







Effect of preoperative education and ICU tour on patient and family satisfaction and anxiety in the intensive care unit after elective cardiac surgery: a randomised controlled trial

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ABSTRACT

Background Preoperative education may help participants to psychologically prepare themselves for surgery, but the outcomes of such preparation have rarely been assessed in patients requiring postoperative care in the intensive care unit (ICU) as well as in family members.

Objective To assess the effect of a preoperative multifaceted education intervention on patient and family satisfaction levels in the ICU and measures of perioperative patients' anxiety and depression.

Trial design Single-centre, two-armed, parallel, superiority, randomised controlled trial. Healthcare professionals in ICU and outcome assessor were blinded to treatment allocation.

Participants 100 elective coronary artery bypass grafting±valve surgery patients and their family members.

Interventions Preoperative education comprising of a video and ICU tour in addition to standard care (treatment), versus standard care (control).

Outcomes Patient and family satisfaction levels with ICU using validated PS-ICU23 and FS-ICU24 questionnaires (0–100), respectively; change in perioperative anxiety and depression scores between 1 day presurgery and 3 days postsurgery.

Results Among 100 (50 treatment, 50 control) patients and 98 (49 treatment, 49 control) family members, 94 (48 treatment, 46 control) patients and 94 (47 treatment, 47 control) family members completed the trial. Preoperative education was associated with higher overall patient (mean difference (MD) 6.7, 95% CI 0.2 to 13.2) and family (MD 10.0, 95% CI 3.8 to 16.3) satisfaction scores. There was a weak association between preoperative education and a reduction in patient's anxiety scores over time (MD –1.7, 95% CI –3.5 to 0.0). However, there was no evidence of a treatment effect on patient's depression scores over time (MD –0.6, 95% CI –2.3 to 1.2).

Conclusion Providing comprehensive preoperative information about ICU to elective cardiac surgical patients improved patient and family satisfaction levels and may decrease patients' anxiety levels.

Trial registration number ChiCTR-IOR-15006971.

INTRODUCTION

Undergoing cardiac surgery is a stressful event for both patients and family members. In patients waiting for cardiac surgery, the prevalence of clinically significant anxiety and depression were 28% and 47%, respectively.¹ This may be because of uncertainties about survival, risk of complications, and fears about the intensive care unit (ICU) environment and process of care in the early postoperative period, and concerns about the time to resumption of normal living activities. Higher levels of preoperative anxiety and depression in patients undergoing coronary artery bypass graft (CABG) surgery are strongly associated with psychological distress in the postoperative period.² In addition, family members of cardiac surgical patients are often more anxious than patients themselves about the upcoming cardiac surgery³ but report lower levels of anxiety and higher satisfaction levels if their information needs about surgery and treatment for patients are met.⁴ It is, therefore, plausible that interventions that reduce postoperative anxiety and depression may also improve both patient and family satisfaction.

Multimedia (video, audio tapes, interactive computer-guided learning) formats of preoperative education increased patient knowledge scores more than text, which

in turn increased knowledge scores more than verbal formats in a systematic review of 34 mixed surgical trials involving 3742 participants.⁵ In cardiac surgery, preoperative education programmes of various formats have shown reductions in patient's postoperative anxiety levels in some^{6–8} but not all trials.^{9–11} Similarly postoperative depression was reduced by preoperative education⁶ but this finding was not universal.¹¹ A recent randomised controlled trial (RCT) of a preoperative ICU visit before cardiac surgery in 38 patients showed similar reductions in anxiety and depression levels at 3 days after ICU discharge, similar satisfaction level with ICU care but a lower family satisfaction level with ICU information.¹² However, the results are difficult to interpret as there were insufficient details about the preoperative ICU visit intervention.

Patient and family expectations vary culturally in their participation in the ICU decision-making process and communication with ICU staff. In Chinese culture, patients are perceived to be protected by family;¹³ healthcare decisions are generally made by the family as a group and made by older generation¹³ as the family plays a key role in medical decision-making under the influence of Confucian family values. Therefore, measuring the quality of ICU care under these circumstances involves consideration to evaluating satisfaction levels as important patient and family centred outcomes.¹⁴

In view of the absence of data on the effect of the same preoperative education package on both patient and family satisfaction, as well as the existing heterogeneity of findings regarding the effect on anxiety and depression, and possible cultural differences in healthcare expectations, we conducted a RCT with two objectives. The primary objective was to assess the effect of a preoperative multifaceted education intervention on both patient and family satisfaction levels in the ICU. The secondary objective was to evaluate the effect of preoperative education on perioperative patients' anxiety and depression levels. The primary hypothesis was that preoperative multifaceted patient education is associated with an increase in both patient and family satisfaction levels after elective cardiac surgery, and the secondary hypothesis was that the intervention is associated with a reduction in patient anxiety and depression levels after cardiac surgery.

METHODS

Study design

This study was a pragmatic single-centre, two-armed, parallel, superiority, RCT (ChiCTR-IOR-15006971). Block randomisation with 1:1 allocation was carried out according to a computer-generated sequence using a software programme (PASS V.11 software, NCSS, Kaysville, Utah, USA) by the last author who was not involved in the screening, patient recruitment, clinical care or data collection. Consecutively numbered sealed opaque envelopes were used for treatment

allocation concealment and were opened by the first author after obtaining informed patient consent before surgery. Both groups received standard care but patients and their family members allocated to the intervention group received more comprehensive and structured information in a preoperative video and ICU tour (see description of intervention). Healthcare professionals in the ICU, the outcome assessor and the author responsible for data analysis were blinded to the treatment allocation of the participants. A detailed study protocol has previously been described.¹⁵ The study results are reported according to the CONSORT statement.¹⁶

Settings

After study approval from the local research ethics committee (CRE reference number 2015.308), we conducted the study between September 2015 and August 2017. All elective coronary artery bypass grafts with or without valve replacement (CABG±valve) surgery were routinely admitted to a mixed medical and surgical 23-bed ICU for early postoperative care and monitoring with 1:1–2 nursing at all times with an expected discharge from ICU to a high dependency cardiothoracic ward within 24 hours after surgery.

Participants

We included adult patients undergoing first time elective CABG±valve surgery and their family members above the age of 18. Family members were defined as any persons with close family, social or emotional relationships to the patient participants in the study;¹⁷ this included spouses, siblings, parents, children and partners. As more than one family member could visit the patient, family participants selected among themselves who was to participate in the study.

Patients were excluded if they had emergency cardiac surgery, had a medical history of dementia, psychosis or neurological diseases. We also excluded both patients and family members if they did not understand Cantonese, had previous cardiac surgery experience(s) or had prior exposure to critical care.

Interventions: preoperative education and standard care versus standard care

Patients who were randomised to the intervention group were provided with a preoperative multifaceted education package 1 day before surgery, in addition to the standard care that was given to the control group. Their family members were also invited to join the educational intervention comprising of a 15 min educational video on a computer laptop and an ICU tour.

The video about postoperative ICU care was filmed with a professional standardised patient actor, a cardiac surgeon and ICU doctors and nurses in Cantonese, with English subtitles (<https://www.youtube.com/watch?v=WALZYNfDKWE>). The content included

the following aspects: (1) ICU environment (typical bedside equipment such as cardiac monitors, ventilators, infusion pumps and routine activities such as ward rounds, bathing times and so on); (2) types of invasive tubes and lines (oral endotracheal tube, pacemaker, chest drainage tubes, urinary catheter and intravenous lines); (3) postoperative pain management (pain experience and pain relief methods); (4) medical management (mechanical ventilation weaning, duration of chest drainage tubes in situ, recognition of delirium symptoms and treatments available, and expected duration of ICU stay); (5) communication between patients, family members and ICU staff (role of dedicated bedside nurse, communication methods between different parties, requesting interviews between family, ICU/surgical clinicians) and (6) family support (visiting guidelines, handwashing hygiene and importance of touch for patient reassurance). We restricted the access to ensure the availability of the video only to selected staff members, patients and families during the study period to avoid any performance bias on the ward. For the 10 min guided ICU tour, led by a dedicated ICU doctor or nurse, after watching the video, participants experienced the ICU environment (including the waiting room) and observed commonly used medical devices used for early postoperative care.

Participants allocated to the control group received the usual (standard) preoperative care from the cardiac surgical team, anaesthesiologists and ward nurses. This included unstructured information given to participants on general surgical procedures, associated medical risks and postoperative care processes. Both groups received standardised surgical and anaesthetic procedures, and perioperative care according to existing ICU protocols for postoperative sedation, analgesia and weaning from mechanical ventilation.

Outcome measures

The primary outcome was satisfaction score, measured using the validated and reliable Chinese 23-item patient satisfaction with the ICU (PS-ICU23) and 24-item family satisfaction with the ICU (FS-ICU24) questionnaires.¹⁸ The item about atmosphere of the ICU waiting room was not included in the patient satisfaction questionnaire as patients did not generally have an opportunity to visit the waiting room. All items in the questionnaires were on a 5-point Likert scale (except the last item) and were transformed to 0 to 100 points (0=poor satisfaction, 100=high satisfaction) as follows: transformed value = ((actual item value – lowest possible item value)/(possible item range)) × 100 to standardise the response scale across all items and to make the items more meaningful, following the methodology recommended by the authors of the original FS-ICU questionnaire.¹⁹ Subscales and total scores were estimated by averaging available items.¹⁹ In the Chinese PS-ICU23 and FS-ICU24 questionnaires, there were three subscales: satisfaction with

care, satisfaction with information and satisfaction with decision-making process as well as the overall ICU satisfaction score, similar to constructs found in a previous UK FS-ICU24 questionnaire.²⁰ A blinded outcome assessor collected the completed PS-ICU23 and FS-ICU24 questionnaires on the third day after surgery.

The secondary outcome measures were changes in patient perioperative anxiety and depression scores, measured using the Chinese-Cantonese version of the Hospital Anxiety and Depression Scale (HADS).²¹ Items were scored on a 4-point Likert scale (0–3) according to the authors' recommendation.²¹ The anxiety and depression subscales ranged from 0 to 21, with higher scores indicating higher severity of disorder. The anxiety subscale has a sensitivity of 81% (95% CI 69% to 93%) and specificity of 61% (95% CI 48% to 95%) at a cut-off point of above 5 for identifying an anxiety disorder.²¹ For identifying a depression disorder, the depression subscale has a sensitivity of 74% (95% CI 61% to 87%) and specificity of 78% (95% CI 67% to 90%) at a cut-off point above 9.²¹ The HADS questionnaires were completed by patients before surgery and at 1 week after surgery. A blinded outcome assessor collected the completed HADS questionnaires after surgery.

Other variables

We collected the following data from the patient's medical record and from the Hospital Authority Clinical Management System electronic database: age, gender, education levels, American Society of Anaesthesiologists Physical Status Classification, patient's comorbidities, surgical and anaesthetic details, duration of mechanical ventilation, delirium assessment using routine bedside Confusion Assessment Method for the ICU,²² severity of illness score on ICU admission (APACHE II),²³ duration of ICU and hospital stays and the 30-day mortality status after surgery. The patient's predicted mortality was assessed using the logistic European System for Cardiac Operative Risk Evaluation (EuroScore) method²⁴ recorded in a Cardiothoracic Surgery database, an identical dataset to the Society for Cardiothoracic Surgery in Great Britain and Ireland. We also recorded family member details, such as the relationship to the patient, their age, gender, education level and living arrangements with the patient.

Sample size

As described in the study protocol,¹⁵ we planned a sample size of 45 in each group to have a 80% power to detect a mean difference (MD) of 10 points (the difference between mean control group satisfaction level of 70 and a mean intervention group satisfaction level of 80) with an assumption that the common SD was 16.6 (ie, a moderate effect size of 0.60) using a two group t-test with a 0.05 two-sided significance

level. We assumed a dropout rate of approximately 10%, so recruited 100 patients for the study (50 patients in each group). The sample size calculations were performed using nQuery Advisor 7.0 (Statistical Solutions, Cork, Ireland).

Data analysis

Normality of the data was tested visually and using the Shapiro-Wilk's test. Group comparisons of continuous parametric and non-parametric variables for surgical characteristics were assessed using Student's t-test and Mann-Whitney U test, respectively. Group comparisons of categorical data were tested with χ^2 or Fisher's exact tests.

Missing data values of satisfaction scores were imputed with multiple imputation method in SPSS V.24.0 (IBM, Armonk, New York, USA) for the intention-to-treat analyses. Subdomain scores and total score were calculated with imputed item scores using age, gender and education level as predictive variables, with 50 imputed datasets created. The MD was adjusted for df because of the small sample using Stata V.13 (Stata, College Station, Texas, USA).²⁵ The differences in subdomains of satisfaction between groups were tested with independent sample t-tests or one-way analysis of variance in the as-treated analysis with three groups (video plus ICU tour, video only and control). For the HADS questionnaire, missing values were checked and imputed using the median as there was 1% missing data after surgery. The MDs in anxiety and depression levels between groups over time (interaction time*group variable) were

examined using the generalised estimating equation with a Gaussian distribution, identity-link function, exchangeable correlation with robust SEs. While the level of significant was set at $p < 0.05$, we interpreted borderline significance using the terminology outlined by Pocock and Ware.²⁶

RESULTS

Participants

From September 2015 to August 2017, 474 patients were screened for eligibility, of whom 100 were randomised (details of the patient flow are given in the CONSORT diagram—figure 1). Of these, 94 (48 treatment and 46 control) patients and 94 (47 treatment and 47 control) family members completed the trial (figure 1). Of the 48 patients who received the educational video, 19 (40%) elected to join the ICU tour as well. Forty-two (89%) of 47 families watched the video and 17 (36%) joined the ICU tour. Common reasons for not joining the ICU tour were patients' or family members' mobility problems making it difficult for them to walk between the cardiothoracic surgical ward and ICU, family member was unavailable during visiting hours and that sufficient information was already given in the educational video.

Baseline characteristics of participating patients and family members are shown in table 1. There were no differences between groups for surgical characteristics and duration of ICU and hospital stays (table 2). All patients were alive at 30 days after surgery.

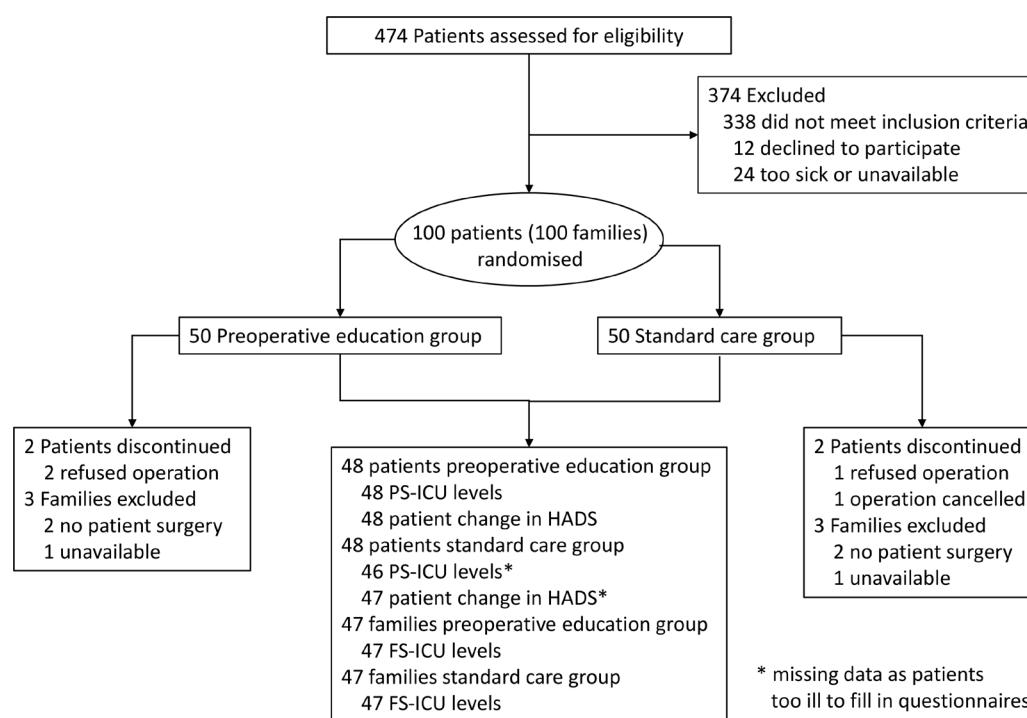


Figure 1 Participants flow diagram for the randomised controlled trial. FS, family satisfaction; HADS, Hospital Anxiety and Depression Scale ; ICU, intensive care unit; PS, patient satisfaction.

Table 1 Baseline characteristics of participants

Characteristic	Education and standard care	Standard care
Patients	n=50	n=50
Age, mean (SD), years	61.8 (7.3)	61.4 (8.5)
Sex, n (%)		
Male	43 (86.0)	38 (76.0)
Female	7 (14.0)	12 (24.0)
Education level, n (%)		
Primary school or below	15 (30.0)	20 (40.0)
Secondary school	29 (58.0)	28 (56.0)
University or above	6 (12.0)	2 (4.0)
Comorbidities, n (%)		
Diabetes	30 (60.0)	20 (40.0)
Hypertension	38 (76.0)	36 (72.0)
Hyperlipidaemia	21 (42.0)	20 (40.0)
Other*	6 (12.0)	5 (10.0)
Family members	n=47	n=47
Age, mean (SD), years	48.4 (13.3)	45.9 (14.0)
Sex, n (%)		
Male	13 (27.7)	11 (23.4)
Female	34 (72.3)	36 (76.6)
Education level, n (%)		
Primary school or below	5 (10.6)	10 (21.3)
Secondary school	34 (72.3)	23 (48.9)
University or above	8 (17.0)	14 (29.8)
Relationship to patient, n (%)		
Spouse	27 (57.4)	25 (53.2)
Sibling	3 (6.4)	2 (4.3)
Children	15 (31.9)	16 (34.0)
Other	2 (4.3)	4 (8.5)
Living with patient, n (%)		
No	6 (12.8)	15 (31.9)
Yes	41 (87.2)	32 (68.1)

*Chronic renal impairment, nephrotic syndrome, asthma.

Effect of preoperative education

For the PS-ICU23 questionnaire, we imputed 10.1% data for missing and not applicable responses when transforming item responses. In the intention-to-treat analysis, patients in the intervention group had higher overall ICU satisfaction than controls, with a MD of 6.7 (95% CI 0.2 to 13.2; $p=0.044$). However, there was little or no difference between groups when considering each of the subdomains of patient satisfaction (table 3). In the as-treated analysis without data imputation, there were little or no group differences in the overall total patient satisfaction score or across the three subdomains of care, information and decision-making process (table 3). Responses to individual items in the PS-ICU23 are shown in online supplementary table 1.

In the FS-ICU24 questionnaire, we imputed 9.6% data for missing and not applicable responses. For family respondents, the preoperative education intervention was associated with higher overall FS-ICU24

Table 2 Surgical characteristics of participating patients

	Intervention (n=48)	Control (n=48)	P value
Cardiac surgery type, n (%)			
CABG only	44 (91.7)	42 (87.5)	0.504
CABG with valve replacement	4 (8.3)	6 (12.5)	
Duration of surgery (min), median (IQR)	273 (232–300)	250 (230–279)	0.197
Duration of anaesthesia (min), median (IQR)	341 (269–348)	294 (269–334)	0.468
CPB total time (min), median (IQR)	100 (87–114)	99 (82–117)	0.739
ASA Physical Status, n (%)			
I	0 (0)	0 (0)	0.849
II	6 (12.5)	7 (14.6)	
III	40 (83.3)	38 (79.2)	
IV	2 (4.2)	3 (6.3)	
APACHE II Score, mean (SD)	12.9 (4.7)	12.3 (4.2)	0.526
Logistic Euroscore, mean (SD)	2.1 (1.9)	2.5 (1.9)	0.344
Mechanical ventilation time (h), median (IQR)	7.0 (4.1–11.7)	7.2 (4.6–9.3)	0.942
Sedation drug in ICU, n (%)			
Propofol	48 (100)	48 (100)	–
Midazolam	1 (2.1)	3 (6.3)	0.617
Dexmedetomidine	3 (6.3)	2 (4.2)	1.000
Delirium, n (%)	1 (2.1)	4 (8.6)	0.362
Hyperactive	0	2	–
Hypoactive	0	2	–
Mixed	1	0	–
ICU length of stay (hours), median (IQR)	21.1 (18.7–22.9)	21.8 (20.8–23.2)	0.312
ICU outcomes			
Alive, n (%)	48 (100)	48 (100)	–
Hospital length of stay (days), median (IQR)	9.5 (8.0–14.0)	9.0 (7.0–11.3)	0.319
Hospital discharge status			
Alive, n (%)	48 (100)	48 (100)	–
30-day status			
Alive, n (%)	48 (100)	48 (100)	–

ASA, American Society of Anesthesiologists; CABG, coronary artery bypass grafting; CPB, cardiopulmonary bypass; EuroSCORE, European System for Cardiac Operative Risk Evaluation; ICU, intensive care unit.

scores in the intention-to-treat analysis, with a MD of 10.0 (95% CI 3.8 to 16.3; $p=0.002$). This may be explained by higher FS-ICU24 satisfaction with care subdomain (MD=10.5, 95% CI 3.7 to 17.3; $p=0.003$) and satisfaction with information subdomain (MD=13.0, 95% CI 5.5 to 20.5; $p=0.001$) (table 3). Similar results were found in the as-treated analyses without data imputation (table 3). Posthoc Bonferroni test showed that the combined intervention of video and ICU tour was associated with higher overall ICU family satisfaction than the video only ($p=0.009$). Responses to individual items in the FS-ICU24 are shown in online supplementary table 2.

Table 3 Mean (SD) overall patient and family satisfaction with ICU scores and domain scores by analyses

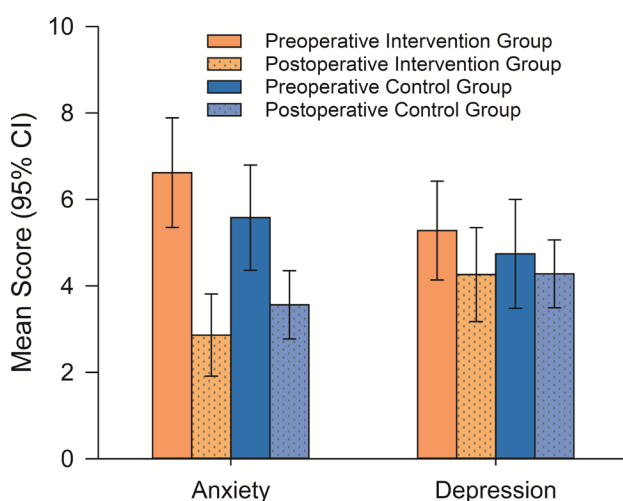
Perspective	Intention-to-treat analysis			As-treated analysis			
Patient	Intervention (n=50)	Control (n=50)	P value	Video and tour (n=19)	Video only (n=29)	Control (n=46)	P value
Overall	76.1 (13.4)	69.4 (18.4)	0.044	80.1 (14.1)	75.2 (12.6)	70.3 (19.2)	0.085
Care	76.6 (15.7)	69.8 (22.0)	0.079	82.4 (17.3)	75.0 (14.8)	71.5 (23.2)	0.136
Information	76.8 (17.0)	69.2 (22.2)	0.072	82.3 (16.3)	76.0 (16.1)	70.4 (23.7)	0.097
Decision-making process	73.3 (15.5)	68.4 (14.9)	0.124	68.0 (18.4)	75.6 (16.0)	67.3 (15.9)	0.088
Family	Intervention (n=47)	Control (n=47)	P value	Video and tour (n=17)	Video only (n=25)	Control (n=47)	P value
Overall	77.5 (14.6)	67.5 (16.0)	0.002	86.1 (11.0)	71.5 (14.7)	68.0 (16.6)	<0.001
Care	78.5 (16.1)	68.0 (17.1)	0.003	88.0 (13.0)	72.7 (16.6)	68.5 (17.6)	<0.001
Information	78.6 (17.2)	65.6 (19.1)	0.001	88.4 (12.6)	71.9 (18.5)	66.1 (19.9)	<0.001
Decision-making process	72.7 (15.5)	68.7 (19.3)	0.273	77.0 (13.6)	66.9 (15.0)	68.4 (19.5)	0.088

ICU, intensive care unit.

The groups did not substantially differ in baseline anxiety scores (MD 1.0, 95% CI -0.7 to 2.8 , $p=0.246$) or in baseline depression scores (MD 0.5, 95% CI -1.2 to 2.2 , $p=0.534$). Based on the intention-to-treat analysis, preoperative education may be more effective in reducing the patient's anxiety scores (MD -1.7 , 95% CI -3.5 to 0.0 ; $p=0.056$) (figure 2). However, there was no evidence of an effect on patient's depression scores (MD -0.6 , 95% CI -2.3 to 1.2 , $p=0.525$, figure 2). In the as-treated analysis without data imputation, there was no evidence of a differential effect of the video and ICU tour, video only or control on patients' anxiety scores ($p=0.157$) and depression scores ($p=0.732$).

DISCUSSION

Our data show that the multifaceted preoperative education was effective in increasing overall patient and family satisfactions levels. There was a strong association between the preoperative education and the subdomains of satisfaction with care and information delivery among family members, but this association

**Figure 2** Mean (95% CI) patients' anxiety and depression scores before and after surgery using the Hospital Anxiety and Depression Scale.

was weaker among patients. We found little or no difference between groups for patient and family satisfaction with the decision-making process subdomain. Our preoperative education intervention may reduce patient's anxiety levels but there was no evidence of an effect on reducing patients' depression levels. These results demonstrate that preoperative education can improve patient and family satisfaction following elective coronary surgery. This may be due to a reduction in patient anxiety, but is not due to a reduction in depression. To our knowledge, this is the first study to investigate the effects of the same preoperative educational package on both patients and family members.

It is notable that the programme did not improve satisfaction in the decision-making domain. This is, perhaps, not surprising. The major decision to be made in the preoperative period is whether to undergo surgery. For major surgery, such as cardiac surgery, it seems unlikely that postoperative care (the focus of our education programme) is likely to be a major consideration in this decision.

The FS-ICU24 results using the as-treated analysis without data imputation suggest that the combination of video and ICU tour components was most effective in meeting the concerns and needs of family members. The self-selected family member chosen to participate in the trial may have been more responsive to the content in the educational video through fulfilling their information needs and feeling more reassured after support from healthcare workers involved in the ICU tour. There were little or no differences in the overall patient satisfaction and associated subdomains, and in anxiety and depression levels, between the three groups in the as-treated analyses. These findings may reflect the imprecision of the group estimates from the decrease in statistical power.

Our results were largely consistent with a recent scoping review on interventions to improve family satisfaction and psychological well-being in family members of adults admitted to ICU.²⁷ In the scoping

review of 7 studies involving 747 participants, structured written and oral information showed some effect in improving family satisfaction levels and reducing family member's psychological distress.²⁷ Alternatively, our results may just simply reflect more opportunities and time spent in interacting with research staff during the ICU tour.

In contrast to our findings, small differences in patient's anxiety and depression levels were associated with patient education comprising of an information leaflet and verbal advice 2–3 days before cardiac surgery in another study.⁶ This difference between studies is unlikely to be due to a difference of format or timing: a systematic review found that there was little or no difference on perioperative anxiety levels between different formats or timing of information delivery.⁵

The main strength of this study was that we used validated Chinese versions of the PS-ICU23 and FS-ICU24 questionnaires which had sound psychometric properties.¹⁸ These included high construct validity, measurement equivalence across groups (gender, mechanical ventilation, casemix, length of stay in ICU), reliability (internal consistency) and moderate level of agreement between patients and family members' perspective on satisfaction.¹⁸ We also made attempts to minimise the risk of selection, performance and detection biases. However, there were several limitations. First, the results may not be applicable to other surgical patient populations requiring postoperative ICU care and there may be limited generalisability to other centres since this was a single centre RCT. Second, it is unclear whether our preoperative education intervention was associated with reductions in family member's anxiety and depression levels as we did not measure this outcome. Third, less than half the patients and family members in the intervention group participated in both the video and ICU tour components in this pragmatic trial. Finally, as our multifaceted preoperative education intervention was a complex healthcare intervention,²⁸ there is some uncertainty on which particular element contributed to improving the patient and family satisfaction scores. As we did not have a sham intervention in the control group, we cannot exclude the possibility that the improvement was due to the time spent interacting with research staff rather than a specific feature of the education.

CONCLUSION

Providing comprehensive and structured information about various aspects of early postoperative care in the ICU before cardiac surgery improved patient and family satisfaction levels and may decrease patient's anxiety levels but not patient's depression levels.

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Contributors VKWL, KMH and AL conceived the study. VKWL and AL designed the study protocol, with input from PL, KMH, CDG, MJU and GMJ. VKWL, W-TW and PL collected the data. VKWL and AL analysed the data, with input from CDG, MJU and GMJ. VKWL and AL drafted the manuscript and made revisions following critical review by all authors. All authors approved the final version of the manuscript.

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Competing interests None declared.

Patient consent for publication Not required.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. The preoperative education video about postoperative care in the intensive care unit after cardiac surgery is available at: <https://www.youtube.com/watch?v=WALZYNfDKWE>.

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