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A preoperative education intervention to reduce anxiety and improve recovery among Chinese cardiac patients: A randomized controlled trial☆

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ABSTRACT

Background: Patients awaiting cardiac surgery typically experience significant physical and psychological stress. However, although there is evidence that preoperative education interventions can lead to positive postoperative outcomes for surgical patients in general, less is known about the effectiveness among patients undergoing cardiac surgery, especially Chinese cardiac patients.
Objectives: To determine whether a preoperative education intervention designed for Chinese cardiac patients can reduce anxiety and improve recovery.
Design: Randomized controlled trial.
Settings: Cardiac surgical wards of two public hospitals in Luoyang, China.
Methods: 153 adult patients undergoing cardiac surgery were randomized into the trial, 77 to a usual care control group and 76 to preoperative education group comprising usual care plus an information leaflet and verbal advice. Measurement was conducted before randomization and at seven days following surgery. The primary outcome was change in anxiety measured by the Hospital Anxiety and Depression Scale (HADS). Secondary outcomes were change in depression (HADS), change in pain as measured by subscales of the Brief Pain Inventory-short form (BPI-sf), length of Intensive Care Unit stay and postoperative hospital stay.
Results: Of 153 participants randomized, 135 (88.2%) completed the trial. Participants who received preoperative education experienced a greater decrease in anxiety score (mean difference −3.6 points, 95% confidence interval −4.62 to −2.57; $P < 0.001$) and a greater decrease in depression score (mean difference −2.1 points, 95% CI −3.19 to −0.92; $P < 0.001$) compared with those who did not. There was no difference between groups in average pain, current pain, and interference in general activity, mood and walking ability. Patients randomized to the preoperative education group reported less interference from pain in sleeping (mean difference −0.9 points, 95% CI −1.63 to −0.16; $P = 0.02$). There was some evidence to suggest a reduced number of hours spent in the Intensive Care Unit among preoperative education patients ($P = 0.05$) but no difference in length of postoperative hospital stay ($P = 0.17$).
Conclusions: This form of preoperative education is effective in reducing anxiety and depression among Chinese cardiac surgery patients. Based upon existing evidence and international practice, preoperative education should be incorporated into routine practice to prepare Chinese cardiac patients for surgery.

☆ *Trial registration*: Current controlled trials ISRCTN87451169.

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What is already known about the topic?

- Cardiac surgery can be physically and psychologically stressful.
- Preoperative education may improve postoperative recovery for surgical patients in general, but evidence from trials of preoperative education among cardiac surgery patients has given conflicting results.

What this paper adds

- Within a healthcare culture where information provision is not prioritized, a simple preoperative education intervention for Chinese cardiac surgery patients can reduce postoperative anxiety and depression.

1. Introduction

Patients awaiting cardiac surgery typically experience significant physical and psychological stress, including high levels of anxiety and depression due to fears, worries, and uncertainties about surgery (Fitzsimons et al., 2000; Gallagher and McKinley, 2007). These can exacerbate symptoms of the existing disease, adversely affect physiological parameters before and during anesthesia, and also can result in prolonged recovery (Andrew et al., 2000; Duits et al., 1997; Pignay-Demaria et al., 2003).

Preoperative education has been used to improve patients' experiences by providing health care relevant information, coping skills, and psychosocial support before surgery (Kruzik, 2009; Scott, 2004). Compared with usual care, preoperative education can promote positive postoperative outcomes in mixed groups of surgical patients (Shuldham, 1999a,b). With reference to patients undergoing orthopedic surgery, the meta-analysis of Johansson et al. (2005) found that preoperative education can improve patients' anxiety and knowledge. A randomized controlled trial (Pager, 2005) demonstrated that preoperative information for patients experiencing cataract surgery resulted in less anxiety, and greater understanding of, and satisfaction with, their treatment. Another randomized controlled trial conducted by Lin and Wang in Taiwan (2005) found that a preoperative nursing intervention had a positive effect on anxiety and pain for patients undergoing abdominal surgery.

However, although there is evidence that preoperative education interventions can lead to positive postoperative outcomes for surgical patients in general, less is known about their effectiveness for patients undergoing cardiac surgery. Previous studies have produced conflicting findings. Some studies have highlighted the effects of preoperative education on improving physical and psychosocial recovery for coronary artery bypass surgery patients (Babaee et al., 2007; McHugh et al., 2001; Shelley and Pakenham, 2007) while other studies found no evidence that cardiac patients' anxiety is reduced (Asilioglu and Celik, 2004; Lamarche et al., 1998; Shuldham et al., 2002) or of any effect on hospital stay (Shuldham et al., 2002). Shuldham's review (2001) concluded that preoperative education did not benefit patients' recovery from coronary artery bypass surgery. Evidence in the field of preoperative education is limited and has tended to be based on weak trial design such as non-randomized trials or randomized trials with relatively small sample sizes.

Among various forms of preoperative education interventions designed for cardiac surgery patients, few attempts have been made to evaluate the effectiveness of verbal communication assisted with the use of written information. Furthermore, most studies are conducted in western countries. The effect of preoperative education may be different among Chinese patients as there is evidence to suggest that cultural factors may influence patients' responses to such interventions (Cheung et al., 2003). Despite a substantial increase in the availability of information about patients' illness and treatment in many western countries, the provision of such information in Chinese hospitals is often poor, with minimal interaction between healthcare providers and patients (Henderson and Chien, 2004).

Cardiovascular diseases have become one of the leading causes of death among Chinese adults. In a country with high population growth and a rapidly expanding economy, it is estimated that over 8 million Chinese are in need of cardiac surgery with over 74,000 cardiac operations taking place in Chinese hospitals each year (Pezzella, 2006; Zhang and Chen, 2007). However, there are no current guidelines from Chinese national health organisations regarding preoperative information needs for this group of patients.

Our primary interest was to determine whether provision of a preoperative education intervention comprising an information leaflet and verbal advice could reduce anxiety among Chinese patients undergoing cardiac surgery. In this study, we also aimed to evaluate whether this form of preoperative education could reduce symptoms of depression, decrease pain, and improve recovery.

2. Methods

We carried out a randomized controlled trial to compare usual care alone with usual care plus a preoperative education intervention comprising an information leaflet and verbal advice. The trial took place in the cardiac surgical wards of two public hospitals in Luoyang, China. At each hospital approximately 300 cardiac surgical procedures are performed each year. Ethical approval for this study was granted by the First Affiliated Hospital of Henan University of Science and Technology Teaching and Research Ethics Committee and the Luoyang Central Hospital Research Ethics Committee.

2.1. Participants, recruitment, consent and baseline assessment

All adult patients (18 years old or above) undergoing elective cardiac surgery were eligible for the trial if they were able to speak, read, and write Chinese. Cardiac surgery included coronary artery bypass grafting, valve surgery, congenital and other open heart surgery. Heart transplants are not performed at the two hospitals where the study took place. We excluded patients who were

emergency cases and those who had undergone cardiac surgery on a previous occasion.

Typically, patients who require cardiac surgery are admitted seven days prior to the surgery to facilitate nursing and medical assessments, tests, and preparations. Patients eligible to participate in this study were identified by the duty doctor responsible for providing diagnostic assessment. PG contacted potentially eligible patients to confirm whether or not they met the inclusion criteria and then invited them to participate in the trial, typically on the second or third day following hospital admission. Following an explanation of the purpose of the trial and process of trial involvement, patients were asked if they would consent to participate. Once written consent was obtained we undertook baseline assessment. This included patient socio-demographics, presence or absence of co-morbidities, type of surgery, previous hospitalization, blood pressure, heart rate, pain, anxiety and depression.

2.2. Randomization

After baseline assessment, participants were randomly allocated to one of the two arms of the trial, usual care or usual care plus preoperative education. Allocation was determined by a stratified block randomization, with random block size and stratified by the two study hospitals. The randomization list was prepared by AA using the 'ralloc' command in Stata version 9.2. AA had no contact with study participants.

Randomization was implemented by PG using a series of consecutively numbered, opaque, sealed envelopes. The envelope was opened in the presence of the participant after baseline assessment was completed. Following the assignment to study group, it was explained to the participant in greater detail what would be expected of them. Participants in the preoperative education group were asked not to inform clinical staff about their allocation during the trial.

2.3. Interventions

2.3.1. Usual care

Both study hospitals are teaching hospitals and care provided in the two cardiac surgical wards was similar. All participants in the trial received usual care, consisting of two separate visits from the surgeon and anesthetist one day before surgery. These visits constituted the main opportunity whereby patients and family members could gain information related to the general process and risks of their surgery and anesthesia, the use of analgesia and/or pain management. During these visits, the surgeon and anesthetist would respond to specific concerns of the patient or their family and obtain informed consent for the proposed surgery and general anesthesia. Additional information was available from the ward-based cardiac nurses though this tended to be responsive rather than proactive.

2.3.2. Preoperative education

For patients randomly allocated to the preoperative education intervention group, this intervention took place in an undisturbed setting on the ward following randomization (at least two to three days before surgery). It comprised an information leaflet 'Your Heart Surgery' together with approximately 15–20 min of verbal advice by PG. This leaflet was specifically designed by PG for Chinese cardiac pre-surgical patients, their family and friends, based on previous literature around patient information leaflet development and patient education theories. The final version was reviewed by 10 representatives of Chinese cardiac surgery patients and five clinical experts regarding its content, technical characteristics and practicability.

The leaflet was in the form of a double-sided A4 page formatted so that it could be gate-folded into three to allow ease of use and printed in colour. Illustrations were used to improve clarity and understanding. The contents of the leaflet were divided into several short sections under the headings: preoperative tests and preparation; the stay in the Intensive Care Unit (ICU) after surgery; returning to the cardiac surgical ward; and recovery at home. It also provided a contact number to call for further help after discharge from hospital if required.

The exact timing for the delivery of the intervention was arranged so that family members could be present if desired by the patient. The intervention began with PG welcoming the participant and (where present) family members, and distributing the information leaflet. The participant was given time to browse the leaflet. PG then talked it through with them section by section, offering practical advice and discussing any questions they had.

In order to minimize possible contamination between the two arms of the trial, a copy of the leaflet was put into an envelope for the participant to take away. Each participant was asked not to share it with other patients on the ward. The features of usual care and preoperative education intervention are described in Table 1.

2.4. Outcome measures

Outcome measures were assessed on the seventh day after surgery by a cardiac nurse who was blinded to group assignment.

2.4.1. Primary outcome measures

The primary outcome was change in anxiety as measured by the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983) between baseline and follow-up. HADS consists of 14 questions, seven relating to anxiety (anxiety subscale) and seven to depression (depression subscale). Each question has four response categories, with a possible score of 0–3, and the HADS produces scores on each subscale ranging from 0 to 21, with higher scores indicating a greater degree of anxiety and depression. The Chinese-Cantonese version has good internal consistency and external validity, with favourable sensitivity and specificity for screening for psychiatric disorders (Lam et al., 1995; Leung et al., 1999).

2.4.2. Secondary outcome measures

Secondary outcomes were change in symptoms of depression, change in pain, length of ICU stay and postoperative hospital stay. Symptoms of depression were measured using the depression subscale of the HADS.

Table 1
The features of usual care and preoperative education.

Element	Usual care	Preoperative education
General description	Unstructured verbal information only	Leaflet based advice, explanation and discussion
Form	Two separate visits from the surgeon and anesthetist. Responsive information from the cardiac nurses on the ward	Distribution of an information leaflet 'Your Heart Surgery' and provision of 15–20 min verbal advice
Key content	General information about the surgery and anesthesia	Specifically tailored procedural and instructional information throughout cardiac surgery patients' journey from admission, preoperative tests and preparation, postoperative ICU and ward stages, till recovery after discharge from hospital
Use of written materials	None	The information leaflet with simple texts and diagrams handy for quick reference
Mode of delivery	Different staff members	Specialist cardiac nurse
Timing	One day before surgery	At least two to three days before surgery

We used the Brief Pain Inventory-short form (BPI-sf) to measure perceived pain (Cleeland, 1989). It is a 11-item questionnaire that consists of a pain severity subscale to rate pain severity in four domains (worst, least, average and right now) and a pain interference subscale to measure the perceived degree to which pain interferes with daily activities in seven functional domains (general activity, mood, walking ability, work, relations with others, sleep, enjoyment of life). Each item is rated with a 10 cm visual analogue scale. The Chinese version of BPI-sf is a reliable and valid measure of pain among patients with cancer (Ger et al., 1999; Wang et al., 1996).

Data for the length of ICU stay and postoperative hospital stay were obtained from the individual medical records at discharge. The ICU stay was the actual number of hours the participant spent in the Intensive Care Unit and postoperative hospital stay was calculated from the day of surgery until the day of order for discharge.

2.4.3. Sample size and statistical analysis

A power calculation was based on the primary outcome of anxiety score on the HADS. Other studies (Arnold et al., 2009) have demonstrated that a difference of two points on the HADS anxiety score constitutes a clinically meaningful change in anxiety. Assuming a standard deviation of four points we calculated that we needed 63 participants in each arm to have 80% power at a significance level of 0.05. Therefore we aimed to recruit a total of 148 participants in order to allow for a 15% attrition rate.

Analyses were carried out blind, with the groups known as 'arm 1' and 'arm 2'. The use of a strict intention to treat analysis was impossible in cases of missing data such as loss to follow-up (Abraha and Montedori, 2010). All participants who completed follow-up were analyzed as a part of the group to which they were randomized and those lost to follow-up were excluded from analyses.

Descriptive statistics were used to summarize baseline assessment. We used independent-samples *t*-tests for anxiety, depression, pain, and non-parametric Mann–Whitney *U* tests for length of stay outcomes. In addition, linear regression models were also used to compare anxiety, symptoms of depression, and pain scores between two groups at follow-up after controlling for baseline score, age, gender, education level, and surgery type. These covariates were chosen a priori. Both adjusted and unadjusted results are reported.

The HADS produced one overall summative score for anxiety and another for depression, while the BPI-sf comprised of a series of domains that did not produce one overall summative score and were presented separately. In order to limit the use of multiple statistical tests, the six domains of pain measure identified to be most relevant were included in analyses (average pain and current pain on pain severity subscale, and general activity, mood, walking ability, and sleep on pain interference subscale). All reported *P* values are two-tailed, with $P < 0.05$ considered as significant. Data from the trial were entered into an Access database. The analyses were performed using SPSS version 16.

3. Results

Between 1st December 2009 and 17th March 2010, of the 245 potential participants assessed, 156 were eligible, of whom 153 (98.1%) consented to participate, completed baseline measures, and were randomized (76 to preoperative education, 77 to usual care). Of these, 18 were lost to follow-up. Reasons for attrition were having died after surgery ($n = 2$), being transferred to another hospital ($n = 2$), and being discharged without undergoing surgery ($n = 14$) leaving a total of 135 who completed the trial (Fig. 1). Reasons for attrition did not appear to differ between those randomly allocated to the preoperative education group and those randomly allocated to the usual care group. Of the 135 who completed the trial, complete data were available for all outcomes with 100% item response for outcome scales.

3.1. Baseline characteristics

Preoperative education and usual care groups were similar at baseline in terms of socio-demographic profile, type of surgery, the presence of co-morbidities, previous hospitalization and operation history, physical and pain measures. However, there was a small difference between the groups in HADS score. The mean HADS anxiety score was 1.3 points higher in the usual care group than in the preoperative education group (7.3 compared with 6.0). The

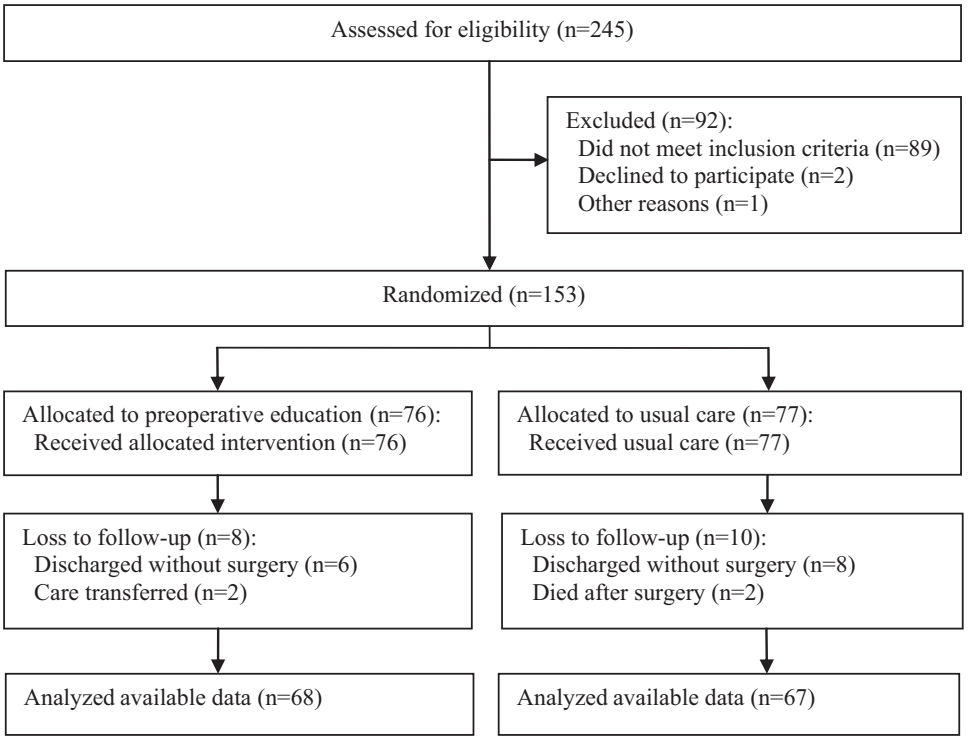

Fig. 1. Flow of participants through trial.

mean HADS depression score was 1.1 points higher in the usual care group (5.9 compared with 4.8). These indicated a greater degree of anxiety and depression at baseline among the usual care group (Table 2).

3.2. Primary outcome

3.2.1. Anxiety

Both groups had reduced anxiety scores at follow-up. But those in the preoperative education group had a mean decrease in anxiety score of 3.5 points (SD 4.50) while those in the usual care group had a reduction of 0.7 points (SD 4.95). The participants in the preoperative education group experienced a greater decrease in anxiety than those in the usual care group (mean difference -2.7, 95% confidence interval -4.35 to -1.13, $t = 3.37$; $P = 0.001$). When adjustments were made for baseline anxiety score, age, gender, education level, and type of surgery, it appeared to widen the difference between the two groups, with the preoperative education group having a significantly lower anxiety score at follow-up (mean difference −3.6, −4.62 to −2.57; $P < 0.001$) (Table 3).

3.3. Secondary outcomes

3.3.1. Depression

Both groups had lower depression scores at follow-up: a mean reduction of 2.3 points (SD 4.41) was observed in the preoperative education group compared with 0.6 points (SD 4.94) in the usual care group. The participants in the preoperative education group had significantly lower scores for depression than the usual care group (baseline adjusted mean difference −2.1, −3.19 to −0.92; $P < 0.001$) (Table 4).

3.3.2. Pain

At follow-up, both groups had reported worse pain with increased scores for the majority of pain measures. Mean changes from baseline were greater in the usual care group for the six tested domains. However, there was no difference between the two groups in the severity of average pain experienced ($P = 0.13$) and current pain experienced ($P = 0.14$). There was also no evidence of a difference between groups in the amount of general activity interfered with by pain ($P = 0.67$), mood ($P = 0.06$), and interference with walking ability ($P = 0.10$). However, the mean difference in score for the domain of pain interference with sleep was −0.9 points (−1.63 to −0.16; $P = 0.02$), indicating that participants in the usual care group had more problems with sleep due to pain (Table 4).

3.3.3. Length of stay

Table 5 presents a comparison of the two groups on the length of stay outcomes. Participants receiving the preoperative education intervention spent 4 h less in the ICU than participants receiving the usual care only (median 44 h versus 48 h). Borderline statistical significance was noted for the preoperative education group ($P = 0.05$). However no difference was found in length of post-operative hospital stay: the preoperative education group stayed 14 days in hospital after surgery compared with 12 days for the usual care group ($P = 0.17$).

Table 2
Baseline characteristics of participants ($n = 153$) randomized to the usual care or preoperative education group. Values are numbers (percentages) unless stated otherwise.

Variables	Usual care ($N = 77$)	Preoperative education ($N = 76$)
Mean (SD) age in years	52.3 (15.99)	52.0 (16.12)
Gender		
Male	40 (51.9)	44 (57.9)
Female	37 (48.1)	32 (42.1)
Marital status		
Married	66 (85.7)	59 (77.6)
Widowed, separated, divorced	4 (5.2)	7 (9.2)
Single	7 (9.1)	10 (13.2)
Education		
≤9 years[a]	56 (72.7)	56 (73.7)
>9 years	21 (27.3)	20 (26.4)
Living alone	4 (5.2)	2 (2.6)
Employment status		
Employed	19 (24.7)	16 (21.1)
Unemployed	38 (49.4)	41 (53.9)
Retired	20 (26.0)	19 (25.0)
Type of surgery		
Coronary artery bypass grafting	33 (42.9)	37 (48.7)
Valve surgery	28 (36.4)	24 (31.6)
Congenital and others	16 (20.8)	15 (19.8)
Co-morbidities		
Yes[b]	23 (29.9)	28 (36.8)
No	54 (70.1)	48 (63.2)
Previous hospitalization	6 (7.8)	9 (11.8)
Previous operations	6 (7.8)	9 (11.8)
Physical assessment mean (SD)		
Heart rate (beats/min)	76.3 (7.67)	78.9 (8.85)
Systolic pressure (mm Hg)	116.8(14.15)	113.8 (11.78)
Diastolic pressure (mm Hg)	72.1 (9.58)	71.0 (8.76)
Anxiety and depression mean (SD)		
HADS anxiety subscale	7.3 (4.33)	6.0 (3.59)
HADS depression subscale	5.9 (4.35)	4.8 (3.17)
Pain measures mean (SD)		
BPI-sf pain severity items		
Average pain	1.1 (1.65)	0.8 (1.33)
Current pain	0.4 (1.00)	0.2 (0.66)
BPI-sf pain interference items		
General activity	1.6 (2.59)	1.3 (2.28)
Mood	1.8 (2.60)	1.6 (2.29)
Walking ability	2.3 (3.20)	2.1 (2.74)
Sleep	1.5 (2.72)	1.2 (2.38)

[a] Nine-years of compulsory education from elementary to junior high school.
[b] The presence of hypertension, or diabetes, or depression, or other co-morbidities.

4. Discussion

Among participants randomized to the preoperative education group, there was a greater reduction in anxiety and depression and less pain interference with sleep compared with those in the usual care group. In our trial, we did not observe differences between the two groups in terms of average pain, current pain, and interference from pain in general activity, mood and walking ability. The preoperative education intervention appears to benefit these Chinese patients' psychological health. A lack of difference between randomized groups in postoperative hospital stay and the borderline evidence that the preoperative education intervention can reduce hours spent in ICU suggests that any benefits to physical recovery are likely to be in the immediate rather than the longer-term.

4.1. Strengths and limitations of the study

To our knowledge this was the first randomized controlled trial to assess the effect of preoperative education among Chinese patients undergoing cardiac surgery. The sample size of 153 is larger than most other trials of this nature that have been conducted in Australia, Norway (Sørlie et al., 2007) and the UK (McHugh et al., 2001). Most of the larger studies to look at the effect of preoperative information for cardiac surgical patients are non-randomized in design (Ivarsson et al., 2005).

Table 3
Primary outcome for usual care group and preoperative education group.

Outcome	Usual care	Preoperative education	Unadjusted[b]		Adjusted[c]	
			Mean difference (95% CI)	*P* value	Mean difference (95% CI)	*P* value
Mean (SD) anxiety score[a]						
At baseline ($n = 153$)	7.3 (4.33)	6.0 (3.59)				
At follow-up ($n = 135$)	6.1 (2.87)	2.5 (3.10)				
Mean change (SD) from baseline	−0.7 (4.95)	−3.5 (4.50)	−2.7 (−4.35 to −1.13)	0.001	−3.6 (−4.62 to −2.57)	<0.001

[a] Anxiety score on Hospital Anxiety and Depression Scale (HADS) 0–21: higher score indicating a greater degree of anxiety.
[b] Independent-samples *t*-test.
[c] Linear regression: controlling for baseline anxiety score, age, gender, education level, and types of surgery.

Recruitment to our study was highly successful, with only two patients declining to take part. It was emphasized to patients that participation was voluntary and although there was a relatively small window between admission and surgery in which to inform, recruit and consent patients, all were given at least a day to consider their participation. The main reason for loss to follow-up was being discharged without surgery ($n = 14$) with the remaining attrition due to reasons of death, and care transfer to another hospital. In China, it is not unusual for patients to discharge themselves prior to surgery. This may be due to the financial cost incurred by the patient if the procedure is to go ahead. We cannot ignore the possibility of the preoperative education intervention having influenced a patient's decision to discharge themselves before surgery. However, we feel this is an unlikely explanation given the similarity of attrition between the two groups (six from the preoperative education group and eight from the usual care group) and that this overall rate is similar to that observed outside the trial period.

Due to the nature of the intervention we could not blind participants to study group allocation. There is the risk therefore that some of the differences observed at follow-up may be due to social desirability bias. To counteract this potential problem we ensured that the nurse collecting follow-up self-completion measures was not the nurse (PG) who delivered the preoperative education intervention. Those conducting the analysis (PG and AA) were blind to study group labels. That we found some evidence of a difference in hours spent in ICU postoperatively also suggests that the difference in outcomes observed were not limited to self-reported outcomes. Outcomes were observed at seven days following surgery. We cannot infer from our study whether the positive effects of the preoperative education intervention we observed would persist beyond this period.

Although patients allocated to preoperative education were asked not to pass on the leaflet, the possibility of contamination between the two groups cannot be excluded. We did not have the resources to cluster randomize so patients allocated to different groups could, in theory, be cared for in the same preoperative ward alongside each other. However, the effect of contamination is likely to have resulted in an underestimation of differences between the two groups at follow-up.

Table 4
Secondary outcomes for usual care group and preoperative education group.

Outcomes	Usual care ($n = 67$)	Preoperative education ($n = 68$)	Unadjusted[b]		Adjusted[c]	
			Mean difference (95% CI)	*P* value	Mean difference (95% CI)	*P* value
Depression subscale[a]						
Mean change (SD) from baseline	−0.6 (4.94)	−2.3 (4.41)	−1.6 (−3.23 to −0.04)	0.04	−2.1 (−3.19 to −0.92)	<0.001
Pain severity items[d]						
Mean change (SD) from baseline						
Average pain	1.1 (2.23)	0.7 (1.94)	−0.4 (−1.07 to 0.36)	0.33	−0.4 (−0.96 to 0.13)	0.13
Current pain	0.8 (1.63)	0.6 (1.28)	−0.2 (−0.66 to 0.34)	0.53	−0.3 (−0.72 to 0.11)	0.14
Pain interference items[e]						
Mean change (SD) from baseline						
General activity	1.6 (3.21)	1.4 (2.74)	−0.2 (−1.20 to 0.83)	0.72	−0.2 (−0.95 to 0.62)	0.67
Mood	0.7 (3.25)	−0.0 (2.86)	−0.8 (−1.83 to 0.25)	0.14	−0.8 (−1.60 to 0.02)	0.06
Walking ability	1.1 (3.77)	0.4 (3.03)	−0.7 (−1.87 to 0.46)	0.23	−0.6 (−1.43 to 0.14)	0.10
Sleep	0.9 (3.10)	−0.1 (2.77)	−1.0 (−2.03 to −0.03)	0.04	−0.9 (−1.63 to −0.16)	0.02

[a] Depression score on Hospital Anxiety and Depression Scale (HADS) 0–21: higher score indicating a greater degree of depression.
[b] Independent-samples *t*-test.
[c] Linear regression: controlling for baseline score, age, gender, education level, and type of surgery.
[d] 10 cm visual analogue scale: 0 = no pain; 10 = the worst pain.
[e] 10 cm visual analogue scale: 0 = does not interfere; 10 = completely interferes.

Table 5
Length of stay outcomes for usual care group and preoperative education group.

Length of stay	Median (interquartile range)		*P* value[a]
	Usual care ($n = 67$)	Preoperative education ($n = 68$)	
Hours in ICU	48.0 (39.0 to 77.0)	44.0 (23.3 to 67.0)	0.05
Days in hospital after surgery	12.0 (10.0 to 17.0)	14.0 (9.3 to 19.8)	0.17

[a] Mann–Whitney *U* test.

The study was conducted in two hospitals where protocols for usual care and the pre-operative education were identical. However environmental factors such as ward staff and ward layout may have had an effect on patients' psychological health. Although randomization was stratified by hospital the trial was not powered sufficiently to test for an interaction between study group and hospital.

4.2. Comparison with other studies

Previous trials on preoperative education for cardiac patients have provided conflicting evidence. It is also difficult to compare our findings with trials where preoperative education interventions are highly variable or poorly described. A small clinical trial of a preoperative health education program with 70 coronary artery bypass graft patients observed improvements in emotional reaction, pain, and sleep (Babaee et al., 2007). Some studies have found no evidence of the effects of the provision of preoperative information on postoperative anxiety and depression (Goodman et al., 2008; Ivarsson et al., 2005; Shuldham et al., 2002). The relative lack of routine information provided to Chinese patients could explain why the impact of a structured preoperative education intervention had a greater impact on psychological health than similar interventions delivered to cardiac surgery patients in western countries. On the other hand, our finding of relatively little impact on postoperative pain is consistent with a previous study (Shuldham et al., 2002).

Arthur et al. (2000) found that patients who received preoperative intervention spent one less day in the hospital after surgery and two less hours in the ICU. Another study (Shuldham et al., 2002) found that there was no difference between groups in relation to their ICU stay but their preoperative intervention group spent one day longer in hospital after surgery. In our study, we found borderline evidence that preoperative education resulted in a reduction of 4 h of the ICU stay. Although no statistically significant difference in postoperative hospital stay was observed, the median length of stay was two days greater in the preoperative education group compared with those who received usual care only. One possible explanation for this is the slightly higher proportion of preoperative education group patients undergoing bypass surgery.

4.3. Implications and future research

This study has demonstrated that a preoperative education intervention comprising an information leaflet and verbal advice can improve psychological outcomes among Chinese cardiac patients. Currently, the culture of healthcare delivery in China does not prioritize the provision of information for patients, thus we recommend that this area of care should receive attention. This intervention was relatively simple to design and administer and may offer substantial gains for cardiac surgery patients. Staff training in the importance of delivering this form of intervention is of key concern if evidence from this trial is to be incorporated into routine practice. Perhaps a first step is raising awareness among nurses of the potential for alleviating symptoms of anxiety and depression among the patients in their care.

In China the time from admission to surgery is typically one week although there is an increasing trend toward shortening this period. This is in contrast to cardiac surgery performed in western countries where patients undergoing elective surgery are admitted on the day of the procedure. While longer preoperative hospital stay gives ample time for preoperative intervention, it is possible that this partially accounts for a relatively high level of baseline anxiety which has allowed us to demonstrate such a large impact of preoperative education on patient anxiety. The effect of decreasing preoperative hospitalization on patient anxiety and other postoperative outcomes is a subject suitable for future research.

There is an increasing awareness in western countries of the costs associated with poor health literacy (Eichler et al., 2009) but the concept of health literacy has been given scant attention in China. There is a need for observational studies to determine the level and variation of health literacy among Chinese health care users, and qualitative research to gain greater insights into how good health literacy is achieved. Future research should target the dearth of trials into complex interventions delivered within the context of Chinese healthcare. Complex interventions are context specific (Craig et al., 2008) and it is unwise to assume that evidence from western countries is directly transferable to Chinese healthcare settings without further investigation.

Contributors

PG conceived the study under supervision of AA and LE. Data collection was undertaken by PG. AA and PG conducted the statistical analysis and interpreted the data. PG drafted the manuscript. AA and LE reviewed and edited the manuscript. All authors approved the final manuscript and act as guarantors for the study.

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Conflicts of interest

All authors have completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare (1) no financial support for the submitted work from anyone other than their employer; (2) no financial relationships with commercial entities that might have an interest in the submitted work; (3) no spouses, partners, or children with relationships with commercial entities that might have an interest in the submitted work; and (4) no non-financial interests that may be relevant to the submitted work.

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Ethical approval

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