Addition of Acupuncture and Self-Care Education in the Treatment of Patients with Severe Angina Pectoris May be Cost Beneficial: An Open, Prospective Study

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ABSTRACT


Design: An open prospective study on an unselected group of patients. For comparison of risk three control groups were used: (1) published data concerning medical and invasive treatments; (2) an age- and sex matched group obtained from a randomly selected Danish population of 14,000 people; and (3) the 211 patients in this group with angina pectoris symptoms.

Setting: The treatment was carried out on an outpatient basis in a private research clinic.

Subjects: 105 patients with angina pectoris, 73 candidates for invasive treatment, and 32 for whom this was rejected.

Interventions: Acupuncture and self-care education was added to the pharmaceutical treatment.

Outcome measures: Healthcare expenses, a satisfactory medical status defined as New York Heart Association (NYHA) classification 0-I and/or no use of antianginal medication, and risk measured as cardiac death or myocardial infarction.

Results: The estimated cost savings during 5 years were $32,000 (U.S.) per patient, mainly due to a 90% reduction in hospitalization and 70% reduction in needed surgery. Compared to 8% before treatment, 53% of the patients achieved a life without limitations (NYHA 0-I) 1 year after treatment, as did 69% after 5 years. No increased risk for myocardial infarction or cardiac death was observed.

Conclusions: The addition of acupuncture and self-care education was found to be cost beneficial in patients with advanced angina pectoris. The results invite further testing in a randomized controlled trial.

INTRODUCTION

The conventional treatment of coronary artery disease is either medication, coronary artery bypass grafting (CABG), or percutaneous transluminal balloon angioplasty (PTCA). However, the risks are substantial, reoperation often needed and expenses high (Htalky et al., 1997). It has been reported that lifestyle adjustments and acupuncture are help-

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ful for patients with angina pectoris (Ornish et al., 1990; Ballegaard et al., 1991). A long-term cost-benefit analysis of acupuncture and a special designed self-care education in addition to pharmaceutical treatment is reported.

MATERIAL AND METHODS

Design

A cost–benefit analysis calculated the economical consequences of a treatment as the relationship between the expenses and saving for the society (Johannesson et al., 1991). Accordingly, it is not a scientific study evaluating the effect of the treatment. To do so, a different design is needed. The study is based on questionnaires sent to the patients annually. Risk calculation and hospitalization data from all patients are included. If the patient did not answer the questionnaire, the information was obtained from the patient’s general practitioner. For risk calculation, three control groups were used: (1) published data concerning medical and invasive treatments; (2) an age- and sex-matched group obtained from a randomly selected Danish population of 14,000 people; and (3) the 211 patients in this group with angina pectoris symptoms.

Patients

We treated 105 consecutive patients, who contacted the private outpatient clinic for treatment by their own initiative. Seventy-three were candidates for invasive treatment, and for 32 this was rejected because of high operative risk (6 patients), high reoperative risk (7 patients), operation technically not possible (5 patients), reoperation technically not possible (7 patients), and second reoperation not possible (7 patients). Patient data are summarized in Table 1.

The intervention

The patients received 12 consultations within a 4-week period. At each visit the patients was given acupuncture as well as education in self-care.

Acupuncture is the treatment of disease by insertion of needle on specific locations in the skin of the patient. In addition, the practitioner is a coach for the patient in striving toward a life in balance with oneself and one’s surroundings aiming to optimize the balance between the capacity of the organism to heal itself and the lifestyle of the patient (Veith, 1949). The main philosophy behind the treatment is self-care by the patients. The effect of the needle is used to underline that self-care is a possible strategy. The improvement experienced by the patient during acupuncture is caused by mechanisms in the body of the patient. Acupuncture reduces the activity of specific nerves: Decreased activity in the sympathetic nervous system leads to a decrease in total peripheral resistance, whereby the demand for the pumping function of the heart decreases (Mannheimer et al., 1985; Emanuelson et al., 1987). In the heart muscle itself, the decrease in sympathetic activity leads to a relaxation of the ring muscle in the walls of the arterioles. Accordingly, the lumen of the vessels increases and the part of myocardium that is lacking oxygen receives more (Chaucan et al., 1994). As a consequence, the working capacity of the heart increases, which the patient experiences as increased physical capacity and less pain (angina) in the heart. This effect has been shown in clinical studies (Ballegaard et al., 1986; Richter

<table>
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<th>TABLE 1. Characteristics of the 105 Patients Before Treatment</th>
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<tr>
<td>Median age (year)</td>
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<td>Sex (male gender)</td>
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<tr>
<td>NYHA class</td>
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<td>0-I</td>
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<td>II-IV</td>
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<tr>
<td>Medication</td>
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<td>β-blockers</td>
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<td>Calcium antagonists</td>
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<td>Long-lasting nitrates</td>
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<td>Heart failure</td>
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<td>Myocardial infarction</td>
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<td>CABG or PTCA</td>
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<td>CABG or PTCA rejected</td>
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<tr>
<td>Body-mass index (kg/m²) (median, 5%-95% percentiles)</td>
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<tr>
<td>Total serum cholesterol (mmol/L) (median, 5%-95% percentiles)</td>
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NYHA, New York Heart Association; CABG, coronary artery bypass grafting; PTCA, percutaneous transluminal coronary angioplasty.
et al., 1991). Acupuncture was performed with the patient in the supine position and done in agreement with traditional Chinese practice (Beijing College of Traditional Chinese Medicine, 1980). After obtaining needle sensation (or the arrival of qi), the needles were left in situ for 20 minutes with no further mechanical or electrical stimulation. Five principal points were used: Shanzhong (C.V. 17), Jueyinshu and Xinshu (U.B. 14 and 15), Neiguan (Per. 6), and Zuzanli (St. 36).

The aim of self-care education is to provide the patient with the motivation and tools to exert daily control of their health. It consists of an understanding of the mechanisms underlying the disease, bridging Western science and classical Chinese healthcare philosophy, daily acupressure as a feedback technique, and lifestyle adjustments.

The acupressure feedback technique is based on the following hypothesis. There is a close relationship between the tenderness of specific acupuncture points and the local activity of the autonomic nervous system, a high degree of soreness is associated with increased sympathetic tone leading to constriction of arteriolar ring muscles of the myocardium and subsequently increased risk of attacks of angina.

During the instruction period, the patient finds that acupressure decreases the soreness of the acupoints and simultaneously alleviates anginal pain. The patient (and possibly the spouse) is instructed to perform acupressure twice daily for prevention and at the beginning of an anginal attack. Acupressure is performed by applying firm, painless finger pressure. After 20–30 seconds of acupressure, the patient is asked whether the underlying soreness has decreased. If not, the procedure is repeated with slightly increased pressure. Total acupressure time is 1 minute at points on the sternum at the level of the fourth intercostal space (Shanzhong, C.V. 17) and on the back 1.5-inch lateral to the spinal process of the fourth and fifth thoracic vertebra (Jueyinshu and Xinshu, U.B. 14 and 15) (Fig. 1).

The results of acupressure teaches the patient that individual control is possible; the daily success obtained by performing acupressure helps to motivate the patient for self-care.

The lifestyle suggestions focus on the addition of new behavioral patterns with positive effects rather than restrictions of patterns with negative effects because the success rate of positive reinforcement is higher than that of negative (Takahashi et al., 1995; Weinstein et al.,

**FIG. 1. Location of acupuncture points used for acupressure** A: front; B: back. Not shown, but just as important, are points Pericardium 6, 2 cm above the transverse crease of the wrist between the tendons of palmaris longus and flexor carpi radialis, and Stomach 36 (Zuzanli), which is 3 cm below the inferior border of the patella and one finger-breadth from the anterior crest of the tibia.
The suggestions included: stress-coping techniques (Schwartz, 1983; Pennebaker, 1989; Kobasa et al. 1985; McClelland, 1979), daily relaxation exercise (Benson and Stuart, 1992), daily physical exercise, ie, a 20-minute walk (Leon et al., 1987; Paffenberger et al., 1993; Lakka et al., 1994) or the Royal Canadian Air Force physical fitness program (Royal Airforce, 1960a, 1960b) and/or yoga exercises, as well as nutritional recommendations including a moderate consumption of red wine (Stampfer et al., 1988; Jackson et al., 1991; Doll et al., 1994; Gronbaek et al., 1995), Mediterranean diet (De Lorgieril et al., 1994), and to decrease total blood cholesterol and high-density lipoprotein/low-density lipoprotein (HDL/LDL) cholesterol ratio by consuming olive oil (Mesink et al., 1987), nuts (Fraser et al., 1992), fish (Kromhout et al., 1985; Saito et al., 1987), cacao (Waterhouse et al., 1996), vegetables rich in vitamin E, vitamin C, and beta-carotene as well as flavonoids (Stampfer et al., 1988; Rimm et al., 1993; Engstrom et al. 1992; Gazziano et al., 1990; Her- tog et al., 1993). The majority of these suggestions have been found to have an independent positive effect on arteriosclerotic disease. These suggestions are somewhat different from the lifestyle adjustment program of Ornish and colleagues (1990), which recommends no tobacco, no alcohol, no animal fat, no meat, no nuts, and no oils.

Outcome measures

The expenses in Denmark in May 1997 were (U.S. $) $20 and $40 for consulting a general practitioner and a cardiologist, respectively; and $250 and $500 per day for ambulatory treatment and hospitalization, respectively. The 5-year cost for PTCA and CAGB is $56,000 (Htalky et al., 1997). The annual cost for medical treatment alone is $5,000 (Andersson and Kartmann, 1995). The 12 acupuncture treatments cost $1,500.

A satisfactory medical status was defined as performance according to New York Heart Association (NYHA) classification 0–I and/or no need for antianginal medication (King et al., 1994). Quality of life and degree of disease was measured on a 100-mm visual analogue scale, before and after treatment. Myocardial infarction and cardiac death was used for calculations of the risk of cardiac complications and was considered not to be influenced by patient or practitioner bias (Wulff, 1981). The results were compared to published data for medical and invasive treatments (King et al., 1994; Yusuf et al., 1994). Furthermore, two Danish reference groups were drawn from the data of a randomly selected population of 14,000 citizens in the Copenhagen City Heart Study (Appleyeard et al., 1989): one group was healthy and matched the acupuncture group for sex and age; the other group consisted of the 211 patients who reported signs of angina pectoris with no previous myocardial infarction. The average age of this group was 63 years and two-thirds were men.

Before treatment, the patients were asked to estimate their expectations concerning the outcome of the treatment on a visual analogue scale and to fill in the Beck Depression Inventory (Beck et al., 1987). The compliance with the self-care education was evaluated from a four-point ordinal scale.

A standard statistical analysis was used to estimate the accumulated risk for cardiac death or myocardial infarction (Pepe and Flemming, 1991). Comparison between expectations for males and females was made using nonparametric tests for nonpaired data (Mann-Whitney). Correlation analyses were calculated by Kendall’s nonparametric test. Five percent (5%) was used as the significance limit.

RESULTS

The patients were followed for 3–126 months (median 34) from the beginning of treatment to one of the following events: myocardial infarction, death, invasive treatment or end of observation period (May 15, 1997) (Fig. 2). After treatment, body mass index and serum cholesterol were as before ($p > 0.1$).

Economic benefits

The estimated savings for a patient receiving acupuncture and the self-care education were $32,000 (U.S. $) during 5 years of follow-up, mainly due to a 90% reduction of hospitalization and avoidance of surgery in 52 patients (71%) (Table 2). For the 32 patients who
were rejected for surgery, the healthcare costs were $8,800 (U.S. $) per patient in the last year before treatment (on average 14 in-hospital days, 3 outpatient visits, 5 1/2 visits to general practitioner, 1–2 visits to cardiologists and $1,400 (U.S. $) for medication). During the first year of treatment, these costs were reduced to $2,300, $1,700 in the second year and $1,200 (U.S. $) for the rest of the years. During the first year of treatment, the patients received an average of 16 acupuncture consultations and 5 consultations during each of the subsequent years. The calculated savings and healthcare costs for each patient during 5 years are approximately $31,000 (U.S. $) (Table 2). For the 73 patients who were candidates for surgery, the healthcare costs during the last year before acupuncture were $3,500 (U.S. $) per patient (4–8 in-hospital days, 2 outpatient visits, 3 visits to general practitioner; 1–5 visits to cardiologists, and $800 (U.S. $) for medication). During the first year after treatment, the expenses decreased to $1,100, $800 in the second year, and $900 for each of the following years (all in U.S. $). The number of acupuncture treatments were 12 during the first year, 2 in the second year, and 1 in the following years. Based on the calculated economic consequences of surgery (Halky et al., 1997) and the fact that surgery was cancelled for 52 of 73 candidates (71%) the total shared saving for each of the 73 patients during the 5-year period was $36,000 (U.S. $).

Subjective benefits

Compared to 8% before treatment, 53% of the patients belonged to NYHA 0–I after 1 year, 36% after 3 years and 69% after 5 years. Before treatment, 4% were without antianginal medication; 12% were after 1 year, 35% after 3 years, and 34% after 5 years. Before treatment the median nitroglycerine consumption was 3 tablets a week (interquartile range 0–11 tablets), compared to zero tablets after 1, 3, and 5 years respectively (all interquartile ranges 0–1 tablet).
(all \( p < 0.0001 \)). Before treatment the reported median degree of disease was 71 mm on a 100-mm visual analogue scale (interquartile range 48–90 mm), compared to 24, 25, and 26 mm after 1, 3, and 5 years, respectively (interquartile ranges: 11–39 mm, 9–40 mm, 15–39 mm) (all \( p < 0.0001 \)). Similarly, the quality of life improved; the median value was 64 mm on a 100-mm visual analogue scale before treatment (interquartile range 45–83 mm), compared to 21, 23, and 24 mm after 1, 3, and 5 years respectively (interquartile ranges: 12–35 mm, 9–38 mm, 14–39 mm) (all \( p < 0.0001 \)).

**The risk rate**

The estimated accumulated risk for cardiac death or myocardial infarction was 4%, 10%, and 13% after 1, 3, and 5 years, respectively. Similar rates for conventional treatments are 8%–15%, 18%–23%, and 24%–31% (King et al., 1994; Yusuf et al., 1994). In the Danish reference groups the corresponding figures were 1%, 3%, and 5% for the general population and 4%, 13%, and 19% for the 211 patients with symptoms of angina pectoris without previous myocardial infarction (Fig. 3).

**Psychological aspects**

Compared to men, women had a significantly more positive expectation concerning the outcome of the treatment \( (p < 0.0005) \), with no difference in degree of disease or effect of the treatment. Before treatment there was a significant correlation between degree of depression and severity of disease expressed as NYHA classification (correlation coefficient 0.37, \( p < 0.001 \)). Furthermore, the degree of depression prior to the treatment correlated independently of the effect measured as change in NYHA classification (partial correlation coefficient 0.56; \( p < 0.001 \)).

**Compliance**

On average 34 months after treatment with acupuncture and self-care education, 78% of the patients were still using acupressure (60% daily); 67% were using the relaxation procedure (33% daily); 80% exercise regularly (40% daily); and 92% were eating at least partly healthy diets.

**DISCUSSION**

In our 105 consecutive patients with severe angina pectoris, the addition of acupuncture and self-care education to the pharmaceutical treatment was found to be cost beneficial. Savings were $32,000 (U.S. $) per patient, and most patients achieved a life without limitations (NYHA 0–I) without increasing the risk of myocardial infarction or death. Expenses for social costs are not included in the cost-benefit analysis. More than 40% of the patients in this study received social payments due to their heart disease, which often were more than $15,000 (U.S. $) annually. Patients who belong to NYHA class 0–I are usually capable of working and will not need such a support. Among the 105 patients, 8% belonged to NYHA class 0–I before treatment and 69% belonged after treatment. Accordingly, it seems likely that savings on social costs are possible.

The cost savings are based on a comparison of costs before and after treatment, plus the published data for the financial consequences of invasive treatments (Htalky et al., 1997). However, if our patients had pharmaceutical treatment only, an 80% reduction in cost would still be achieved, when compared to the cost during the last year before treatment or published results for pharmaceutical treatment (Andersson and Kartmann, 1995). Concerning
risk calculation, the occurrence of silent myocardial infarctions among our patients cannot be ruled out because we have no follow-up electrocardiograms. However, this risk is considered slight due to the severity of disease. Several cerebral complications are frequent after surgery (Roach et al., 1996) and the risk of cardiac death and myocardial infarction increases after reoperation (Savage et al., 1997), which is often needed (King et al., 1994; Yusuf et al., 1994). Most of our patients would have been excluded from invasive studies (King et al., 1994; Yusuf et al., 1994) due to an increased risk related to previous PTCA or CABG or because they were unsuitable for invasive treatment. Among the patients of King et al. (1994), 92% were excluded due to increased risk and in similar studies 96% and 97% of the patients were excluded prior to the study (Hampton et al., 1993; Hamm et al., 1994). Thus, the results involving invasive treatment are not applicable to a large nonselected diverse population (Anonymous, 1995). In our study no patients were excluded. Compared to only medically treated patients (Yusuf et al., 1994) ours were on an average 10 years older. Additionally, the Danish angina pectoris reference group had had no prior myocardial infarction, compared to 57% of our patients. Thus, our patients should be expected to be at higher risk. Spontaneous healing among angina pectoris patients has been reported to vary from 15% to 30% (Kannel et al., 1972; Fry, 1976), compared to more than 60% among our patients. As our report concerns an open study, it cannot be ruled out that the achieved benefits were due to the placebo effect. Moreover, it is not possible to separate the effect of the individual parts of the treatment program. Placebo has a well-documented influence on the daily life of angina pectoris patients, measured according to NYHA (Benson and McCallie, 1979). However, placebo is regarded as having no influence on myocardial infarction and death (Wulff, 1981). Furthermore, the 5-year duration of the observation period, the minimal degree of contact between patient and doctor during the last 4.9 years of this period, and the fact that the low expectation of benefit among men did not lead to an inferior result indicate that placebo cannot account for the full effect. Weight loss and lowering of serum cholesterol were beneficial effects of lifestyle changes (Ornish et al., 1990), but we could not obtain similar findings. Consequently, it is likely that the 75% compliance rate for the self-care education as well as activation of cardiovascular autoregulation and reduction in sympathetic tone caused by acupuncture and acupressure (Bølegaard et al., 1991, 1993) have contributed to

FIG. 3. Accumulated risk of myocardial infarction or cardiac death for patients treated with acupuncture and self-care education, medication (Yusuf, et al., 1994), surgery (Yusuf, et al., 1994), an age- and sex-matched control group from the general population and for the 211 patients within this group, who had symptoms of angina pectoris, but no previous myocardial infarction (Appleyard, et al., 1989). CABG, coronary artery bypass grafting.
the improvements. In conclusion, in our 105 patients with advanced angina pectoris treated with acupuncture, self-care education, and medicine, cost savings were $32,000 (U.S. $) per patient. In addition, more than 70% of the patients achieved a life without limitations, with no increased risk for cardiac death or myocardial infarction. The results invite confirmation by randomized controlled trials.

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REFERENCES


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