Comparison assessment methods of smoking consequences use in primary care

Porównanie metod oceny skutków palenia tytoniu wykorzystywanych w podstawowej opiece zdrowotnej

Cigarette smoking is an independent factor influences on development of smoke related diseases (for example COPD, emphysema). The aim of the study was to check correlation between the changes in respiratory tract and use additional tests such as: a spirometric test, a chest radiogram and measurement of exhaled carbon monoxide among subjects. In the study took part 398 people: 182 active smokers, 145 ex-smokers and 71 never smokers. Average age of participants was 49.3±14.7 years, and number of years smoked cigarettes was 25 among men and 22 among women (p<0.001). COPD has been diagnosed at 110 women (36-32.7% active smokers, 44-40% never smokers and 30-27.3% former smokers) and at 108 men (53-40.8% active smokers, 52-23.9% never smokers and 77-35.3% former smokers). Emphysema has been diagnosed at 22 women (11-50% active smokers, 3-13.6% never smokers, 8-36.4% former smokers) and at 54 men (23-42.6% active smokers, 1-1.9% never smokers, 30-55.6% former smokers). The measurement of carbon monoxide in exhaled air was noted at 122 active smokers, 3 never smokers and 31 former smokers. In comparison to the chest radiogram, the spirometric test (COPD and emphysema) with the level of CO exhaled by subjects showed strong dependence for emphysema ( =8.655; p=0.004; C=0.207) and for COPD ( =10.522; p<0.002; C=0.228). The same statistically significant correlation showed results among active smokers for emphysema ( =6.919; p=0.008528; C=0.272) and for COPD ( =43.512; p<0.001; C=0.633). The research showed that there are strong dependence between gender and tobacco smoking, and also correlation between respiratory tests used in this paper and changes which appeared as results of tobacco smoking.

Introduction

In Poland, the problem of smoking concerns 37% of men and 23% of women, who smoke cigarettes every day. Although since a couple of years the number of ex-smokers increases (now there are 23% of men and 13% of women), a general practitioner almost every day examines a smoking pa-
tient [8]. A primary medical care unit may carry out tests evaluating the tobacco addiction (Fagerström test) or the person's readiness to give up smoking (Schneider test), but none of those tests shows changes occurring in permanent smoker's respiratory system.

Smoking is an independent factor causing tobacco-related diseases, such as chronic obstructive pulmonary disease (COPD). It is one of the most common diseases in the world and the only one that causes growing mortality. Unfortunately, since it reveals asymptptomatically for years, COPD is usually being recognized in a late period. The first symptoms are associated with cigarettes and the further ones with cardiovascular diseases. The diagnosis may be made by a non-invasive method, which is spirometry. Spirometry is the most common test, measuring ventilatory efficiency of the lungs. It checks a decreasing forced expiratory volume in one second (FEV1), which in case of a smoker decreases by 40 ml a year and is twice higher than in case of a non-smoker. Such significant and fast decreasing of ventilatory reserve of smoker's lungs means, that giving up spirometry test deprives him of a proper diagnosis, leading to breathing disability and premature death.

Another important examination, evaluating the results of permanent smoking, is a chest radiograph. Unlike spirometry, evaluating the lung function, chest radiograph shows changes in aeration and vascularization of lungs, changes in cardiac silhouette and in the shape of chest and diaphragm. Interpreting a radiograph we are looking for symptoms of emphysema which, along with chronic bronchitis, is considered a form of COPD. At the preliminary stage of COPD a radiograph is normal. In case of emphysema, a radiograph shows changes in the lungs, consisting in enlarged air sacs lying peripherally from terminal bronchiolae, which results in breaking down alveoli walls. The occurring changes are irreversible [11].

Apart from functional examination and imaging of respiratory system, we can also evaluate the carbon monoxide poisoning. There are over 4,000 chemicals and even more trace elements in cigarette smoke. Tobacco smoke exhaled by a smoker contains gas and molecular fraction. About 4% of carbon monoxide belongs to gas fraction, but even its smallest concentration is harmful and inactivates internal respiration [7]. Using the MicroCO meter we can evaluate the level of carbon monoxide intoxication, since its value in the examined person's blood correlates with carboxyhemoglobin concentration (COHb).

Each test, presented in this work, available at primary medical care units, has a different task. The aim is to detect disease early and prevent it from further expansion by taking tobacco activities.

The aim of the study was inspecting the dependencies between changes in respiratory system using three independent tests: spirometry, chest radiograph and carbon monoxide evaluation among actual smokers, ex-smokers and persons who have never smoked tobacco.

### Table I

<table>
<thead>
<tr>
<th>CO (ppm)</th>
<th>%COHb</th>
<th>Results/cigarette consumption</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>0.8</td>
<td>Non smoker</td>
<td>Green</td>
</tr>
<tr>
<td>6-10</td>
<td>1.6</td>
<td>Light Smoker &lt;10 cigarettes</td>
<td>Amber</td>
</tr>
<tr>
<td>11-72</td>
<td>1.8-12</td>
<td>Heavy Smokers 10-20 cigarettes</td>
<td>Red</td>
</tr>
<tr>
<td>&gt;72</td>
<td>&gt;12</td>
<td>Suspected poisoning</td>
<td>Red + alarm</td>
</tr>
</tbody>
</table>

### Table II

**Characterization of cigarette smoking among subjects in relation with gender.**

<table>
<thead>
<tr>
<th>Subjects / years</th>
<th>Smokers (%)</th>
<th>Non-smokers (%)</th>
<th>Ex-smokers (%)</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>88 (48.4)</td>
<td>57 (80.3)</td>
<td>62 (42.8%)</td>
<td>100</td>
</tr>
<tr>
<td>Men</td>
<td>94 (51.6%)</td>
<td>14 (19.7%)</td>
<td>83 (57.2%)</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>182 (100.0%)</td>
<td>71 (100.0%)</td>
<td>145 (100.0%)</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table III

**Spirometry results among subjects.**

<table>
<thead>
<tr>
<th>COPD</th>
<th>Smokers (%)</th>
<th>No smokers (%)</th>
<th>Ex-smokers (%)</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>36 (32.7)</td>
<td>8 (7.4)</td>
<td>44 (40.0)</td>
<td>100</td>
</tr>
<tr>
<td>Men</td>
<td>53 (49.1)</td>
<td>8 (7.4)</td>
<td>47 (43.5)</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>89 (40.8)</td>
<td>52 (23.9)</td>
<td>77 (35.3)</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ z^2=31.908 \]
\[ p=0.000000 \]
\[ C=0.505 \]

### Materials and Methods

The research included 398 patients from a primary medical care unit. They were presented the author's questionnaire concerning the evaluation of smoking. Also there were made such tests as spirometry (Lung Test 1000), chest x-ray and measurement of exhaled carbon monoxide (CO) by means of MicroCO Medical meter. During the test with the meter the colour of a diode shows value of exhaled carbon monoxide in ppm. This value correlates with carboxyhemoglobin concentration (COHb) and evaluates the patient as far as the number of smoked cigarettes is concerned. All data show table I. Subjects, who took part in the study, were divided into groups: active smokers (group I), never smokers (group II) and people who have no smoked for at least 2 years (group III). Table II shows wide characteristics of gender subjects and number years smoked cigarettes among ex-smokers and active smokers.

### Results

In the survey 398 persons took part, 207 women (52.0% of participants) and 191 men (48.0% of participants). Average age of the participants was 49.3±14.7 years. Women were younger than men about 6 years. Average age of women was 46.9±14.2 years (p<0.001). Men, who took part in the study, smoked on average 7 years longer than women. Occurrence emphysema was twice often among men than women, and four times often among former smokers men than former smokers women. The total characteristic shows table IV.

The next test shows present status of tobacco smoking and the value of exhaled carbon monoxide in ppm (table V). Ex-smokers declared non smoking for 2 years in questionnaire, but the meter showed that 31 subjects still smoke or they are passive smokers. Green colour of diode most often appeared among ex-smokers and non-smokers. Average of half packet of cigarette smoke 50% active smokers and 20% ex-smokers. All data were presented in table V.

In the next two tables VI and VII compared two methods chest x-ray and spirometry to value of exhaled carbon monoxide obtained by use MicroCO meter.

### Discussion

Methods used by a general practitioner should be accessible, inexpensive and accurate. Their sensitivity is extremely impor-
A permanent smoker lives approximately 17 years shorter than a person who has never smoked, because of tobacco smoking. From among three additional tests spirometry turned out to be the most sensitive method. It showed obstructive changes in 218 out of 398 subjects. Spirometry is not a new method. In Poland it was disseminated in the 50-ies and 60-ies of the 20-th century but still it seems to be an underestimated technique [12]. According to Polish and international standards COPD may be diagnosed only after spirometry is performed [10]. Within the survey COPD was diagnosed among 44 non-smoking women (40%) and 8 men (7.4%). Excluding occupational exposure, the other important factor appears to be passive smoking and air pollution. The latest studies show that women’s lungs are more susceptible to harmful effects of tobacco smoke than men’s [9]. The results of the study show a strong dependence between gender and tobacco smoking in case of diagnosed COPD. The outcome was confirmed by MicroCO meter test, which showed that among 89 smokers with diagnosed COPD, up to 81 had a bad result of exhaled carbon monoxide. The meter is very sensitive, because negative result was obtained only in case of 1 person. At present it is estimated that only 20% of people with COPD has been diagnosed properly and is treated. Therefore spirometry should be performed also in case of former smokers. The study shows that in 43% of men and 27.3% of women COPD has been detected.

Another additional test, confirming a strong influence of smoking on changes in respiratory system, is chest radiograph. Most emphysema cases were diagnosed in the group of ex-smokers who smoked for the longest period of time (tab. I, VI) [2]. Emphysema changes occur slowly, after many years of smoking cigarettes. They were diagnosed twice more often in current men smokers, who have smoked 7 years longer than women [4,5]. Chest x-ray should also be performed if spirometry test suggests the occurrence of COPD. Emphysema is a component of COPD and people with diagnosed emphysema experience more severe form of COPD [1]. The last test described in this work is a non-invasive method allowing objectively evaluate the exposure of a person to tobacco smoke. It is a quick test defining the quantity of smoked cigarettes and/or the value of passive exposure. Among 398 subjects, the meter showed CO exhaling in case of 155 persons - 122 smokers, 31 ex-smokers and 2 people who have never smoked.

The achieved results verified the questionnaire, filled up by the subjects, concerning cigarette smoking. It was significant especially in ex-smokers, where in case of 28 subjects the meter showed that they still smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous. The meter measurement in ex-smokers may be used to verify the credibility of the questionnaire (some of the former smokers returned to smoking habit) and evaluate if they smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous. The meter measurement in ex-smokers may be used to verify the credibility of the questionnaire (some of the former smokers returned to smoking habit) and evaluate if they smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous. The meter measurement in ex-smokers may be used to verify the credibility of the questionnaire (some of the former smokers returned to smoking habit) and evaluate if they smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous. The meter measurement in ex-smokers may be used to verify the credibility of the questionnaire (some of the former smokers returned to smoking habit) and evaluate if they smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous. The meter measurement in ex-smokers may be used to verify the credibility of the questionnaire (some of the former smokers returned to smoking habit) and evaluate if they smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous. The meter measurement in ex-smokers may be used to verify the credibility of the questionnaire (some of the former smokers returned to smoking habit) and evaluate if they smoke about 10 cigarettes, 2 of them a packet per day and one person a number of cigarettes regarded as dangerous.
Comparison spirometry test to measurement of exhaled CO by subjects showed a strong dependence between these both methods ($\chi^2=10.522; p<0.002; C=0.228$). The same strong dependence was noted among active smokers ($\chi^2=43.512; p<0.001; C=0.633$). However, 52 non smokers subjects had COPD but only 1 person exhaled CO ($\chi^2=0.003; p>0.05$). No statistically also significant differences were noted among ex-smokers even though 19 had negative measurement ($\chi^2=1.061; p>0.05$).

**Conclusions**

There is a strong dependence between gender and the fact of tobacco smoking, and also correlation between additional respiratory tests and changes causing tobacco smoking.

**References**

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**Table VII**

Occurrence of COPD and results of test based on the Micro CO meter.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Positive n %</td>
<td>Negative n %</td>
<td>Razem n %</td>
<td>Positive n %</td>
</tr>
<tr>
<td>No</td>
<td>124 51.5 54</td>
<td>34.8 178</td>
<td>45.0</td>
<td>124 51.5 54</td>
</tr>
<tr>
<td>Yes</td>
<td>117 48.5 101</td>
<td>65.2 218</td>
<td>55.0</td>
<td>117 48.5 101</td>
</tr>
</tbody>
</table>
| Total      | 241 100.0 155 | 100.0 396 | 100.0 | 241 100.0 155 | 100.0 396 | 100.0 | 241 100.0 155 | 100.0 396 | 100.0 | 241 100.0 155 | 100.0 396 | 100.0

versible (table VI).