# Changes in psychological distress and quality of life after esophageal cancer surgery: A prospective study

**Jeong Hye Kim** ( jhkimnur@ulsan.ac.kr )
University of Ulsan https://orcid.org/0000-0001-5384-706X

**Ju Ri Jung**
Asan Medical Center

**Research article**

**Keywords:** Esophageal cancer, Anxiety, Depression, Quality of life

**Posted Date:** August 19th, 2020

**DOI:** https://doi.org/10.21203/rs.3.rs-54022/v1

## Abstract

# Background

Esophageal cancer patients experience physical and psychological difficulties after surgery. This study aimed to identify the changes in psychological distress and quality of life in patients with esophageal cancer before surgery to three months after surgery.

# Methods

We enrolled 49 patients who were scheduled to undergo esophageal surgery at a tertiary hospital in Seoul, South Korea in this prospective study. Patients' psychological distress and quality of life were assessed with the Korean scales HADS, EORTC QLQ-C30, and QLQ-OES18 at the pre-surgery, one-month post-surgery, and three months post-surgery.

# Results

Moderate-to-severe depression was reported in 12.2% of patients at the pre-surgery evaluation, in 57.1% of patients one-month post-surgery, and 8.2% of patients three-months post-surgery. Moderate-to-severe depression was reported in 12.2% of patients at the pre-surgery evaluation, in 63.3% of patients one-month post-surgery, and 16.3% of patients three months post-surgery. Clinically significant, moderate changes (10–20 points) in physical functioning, insomnia, nausea and vomiting, and dyspnea, and significant, large changes (> 20) in role functioning, fatigue, pain, and appetite loss (per EORTC QLQ-C30) were reported from pre-surgery to one-month post-surgery. Clinically significant, moderate changes (10–20 points) in dysphagia and taste problems and a significant, large change (> 20) in eating difficulties (per QLQ-OES18) were reported from pre-surgery to one-month post-surgery.

# Conclusion

One month after esophageal cancer surgery, patients demonstrated severe psychological distress and worsening quality of life.


## Introduction

Cancer is the leading cause of death in Korea, accounting for 29.1% of all deaths. Esophageal cancer accounts for 1.1% of all cancers, with 2,344 cases per year. More than 50% of patients diagnosed with esophageal cancer die, and it ranks 10th in total cancer deaths. Esophageal cancer has a very high mortality rate, poor prognosis, and is difficult to treat (1). With the development of surgery, radiotherapy, and chemotherapy, treatment outcomes have improved slightly, as have five-year relative survival rates, from 21.5% in 2001–2005 to 38.0% in 2013–2017 (2). This rate is still low.

The most important curative treatment method for esophageal cancer is surgery (3, 4). There is a wide range of surgeries, which leads to a possible postoperative complications (5). After esophageal cancer surgery, the patient experiences a variety of physical symptoms, including pain, changes in eating habits, constipation, reflux, sore throat, dry mouth, taste changes, coughing, and difficulty speaking (6, 7). This leads to poor nutrition and reduced quality of life (3, 8). Patients also experience psychological stress, such as anxiety and depression, from the time of diagnosis to the treatment, including surgery (9). Psychological distress is common among patients with esophageal cancer (10).

A study of the changes in anxiety and depression levels before and six and 12 months after esophageal cancer surgery demonstrated that anxiety levels remained stable over time, while levels of depression increased until 12 months post-surgery (10). Another study examining changes in psychological stress showed the highest psychological stress levels occurred two to four weeks after surgery (11).

The quality of life of patients with esophageal cancer decreases immediately after surgery and gradually improves three months post-surgery (12). Deterioration of quality of life is greatest two months after surgery, and generally improves four months after surgery (7). After surgery, patients experienced emotional problems, such as physical symptoms, anxiety, and depression.

This study measured psychological stress and quality of life in patients with esophageal cancer during the early postoperative recovery period.

## Methods

# Study Design and patients

This was a prospective longitudinal study. Participants were scheduled for esophageal cancer surgery and had no recurrence or distant metastases. We included patients 20 years of age or older who provided written informed consent. Patients who underwent esophageal reconstruction were excluded.

The significance level to determine the number of subjects was 0.05, the mean effect size was 0.25, and the power of 0.8 was based on a repeated measures variance analysis using G * Power 3.1.6. Based on three measurements, we determined a sample size of at least 28 people was necessary. From June of 2016 to January of 2017, 70 patients underwent esophageal cancer surgery. The eight patients who underwent esophageal reconstruction using the small and large intestine were excluded. After surgery, a total of 21 patients were released, including one patient who went to another hospital, 10 patients who refused the questionnaire due to poor performance status, two patients who died. The remaining 49 patients were the final study subjects.

Data were collected after the Institutional Review Board (IRB No. 2016 – 0236) of a tertiary hospital in Seoul, South Korea, provided approval. The investigator visited the subjects who volunteered to participate before surgery and one and three months after surgery to explain the purpose of the study and complete the study participation agreement. Patients' clinical characteristics were collected from electronic medical records.

Measures

Psychological distress

The Korean version of the Hospital Anxiety and Depression Scale (HADS) (13) measures symptoms of anxiety and depression. It consists of 14 items, seven items for the anxiety subscale (HADS Anxiety), which focuses on generalized anxiety disorder symptoms, and seven for the depression subscale (HADS Depression), which focuses on anhedonia, the main symptom of depression. Each item is scored on a response-scale with four alternatives ranging between 0 and 3. After adjusting for six items that are reversed scored, all responses are summed to obtain two subscales. The recommended cut-off scores, according to Zigmond and Snaith (14), are 8–10 for doubtful cases and ≥ 11 for definite cases. The reliability of the anxiety instrument was indicated by Cronbach's α = 0.86 when standardized in Korean, and Cronbach's α = 0.92 in this study. The reliability of the depression instrument was indicated by Cronbach's α = 0.86 when standardized in Korean (13), and Cronbach's α = 0.84 in this study.

Quality of life

Quality of life was assessed using the Korean version of the European Organization for Research and Treatment of Cancer (EORTC) Core QOL Questionnaire, the QLQ-C30, version 3.0 (15), and its supplementary esophageal cancer questionnaire EORTC QLQ-OES18. EORTC QLQ-C30 consists of five multi-item function scales (physical, role, cognitive, emotional, and social), three multi-item symptom scales (fatigue, nausea and vomiting, and pain), six single-item symptom scales (dyspnea, insomnia, appetite loss, constipation, diarrhea, and financial impact), and a two-item global quality of life scale. EORTC QLQ-OES18 was used to assess problems common in patients with esophageal cancer (6). This 18-item questionnaire consists of four scales (dysphagia, reflux, eating difficulties, and esophageal pain) and six single items (dysphagia, trouble swallowing saliva, choking, dry mouth, coughing, speech difficulties, and taste problems). In both questionnaires, the four response alternatives were: 'not at all', 'a little', 'quite a bit' and 'very much'. The only exception was the global quality of life scale, which had a seven-graded rating, ranging from 1 'very poor' to 7 'excellent'. EORTC QLQ-C30 and QLQ-OES18 were scored according to the EORTC manual. All scores were linearly transformed to a 0 to 100 scale.

A higher score on the functioning and the global quality of life scales indicate better health. A higher score on the symptom scales indicates a higher level of symptom burden. A difference of 5–10 points in scores represents a small change, a change of 10 to 20 points indicates a moderate change, and a difference of greater than 20 points indicates a large, significant change from the patient's perspective. In a previous study (15) QLQ C-30 was Cronbach's α = 0.60–0.87. In this study, Cronbach's α = 0.74–0.86. QLQOES18 instrument reliability was indicated by Cronbach's α = 0.82 when standardized in Korean, and Cronbach's α = 0.72 in this study.

Data analysis

The collected data were analyzed using SPSS WIN version 22.0. We used descriptive statistics to analyze the participants' demographic and clinical characteristics, psychological distress, and quality of life. A repeated measure ANOVA was used to analyze

changes in psychological distress and quality of life.

## Results

# Participants’ demographic and clinical characteristics

Table 1 shows the demographic and clinical characteristics of the study participants. A total of 49 subjects participated in this study, including 46 men (93.9%), and the mean age was 63.0. Exactly 22 (44.9%) graduated from middle school, while 36 (93.9%) were married, and 25 (51.0%) were employed. Regarding the preoperative cancer stage, 28 patients (57.2%) were in stage 0-□, 10 patients (20.4%) were in stages □ or □, and one patient (2.0%) was in stage □. The most common treatment was the Ivor Lewis operation (32 patients [65.3%]), while 15 patients (30.6%) underwent neoadjuvant treatment.

Table 1
Demographic and clinical characteristics of study participants (n = 49)

| Variables | Categories | n(%) or M ± SD |
|---|---|---|
| Gender | Male | 46(93.9) |
| | Female | 3(6.1) |
| Age (yr) | | 63.0 ± 7.12 |
| | < 60 | 16(32.7) |
| | ≥ 60 | 33(67.3) |
| Education | Below middle school | 22(44.9) |
| | High school | 17(34.7) |
| | College and above | 10(20.4) |
| Marital status | Spouse | 47(96.0) |
| | No spouse | 2(4.0) |
| Job | Employed | 25(51.0) |
| | Unemployed | 24(49.0) |
| Stage of cancer | 0-□ | 28(57.2.) |
| | □ | 10(20.4) |
| | □ | 10(20.4) |
| | □ | 1(2.0) |
| Type of surgery | Ivor Lewis operation | 32(65.3) |
| | Mckeown operation | 16(32.7) |
| | Transhiatal esophagectomy | 1(2.0) |
| Neoadjuvant treatment | Yes | 15(30.6) |
| | No | 34(69.4) |

# Changes in psychological distress

Table 2 displays the changes in psychological distress. Moderate-to-severe anxiety was indicated in 12.2% of subjects at the pre-surgery evaluation, in 57.1% of subjects one-month post-surgery, and in 8.2% of subjects three months post-surgery. Anxiety significantly changed by measurement time ($F = 59.56$, $p < .001$). The mean anxiety score of one month after surgery (11.73 ± 4.78) was higher than at the pre-surgery evaluation (6.80 ± 4.38) and three months after surgery (5.92 ± 3.07).

Table 2
Changes in psychological distress

| Variables | | Pre-surgery | 1-month post-surgery | | 3-months post-surgery | | | |
|---|---|---|---|---|---|---|---|---|
| | | N(%) or M ± SD | N(%) or M ± SD | F(*p*) (vs. baseline) | N(%) or M ± SD | F(*p*) (vs. baseline) | F(*p*) (vs. one month) | F(*p*) |
| Anxiety | | 6.8 ± 4.38 | 11.73 ± 4.78 | 154.71(<.001) | 5.92 ± 3.07 | 1.74(.193) | 85.62(<.001) | 59.56(<.001) |
| | 0 ~ 7 | 31(63.3) | 10(20.4) | | 40(81.6) | | | |
| | 8 ~ 10 | 12(24.5) | 11(22.4) | | 5(10.2) | | | |
| | 11 ~ 21 | 6(12.2) | 28(57.1) | | 4(8.2) | | | |
| Depression | | 6.71 ± 4.01 | 12.39 ± 4.55 | 200.93(<.001) | 7.06 ± 3.31 | 0.33(.571) | 91.32(<.001) | 72.13<.001) |
| | 0 ~ 7 | 29(59.2) | 11(22.4) | | 27(55.1) | | | |
| | 8 ~ 10 | 14(28.6) | 7(14.3) | | 14(28.6) | | | |
| | 11 ~ 21 | 6(12.2) | 31(63.3) | | 8(16.3) | | | |

Moderate-to-severe depression was reported in 12.2% of subjects at the pre-surgery evaluation, in 63.3% of subjects one-month post-surgery, and in 16.3% of subjects three months post-surgery. Depression significantly changed by measurement time (F = 72.13, p < .001). The mean depression score one month post-surgery (12.39 ± 4.55) was higher than at the pre-surgery evaluation (6.71 ± 4.01) and three months after surgery (7.06 ± 3.31)(Fig. 1-A).

# Changes in quality of life

There were significant changes over time in multiple domains, including the global quality of life (F = 10.42, p < .001), physical functioning (F = 30.51, p < .001), role functioning (F = 50.13, p < .001), cognitive functioning (F = 4.78, p = .011), fatigue (F = 21.95, p < .001), insomnia (F = 6.54, p < .001), pain (F = 19.98, p < .001), constipation (F = 3.20, p = .045), nausea and vomiting (F = 8.57, p < .001 ), loss of appetite(F = 21.54, p < .001), and dyspnea (F = 9.19, p < .001)(Fig. 1-B). Clinically significant, moderate changes (10–20 points) in physical functioning, insomnia, nausea and vomiting, and dyspnea, and a significant large change (> 20) in role functioning, fatigue, pain, and appetite loss were reported from the pre-surgery period to one-month post-surgery (Table 3).

Table 3
Changes in quality of life

| Variables | Pre-surgery | One-month post-surgery | | Three months post-surgery | | | F(p) |
|---|---|---|---|---|---|---|---|
| | M ± SD | M ± SD | F(*p*) (vs. Pre-surgery) | M ± SD | F(*p*) (vs. Pre-surgery) | F(*p*) (vs. 1-month) | |
| **QLQ-C30 functional scales** | | | | | | | |
| Physical functioning | 85.58 ± 12.79 | 65.99 ± 16.46 | 47.37(<.001) | 77.14 ± 14.08 | 10.42(.002) | 30.67(<.001) | 30.51(< .001) |
| Role functioning | 85.03 ± 17.76 | 55.44 ± 18.13 | 135.97(<.001) | 72.11 ± 22.15 | 13.53(.001) | 36.75(<.001) | 50.13(< .001) |
| Emotional functioning | 71.43 ± 23.81 | 69.9 ± 20.89 | 0.17(.683) | 74.83 ± 17.22 | 0.80(.376) | 2.82(.099) | 1.04(.359) |
| Cognitive functioning | 84.35 ± 18.76 | 88.78 ± 18.13 | 3.34(.074) | 92.18 ± 13.65 | 7.18(.010) | 2.29(.142) | 4.78(.011) |
| Social functioning | 70.41 ± 27.27 | 64.63 ± 23.23 | 1.69(.199) | 64.29 ± 19.25 | 2.38(.130) | 0.01(.923) | 1.50(.230) |
| **QLQ-C30 symptom scales** | | | | | | | |
| Fatigue | 25.62 ± 17.74 | 46.26 ± 17.32 | 50.08(<.001) | 35.83 ± 19.55 | 9.03(.004) | 11.99(.001) | 21.95(< .001) |
| Insomnia | 24.49 ± 30.26 | 42.18 ± 21.27 | 13.19(.001) | 30.61 ± 27.08 | 1.03(.316) | 9.72(.003) | 6.54(.005) |
| Pain | 9.52 ± 16.32 | 32.99 ± 20.27 | 35.38(<.001) | 24.15 ± 23.09 | 11.97(.001) | 8.92(.004) | 19.98(< .001) |
| Constipation | 16.33 ± 23.69 | 22.45 ± 23.95 | 2.13(.151) | 11.56 ± 23.13 | 1.00(.322) | 7.65(.008) | 3.20(.045) |
| Diarrhea | 10.20 ± 18.26 | 15.65 ± 21.63 | 1.92(.173) | 13.61 ± 24.46 | 0.71(.404) | 0.39(.537) | 1.07(.537) |
| Nausea and vomiting | 5.44 ± 10.42 | 18.71 ± 22.47 | 16.94(<.001) | 12.59 ± 17.85 | 5.84(.020) | 3.19(.080) | 8.57(< .001) |
| Appetite loss | 17.01 ± 26.46 | 42.18 ± 28.69 | 21.27(<.001) | 14.29 ± 20.41 | 0.40(.533) | 44.88(<.001) | 21.54(< .001) |
| Dyspnea | 15.65 ± 22.67 | 31.97 ± 24.49 | 16.48(<.001) | 21.77 ± 23.13 | 2.25(.141) | 9.03(.004) | 9.19(< .001) |
| Financial difficulties | 27.89 ± 28.34 | 31.29 ± 19.73 | 0.67(.417) | 29.93 ± 24.76 | 0.16(.69) | 0.14(.710) | 0.31(.708) |
| **QLQ-C30 Global quality of life** | 59.01 ± 20.68 | 50.17 ± 18.67 | 6.42(.015) | 65.48 ± 14.73 | 3.24(.078) | 26.21(<.001) | 10.42(< .001) |

There were significant changes over time for esophageal cancer-specific symptoms, including dysphagia ($F = 13.90$, $p < .001$), eating difficulties ($F = 18.53$, $p < .001$), reflux ($F = 2.38$, $p = .015$), dry mouth ($F = 3.16$, $p = .047$), and taste problems ($F = 5.86$, $p = .004$). Clinically significant, moderate changes (10–20 points) in dysphagia and difficulties tasting and a significant, large change (> 20) in eating difficulties on QLQ-OES18 were reported from the pre-surgery period to one-month post-surgery (Table 4).

Table 4
Changes in esophageal-specific symptoms

| Symptoms | Pre-surgery | One-month post-surgery | | Three months post-surgery | | | F(*p*) |
|---|---|---|---|---|---|---|---|
| | M ± SD | M ± SD | F(*p*) (vs. Pre-surgery) | M ± SD | F(*p*) (vs. Pre-surgery) | F(*p*) (vs. 1month) | |
| Dysphagia | 68.93 ± 30.76 | 53.29 ± 16.97 | 10.90(.002) | 74.15 ± 14.59 | 1.34(.252) | 53.40(<.001) | 13.90(<.001) |
| Eating difficulties | 18.54 ± 20.00 | 41.67 ± 18.40 | 41.32(<.001) | 29.08 ± 22.38 | 5.04(.029) | 18.87(<.001) | 18.53(<.001) |
| Reflux | 14.97 ± 17.09 | 21.09 ± 16.24 | 3.33(.074) | 20.41 ± 15.69 | 2.54(.118) | 0.09(.771) | 2.38(.015) |
| Esophageal pain | 10.2 ± 13.77 | 10.43 ± 17.77 | 0.01(.945) | 6.35 ± 14.34 | 1.69(.199) | 3.63(.063) | 1.32(.273) |
| Trouble swallowing saliva | 9.52 ± 21.52 | 10.88 ± 26.69 | 0.08(.781) | 10.88 ± 23.95 | 0.08(.776) | 0.00(1.00) | 0.05(.950) |
| Choking | 8.16 ± 17.39 | 9.52 ± 21.52 | 0.11(.743) | 8.84 ± 21.27 | 0.03(.864) | 0.34(.844) | 0.06(.939) |
| Dry mouth | 29.25 ± 30.91 | 31.97 ± 29.63 | 0.23(.633) | 18.37 ± 27.27 | 3.18(.081) | 6.34(.015) | 3.16(.047) |
| Tasting problems | 11.56 ± 21.03 | 22.45 ± 22.96 | 8.72(.005) | 11.56 ± 19.90 | 0.00(1.00) | 10.12(.003) | 5.86(.004) |
| Coughing | 10.88 ± 19.71 | 20.41 ± 24.36 | 6.00(.018) | 14.29 ± 28.05 | 0.47(.498) | 1.83(.182) | 2.31(.104) |
| Speech difficulties | 13.61 ± 27.15 | 20.41 ± 27.06 | 1.82(.184) | 12.24 ± 22.25 | 0.07(.789) | 5.21(.027) | 1.80(.175) |

## Discussion

This study examines changes in psychosocial distress and quality of life three-months after esophageal cancer surgery. According to our study results, 57.1% of patients who underwent esophageal cancer surgery experienced severe anxiety one-month later, and 63.3% had severe depression. Anxiety and depression were higher one-month postoperatively than they were preoperatively, and they recovered to preoperative levels three months postoperatively. The results showed that the highest psychological stress was observed two to four weeks after surgery for esophageal cancer (11), and more than 40% of patients experienced anxiety and depression during their first outpatient visit after esophageal cancer surgery (16). Patients with esophageal cancer experience severe anxiety and depression one month after surgery. Currently, most medical staff focus on physical recovery after surgery, not the emotional recuperation. Therefore, doctors must assess and conduct active interventions to reduce psychological distress in esophageal cancer patients early during the post-operative period.

Patients with esophageal cancer experience declines in quality of life of patients immediately after surgery, and gradually improvements are noted after three months (6). In this study, functional quality of life (except for cognitive functioning) decreased one month after surgery and recovered at three months after surgery. Physical functioning and role functioning subscales and global quality of life scales decreased one month after esophageal cancer surgery. Quality of life deteriorates within two months of esophageal cancer surgery. Patients experienced negative consequences due to various physical, psychological, and social problems after surgery, especially during the early stages of recovery (17, 18). In a previous study of the supportive care needs of this patient population, many subjects highly scored statements such as "I was afraid to lose my independence" and "I was afraid that cancer would spread." A large, significant change in role functioning was reported from pre-surgery to one-month post-surgery. The post-surgery role conflict, psychological anxiety associated with physical recovery, and the burden of returning to work all affect the patients' psychological well-being (19). Consistent with previous research, symptom scores, including fatigue, insomnia, pain, nausea and vomiting, and appetite loss (but not constipation) worsened at as assessment one month after surgery (3).

Before surgery, patients with esophageal cancer experience pain and uncertainty. After surgery, they face a decreased quality of life due to abrupt physical changes and adaptation processes. Appropriate interventions during the early recovery might counter the low quality of life scores of the post-operative period.

Subjects reported the worst symptoms one month after surgery. In particular, dysphagia, eating difficulties, and taste problems were noted at that time. Esophageal cancer surgery involves various anatomical changes, including decreased blood flow in the gastrointestinal tract, damage to the gastrointestinal sphincter, changes in nerve distribution, decreased esophageal peristalsis, and reduced food retention time in the gastrointestinal tract (17). A previous study of 49 patients who underwent esophageal cancer surgery showed similar results (8). Research indicates that esophageal cancer symptoms worsen two to four weeks after surgery compared with the preoperative period (11). In the first year after esophageal cancer surgery, the most severe symptoms tend to occur two months postoperatively (7). Although not analyzed in this study, dysphagia during the posttreatment period is a significant predictor of anxiety and depression (10). Therefore, esophageal cancer patients with dysphagia may experience psychological distress. Psychological distress and physical symptoms should both be evaluated in esophageal cancer patients. In particular, health care providers should assess dietary intake to monitor for eating problems, and nutrition counseling should be provided as needed.

Patients have a reduced ability to cope with unexpected symptoms post-surgery. Therefore, nursing intervention programs should be developed to facilitate the treatment process and manage symptoms after discharge through systematic education. In one study of patients who were undergoing esophageal cancer surgery, a nurse-led support program, including telephone counseling, conducted periodically for six months after discharge had a positive effect on patient satisfaction and their ability to cope with symptoms (7).

The strengths of this study include its longitudinal design and the fact that a short-term survey was conducted for 3 months after esophageal cancer surgery. The study aimed to conduct an integrated survey of quality of life in this patient population, including psychological aspects of recovery. The results of this study can be used to develop interventions to assess psychological distress and improve quality of life during early recovery from esophageal cancer surgery. Further study is needed to identify the factors affecting psychological distress and quality of life during each period following esophageal cancer surgery.

This study has limitations associated with patients in a general hospital. Future research should utilize more objective assessments of psychological distress and quality of life when using self-reporting tools. In particular, the decline in quality of life on a physical function scale should be evaluated using objective indicators, such as body weight and body mass index.

Patients with esophageal cancer may experience poor quality of life, with various physical and emotional changes after surgery. This study prospectively confirmed the changes in psychological distress and quality of life during a three-month period after esophageal cancer surgery. There were notable decreases in quality of life and worsening of various symptoms one month after esophageal cancer surgery, which indicates that early intervention is necessary.

## Declarations

**Authors' contributions**: Ju Ri Jung study design, data collection, writing the manuscript, and confirmation of the manuscript, Jeong Hye Kim study design, data collection, and confirmation of the manuscript.

**Funding information**: The authors have no funding sources to declare.

**Compliance with ethical standards**

Conflict of interest: The authors declare that they have no conflict of interest.

Study Approval: This study was approved by the Institutional Ethics Review Board of Asan Medical Center in Seoul, Korea.

Informed Consent: The authors declare that informed consent was obtained from all individual participants included in the study.

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## Figures

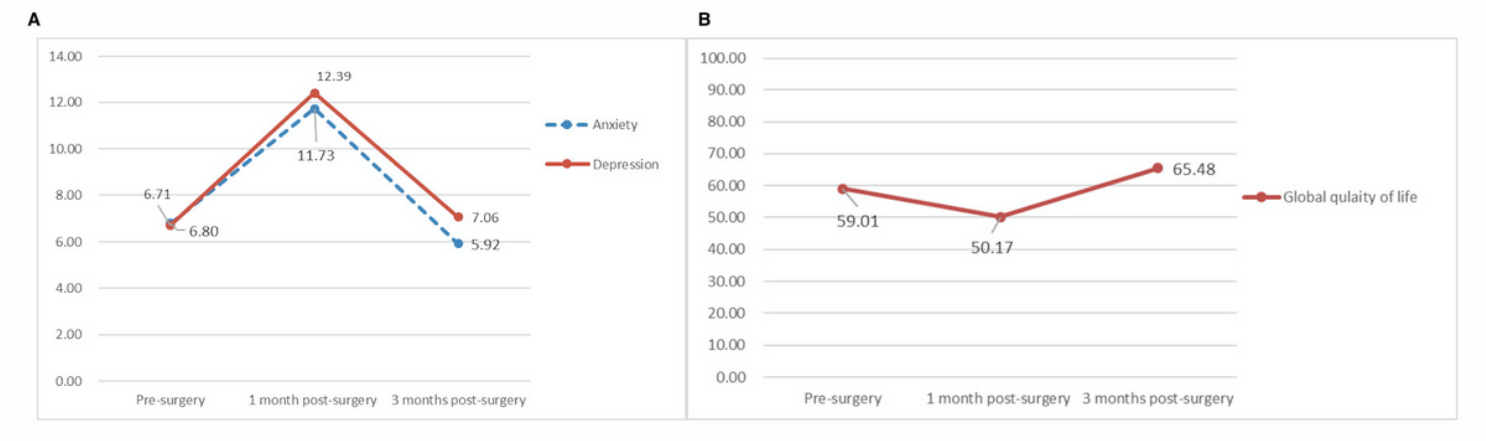


**Figure 1**

A. Changes in psychological distress. B. Changes in quality of life