Acute medical complications and the medical risk-related history in the general dental practice
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CHAPTER 1

Introduction
Chapter 1: Introduction

General introduction

This collection of studies describes recent developments in the knowledge area between dentistry and medicine. For preventive programs in dentistry in particular, understanding the medical conditions of the patients is highly relevant to ensure safe dental care. Currently, the need for accurate information seems to increase because of changing aspects of our current society.

During the last decades increased possibilities of dental treatment, like implantology, placed high demands on the general health of the dental patient. Developments in society like the aging of the population and the policy towards optimal retention of natural teeth, involves treating more elderly in the general dental practice. The increased possibilities of medicine and its tendency towards outpatient care have additional influences on the patients’ condition. As a result, relatively more apparently healthy but medically compromised patients are expected to visit the general dental practice. In order to ensure safe dental care and to prevent medical emergencies, one could improve their medical condition by treating their medical problem (reducing their ASA risk) or one could adapt their dental treatment.

This increased need for medical information is also applied in adjustments of the schooling of general dental practitioners. In the Netherlands, rules with regard to the schooling in dentistry are given in the Resolution of October 3, Staatsblad 1997. On a European level, recommendations concerning clinical proficiencies of dentists are made by the European commission (Brussels, 1996).

A tool in the detection of medically compromised patients is taking a medical history. In the studies to be presented here, a valid patient administered medical risk-related history, named MRRH, is used. De Jong gives an elaborate description of the structure of the MRRH in her thesis (1992). In the content of the present thesis, the initial content of the MRRH is improved and validated along the lines of De Jongs thesis.
Chapter 1: Introduction

Literature: a review

Earlier publications concerning the main areas of this thesis concern mainly 1) case studies or 2) descriptions of the field under study. With respect to the latter category, standard publications like ‘Dental management of the Medically Compromised Patient’ by Little and Falace (1994) and ‘Internal medicine for dentistry’ by Abraham-Inpijn (1993) are used to understand the complexity of the interaction between medicine and dentistry.

A selection of quantitative studies, relevant to our studies, is listed below. Besides the quantitative aspect, important is that 1) the study concerned patients visiting the general dental practice and whether 2) these patients were over the age of 18 and 3) were examined on medical problems relevant for dental treatment.

We may add that studies 1, 2 and 3 on medical problems were conducted among general dental practitioners. Studies 4, 5 and 6 examine the dental treatment among elderly.

Studies 7 and 8 examine mortality and morbidity in general dental practices. Studies 9 to 14 describe the prevalence of medical emergencies in general dental practices. Studies 5, 12, 13, 14 and 17 concern the recording of vital signs by dentists. And finally, studies 15, 16 and 17 concern post- and undergraduate medical education of dentists.

4,785 medical histories of dental adult patients revealed that chronic illnesses affect all ages. The dentist must be cognizant of all these medical conditions, so that, where indicated, consultation with members of other health sciences can be obtained, prior to providing definitive treatment.

4,087 Patients in 47 dental practices completed a patient administered risk related medical history. 37.2% of these patients reported at least one medical problem. Hypertension, chronic bronchitis and allergies were the items most frequently mentioned. The frequencies of heart disease, hypertension, endocrinologic and neurologic disorders increased with age while allergies and COPD. were evenly distributed over age.
Chapter 1: Introduction


Medical histories of 1,500 patients attending one primary health care dental practice were examined. Relevant medical histories and drug therapy were found in 27.7% of the patients. Most frequently mentioned problems were cardiovascular disease (10.4%), hepatitis (7.9%), and drug allergies (7.0%).


The distribution of the world population has resulted in a significant increase in the percentage of older adults in the industrialized countries. The aging populations in these countries are tending to maintain natural teeth longer and so they require preventive and restorative dental services for a longer period.


Systemic diseases, blood pressure and pulse rate were investigated in 1012 elderly patients (>65 years) who visited a gerodontic clinic in Tokyo. One or more systemic diseases were found in 64% of the patients. Most frequently mentioned were hypertension (30.9%), angina pectoris (9.2%), diabetes mellitus (7.6%) and arrhythmia (5.3%).

6. ‘Self reported medical conditions and drug use among elderly dental patients’ by McDermott et al.(1990).

156 elderly patients (>65 years) completed a self-administered questionnaire and an oral sheet. Cardiovascular disease (26.9%) was the most frequently found medical condition. 15% of the patients were using three or more medications.


A study of deaths associated with dentistry and dental disease in England and Wales between 1980 and 1989 was undertaken. While most are still associated with general anesthesia, the total number has decreased, compared to the previous decade, just like the percentage of deaths in which general anesthesia was thought to play a significant part. There were only four deaths involving an operator/anesthetist compared with 13 in the previous decade and all four took place between 1980 and 1983. However, there were two deaths associated with sedation techniques, both of which occurred after 1984, whereas there had been none in the
previous decade. On the information available, it is still not possible to establish the role of the patient's posture in these deaths.


Factors involved in causing morbidity and mortality statistics in a national database of dental patients who received either pharmacosedation or general anesthesia, were identified. All dental boards were asked detailed information on this subject concerning the last 15 years. 43 cases were reported from nine States, with mortality comprising 81.4% of the cases. The mean patient age was 18, range 2 to 42 years. 74% were classified as ASA 1, 21% as ASA class 2, 4% as ASA class 3. The mean number of pharmacological agents used was 3, range 1 to 7. In 32% of the cases heart rate was monitored, in 23% respiration was monitored, in 23% blood pressure was monitored, in 8% tissue oxygen saturation was monitored, and in 4% heart rhythm was monitored. 59% of the practitioners performed basic life support as a part of resuscitative efforts, 21% performed some measure of advanced cardiac life support, and in 45% of the cases narcotic reversal was attempted.


1,304 general dentists in Florida and Kentucky reported emergencies for a 10-year period. Most frequently mentioned were syncope (67.5%), angina pectoris (9.8%) and reactions to epineshrine (7.9%). More than 90% of the general dentists were trained to use the office emergency equipment. Nearly 75% of these dentists had emergency drug kits and in 41% of the offices emergency drills were conducted.


4,309 private practice dentists reported 30,602 medical emergencies during a 10-year period. It is important that staff members are able to recognize medical emergencies and manage such problems. The management of six common emergencies, unconsciousness, altered consciousness, convulsions, respiratory distress, drug-related crises and chest pains, is described.
Chapter 1: Introduction

11. 'Medical emergencies in general dental practice in Great Britain. Part 1: Their prevalence over a 10-year period' by Atherton, McCaul and Williams (1999).

74% of a random sample of 1000 general dental practices (GDPs) in England and Wales and 500 in Scotland participated in a survey on medical emergencies. 70.2% of GDP’s reported an emergency, most common were: fits and seizures (31%, 36.3%), swallowed foreign body (15.7%, 18.1%), attacks of asthma (13.8%, 11.1%), chest pains associated with angina pectoris (10.1%, 11.0%), and diabetic events (10.6%, 9.0%).


It was assumed that dentists employ a complete system of physical evaluation for all new patients in their dental practices. Results of a survey of 1,588 dentists demonstrated that the use of a written medical history questionnaire was commonplace. Monitoring of the heart rate and rhythm, even in patients with cardiovascular disease or high blood pressure, was severely limited in scope. A significant number of dentists still employ epinephrine impregnated gingival retraction cord, and of these, 40% had observed ‘epinephrine reactions’.


Some 34% of 887 general dental practitioners in Northern England participated in a postal survey on the prevalence of medical emergencies in the previous 12 months. Furthermore, the ability to manage medical emergencies, the training in medical emergencies and emergency management requirements were examined. Most frequently mentioned emergencies were vasovagale collapse (1.9 cases per dentist per year), hypoglycaemia and angina (0.17), and epileptic fit (0.13).

Some 96% of the dentists believed that they were able to perform resuscitation, give an intramuscular injection (81%), and take a blood pressure (61%).


65% of 1250 GDP’s responded to a postal survey regarding occurrence of medical emergencies and medical drugs and equipment. One in seven practitioners had to resuscitate a patient. Adverse reaction to local anesthetics, grand mal seizures, angina pectoris and hypoglycaemia occurred most frequently. 57% felt that they could perform CPR.
(cardiopulmonary resuscitation) effectively for five minutes while 96% of the practitioners indicated that GDP should be trained in CPR.

15. 'Management of an emergency: to be prepared for the unwanted event' by Lipp et al. (1992).

The authors state that every dental office needs an adequate emergency treatment structure. Repeated training in emergency techniques is encouraged for the dentist and the dental office staff. Whenever possible, a recognized risk factor should be eliminated or its possible influence minimized before dental treatment. Several monitors (blood pressure, ECG, and pulsoximetry) have been introduced and have indications in special patient groups.


45% of 350 randomly selected dentists responded; of these, 42.5% indicated to be competent in EAR (expired air resuscitation) and CPR (cardiopulmonary resuscitation) on graduation and 61% had undertaken training since graduation. 76% believed that they could do EAR effectively and 64% CPR.

17. 'Medical emergencies in general dental practice in Great Britain. Part 3: perception of training and competence of GDP's in their management' by Atherton, McCaul and Williams (1999).

A study among a random sample of 1500 dentists, 1000 in England and Wales and 500 in Scotland; 74% returned a postal survey questionnaire. 75% of dentists received training as undergraduates in the management of medical emergencies, 95% had postgraduate training. Aspect of training most frequently recalled was CPR (undergraduate: 94%, postgraduate: 99%). This was followed by use of emergency drugs (undergraduate: 62%, postgraduate: 63%). 80% of dentists felt 'fairly well' or 'well' prepared for an emergency, nevertheless, 96% expressed a need for further training.


The paper reports the results of a survey among 51 of 55 U.S. dental schools to reassess the status of programs of medical emergency education and to examine progress to date during the last 9 years. Examined was whether 1) schools taught how to manage various medical
Chapter 1: Introduction

emergencies, 2) whether school had policies on relevant medical issues, and 3) whether there were requirements for routinely taking vital signs. While the number of school policies improved in generally, routine measurements of vital signs of patients has diminished since 1983.
Recommendations for the present series of studies

A number of recommendations relevant for this project originated from the review of the studies on this topic. When investigating the medically compromised patient and medical complications in dentistry these recommendations have to be taken into account. To illustrate:

(1) In order to overcome a selection bias our dentists were asked to investigate every patient over the age of 18 using the MRRH (Chapter 2). The patient had to give informed consent. This was according to the recommendations on medical ethics of the World Health Association (Helsinki 1964; Tokyo 1975).

(2) An improved version of the MRRH was used. These improvements were in accordance with recommendations given by De Jong in her thesis ‘The medical history in dentistry’ (1992).

(3) The registration of medical complications had to be carried out frequently in order to prevent information loss or incorrect reports.

(4) The registration protocol contained control mechanisms. Each month we received a form that stated whether the dentist had registered a medical complication or not. If no form was received the dentist was contacted by telephone.

(5) According to the motivation theory of Warwick and Lininger (Sample survey, 1975) the commitment to actively participate in a study is a result of certain constantly changing positive and negative influences. We positively motivated the participant by sending an informative bulletin every three months. The research team and participant kept in contact on a monthly basis. In case of medical questions, general or related to dentistry, our department could be contacted. Two internists at staff gave advice. After the evaluation the participant received a tape on reanimation or epilepsy. Negative feelings were confronted by clearly explaining the research procedure, emphasizing confidentiality and processing data on number and not name.

(6) With respect to making inferences, the control and reference group must not be different on relevant dentist and practice characteristics. In order to determine representativeness, the samples studies should be compared to general population values.
Chapter 1: Introduction

Description of research concepts

In this thesis the term ‘medically compromised’ is related to dental treatment, in the sense that medical treatment can interfere with dental treatment. Patients with at least one positive answer to the questions of the Medical Risk Related History (MRRH) are labeled ‘medically compromised’. This is only a partition of the total population of ‘medically compromised’. For example, a person with ‘ulcus ventriculi’ is medically compromised but not detected by using the MRRH since this medical problem is not relevant to the patients’ dental treatment. I like to refer to the thesis of De Jong ‘The medical history in dentistry’ for elaborate descriptions of the relevant medical problems.

A medical complication, also referred to in literature as medical emergency, is defined in this thesis as a temporary or permanent deterioration in the patient’s physical condition during his stay in the dental practice. This is reflected in a change in vital signs, such as level of consciousness, pulse rate, blood pressure, frequency and nature of breathing and additional diagnostic symptoms.

The following brief description of medical complications is given 18-20.

*Hyperventilation syndrome:* The traditional definition of hyperventilation syndrome describes "a syndrome, characterized by a variety of somatic symptoms induced by physiologically inappropriate hyperventilation and usually reproduced by voluntary hyperventilation" 21.

This condition can be biochemically induced or can be due to psychological stress. It causes a lowering of carbonic acid in the blood and an increase of the pH in the blood. Symptoms can be long and deep breathing followed by unpleasant effects like: dizziness, tingling fingers, tinges around the mouth, chest pain, and headache. Breathing into a closed bag will lower the elevated pH in the blood and the clinical signs will disappear gradually.

*Orthostatic collapse:* A condition that occurs when suddenly standing from a sitting or recumbant position. In this case, the blood stays mainly in the lower part of the body and the brain is not sufficiently provided with oxygen. The blood pressure falls, which results in dizziness; the fall can result in a diminution of consciousness. The body responds to this situation with vasoconstriction and tachycardia in order to make the blood pressure rise. This process can take several seconds and results in a collapse.

*Collapse vasovagale:* Overstimulation of the nervus vagus results in a sinusbradycardia and hypotension. The nervus vagus participates in many autonomic functions, such as breathing and heart functions. Sudden loss of consciousness can occur, but among young people only
when standing up, since the blood circulation is usually sufficient in recumbant and sitting positions. Symptoms: paleness, bradycardia (pulse rate<60/min), sweating, yawning and a diminished level of consciousness.

**Collapse ECI (E Causa Ignota):** A sudden diminution in consciousness that can last from seconds to minutes, of which the cause is unknown.

**Angina Pectoris:** A pain below the breast bone which can be a sign of acute ischaemia of the cardiac muscle. Angina pectoris can be a prodrome for a myocardial infarction, especially the unstable type Angina Pectoris. Assumed is that the ischaemia occurs when an effort, emotion or coldness appeal to an insufficient coronary blood flow. Stress, for instance dental stress, can be an inductor of angina pectoris and should be avoided if possible.

**Arrhythmia:** A disturbance in the normal heart rhythm. The normal heart rhythm originates in the sinus node and results in a regular heart rhythm of 60/100 per minute. For a person or patient who had an episode of arrhythmia, it is important to ask whether it is accompanied by clinical signs and symptoms, such as hypotension and heart failure and whether it is provoked by certain physical and psychological conditions.

**Hypoglycaemia:** This condition occurs, exceptions excluded, only among patients with diabetes mellitus, who are on medication for this disorder. Diabetes Mellitus is a disorder in the metabolism that is caused by an absolute or relative deficiency of insulin. Treatment is given by daily injections of insulin. When the blood sugar level falls below the normal value of 4 mmol/l, the patient develops a state of hypoglycaemia. Prodroms can be agitation, paleness, and pain in the stomach. Hypoglycaemia has symptoms that, without intervention, end in a coma. Administration of sugar if patient is conscious or glucagon intramuscular or glucose intravenous if the patient is unconscious or not able to swallow, is required.

**Allergic reaction:** Hypersensitive reaction to allergens, based on an immunologic process. In dentistry, the type I and IV reaction can occur. Immediate type allergy (Type I) occurs during or direct after exposure to the allergen. Contact allergy (type IV) is an inflammatory reaction that occurs at the location of contact with the allergen. Main allergies relevant to dentistry are preservatives in local anaesthetic, antibiotics and dental materials.

**Persistent bleeding:** Cases of persistent bleeding due to problems in coagulation were registered in our study. Persistent bleedings do not only complicate dental interventions but can also lead to local infections and to a delay in woundhealing.

**Vena cava inferior syndrome:** This complication occurred in our study among women in their mid-last term of pregnancy. Due to lying in the dental chair, compression of the vena cava
Chapte rr 1: Introduction

inferior by the uterus occurs. Some symptoms are dizziness, diminished consciousness and a decline in blood pressure. Changing the lying position of the woman by turning her on her left side will relieve the symptoms.

*Grand mal epilepsy:* A specific type of epilepsy. Prodroms can be divers, for instance visual hallucinations or strange feelings or taste (aurea). An immediate loss of consciousness occurs. A tonic phase (respiration stops) is followed by a clonic phase (muscle cramps) in which the patient can be incontinent for urine. The tongue can get stuck between the teeth. Gradually the patient relaxes and the respiration returns. The patient may stay unconscious during a period of several minutes. When the patient regains consciousness he can be disorientated and suffering from a headache. Dental treatment should not provoke an attack; a preventive measure for tongue bite is the use of a mouth prop.

*TIA (=Transient ischaemic attack)* is a temporary (<24 hours) phenomenon of neurologic problems due to a problem in the blood supply of the brain. This phenomenon relates to the location of the circulatory problem, for example, the symptoms can be crooked mouth or paralysis of the arm.

*Vertebro basillar insufficiency* is an intermittent insufficiency of the circulation in the vascular area of the arteriae vertebrales and basillares. It can occur among people with local arteriosclerosis or, related to the dental setting, when the patients’ head is pulled backwards too far.

Symptoms can be brief attacks of dizziness, tendency to fall down, and walking disorders.
Chapter 1: Introduction

Aims of the studies

Central threads through this thesis are medical compromised patients and acute medical complications in the general dental practice. In order to inventory these themes and possible factors of influence five studies are conducted, described in chapter 2 though 6.

Chapter 2 describes an inventory of medically compromised patients in 50 general dental practices. As a detection tool a medical risk-related history on a total of 29,424 patients was used. This enabled us to inventory nature, number and severity of the medical problems found.

Chapter 3 describes a pilot study among 471 dentists who were asked to send in reports on the medical complications in their general dental practice.

Chapter 4 is a continuation of this study but contains more feedback and motivation mechanisms compared to the pilot study. The research design was altered in accordance with recommendations of the pilot study. Notable is the prospective nature of this survey; the dentists were asked to register medical complications during the following twelve months.

Chapter 5 contains a study among the dentists who participated in the study described in chapter 4. These dentists received a questionnaire two months after the registration period. Questions were posed concerning demographic data, medical education of the dentist and the medical complication; the registration of the medical complications and opinions concerning the registration of dentists and patients.

Chapter 6 describes an exploratory study among 9 European countries on medical histories and medical compromised patients. All European countries have to abide by the same regulations with respect to dentistry as laid down by the advisory committee of the European Commission. With regard to patient administration assessment and diagnosis European dentists are, for one, assumed to be taking a proper case history including a medical history. The Dutch MRRH is taken as starting-point.
Chapter 1: Introduction

References


Chapter 1: Introduction