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Neurosurgical enhanced recovery after surgery (ERAS) programme for elective craniotomies: are patients satisfied with their experiences? A quantitative and qualitative analysis

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ABSTRACT

Objective To evaluate patient satisfaction and associated predictors at discharge, as well as patient experience at 30-day follow-up, in a neurosurgical enhanced recovery after surgery (ERAS) programme.

Design A single-centre, prospective, randomised controlled study.

Setting A tertiary hospital in China.

Participants A total of 140 neurosurgical patients aged 18–65 years old who had a single intracranial lesion and were admitted for elective craniotomy between October 2016 and July 2017 were included.

Interventions Patients were randomised into two groups: 70 patients received care according to a novel neurosurgical ERAS protocol (ERAS group) and 70 patients received conventional perioperative care (control group).

Outcome measures Patient satisfaction at discharge was evaluated using a multimodal questionnaire. A secondary analysis of patient experience regarding participation in the ERAS programme was conducted using a semistructured qualitative interview via telephone at 30-day follow-up.

Results The mean patient satisfaction was significantly higher in the ERAS group than in the control group at discharge (92.2±4.3 vs 86.8±7.4, p=0.0001). The most important predictors of patient satisfaction included age (OR=6.934), postoperative nausea and vomiting (PONV) Visual Analogue Scale (VAS) score (OR=0.184), absorbable skin suture (OR=0.007) and postoperative length of stay (LOS) (OR=0.765). Analysis on patient experience revealed five themes: information transfer, professional support, shared responsibility and active participation, readiness for discharge, and follow-up, all of which are closely related and represent positive and negative aspects.

Conclusions Measures that include decreasing PONV VAS score, incorporating absorbable skin suture and shortening LOS seem to increase patient satisfaction in a neurosurgical ERAS programme. Analysis of data on patient experience highlights several aspects to achieve patient-centred and high-quality care. Further studies are warranted to standardise the assessment of patient satisfaction and experience in planning, employing and appraising the ERAS programme.

Trial registration number ChiCTR-INR-16009662.

Strengths and limitations of this study

- This is a randomised controlled trial to evaluate patient satisfaction.
- This study incorporated both quantitative and qualitative analyses.
- The qualitative analysis was done solely on patients in the enhanced recovery after surgery programme without the controls.

INTRODUCTION

Enhanced recovery after surgery (ERAS) or fast-track surgery programme, which was first proposed and applied by Kehlet in 1997, has been proven to benefit patients with shortened hospital length of stay (LOS), improved functional recovery, and decreased morbidity and healthcare costs in several surgical fields including colorectal surgery, urological surgery, orthopaedic surgery, cardiac surgery and gynaecological surgery.[1–3] Recently, our group had proposed the first neurosurgical ERAS protocol for patients undergoing elective craniotomy and had completed the first randomised controlled trial to evaluate its efficacy and safety.[4] Similar to previous studies, our ERAS programme is a multidisciplinary, evidence-based protocol consisting of preoperative, intraoperative and postoperative interventions, as well as a discharge plan. Our results confirmed that implementation of the ERAS programme was associated with significant reduction in postoperative LOS and acceleration of functional recovery,

without increasing the complication or readmission/reoperation rates compared with conventional neurosurgical perioperative care.[4]

Despite these known objective benefits of ERAS programme that have been proven repeatedly, very few studies had emphasised the importance of patient satisfaction and experience in participating in such programmes.[3 5 6] However, there is now a drive to apprehend patients' perspective in evaluating quality of healthcare, which is considered to have equal importance as clinical effectiveness and patient safety.[3]

Because of the paucity of studies on patient satisfaction and experience associated with participation in an ERAS programme, we have assessed patient satisfaction at discharge and analysed the predictive factors of patient satisfaction in elective craniotomy patients who had enrolled in a neurosurgical ERAS programme in a prospective, randomised controlled study.

In addition, since patients' perception of comfort is as critical as the objective goals of recovery in judging the effectiveness of medical care delivery, we have further incorporated a secondary analysis of patient experience in participating in the ERAS programme using a semi-structured qualitative interview via telephone at 30-day follow-up after discharge.

METHODS

Patient population

Patients admitted for elective craniotomy at the Department of Neurosurgery of Tangdu Hospital (Xi'an, People's Republic of China) between October 2016 and July 2017 were included in this study of a neurosurgical ERAS programme.[4] A total of 140 patients, aged 18–65 years old, who had a single intracranial lesion and medically eligible for elective craniotomy were enrolled and randomly allocated to two groups. The ERAS group received care according to a novel neurosurgical ERAS protocol, which consists of patient evaluation, patient and family counselling, functional status evaluation, nutritional assessment, smoking and alcohol abstinence, antithrombotic prophylaxis, preoperative intestinal intervention, preoperative oral carbohydrate loading, micro-invasive surgery, scalp incision anaesthesia, non-opioid analgesia, absorbable skin suture, hypothermia avoidance, goal-directed fluid balance, postoperative management of pain and postoperative nausea and vomiting (PONV), early oral nutrition resumption, early ambulation, and so on. The control group received conventional perioperative care according to institutional practice patterns.[4]

Assessment and data collection

Demographic variables including age, sex, height, weight, body mass index, educational level, occupational status, marital status, primary diagnosis of intracranial diseases, American Society of Anesthesiologists (ASA) grade and patient comorbidities (smoking, diabetes, hypertension, hypercholesterolaemia and so on) were recorded. Surgery-related variables including length of surgery/anaesthesia, blood loss, blood transfusion and fluid balance were documented as well. Variables associated with accelerated recovery regimen included PONV Visual Analogue Scale (VAS) score, preoperative carbohydrate loading, absorbable skin suture, mechanical prophylaxis for deep vein thrombosis (DVT), early removal of urinary catheter (within 6 hours), oral solid intake on postoperative day (POD) 1, mobilisation on POD1, postoperative wound drainage and pain management. Clinical outcome variables comprised postoperative LOS, total hospital LOS, readmission, reoperation, postoperative surgical and non-surgical complications, and functional recovery (ie, Karnofsky performance status (KPS)) at discharge and at 30-day follow-up.

A modified edition of a validated patient satisfaction questionnaire consisting of five modules with 20 questions was applied to assess patient satisfaction at discharge.[7] A cross-sectional pilot study was done to validate the instrument, which showed acceptable internal reliability consistency (Cronbach's alpha exceeded 0.70 for all modules) and test–retest reliability (weighed kappa index ranged from 0.92 to 0.96, intercorrelation coefficient ranged from 0.70 to 0.92). The modules incorporated information, medical care, nursing care, enhanced recovery, comfort and others, each of which consists of four questions (online additional file 1). Each question was answered using a 1–5 point numerical scale, with higher points indicating higher levels of patient satisfaction: 1=completely dissatisfied, 2=moderately dissatisfied, 3=neutral, 4=moderately satisfied and 5=completely satisfied. A scoring scale between 0 and 100 was thus derived from the sum of scores for the individual questions, with 100 indicating the highest level of satisfaction. Educational level, professional status and marital status were also recorded. An interviewer, who was a surgical resident on rotation, not involved in patient care and blinded to patient allocation, was appointed to fill in all questionnaires.

The secondary assessment at 30-day follow-up after discharge was done via telephone interview. Only patients enrolled in the ERAS programme were included in this part of the study. On discharge an informed consent was obtained from each patient who wanted to participate. Maximum variation sampling was applied to form a purposive sample of 46 participants. In order to obtain and analyse patient experience in participating in the ERAS programme, an interpretative phenomenological approach was used.[8] Interviews were conducted by doctors from the Department of Neurosurgery (BL, YuW, YZ, TaZ, YX, LeC, YiW), employing a rule of not interviewing his/her own patients during hospital care. Participants were contacted via telephone at home, with some having their family members present during the interview. A semistructured interview guide consisting of six domains (online additional file 2) was designed to start with a warm-up to greet patients and assess the 30-day follow-up KPS. Open, broad questions were asked first to

Table 1 Sociodemographic and clinical features

Variable	ERAS group	Control group	P value
	Patients, n (%)		
Patients (n)	70	70	
Age (years)			0.612
<50	33 (47.1)	36 (51.4)	
50–65	37 (52.9)	34 (48.6)	
Sex (male/female)	22/48	26/44	0.476
BMI			0.617
<18.5	3 (4.3)	3 (4.3)	
18.5–23.9	47 (67.1)	52 (74.3)	
>24	20 (28.6)	15 (21.4)	
Education			0.164
No education	4 (5.7)	0 (0)	
Primary school	8 (11.4)	5 (7.1)	
Secondary school/high school	34 (48.6)	39 (55.7)	
College/more than college	24 (34.3)	26 (37.1)	
Occupation			0.352
Employed	29 (41.4)	31 (44.3)	
Home maker	18 (25.7)	14 (20.0)	
Unemployed	12 (17.1)	19 (27.1)	
Student	3 (4.3)	3 (4.3)	
Retired	8 (11.4)	3 (4.3)	
Marital status			>0.999
Unmarried (single/divorced)	5 (7.1)	5 (7.1)	
Married	65 (92.9)	65 (92.9)	
ASA grade			0.410
Grade I	13 (18.6)	17 (24.3)	
Grade II	57 (81.4)	53 (75.7)	
Intracranial lesions			0.779
Meningioma	38 (54.3)	30 (42.9)	
Vestibular schwannoma	7 (10.0)	9 (12.9)	
CPA epidermoid cyst	6 (8.6)	8 (11.4)	
Glioma	13 (18.6)	18 (25.7)	
Trigeminal neuralgia	3 (4.3)	3 (4.3)	
Cavernous malformation	3 (4.3)	2 (2.9)	

ASA, American Society of Anesthesiologists; BMI, body mass index; CPA, cerebellopontine angle; ERAS, enhanced recovery after surgery.

encourage patients to describe their general feelings and experiences about the ERAS programme. A series of questions addressing specific domains including information transfer, symptom management and accelerated recovery, and discharge and follow-up were then asked to determine possible problems and concerns. Finally, cool-down questions were asked to allow patients to add information that has not been discussed. All interviews were audio-recorded and professionally transcribed verbatim immediately after the interview for analysis. No patient refused to participate or dropped out. The recruitment of additional patients stopped when data analysis shows no change with more interviews, which is a convention for qualitative studies.

Compliance with ethical standards

The trial was prospectively registered at the Chinese Clinical Trial Registry (http://www.chictr.org.cn/showproj.aspx?proj=16480) on 27 October 2016. The first patient was enrolled on 30 October 2016.

Patient satisfaction at discharge was one of the secondary endpoints included in the original study protocol approved by the institutional review board (IRB).[4] For the purpose of constant quality improvement, the ERAS protocol has been continually applied and refined based on feedback from patients and providers, as well as updates in the related fields. Qualitative interview on patient experience at 30-day follow-up was additionally included in the study and was further approved by the IRB.

Statistical analysis

To test whether variables differed across groups, the χ^2 test or Fisher's exact test was used according to the testing condition. Comparisons between continuous data were done using analysis of variance (with Scheffe's method for multiple comparisons) or Mann-Whitney U test (with Kruskal-Wallis test for multiple comparisons) according to the testing condition. Multinomial logistic regression was used to identify possible predictors of patient satisfaction. Statistical significance was defined as $p<0.05$. All tests were two-sided. Statistical analysis was performed using SPSS V.16.0 software.

As part of a randomised controlled study evaluating the safety and efficacy of a neurosurgical ERAS programme, patient satisfaction at discharge was assessed as a secondary outcome.[4] The sample size was powered to be 58 patients in each group based on the hypothesis that the primary outcome (ie, postoperative LOS) would be reduced by 25% (from about 7 days to 5 days) with a power of 80% and a significance of 5%. Assuming a maximal dropout rate of 20%, the final sample size was determined as 70 patients per arm.[4]

Qualitative data analysis of the secondary assessment at 30-day follow-up was done using interpretative phenomenological analysis as previously described by Smith *et al*.[8] Briefly, each transcribed interview was read and coded by three researchers independently (BL, SL, YuW), and then discussed thoroughly by the research team to identify prominent themes. The process of analysis was done in parallel with the interview so that the developing themes could be tested with reference to new data. Similar themes were then grouped and combined to obtain the final themes. Finally, the themes were interpreted and

explained to reveal general issues in common as well as unique features of each individual regarding patient experiences. A subgroup of participants were approached later during their follow-up at the hospital outpatient clinic to provide feedback on the findings of the researchers.

Patient and public involvement

No patients or members of the public were involved in the development and design of this study. Patients and the general public will be informed of the study results via peer-reviewed journals.

RESULTS

A total of 140 patients were enrolled in the study and were randomised into two groups: 70 patients were allocated to the ERAS group receiving care according to the neurosurgical ERAS protocol and 70 patients were allocated to the control group receiving conventional perioperative care. Demographic and clinical features did not significantly differ between the two groups (table 1). Details of surgery, accelerated recovery regimen and clinical outcomes were outlined in our previous report.[4] Briefly, there was no significant difference with regard to surgery-related variables between the groups, whereas all accelerated recovery regimen-related variables differed significantly between the groups, which were in accordance with the ERAS protocol (table 2). Additionally, a shorter postoperative LOS (−3 days, p<0.0001) was observed in the ERAS group, which was associated with absorbable skin suture, oral solid intake on POD1 and no postoperative wound drainage in multivariate regression analysis. There was no perioperative mortality nor 30-day reoperation/readmission in either group. There was no difference in terms of surgical and non-surgical complication rates between the groups. Functional recovery in terms of KPS scores both at discharge and at 30-day follow-up was similar in the ERAS versus the control group.[4]

Patient satisfaction at discharge

All patients completed the questionnaire on patient satisfaction at discharge. The mean patient satisfaction in the ERAS group was significantly higher than that in the control group at discharge (92.2±4.3 vs 86.8±7.4, p=0.0001). Detailed patient satisfaction scores according to each module are shown in table 3.

A predefined cut-off value of 90 classified patients into 'highly satisfied group' (patient satisfaction score ≥90) and 'not highly satisfied group' (score <90). Six (8.6%) and 37 patients (52.9%) were not highly satisfied in the ERAS and control groups, respectively, which were significantly different (p<0.0001).

Univariate analysis including demographic, surgery-related, clinical and ERAS regimen variables showed significant association between a higher overall patient satisfaction and the following parameters in the ERAS group: mild PONV VAS, absorbable skin suture and mild pain VAS on POD1 (online supplemental table 1). ASA

Table 2 Variables associated with surgery and accelerated recovery regimen

Variable	ERAS group	Control group	P value
	Patients, n (%)		
Patients (n)	70	70	
Length of procedure (hours)			0.180
<3	15 (21.4)	22 (31.4)	
≥3	55 (78.6)	48 (68.6)	
Blood loss during surgery (mL)			0.310
<300	30 (42.9)	36 (51.4)	
≥300	40 (57.1)	34 (48.6)	
PONV VAS			0.115
Mild (1–4)	60 (85.7)	50 (71.4)	
Moderate (5–6)	7 (10.0)	15 (21.4)	
Severe (7–10)	3 (4.3)	5 (7.1)	
Preoperative carbohydrate loading			<0.0001
Yes	64 (91.4)	0 (0)	
No	6 (8.6)	70 (100.0)	
Absorbable skin suture			<0.0001
Yes	54 (77.1)	0 (0)	
No	16 (22.9)	70 (100.0)	
Mechanical prophylaxis for DVT			<0.0001
Yes	45 (64.3)	11 (15.7)	
No	25 (35.7)	59 (84.3)	
Removal of urinary drainage (hours)			<0.0001
≤6	52 (74.3)	0 (0)	
>6	18 (25.7)	70 (100.0)	
Time to first oral solid intake (hours)			<0.0001
≤24	38 (54.3)	12 (17.1)	
>24	32 (45.7)	58 (82.9)	
Ambulation on POD1			<0.0001
Yes	45 (64.3)	0 (0)	
No	25 (35.7)	70 (100.0)	
Postoperative wound drainage			<0.0001
No	58 (82.9)	2 (2.9)	
Yes	12 (17.1)	68 (97.1)	
Pain VAS on POD1			<0.0001
Mild (1–4)	55 (78.6)	23 (32.9)	
Moderate (5–6)	13 (18.6)	42 (60.0)	
Severe (7–10)	2 (2.9)	5 (7.1)	
Postoperative LOS (days)			<0.0001
≤4	32 (45.7)	7 (10.0)	
>4	38 (54.3)	63 (90.0)	

DVT, deep vein thrombosis; ERAS, enhanced recovery after surgery; LOS, length of stay; POD, postoperative day; PONV, postoperative nausea and vomiting; VAS, Visual Analogue Scale.

Table 3 Patient satisfaction scores at discharge

Variable	ERAS group Median (range)	Control group Median (range)	P value
Overall satisfaction	92.2 (85–100)	86.8 (50–100)	0.0001
Information	17.4 (15–20)	16.5 (12–20)	0.039
Medical care	18.9 (15–20)	18.3 (15–20)	0.043
Nursing care	19.2 (17–20)	18.6 (15–20)	0.032
Enhanced recovery	18.5 (15–20)	15.7 (10–20)	<0.0001
Comfort and others	18.2 (14–20)	17.9 (12–20)	0.317

ERAS, enhanced recovery after surgery.

grade I, absorbable skin suture and shorter postoperative LOS (no more than 4 days) were related to higher satisfaction of medical care. Occupational status was correlated with nursing care, with the unemployed expressing higher satisfaction than those who were employed and home maker/student/retired. Mild pain VAS on POD1 also showed more satisfaction with nursing care. Four parameters consisting of PONV VAS, absorbable skin suture, mild pain VAS on POD1 and shorter postoperative LOS were related to higher satisfaction with enhanced recovery. No variable was found to be statistically correlated with the satisfaction domains of information or comfort and others. Multivariate logistic regression including variables with p<0.20 in the univariate analysis was done to identify independent predictors of higher overall patient satisfaction. Only ASA grade (β coefficient, 3.6; OR, 36.7; 95% CI 4.4 to 303.7; p=0.001) was found to influence patient satisfaction significantly.

On the other side, univariate analysis for the control group revealed ASA grade I as the only parameter associated with a higher overall patient satisfaction (data not shown). Older age (≥50) and lower educational level (with no education or primary education) had a positive correlation with higher satisfaction with information. Factors including ASA grade I and mild PONV VAS were significantly related to higher satisfaction of medical care. ASA grade I was also related to higher satisfaction with nursing care as well as comfort and others. The results of multivariate analysis showed that age (β coefficient, 3.5; OR, 34.4; 95% CI 2.5 to 474.7; p=0.008) and ASA grade (β coefficient, −3.5; OR, 0.03; 95% CI 0.002 to 0.6; p=0.024) were independent predictors of overall patient satisfaction.

When combining the two groups together, variables including mild PONV VAS, preoperative carbohydrate loading, absorbable skin suture, mechanical prophylaxis for DVT, early removal of urinary drainage (within 6 hours), oral solid intake on POD1, ambulation on POD1, no postoperative wound drainage, mild pain VAS on POD1 and shorter postoperative LOS all positively influenced overall patient satisfaction in univariate analysis (data not shown). These factors were also correlated with better satisfaction with medical care, nursing care and enhanced recovery in univariate analysis. Nevertheless, age (β coefficient, 1.9; OR, 6.9; 95% CI 1.9 to 25.5; p=0.004), PONV VAS (β coefficient, −1.7; OR, 0.2; 95% CI 0.04 to 0.9; p=0.042), absorbable skin suture (β coefficient, −5.0; OR, 0.007; 95% CI 0.0002 to 0.3; p=0.009) and postoperative LOS (β coefficient, −3.8; OR, 0.8; 95% CI 0.2 to 0.9; p=0.020) remained as independent factors affecting patient satisfaction when multivariate analysis was used.

Patient experience at 30-day follow-up

A purposive sample of 46 patients participated in the semi-structured interviews at 30-day follow-up after discharge. A total of 19 men and 27 women aged 18–65 years were interviewed. The duration of interviews ranged 15–30 min. Of the 46 interviews, 2 were excluded from analysis due to poor quality of the material. Patients' experiences in participating in a neurosurgical ERAS programme were organised into five final themes: information transfer, professional support, shared responsibility and active participation, readiness for discharge, and follow-up.

Information transfer

Most patients felt that they were well educated and counselled when they were enrolled in the ERAS programme. However, some reported that too much information was given at the same time so that they were unable to remember everything, nor were they able to think over to ask questions (Table 4, quotes 1). Therefore, it is preferable that the written information was provided 1 week before surgery.

Professional support

Most patients reported that they acknowledged that it was natural to experience pain/fatigue/nausea associated with surgery and anaesthesia, and they were prepared for that to some extent. When they were enrolled in the ERAS programme, they expected that the programme may help in alleviating these discomforts postoperatively. Even though the results have proved that more patients in the ERAS group reported mild pain on POD1 and shortened duration of pain than those in the control group,[4] a few patients were dissatisfied with the management of postoperative pain. The different degrees of satisfaction with postoperative pain management could be explained by the subjectivity of pain and individualised experiences of receiving and tolerating analgesia. However, the patients mentioned that they did feel better when the caregivers showed great empathy and responded to their complaints promptly and actively (table 4, quote 2.1). In contrast, they felt worse when some caregivers simply assured them that 'it was not uncommon' (table 4, quote 2.2). It is valuable for the caregivers to contribute to a positive feeling. Similar issue existed concerning PONV (table 4, quote 2.3).

Some patients also reported that the amount of attention they received declined significantly after the first couple of PODs. They felt that some caregivers did not

Table 4 Quotes from patients

Theme	Quotes
1. Information transfer	1.1. "Well you know it's a good thing but there's simply too much information out there. So I said to myself ok just let the doctors and nurses tell me what to do next. I'll follow the instructions as long as I know they mean good." (Patient 6)
	1.2. "They spent quite some time to explain the document point by point. It sounds great. Everybody wants a better outcome. Then they asked me if I had any questions. Well I could not think of any right away. They said I would keep one copy of the documents and I'm welcomed to ask questions at any time. But later on the nurses came for the pre-op stuff, then the barber, then the anesthetist, and the OR nurses. I was preoccupied with the surgery I didn't even give them a second look. It would be better if they gave me the documents some time earlier rather than only two days before surgery." (Patient 9)
2. Professional support	2.1. "They gave me a patient-controlled analgesia pump for the first couple of days after surgery and it really helped a lot. I didn't feel much pain at that time. But things changed the third day when they switched the pump to oral painkillers. It seemed to me that the oral painkillers helped little. I didn't expect that I'd suffered from surgical pain starting on POD3. Of course I asked for help. Then came this very patient and intellectual nurse. She spent some time to explain to my family and me about the necessity of switching the pump to oral pills. She also told us that the drug used in the pump was the similar type as the oral ones. She mentioned in the end that she could ask the doctors to refill my pump if I really need that. Then I thought well, if I want to go home early I can not rely on the pump. I didn't refill the pump and the pain did subside as time went by. Also, she checked on me later that day before the shift of duty and the next morning the first thing she came to the ward. I was able to be discharged a couple of days later, going home with oral painkillers. I was very thankful to her." (Patient 29)
	2.2. "I knew it was natural to have pain because of the surgery but it was intense. I expected the doctor to do something but he just told me 'It is not uncommon. If I were you I'd have the pain too.' It was not helping." (Patient 26)
	2.3. "The smell of food made me really nauseous and I didn't want to eat at all. I called the nurse and then she called in a doctor. He checked my order of drugs and said they already give me drugs for the nausea and it was natural because there's certainly some swelling in my brain due to the surgery." (Patient 5)
	2.4. "It felt like that they really wanted me to join the program and they really wanted to make sure that I met the milestones. Removal of urinary drain, oral liquid and then solid food intake, off-bed activity… I thought I did everything great. I was proud of myself and grateful to the healthcare team. But after that I felt like I was abandoned. They were probably busy helping others who were not doing great as I did…" (Patient 40)
	2.5. "In the beginning when the nurses had their shifts in front of my bed they would remind each other 'this is an ERAS patient' and I know it means something different. I can tell that they paid more attention to me than to other patients… Later on they were talking like 'this is an ERAS patient and he already got off bed yesterday' Then I became the one who doesn't deserve their attention." (Patient 13)
3. Shared responsibility and active participation	3.1. "You signed the consent and you made a commitment. You are obliged to stay strong and comply with the rules. It is a sort of pressure." (Patient 40)
	3.2. "The second afternoon after I had my surgery the nurse came in to remind me that it was time for me to get off bed and try to walk according to the schedule. Yes I could fetch my meals and they had removed the drip. But I was not feeling well enough. I had some faintness. I asked 'maybe we can try tomorrow morning?' but she kept telling me that how other managed to walk on the second day after surgery and that 'nobody was ready enough for that'. I didn't want to annoy her so I tried. I could not recall what happened next because I passed out. She was scared of course. She came to apologize to me the next day. I don't blame her personally but they should have a mechanism to adjust the goal and not to take them as fixed rules." (Patient 25)
	3.3. "A nurse came in and she shouted 'how come you're still in bed? You don't have any IV fluids today and now try to walk'. But I already walked and I even walked two rounds in the corridor earlier that morning. She did not come early enough to see that… I'm not a soldier to follow the rigid instructions as when to do what." (Patient 15)
4. Readiness for discharge	4.1. "When he [resident] reported to the senior doctor that 'she's going to be discharged today' I thought what's going on, he must be insane. I was not well enough. I'm stilling having this right facial paralysis. I still can't close my right eye tightly." (Patient 20)
	4.2. "I was happy to go home only 3 days after surgery, but I wasn't totally pain free at that time. I couldn't help thinking maybe I should stay for another couple of days and then go home in a better condition?" (Patient 9)
	4.3. "Here in the hospital my son and daughter are around. They are using their annual leave for my hospitalization. But once I go home they'll have their own family and children to look after… They live quite far away… My husband, he has never done any housework at home. If I don't cook, he will starve. How can you expect him to take care of me?" (Patient 7)
	4.4. "My daughter really devoted herself to helping me recover from the surgery and I know that she wanted me home. But she is not a nurse anyway. I simply believe that it is safer to stay in the hospital. You are surrounded by medical staff so if there's anything going wrong they will find it out and deal with it quickly." (Patient 23)
	4.5. "I don't trust the community hospitals and I will certainly go back to the hospital where I had my surgery if anything is wrong. I'm not living close to the hospital. And I know that it's a busy center and there is a huge number of patients to be admitted. What if they can't guarantee a bed if I need readmission?" (Patient 40)

Continued

Table 4 Continued

Theme	Quotes
5. Follow-up	5.1. "This cell phone app works way much better than phone calls. I never called the ward even though I had the number. You nerve know whether the people answers the phone really know whom you are. But it is the doctor who did my surgery and took care of me that is now interacting with me on this app. He knows my condition." (Patient 20)
	5.2. "I know that the doctors are always busy doing the surgeries and dealing with new patients so you don't want to bother them in the middle of their work. I just left a message to my doctor and whenever he got time he would reply or call back. In this way my questions are answered and I don't feel myself as a burden to him." (Patient 9)
	5.3. "The third day after I went home I had a funny feeling around the wound. There was a small lump next to the wound which felt soft. My son took a picture of that with his cell phone and sent it to the doctors. They called me to go to the clinic. It turned out that I developed some water under the scalp and they fixed it easily. That was unimaginably convenient." (Patient 21)

POD, postoperative day.

behave patiently enough when listening and responding to their questions and concerns once they have undergone the most intense period postoperatively and seemed 'stable' compared with other patients (table 4, quotes 2.4 and 2.5).

Shared responsibility and active participation

Although all patients were excited when they were educated preoperatively that they would be able to drink/eat and ambulate sooner than they expected after surgery, some showed a concern of 'being obliged to do so' (table 4, quote 3.1). Some felt that the process of accelerated recovery was designed by the caregivers and they were passively striving hard to meet the individual goals preset by the protocol, which sometimes ended up with unpleasant experiences (table 4, quote 3.2).

In addition, some patients mentioned that they dislike the feeling of being told to follow the 'rigid' instructions in their recovery process; instead, it would be better if they could play a more active role in setting their own targets from day to day after surgery (table 4, quote 3.3).

Readiness for discharge

Many patients expressed their excitement with early discharge, which was also associated with reduced total cost of hospitalisation[4] and faster return to normal life and work. However, a few felt that they were not ready to be discharged because (1) they were still having mild symptoms (table 4, quotes 4.1 and 4.2); (2) they worried that their caretakers might not be able to take care of them at home as good as the caregivers did at the hospital (table 4, quote 4.3); and (3) they felt that it would be safer for them to stay in the hospital for a prolonged period of time for any late-onset postoperative complications that may occur (table 4, quotes 4.4 and 4.5).

Follow-up

All patients praised the convenience of contacting their primary doctors and the relatively prompt response to their questions postdischarge in the current study (table 4, quotes 5). We have been using social media cellphone/website app to contact patients, answer questions, identify possible complications, provide guidance, arrange follow-up visits and offer support to patients in a timely fashion. This doubtlessly helps patients to alleviate their worry about 'being untended' and increase their sense of security on early discharge.

DISCUSSION

To improve health care quality, a thorough study of the target population is doubtlessly of great significance in order to meet the requirements and expectations of individual patients. Patient-oriented outcome measures including functional recovery (eg, KPS) and patient satisfaction are employed for quality evaluation. We have validated the benefits of a neurosurgical ERAS programme in shortening LOS of patients undergoing craniotomy without increasing complication rates.[4] The current study further proved that patients in the ERAS group had higher overall satisfaction, as well as higher satisfaction with individual domains including information, medical care, nursing care and enhanced recovery. Thus, it is possible to provide patients with satisfactory information, care and treatment during a shortened hospital stay. This high satisfaction perceived by the patients, which represents patient-based assurance of quality, should be considered one of the most important endpoints for any study evaluating the quality of hospital stay associated with interventions (such as an ERAS programme).

Multivariate analysis revealed that higher ASA grade was the only independent predictor of a higher patient satisfaction in the ERAS group, whereas older age and lower ASA grade were independent predictors in the control group. These predictors can be interpreted as determinants of patient satisfaction in each group under circumstances in which most other factors do not vary significantly within each group. It is also understandable that mild PONV VAS, absorbable skin suture and shorter postoperative LOS, which are among the key distinguishing factors between the two groups, were independent predictors of patient satisfaction in all patients. Age was also a predictor of patient satisfaction in all patients, which is in accordance with previous studies showing that

older patients tend to have higher satisfaction scores with hospital healthcare.[9–11]

Intriguingly, ASA grade was shown to be a significant predictor of patient satisfaction in the ERAS and control groups, respectively, with opposite direction of association; in the control group, the lower ASA grade, the higher patient satisfaction, whereas in the ERAS group the higher ASA grade, the higher patient satisfaction. In general, patient satisfaction appears to be higher in patients with better self-reported health status as shown in prior studies,[10 11] which is in accordance with the findings in the control group. On the other side, the benefits of the ERAS protocol may account for better satisfaction in patients with higher ASA grade. Satisfaction is a balance between patients' expectations for care and occurrence of care which is actually delivered,[12] and thus reflects changes in health status due to the effectiveness of hospital care. It is possible that for patients with higher ASA grade the ERAS-related interventions have made more profound change in self-perceived health status compared with those with lower ASA grade.

Postoperative LOS was established as an independent predictor of patient satisfaction in all patients in the current study. In addition, it was also related to specific satisfaction domains such as medical care and enhanced recovery in the ERAS group as well as in all patients. The shorter the LOS, the higher the satisfaction, which seems rational and has been shown in other studies as well.[9 11 13]

Bias associated with questionnaire surveys of satisfaction has been recognised as patients tend to overly positively scored the care they received.[14] Furthermore, patients' explicitly positive attitude towards accelerated discharge actually masks their concerns and complaints.[15] Therefore, data on patient experience may provide more information for assessing quality of care in order to identify circumstances surrounding key ERAS components that make patients satisfied (or not), as well as the associated reasons.[16]

In the absence of previous relevant study on patient experience in participating in a neurosurgical ERAS programme, we have conducted a secondary analysis of patient experience at 30-day follow-up after discharge. Based on our results, the five different themes were closely related to each other and represent both positive and negative sides. They showed shortcomings of care which warrant improvement in the future, as well as strong points which may be considered for generalisation.

There is no doubt that information transfer is the first and foremost step of incorporating patients into an ERAS programme. It calls to attention the importance of having ERAS conversation at least 1 week before surgery to allow patients to have enough time to understand the process and ask questions. It was shown that receiving information at appropriate times improved patient satisfaction with their discharge planning.[17 18] This is practical for elective surgeries and should be adopted in future practices.

It is notable that emotional support from healthcare professionals is as crucial as medical interventions in symptom management. When facing dilemmas of burdensome symptoms and expectations for rapid recovery, patients need to mobilise courage and will to follow the ERAS regimen. Although interventions associated with ERAS protocol have been proven to improve management of postoperative pain and PONV significantly,[4] it is perceived by patients from both previous studies[17 19] and ours that professional's empathy and supportive behaviour function as decisive factors in accomplishing the objectives of the ERAS programme. In addition, healthcare professionals are often enthusiastic in counselling the patients at the beginning of the study, and it is important for them to be responsive to patients' need throughout the hospital stay.

It was overlooked in the current study that patients need to take responsibilities for their own to achieve an accelerated recovery and good result. They should be encouraged to act more actively and set their own daily goals after surgery. In addition to the shared responsibility and active participation required for patients,[1 19] they should also possess the right to adjust their goals based on their individual conditions. The supportive role of caregivers should preferably be more like an assistant than a leader to hasten recovery.

Patients expressing insecurities about early discharge has remained a hot and tough issue in several studies on patient experience of ERAS programme. The most common concerns were associated with pain management, mobilisation, identifying postoperative complications and lack of family support.[5 15 19 20] Our patients mentioned all these concerns as well. However, our strategy of follow-up with social media cellphone/website app in a timely and responsive manner has proved to be effective in enhancing patients' sense of security and improving their experience after discharge. It relies less on manpower compared with follow-up visits in person or via phone calls, and benefits the patients significantly. The patients felt that the healthcare providers were still reachable and responsive through the app after discharge. By using the app, not only can the medical staff track and collect follow-up data from the patients, but they can also answer patients' questions, address concerns, guide rehabilitation, identify possible new-onset complications and schedule clinic visits. Therefore, patients' traditional beliefs of 'safer and necessary prolonged convalescence at hospital' would no longer be a barrier to early discharge in the ERAS programme.

One limitation of the current study is that the findings from a single institution with sampled participants cannot be automatically generalised. For one thing, sampling bias may exist. For another, the possible relationship between patients' views and their personal/domestic characteristics was not well studied in the qualitative analysis. Another limitation is the lack of dedicated sample size calculation for outcomes measured in this study since patient satisfaction was a secondary outcome of the main trial.[4] Nevertheless, the risk of an underpowered sample size was to some extent counterbalanced by a post-hoc

power analysis for patient satisfaction, which yielded a post-hoc power of 100%. Above all things, the views of patients in the control group who received conventional perioperative care were not taken into account in the qualitative analysis either. However, the quantitative analysis, which showed higher patient satisfaction with the ERAS programme, goes some way towards validating the qualitative findings.

In addition to patient satisfaction, medical cost reduction should be highly valued as well given the increasing cost burden posed on both the patients and public finance. To this end, ERAS programme may play an important role in quality improvement with cost-effective care.

CONCLUSIONS

Patients in the ERAS group demonstrated higher satisfaction compared with the controls. Factors including age, PONV VAS, absorbable skin suture and postoperative LOS were independent predictors of overall patient satisfaction. Patients value adequate and consistent information transfer as well as professional support in participating in an ERAS programme. It is also important to encourage patients to take active roles and take responsibilities for their own in accelerating recovery. Timely and responsive follow-up modality after discharge could enhance patients' sense of security. The findings of the current study may serve as a stepping stone to promote further research into the evaluation and validation of patient satisfaction and experience in order to improve service delivery and patient care.

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