Acute medical complications and the medical risk-related history in the general dental practice
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CHAPTER 2

Detecting the medically compromised patient in dentistry
by means of the medical risk-related history

A survey of 29,424 dental patients in the Netherlands
Chapter 2: Detecting Medically Compromised Patients by MRRH

Abstract

Background.
This study focuses on the detection of medically compromised dental patients in the Netherlands by means of a validated patient-administered medical risk-related history (MRRH). Due to social changes and scientific innovations in the past decade, more medically compromised patients will be needing special dental treatment.

Methods.
The medical problems of 29,424 dental patients (age 18 years and over) from 50 dental practices in the Netherlands were registered by means of the MRRH. The patients were classified according to the ASA risk-score system, which was modified for dental treatment. An inventory of the number and nature of medical problems and the modified ASA risk score was drawn up in relation to dental treatment and age.

Results.
The average age of the patients was 37.1 ± 13.5 years. According to the current guidelines, dental treatment must be modified if the patient has an ASA score III or IV. A relatively high percentage of patients ages 65-74 (23.9%) and 75 or over (34.9%) did have an ASA score of III or IV. Furthermore, the medical problems were classified into 10 categories, and the relationship to age was examined. The conditions that increased with age were hypertension and cardiovascular, neurological, endocrinological, infectious, and blood diseases.

Conclusions.
For the dental practice these results mean that the MRRH can play an important role in adapting dental treatment to the specific needs of patients. This is especially important in the case of elderly patients.

Keywords: dental care for chronically ill; health status; patient classification
Chapter 2: Detecting Medically Compromised Patients by MRRH

Introduction

Taking a medical history before dental treatment is an important tool in the detection of medical problems in patients. Asking a few general verbal questions about the patient's health, as usually happens, is insufficient. Patients fail to see the connection between their medical problems and the dental treatment. When asked 'Are you in a good health', 95% of one population replied 'Yes'. After verification, 32% were found to be medically compromised. In another study 7% answered 'No' and yet in the case of 5% of these patients their medical condition did not interfere with dental treatment.

Acquiring the skills necessary to identify those medical antecedents that are relevant to dental treatment is the responsibility of every dentist. In addition, he must be aware of the implications of medical problems and medications for dental treatment, with or without local anesthesia.

With the aging of the population and the increased possibilities offered by medical and dental treatment, more medically compromised patients will be visiting the general dental practice. For example, due to expanded outpatient care, many people who a decade ago would have remained in the hospital are now able to visit the general practice. For these medically compromised patients, it is often necessary to adjust the dental treatment to reduce the risk of acute medical complications.

In the present study a patient-administered medical risk-related history (MRRH) was used. This validated questionnaire was developed especially for use in the general dental practice; only questions about medical problems that might interfere with dental treatment have been included. The MRRH contains a total of 19 main questions. One or more subquestions have been added to establish the severity of the medical problem introduced in the main question.

The answers to the medical questions were linked to a modified version of the patient classification system of the American Society of Anesthesiologists (ASA). This version classifies the dental patient by means of a 'potential risk score' for dental treatment and gives dentists a directive for treatment or adjustments to treatment.

There are four ASA risk-score categories that are of interest to general dental practitioners. A list that indicates the medical risk associated with each disease is used by the dentist.

When a patient indicates that he has no medical problems that might interfere with dental
treatment, he is classified as ASA I. A patient with a mild to moderate systemic disease that does not limit daily activity is classified as ASA II. This patient is capable of undergoing routine dental therapy, with stress reduction and preventive measures as indicated. A patient with a moderate systemic disease that limits daily activity but is not incapacitating is classified as ASA III. The dental treatment must be carefully modified and accompanied by stress reduction and medical consultation. A patient with a severe systemic disease that limits daily activity and is a constant threat to life is classified as ASA IV. Only emergency treatment should be provided; medical consultation and hospitalization for stressful elective treatment are essential.

ASA class V is not relevant in the general dental practice, as it is concerned with moribund patients who are not expected to live longer than 24 hours without surgical intervention.

The MRRH is designed in such a way that an affirmative answer to one of the main questions always results in a score of ASA II. For example, if a patient is classified as ASA II because his medical history reveals that he has an artificial heart valve, then antibiotic prophylaxis is needed for invasive dental treatment.

Subquestions discriminate between ASA classes III and IV.

In this study a group of general dental practitioners were asked to interview all their patients over the age of 18 about relevant medical problems, using the MRRH. This research design resulted in a study of a relative large number of dental patients, compared with other studies. The aim of this study was to establish by use of the MRRH for this sample (n=29,424)

- the number of patients with medical problems that might interfere with dental treatment,
- the extent to which these patients are medically compromised and the number of medical problems per patient,
- the relationship between the above-mentioned data and the age of the patient, and
- the severity of the medical problems.
Materials and methods

On the basis of a list of all general dental practitioners in the Netherlands, 50 dentists were selected at random, 19 of whom agreed to participate in the study.

If a dentist declined to take part, an alternate was selected from a list of volunteers, optimally matched according to sex and number of years since graduation.

All participants received a 1-day introductory course that focused on
1: Clarification of the questions in the MRRH;
2: Meaning and use of the ASA risk scores, including preventive measures;
3: Instructions on the procedure to be used during the study.

A number of remarks are in order with respect to the third point. Each dentist was asked to have the MRRH completed by all of his/her patients over the age of 18, in accordance with the terms of the Tokyo/Helsinki convention. Informed consent was obtained, first, with respect to providing information to the dentist and second, with respect to participating in the study. The patients were given a brochure setting out the aims of the investigation and the MRRH\textsuperscript{16-18}. Each patient completed the medical history in the waiting room and the information was verified by the dentist. All the patients were told that declining to participate in the study would not affect their dental treatment. The study was approved by the medical ethical committee of the Academic Medical Center in Amsterdam. The original medical histories were collected and sent anonymously to the investigators; the dentist kept a copy for his or her patient file. The reply forms were read by an optical mark reader and analyzed by means of SPSS. Descriptive statistics, frequencies, and contingency tables with chi-square and $t$ tests were used.
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Results

A total of 50 dentists participated in the study: none of them dropped out, but 3 dentists sent in only a few medical histories. Before the study most of the dentists were used to taking a medical history by simply asking a few general questions. The group consisted of 9 females and 41 males [number of years since graduation: M=12.9, SD=8.4, range=(2,54)], and their practices were in both urban (n=44) and rural areas (n=6), rural being defined as less than 10,000 inhabitants.

Data were collected during a period of 1 year and 4 months. In the course of the trial 30,070 forms were returned. Of these, 646 were excluded from the study: 113 patients were younger than 18, and the ages of 533 other patients were unknown. Thus a total of 29,424 medical histories were available for statistical analysis.

The average age of the patients was 37.1 ± 13.5. There were 15,400 female patients (52.3 %) with a mean age of 36.9 ± 13.6 (range 18-94 years) and 13,551 male patients (46.1%) with a mean age of 37.2 ± 13.3 years (range 18-97 years). The gender of 473 persons (1.6%) were unknown. A t test confirmed that there was no significant difference in age between the male and the female patients (t = 1.17, P=0.244).

<table>
<thead>
<tr>
<th>Inventory</th>
<th>1975</th>
<th>1977</th>
<th>1992</th>
<th>present study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>30</td>
<td>-</td>
<td>39.8</td>
<td>37.1</td>
</tr>
<tr>
<td>Country</td>
<td>USA19</td>
<td>Austr20</td>
<td>Neth21</td>
<td>Neth</td>
</tr>
<tr>
<td>Number</td>
<td>4,785</td>
<td>1,125</td>
<td>4,087</td>
<td>29,424</td>
</tr>
<tr>
<td>Cardiovascular diseases</td>
<td>4.7</td>
<td>6.9</td>
<td>10.0*</td>
<td>6.8card</td>
</tr>
<tr>
<td>Lung diseases</td>
<td>4.4****</td>
<td>7.2</td>
<td>7.2</td>
<td>3.2COPD</td>
</tr>
<tr>
<td>Hypertension</td>
<td>8.9</td>
<td>2.2</td>
<td>6.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Allergies</td>
<td>6.5</td>
<td>14.8**</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>Blood diseases</td>
<td>1.0</td>
<td>3.7***</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Endocrine diseases</td>
<td>3.8</td>
<td>1.7</td>
<td>2.4</td>
<td>2.2</td>
</tr>
<tr>
<td>Neurological diseases</td>
<td>0.7</td>
<td>2.9</td>
<td>1.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Infectious diseases  3.5
Irradiation  0.5
Chronic organic lesions  0.5

Halpern, 1975; the mean age is an estimation
Egglestone, 1977
De Jong, 1992

COPD: chronic obstructive pulmonary disease
Card: cardiovascular disease.

*inclusive irregular heart beat and heart surgery;
**inclusive hay fever;
***inclusive anemia
****only asthma

Table 1 shows the percentage of affirmative replies to medical questions posed in the present and other relevant studies. The questions were grouped according to 10 types of medical problems. Note that compared with other studies, the present study was conducted among considerably more patients of general dental practices. The items mentioned most frequently (>3.0%) in the present study were hypertension, cardiovascular disease, allergies and chronic obstructive pulmonary disease (COPD). Those mentioned only infrequently (<0.5%) were chronic liver and kidney disease, infectious diseases, and malignant tumors.

Figures 1a and 1b show the medical problems of patients in relation to seven age categories. The vertical line represents the percentage of patients with a certain medical problem. The frequencies of most conditions, except allergies, COPD, chronic organic disease and infectious disease, increased exponentially with age.

The variables infectious disease and chronic organic disease have been deleted from the figures, as they are independent of age and had low frequencies of occurrence. The frequencies of the ASA risk classifications for the total patient group are summarized in Table 2: 78.0% of the patients were in ASA class I, 12.7% in class II, 5.7% in class III, and 3.5% in class IV. The ASA scores were also examined in relation to various age categories. In ASA classes II-IV there was a significant increase in frequency with age.
Figure 1a:
The relationship between cardiovascular disease, C.O.P.D., allergy and age, as measured by the MRRH.

In the legend are various age categories listed. Cardiov. is an abbreviation for cardiovascular disease.

Figure 1b:
The relationship between irradiation, neurological-, endocrinological-, blood disease and age as measured by the MRRH.

In the legend are various age categories listed. Neurol. = neurological disease, endo = endocrine disease, blood = blood disease.
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### Table 2:
Frequencies of the ASA Risk Scores in the Various Age Categories as Measured by the MRRH (n=29,424).

<table>
<thead>
<tr>
<th>Age (years) \ ASA score</th>
<th>ASA score I</th>
<th>ASA score II</th>
<th>ASA score III</th>
<th>ASA score IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>4,582 (85.6%)</td>
<td>520 (9.7%)</td>
<td>152 (2.8%)</td>
<td>98 (1.8%)</td>
<td>5,352 (100.0%)</td>
</tr>
<tr>
<td>25-34</td>
<td>7,779 (82.3%)</td>
<td>1,099 (11.6%)</td>
<td>330 (3.5%)</td>
<td>243 (2.6%)</td>
<td>9,451 (100.0%)</td>
</tr>
<tr>
<td>35-44</td>
<td>5,626 (78.9%)</td>
<td>901 (12.6%)</td>
<td>377 (5.3%)</td>
<td>224 (3.1%)</td>
<td>7,128 (100.0%)</td>
</tr>
<tr>
<td>45-54</td>
<td>2,873 (73.5%)</td>
<td>538 (13.8%)</td>
<td>323 (8.3%)</td>
<td>174 (4.5%)</td>
<td>3,908 (100.0%)</td>
</tr>
<tr>
<td>55-64</td>
<td>1,378 (63.1%)</td>
<td>381 (17.4%)</td>
<td>284 (13.0%)</td>
<td>141 (6.5%)</td>
<td>2,184 (100.0%)</td>
</tr>
<tr>
<td>65-74</td>
<td>610 (55.2%)</td>
<td>232 (21.0%)</td>
<td>167 (15.1%)</td>
<td>97 (8.8%)</td>
<td>1,106 (100.0%)</td>
</tr>
<tr>
<td>75 or older</td>
<td>113 (38.3%)</td>
<td>79 (26.8%)</td>
<td>52 (17.6%)</td>
<td>51 (17.3%)</td>
<td>295 (100.0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22,961 (78.0%)</strong></td>
<td><strong>3,750 (12.7%)</strong></td>
<td><strong>1,685 (5.7%)</strong></td>
<td><strong>1,028 (3.5%)</strong></td>
<td><strong>29,424 (100.0%)</strong></td>
</tr>
<tr>
<td><strong>Mean Age</strong></td>
<td><strong>35.7 years</strong></td>
<td><strong>40.1 years</strong></td>
<td><strong>45.2 years</strong></td>
<td><strong>44.9 years</strong></td>
<td><strong>37.1 years</strong></td>
</tr>
</tbody>
</table>

This was consistent with a decrease in frequency with age in ASA class I. The Pearson chi-square test for association of 1,495.2 was highly significant for 18 degrees of freedom (P = 0.000); the null hypothesis of independence between age and ASA score was rejected. A chi-square test could be performed, because there is no dependency among observations. In addition to the chi-square test, t tests were performed. The t tests between all ASA categories showed that age differed significantly between all categories (|t| > 8.05, P = 0.000), except for the comparison between ASA classes III and IV (t = .90, P = 0.366).

The number of medical problems per patient and their relation to age are shown in Table 3. A patient who has an ASA score of IV may have several medical problems, of which at least one results in an ASA score IV.
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Table 3:
Frequencies of number of medical problems in the various age categories, as measured by the MRRH.

<table>
<thead>
<tr>
<th>No. medical problem/ Age (years)</th>
<th>18-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-55</th>
<th>55-64</th>
<th>65-74</th>
<th>75&gt;</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4,582</td>
<td>7,779</td>
<td>5,626</td>
<td>2,873</td>
<td>1,378</td>
<td>610</td>
<td>113</td>
<td>22,961</td>
</tr>
<tr>
<td></td>
<td>85.6%</td>
<td>82.3%</td>
<td>78.9%</td>
<td>73.5%</td>
<td>63.1%</td>
<td>55.2%</td>
<td>38.3%</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>661</td>
<td>1,430</td>
<td>1,236</td>
<td>777</td>
<td>550</td>
<td>318</td>
<td>90</td>
<td>5,062</td>
</tr>
<tr>
<td></td>
<td>12.4%</td>
<td>15.1%</td>
<td>17.3%</td>
<td>19.9%</td>
<td>25.2%</td>
<td>28.8%</td>
<td>30.5%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>91</td>
<td>203</td>
<td>219</td>
<td>203</td>
<td>187</td>
<td>107</td>
<td>59</td>
<td>1,069</td>
</tr>
<tr>
<td></td>
<td>1.7%</td>
<td>2.1%</td>
<td>3.1%</td>
<td>5.2%</td>
<td>8.6%</td>
<td>9.7%</td>
<td>20.0%</td>
<td></td>
</tr>
<tr>
<td>3 or more</td>
<td>18</td>
<td>39</td>
<td>47</td>
<td>55</td>
<td>69</td>
<td>71</td>
<td>33</td>
<td>332</td>
</tr>
<tr>
<td></td>
<td>.3%</td>
<td>.4%</td>
<td>.7%</td>
<td>1.4%</td>
<td>3.2%</td>
<td>6.4%</td>
<td>11.2%</td>
<td></td>
</tr>
</tbody>
</table>
A total of 78.0% of patients answered all questions in the negative, 17.2% (n=5,062) answered yes to one question, 3.6% to two (n=1,069) and 1.1% to three or more.

Table 4 shows the relationship between the various medical problems recorded by the MRRH and the accompanying ASA scores; note that these are the ASA scores for a specific problem. This is not the case in table 2, which shows the overall ASA risk score per person. In general, the higher the ASA risk score, the lower the frequency of medical problems; the exceptions are hypertension and cardiovascular disease.

Table 4:
Medical Problems Measured by the MRRH and their ASA Risk Scores.

<table>
<thead>
<tr>
<th>Medical problem</th>
<th>ASA II</th>
<th>ASA III</th>
<th>ASA IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular disease</td>
<td>1,066</td>
<td>312</td>
<td>620</td>
</tr>
<tr>
<td>C.O.P.D.</td>
<td>515</td>
<td>348</td>
<td>81</td>
</tr>
<tr>
<td>Hypertension</td>
<td>528</td>
<td>643</td>
<td>128</td>
</tr>
<tr>
<td>Allergies</td>
<td>2,246</td>
<td>170</td>
<td>132</td>
</tr>
<tr>
<td>Blood disease</td>
<td>170</td>
<td>78</td>
<td>56</td>
</tr>
<tr>
<td>Endocrinologic disease</td>
<td>359</td>
<td>229</td>
<td>59</td>
</tr>
<tr>
<td>Neurological disease</td>
<td>47</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Infectious disease</td>
<td>21</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Irradiation</td>
<td>161</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chronic organic disease</td>
<td>76</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. '-' means that the medical problem has no ASA III or ASA IV.
Discussion

Today advanced medical technology keeps patients alive longer, and ensures that they spend less time in the hospital. This tendency towards expanded outpatient care means that "apparently healthy" patients with severe medical problems are now appearing in the dental office\textsuperscript{22}. There is a close positive relationship between the percentage of medically compromised individuals and age, and it is precisely the older generation which forms the 'new' population now visiting the dentist\textsuperscript{23-25}. One of the most important factors here is the fact that more people now retain their natural teeth. In 1981 the percentage of Dutch dental patients between 45 and 54 years of age with complete dentures was 41.7\%. By 1991 this had dropped to 23.7\%. For the population between 55 and 64, these percentages were 63.6 and 49.6\%. Today relatively more dental patients are dentate. Between 1981 and 1991 the percentage of people who visited their dentist rose by 13.1\% (from 60.9 to 74.0\%)\textsuperscript{26,27}. The same tendency is seen in many other industrialized countries. Dentists must treat all these patients safely, without systemic complications\textsuperscript{8,28}. During medical treatment under a regional anesthesia, the complication rate depends not only on the age of the patient, but also on the duration of the treatment\textsuperscript{29}. This means that modern elective dental treatment, such as oral implants and periodontal surgery, is a major physical stress inductor.

It is important for general practitioners to be aware of the physical status of their patients, a fact that has been stressed by the advisory committee on the training of dental practitioners in Europe\textsuperscript{6}.

Clearly, the question "Are you in good health" is not sufficient. Patients may not be aware of the significance of a particular medical condition for dental treatment.

For all of the above reasons, the effective use of a validated MRRH can be the first step towards preventing medical complications arising from medical problems in combination with dental treatment. Copies of the validated MRRH are available from the authors.

The dentists who took part in this study were randomly selected; participation was on a voluntary basis without financial compensation. A certain 'natural' selection took place as a result of the dentists' interest in medical matters and the ability to take time out for a short dialogue with the patient. This dialogue was necessary in order to obtain informed consent.
and to record and verify the patients responses to the MRRH. Verification was aimed at
detecting any errors, misunderstandings or skipped questions, so as to reduce the number of
false negative and false positive replies\textsuperscript{12}.

Epidemiological data on dental practice size\textsuperscript{30} suggest that about one-third of the patient
population participated. This is due in part to the age restriction.
Approximately 24\% of all patients who visit a dentist in the Netherlands are under 18\textsuperscript{31} and
therefore excluded from this study.
In an evaluation study involving 44 of the 50 dentists, a question related to informed consent
was included. The answers to the question "How many patients declined to fill in the form"
showed that an average of 4.6 patients per dentist were unwilling to complete the medical
form. In general, however, patients were prepared to cooperate.

Table 1 contains a list of studies dealing with medical problems in dentistry. Some dental
patients do have certain systemic diseases that can interfere with dental treatment. However,
these frequencies vary considerably in the studies listed here. This can be explained by
several factors. For one thing, the age of subjects has increased in recent years, due to the
aging of the population, adequate caries prevention, and the desire of the population in
general to retain their natural teeth. This clearly has an effect on the frequencies found,
especially in the case of age-related diseases. Differences in study design, data collection
methods, and the definition of the systemic diseases themselves are other factors. The first
two factors mentioned above are responsible for the different sample size among the studies.
The sample size of the present study is relatively large. With the exception of the 1977 study,
patients under the age of 18 have consistently been excluded.
Age-related cardiovascular pathology such as heart disease, high blood pressure and blood
disease appears less frequently in the present study than in the one done in 1992. This may be
the result of the differences in the data collection methods or the fact that this MRRH has
benefited from a number of improvements to the previous version. For instance, the category
blood disease included the question 'Do you have anemia'. In the present version this question
has been deleted, thus reducing the number of 'medically compromised' patients.

It was found that 78.0\% of the patients were in ASA category I, which means that no special
precautions need be taken by the dentist. The remaining 22.0\% of patients were medically
compromised (ASA II, III or IV). An important factor here has proved to be age. For example, in age category '18-24' some 4.6% of patients had an ASA score of III or IV. A relative increase in ASA III and IV scores was recorded for patients ages 45-54, while in age category 75 and older this percentage rose to 34.9%.

Some 17.2% of patients had one medical problem, while 4.8% recorded two or more medical problems. In the age category 18-24, 0.3% of patients had three or more medical problems, as opposed to 11.2% in the age category 75 and older. The positive relationship between age and both the ASA score and the number of medical problems is illustrated in Tables 2 and 3. It is clear that taking a thorough anamnesis before dental treatment is important for young adults and even more important for elderly patients.

Table 4 shows the various medical problems and the ASA scores. Medical conditions such as cardiovascular disease and hypertension account for a relatively large proportion of the ASA III and IV scores. The fact that 6.8% of our patient population reported cardiovascular disease, combined with the relatively high ASA risk scores and the cardiovascular pressure caused by dental stress, represent an extra argument for the use of a medical history in the dental practice.

In conclusion
The statement that dentists should be aware of their patient's medical history is supported by this study. In terms of both risk and type of medical problem, there seem to be sufficient grounds for dentists to consider their patient's medical condition before commencing dental treatment. This is particularly important in the case of elderly patients.
References