand the provision of good quality medical care and on the other hand, the creation of a genuine medical-patient relationship which in turn is a satisfaction factor for both the patient and the doctor [39].

III.2. Fatigue related risks

The high level of fatigue in doctors represents an important risk factor for negative outcomes in patients. Fatigue in doctors predispose to errors and negligence [40-42].

In dental practice, negligence can lead to administration of wrong drugs or

administration of drugs in incorrect dosage or by a wrong method (e.g. intravenous instead of intramuscularly). Negligence also predispose to errors in anesthetic practice or during surgery. It can also result in failure to respond to emergency medical situations or in respect of attendance and examination [43-44].

Conclusions

Many of the undesirable and serious events associated to dentistry practice can be prevented.

The careful medical history of the patients is the first step towards prevention of emergency situations and death of the patients.

Medical records of the patient are also important. The records on the treatment should be complete and legible, they should contain details of the drugs administered and the procedures performed during the medical emergency situations.

Given that the oral cavity is the source for numerous microorganisms which can lead to serious infections, the patients must receive from their dentist appropriate counseling regarding the oral hygiene.

The dental practitioners must be well trained to recognize the risk factors for emergency situations, to diagnose them correctly, to choose the appropriate drugs, to implement the emergency measures and to follow up the patient and provide the appropriate care.

Dental team members should be educated and trained so that they can recognize the life threatening situation and intervene promptly. Moreover, the dental medicine settings need to have the means, i.e., drugs, medical instruments and devices, which are necessary for prompt intervention to save the patient's life in emergency situations that may occur during dental treatments.

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