**Clinical Research**

**Depression and anxiety before and after percutaneous coronary intervention and their relationship to age**

Zhiyong Zhao, Jing Luo, Jianmei Wang, Yan Su

*The No.2 Sanatorium for Retired Cadres, National Defense University, Beijing 100143, China*

**Background and Objective**

Percutaneous coronary intervention (PCI) is becoming a common practice in the treatment of patients with coronary heart disease (CHD) of all age. Depression is considered to be a risk factor for the development of CHD and deteriorates the outcome after cardiac rehabilitation efforts. The aim of our study was to evaluate the presence of clinically relevant anxiety and depression in patients before and after PCI. Additionally we evaluated their relationship to age because of the increasing number of elderly patients undergoing PCI.

**Methods**

One hundred and twelve consecutive patients in three Sanatoria for Retired Cadres in Beijing who underwent PCI were asked to fill in the Hospital Anxiety and Depression Scale (HADS) to measure depression and anxiety scores two days before and ten days after PCI. Differences between these pre- and post-surgical scores were then calculated as means for changes, and the amount of elevated scores was appraised. In order to investigate the relationship between age and anxiety and depression, respectively, Spearman correlations between age and the difference scores were calculated. In addition, ANOVA procedures with the factor “age group” and McNemar tests were calculated.

**Results**

25.8% of the patients were clinically depressed before and 17.5% after PCI; 34.0% of the patients were clinically anxious before and 24.7% after PCI. This overall change is not significant. We found a significant negative correlation between age and the difference between the two time points for anxiety (Spearman rho = -.218, \( P = 0.03 \)), but not for depression (Spearman rho = -.128, \( P = 0.21 \)). ANOVA and McNemar tests revealed that anxiety scores and the number of patients high in anxiety declined statistically meaningful only in the youngest patient group. Such a relationship could not be found for depression.

**Conclusions**

Our data show a relationship between age and anxiety. Younger patients are more anxious before PCI than older ones and show a decline in symptoms while elderly patients show hardly any change. (J Geriatr Cardiol 2008; 5:203-206)

**Key words**

coronary heart disease; depression; anxiety; age

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**Introduction**

Depression and anxiety are common in patients with diagnosed coronary heart disease (CHD) as well as in those patients undergoing PCI. Depression is regarded as an independent risk factor for arteriosclerotic deposits in coronary arteries. The pathophysiological processes to explain this relationship are hypercortisolemia related to insulin resistance, sympathetic vagal dysbalance; disturbed regulation of blood pressure, and an unfavorable lifestyle like cigarette smoking. Depression does not only account for a raise in first time CHD manifestation, but it is also related to the success of secondary and tertiary prevention.

In contrast to depression, anxiety is not considered an independent risk factor for MI. Depression is associated with higher postoperative mortality and morbidity. The same relationship was found for acute preoperative anxiety but not for trait anxiety. It is reported, however, that the risk of sudden cardiac death is elevated by anxiety disorders. Pathophysiologically ventricular arrhythmias are considered to explain this phenomenon.

Cardiac intervention in China began in 1984 with percutaneous transluminal coronary angioplasty (PTCA). Reported numbers of patients underwent PTCA in China are 8000 in 1999, 11 753 in 2000, 16 345 in 2001 and about 90 000 in 2005. Percutaneous coronary intervention (PCI) has become common practice in the treatment of CHD patients in China in recent years.

Increased age is considered to be a high risk factor for perioperative mortality. Age is one of the few factors which is included in all of the formulas to calculate mortality risk. Furthermore, it is known that depression affects the life of elderly people more than any physical disorder. No consistent pattern across studies investigating age differences in the occurrence of anxiety and depression is available in the current literature. To our knowledge, the prevalence of clinically relevant anxiety and depression in patients undergoing PCI in relation to age has not been investigated yet.

The objective of the present study was to evaluate the proportion of clinically relevant anxiety and depression and the number of symptoms for both conditions in CHD patients two days before and ten days after PCI surgery in relation to age.

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Corresponding author: Dr. Zhiyong Zhao, MD, No.2 Sanatorium for Retired Cadres, National Defense University, Beijing 100143, China; Tel: (+86) 010-66829256; E-mail: zzyjd @163.com
Patients and methods

Patients
One hundred and twelve consecutive patients in three sanatoria for retired cadres in Beijing, China who underwent PCI were included in the study. Fifty-two patients were surveyed from January to December 2006 while 60 patients were examined from January 2007 to June 2008. The data from 2002 and 2003 were combined since there were no significant differences in terms of depression and anxiety at both measurement points between the two groups.

All patients fulfilled the following criteria: native Chinese speaker, ability to read and write, no neurological deficits, no dementia, no emergency PCI, and signed agreement to participate.

Measurement
Anxiety and depression were measured with the Chinese version of Hospital Anxiety and Depression Scale (HADS).22 Patients were examined two days before and ten days after PCI. The HADS is a short self report questionnaire to screen for anxiety and depression. It was especially developed for hospitalized persons with physical illness. The questionnaire consists of 14 items, seven to measure anxiety and seven to measure depression. The items are formulated as symptoms referring to the last seven days. Each statement can be answered by choosing one out of four options. The answers differ from question to question. There are two ways to analyze HADS values. First, the raw scores for depression and anxiety can be counted in order to measure the number of symptoms. Second, the raw scores can be used to classify patients with elevated and not elevated depression and anxiety scores, respectively. According to research literature, the cut-off for elevated anxiety and depression scores is = 8. Sensitivity and specificity for this cut-off are 0.70 and 0.90, respectively.15

Statistics
McNemar tests were used to find out if there are different proportions of patients with elevated anxiety and depression scores before and after PCI. The raw scores were examined for differences with t-tests for dependent measurements. The relationships between age and anxiety and depression, respectively, were evaluated with non-parametric Spearman rho correlations between patients’ age and the differences of the pre- and the post-surgical values in the HADS score. In order to calculate these differences in anxiety and depression, the values ten days after PCI were subtracted from the values two days before PCI surgery. A positive result indicates higher pre-surgical values, and a negative result indicates higher post-surgical values. A zero result indicates no change between the two measurement points.

In addition, ANOVA procedures for repeated measurements were conducted. The group variable was constructed by creating four age groups. For that purpose the patients were divided into four age groups by means of quartiles. The quartile ranges were 36 to 60 years (n = 28), 61 to 66 years (n = 28), 67 to 72 years (n = 28), and 73 to 78 years (n = 28). Thus, with ANOVA we could evaluate the main effects for the variables “age group” and “time” (repeated measurements) and the interaction effect of both. Given a significant effect, differences were tested with the post-hoc test “Fishers Least Significant Differences” test (LSD). Statistical analyses were conducted using SPSS13.0. A P value of .05 or less was considered to indicate statistical significance.

Missing data were not substituted because of the association between the numbers of missing values and the independent variable age (see result section). Therefore, data from 87 patients were analyzed.

Results
Ten patients (7.0%) suffered from medical complications so they could not fill in the HADS 10 days after PCI. A significant age dependent increase in medical complications could not be detected even though half of the patients who suffered from medical complications were older than 72 years (see Table 1). (Fisher’s exact P = 0.24 for the overall test and P = 0.08 for comparing the youngest with the oldest patient group).

The percentage of patients who filled in the HADS was different between the age groups (see Table 1). Before surgery there were no significant differences (Fisher’s exact: P = 0.12). Ten days after PCI, however, we found highly significant differences (Chi-square = 16.7, df = 3, P< 0.001). The older the age group, the less patients filled in the HADS. Statistically significant differences resulted only by com-

<table>
<thead>
<tr>
<th>Age group [years] (n)</th>
<th>Percentage of medical complications</th>
<th>Percentage of HADS filled in 2 days before PCI</th>
<th>Percentage of HADS filled in 10 days after PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-60 (28)</td>
<td>2.7%</td>
<td>100%</td>
<td>86.1%</td>
</tr>
<tr>
<td>61-66 (28)</td>
<td>5.5%</td>
<td>91.6%</td>
<td>80.5%</td>
</tr>
<tr>
<td>67-72 (28)</td>
<td>5.7%</td>
<td>94.3%</td>
<td>62.8%</td>
</tr>
<tr>
<td>73-78 (28)</td>
<td>14.3%</td>
<td>85.7%</td>
<td>45.7%</td>
</tr>
<tr>
<td>Total</td>
<td>7.0%</td>
<td>92.9%</td>
<td>69.0%</td>
</tr>
</tbody>
</table>
paring age group “36-60 years” with age group “73-78 years” (Chi-square = 12.9; df = 1, P < 0.001) and age group “36-60 years” with age group “67-72 years” (Chi-square = 5.1; df = 1, P = 0.02).

Data analyses with the categorical classification indicate for anxiety that 34.0% of the patients before, 24.7% after PCI, and 16.5% at both time points were highly anxious. 25.8% of the patients were depressed two days before PCI, 17.5% ten days after, and 9.3% at both questionnierzons. For both, anxiety and depression, the changes in these ratios are not significant (McNemar test). However, by testing the accompanied continuous HADS scores a statistically significant decline could be found for anxiety (before surgery: m = 6.78; SD = 3.86, after surgery: m = 5.38; SD = 3.75, \( P < 0.001 \)) as well as for depression (before surgery: m = 5.65; SD = 3.71, after surgery: m = 4.51; SD = 4.08, \( P = 0.001 \)).

We could find a significant correlation between age and the changes in anxiety (Spearman rho = -.218, \( P = 0.03 \)), but not between age and the changes in depression (Spearman rho = -.128, \( P = 0.21 \)). The former indicates that the younger the patient is the larger is the difference between pre- and post-surgical anxiety scores. Specifically, younger patients show a stronger decline in anxiety. These results were confirmed for the continuous HADS anxiety scores by ANOVA procedures. We could prove a significant interaction between the factors “age group” and “time” for anxiety (\( F = 2.89, P = 0.03 \)), and a significant effect for the factor “time” (\( F = 9.86, P = 0.002 \)). The anxiety scores are significantly lower ten days after PCI than two days before surgery. However, and changes dependent on the age group, since the LSD post-hoc test revealed a significant decline in anxiety only in the youngest group (36-60 years) between the two measurement points (\( P < 0.001 \)) (see Table 2 for descriptive scores).

Table 2: Mean values and (SD) in anxiety and depression two days before and ten days after PCI by age groups

<table>
<thead>
<tr>
<th>Age group [years]</th>
<th>Anxiety 2 days before PCI</th>
<th>Anxiety 10 days after PCI</th>
<th>Depression 2 days before PCI</th>
<th>Depression 10 days after PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-60 (n=27)</td>
<td>7.54 (4.41)</td>
<td>4.77 (3.68)</td>
<td>6.25 (4.31)</td>
<td>4.87 (4.17)</td>
</tr>
<tr>
<td>61-66 (n=26)</td>
<td>6.72 (3.69)</td>
<td>5.48 (3.74)</td>
<td>5.21 (3.47)</td>
<td>4.93 (4.27)</td>
</tr>
<tr>
<td>67-72 (n=18)</td>
<td>6.90 (3.40)</td>
<td>6.09 (3.75)</td>
<td>5.33 (3.95)</td>
<td>4.23 (3.13)</td>
</tr>
<tr>
<td>73-78 (n=13)</td>
<td>5.25 (3.45)</td>
<td>5.43 (4.05)</td>
<td>5.75 (2.54)</td>
<td>5.37 (4.78)</td>
</tr>
</tbody>
</table>

The nonparametric McNemar test supports the post-hoc findings, because the amount of high scorers in anxiety and depression is diminished only in the youngest patient group (McNemar = 4.16, \( df = 1, P = 0.04 \)).

For depression we could only find a significant effect of the factor “time” (\( F = 9.85, P = 0.003 \)). Depression scores are lower after the PCI. The number of high scorers does not change over time. (see Table 3 for the numbers of high scorers).

Discussion

In our present study, we found high prevalence of anxiety and depression rates in patients undergoing PCI, compared to the general population, which is consistent with those described in the literature. The decline in anxiety and depression scores from pre to post PCI points to the fact that the patients are under considerable psychic strain before PCI.

We also found that age did not seem to have any influence on the rate of completion of the HADS before PCI. After PCI, however, completion rate decreased significantly with age. This cannot be explained by higher medical complication rates that prevented the patients from filling in the questionnaire. Potential explanations could be physical impairment, a general weakness, and/or the unfamiliar cognitive demand of the test putting too much strain on older patients. In addition, the questionnaire explicitly asks for mental concerns. According to our experience, older people are prone to react to questions like these with avoidance tendencies which could mask psychiatric comorbidity. One of our first assumptions was that patients with elevated anxiety or depression scores two days before PCI surgery would not fill in the HADS for a second time. However, this could not be supported by our data because the number of missing data ten days after PCI was independent of the status of anxiety and depression, respectively (i.e. high-scokers vs. normal scorers). The quantity of missing data is the main limitation of our investigation. However, the re-

Table 3: Number and percentages [%] of high-scorners in anxiety and depression (HADS value \( \geq 8 \)) two days before and ten days after PCI by age groups

<table>
<thead>
<tr>
<th>Age group [years]</th>
<th>Anxiety high-scorners 2 days before PCI</th>
<th>Anxiety high-scorners 10 days after PCI</th>
<th>Depression high-scorners 2 days before PCI</th>
<th>Depression high-scorners 10 days after PCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>36-60 (n = 27)</td>
<td>11 (35.5)</td>
<td>5 (16.1)</td>
<td>9 (29.0)</td>
<td>3 (9.7)</td>
</tr>
<tr>
<td>61-66 (n = 26)</td>
<td>9 (31.0)</td>
<td>6 (20.7)</td>
<td>6 (24.1)</td>
<td>7 (20.7)</td>
</tr>
<tr>
<td>67-72 (n = 18)</td>
<td>9 (42.9)</td>
<td>7 (33.3)</td>
<td>5 (23.8)</td>
<td>3 (14.3)</td>
</tr>
<tr>
<td>73-78 (n = 13)</td>
<td>4 (25.0)</td>
<td>6 (37.5)</td>
<td>5 (31.2)</td>
<td>4 (25.0)</td>
</tr>
</tbody>
</table>
results are congruent with our clinical impressions. Furthermore, we could demonstrate negative correlations between age and changes in depression and anxiety scores. A closer inspection of these negative correlations and the ANOVA results revealed that the younger the patients are the larger is the decrease from pre- to post-surgery scores. There are some possible reasons for the specific age related pattern of anxiety and depression. Information about the intervention, which is routinely performed prior to PCI, may induce thoughts of one's own potential death, since death is mentioned as a possible complication of PCI. These thoughts could have been present in the younger as well as in the older patients. It seems that older patients consider anticipated relief more than the strain imposed by angina pectoris. Younger patients, however, suffer from less physical limitations caused by CHD than the older ones. Therefore it is possible that before PCI surgery the younger patients are more affected by a potential deadly outcome than by the removal of physical CHD symptoms. Another possible explanation is that during their lives older patients were more frequently confronted with thoughts of their own death. As a consequence of knowing the stimulus "own death" patients may habituate resulting in less anxiety. In addition, younger patients may estimate their mortality risk and how long they will live. So, they might calculate a much greater loss than older patients, and stronger anxiety is elicited with the assumed number of years ahead of them. While discussing our results with a 75 year old male patient he mentioned another possible reason. Elder patients mostly have CHD for several years and may have become trained in getting into the hospital. Therefore, they are confronted with fewer new stimuli as compared to most of the younger patients. Remarkably, the ratio of patients with elevated depression values at both time points is only 9.3%. Such a low ratio has not been reported before and may depend on the longitudinal design of our study, while other studies evaluate depression only at a single time point, e.g. before or shortly after PCI surgery.

In conclusion, based on the results of our study one may conclude that many patients have noticeable mental distress before PCI which has to be recognized and treated. The younger the patients are the higher is the decline of symptoms. The older the patients are the less change in symptoms is observed. According to these findings anxiety specific symptoms, e.g. tachycardia, should be kept in mind especially for younger patients before PCI. In short term care and before PCI, treatment should predominantly focus on anxiety. Anxiolytic drugs should be prescribed as soon as possible, and potential threats should be avoided. In this regard, a trustful physician-patient-relationship is of importance. On the other hand, to sustain a good long-term outcome after PCI, treatment of depression surely is more important than treatment of anxiety. With some exceptions, for many patients the best depression therapy is a combination of antidepressants and psychotherapy. The basics of sufficient treatment, however, are reliable and valid diagnostic investigations.

References