Impact of FMEA-Based Nursing on Postoperative Condition of Appendicitis Patients

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ABSTRACT

Backgrounds • Appendicitis (AP) is a prevalent and sudden disease, and although surgery can be effective in treating it, post-surgical care is of great importance in improving the patient's recovery.

Objective • To analyze the impact of Failure Mode and Effect Analysis (FMEA)-based nursing on patients with AP after surgery.

Methods • A total of 104 patients with AP who received treatment in Fuyang Shi Hospital of TCM from December 2021 to February 2023 were enrolled and randomly divided into a control group (n = 52) who received routine nursing and a research group (n = 52) who receive FMEA-based nursing. The time to recovery of bowel sounds, time to defecation by anus, time to anal exhaust, and length of stay were statistically analyzed in both groups after surgery. Pain, sleep, and psychological status of patients before and after surgery were assessed using the visual analog scale (VAS), Pittsburgh Sleep Quality Index (PSQI), and self-rating anxiety scale/self-rating depression scale (SAS/SDS).

Patients' satisfaction with nursing was also investigated, and the incidence of postoperative complications was recorded.

Results • After surgery, the research group showed shorter time to recovery of bowel sounds, time to defecation by anus, time to anal exhaust, and length of stay, and lower scores of VAS, PSQI, SAS, and SDS than those of the control group ($P < .05$). As indicated by the satisfaction survey, compared with the control group, the research group showed a larger number of patients who were very satisfied with nursing and a smaller number of patients who thought their nursing should be improved; the incidence of postoperative complications was also lower in the research group ($P < .05$).

Conclusion • For patients with AP, FMEA-based nursing improves their postoperative recovery, alleviates their pain, and ameliorates their sleep quality, which is of high clinical application value. (*Altern Ther Health Med.* 2025;31(1):343-347).

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INTRODUCTION

Appendicitis (AP) refers to inflammatory changes in the lumen of the appendix due to various causes of blockage or secondary bacterial infection.[1] It tends to occur in young adults aged 20-30 years, with typical symptoms of right lower abdominal pain, elevated body temperature, vomiting, and neutrophilia.[2] At present, appendectomy is often used clinically, but the surgery is invasive, and improper postoperative nursing may cause adverse reactions, affecting the therapeutic effect and prognosis.[3] Therefore, in addition to active treatment, improving postoperative nursing is also of great significance for patients' therapeutic effects, prognosis, and quality of life.[4]

In recent years, a growing number of studies have suggested that nursing significantly improves the outcome of surgical treatment.[5,6] Failure Mode and Effect Analysis (FMEA) is a new perspective nursing assessment model applied to risk analysis to reduce risk events and ensure medical safety through risk assessment in advance, correction of risk factors, and countermeasures.[7,8] FMEA-based nursing plays an important role in the treatment and intervention of multiple diseases.[9,10]

We hypothesized that the application of FMEA-based nursing may help prevent the occurrence of adverse reactions and improve the sleep quality of patients after AP surgery. However, there are no studies available to confirm our view. Therefore, this study will analyze the impact of FMEA care on AP to provide reference and guidance for future clinical treatment of AP.

MATERIALS AND METHODS
Research object

A total of 104 patients with AP who underwent surgery in Fuyang Shi Hospital of TCM from December 2021 to February 2023 were enrolled and randomly divided into a research group and a control group using the random number table method, with 52 patients in each group. Patients in the

research group received FMEA-based nursing, and patients in the control group received routine nursing. The medical ethics committee approved the study, and all patients were informed and signed the informed consent form.

Inclusion and exclusion criteria

Inclusion criteria: Patients diagnosed with acute AP [11] by laboratory examinations such as in the imaging department of the hospital; patients meeting relevant diagnostic criteria, with clear indications for surgery; patients treated with appendectomy; patients with generally normal consciousness and cognition, able to cooperate with the use of scales and examinations for indicators; patients with good compliance; patients without other infectious diseases; patients with complete clinical data.

Exclusion criteria: Patients with important organ diseases such as heart, lung, liver, kidney, and brain; patients complicated with tumor or metabolic diseases; patients with coagulation dysfunction; patients who withdraw from the trial or are lost to follow-up.

Surgical methods

All patients underwent laparoscopic AP surgery. The patients were placed in the lying position, routinely disinfected with sterile sheets, and the procedure was started after satisfactory anesthesia. An A incision was made with the upper edge of the navel to establish an artificial pneumoperitoneum. A laparoscope was placed in the A incision. B and C incisions were made under laparoscopic observation. After finding the appendix, the adhesions and appendiceal mesentery were separated, and the root of the appendix was clamped with separating forceps and ligated. After removing the appendix, the residual appendiceal mucosa is destroyed using an electrocoagulation hook, and the appendix is removed. The incision was then sutured, and routine anti-infective treatment was given postoperatively.

Nursing methods

Routine nursing: Patients in the control group adopted routine nursing. First of all, they were fasted from food and water for 6 h before surgery. During surgery, thermal insulation measures were taken, an abdominal drainage tube and gastric tube were placed, and the incision was cared for to avoid infection. After surgery, the patients were required to have more meals a day but less food at each, and a liquid diet would not be given until defecation and exhaustion. In the later stage, the patients gradually transitioned to semi-liquid and general food.

FMEA-based nursing: Based on the control group, an FMEA group was established, with an experienced nurse supervisor and attending physician as supervisors, and all nursing staff involved received FMEA-based nursing training, after which the nursing process was planned, the highest risk factors, potential causes, and possible problems affecting the recovery of patients who underwent appendectomy in treatment and nursing were analyzed based on experience

obtained from previous case and actively discussed for formulation of improvement measures to promote postoperative recovery of patients. After admission, patient data were collected in a timely manner, targeted interventions were conducted according to their conditions, and detailed examination and evaluation of both physiological and psychological conditions of patients were performed to help relieve the negative emotions of patients in a timely manner. Patients' diets and daily schedules were adjusted to be regular as required by the surgery to ensure the smooth development of surgical treatment. The consciousness of the aseptic operation was emphasized, the aseptic operation was followed, the monitoring of the environment of the operating room was strengthened, and thermal insulation measures were taken. After surgery, adverse reactions that tend to occur were actively intervened, dietary intervention was enhanced, an appropriate amount of activity was arranged for each patient based on the recovery, and assistance was given in carrying out appropriate activities in the ward. Patients were encouraged and supported to establish confidence; their diets were adjusted to ensure the nutrition intake so as to accelerate the recovery speed until discharge. Patients were followed up by telephone for 3 months after surgery, and any questions they raised were answered; in addition, they were instructed in functional exercises so that their quality of life was improved.

Outcome measures

(1) The time to recovery of bowel sounds, time to defecation by anus, time to anal exhaust, and length of stay were statistically analyzed in both groups after surgery.

(2) Patients' pain was assessed using the Visual Analogue Scale (VAS, 0-10 points)[12] before surgery and at 24 h, 48 h and 72 h after surgery, respectively. The higher the score, the higher the pain level of the patient.

(3) Patients' sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI, 0-21 points)[13] before surgery and at 1 d and 5 d after surgery, with higher scores indicating poorer sleep quality.

(4) Patients' psychological status was assessed using the self-rating anxiety/depression scale (SAS/SDS)[14] before and after nursing, with lower scores indicating less anxiety and depression; severe anxiety/depression was considered to be present when scores were ≥50.

(5) A self-made questionnaire was used to assess nursing satisfaction at discharge (1-10 points). The results were very satisfied (10 points), satisfied (7-9 points), to be improved (4-6 points), and unsatisfied (1-3 points).

(6) Postoperative complications, such as intestinal adhesions and incisional infections, were counted in both groups.

Statistical methods

Statistical analysis was performed using the software SPSS v23.0. Measurement data were expressed as mean ± standard deviation ($\bar{x} \pm s$), with independent sample t test for comparison between two groups and analysis of variance and

Table 1. General data

Group	n	Age	Male / Female	Body mass index (kg/m²)	History of gastrointestinal disease No / Yes	Family history of the disease No / Yes
Research	52	38.2±6.8	25 (48.08)/ 27 (51.92)	23.8±2.2	37 (71.15)/ 15 (28.85)	50 (96.15)/ 2 (3.85)
Control	52	39.6±5.9	23 (44.23)/ 29 (55.77)	24.3±2.6	35 (67.31) /17 (32.69)	51 (98.08)/ 1 (1.92)
χ^2/t		.265	.155	.292	.181	.343
P value		1.121	.694	1.059	.671	.558

Bonferroni post-hoc test for comparisons across multiple time points. Enumeration data were expressed as percentages (%) and compared using the chi-square test. $P < .05$ indicates a statistically significant difference.

RESULTS

Comparison of general data

Patients in the two groups were compared in terms of age, sex, body mass index (BMI), etc. The results showed no statistical difference in general data between the two groups ($P > .05$, Table 1), suggesting comparability.

Comparison of postoperative recovery time

The time to recovery of bowel sounds, time to defecation by anus, time to anal exhaust, and length of stay were respectively (12.67±1.48) h, (40.63±3.79) h, (22.25±2.04) h, and (5.892±1.06) d in the research group, which were significantly shorter than those in the control group ($P < .05$, Figure 1).

Comparison of postoperative pain

There was no statistically significant difference in VAS scores between the two groups before and at 24 h after surgery ($P > .05$), while the scores in the research group were lower than those in the control group at 48 h and 72 h after surgery ($P < .05$). There was no significant change in the VAS scores before and at 24 h after surgery in both groups, and the VAS began to decrease at 48 h after surgery and reached its lowest value at 72 h after surgery ($P < .05$, Figure 2).

Comparison of postoperative sleep quality

Also, the two groups showed relatively consistent PSQI scores before surgery ($P > .05$). On day 1 and day 5 after surgery, the scores were respectively (10.10±1.16) and (6.52±1.13) in the research group, lower than those in the control group ($P < .05$). After surgery, both groups showed decreased PSQI scores, which reached the lowest value at 5 d after surgery ($P < .05$, Figure 3).

Comparison of changes in psychological status

Before nursing, there was no difference in SAS and SDS scores between the two groups ($P > .05$). After nursing, the SAS and SDS scores decreased in both groups, which were respectively (17.33±3.22) and (16.33±3.24) in the research group, lower than those in the control group ($P < .05$, Figure 4).

Comparison of nursing satisfaction

As indicated by the results of the satisfaction survey, there was no significant difference in the number of patients

Figure 1. Comparison of postoperative recovery time. A, time to recovery of bowel sounds. B, time to defecation by anus. C, time to anal exhaust. D. length of stay. $P < .05$.
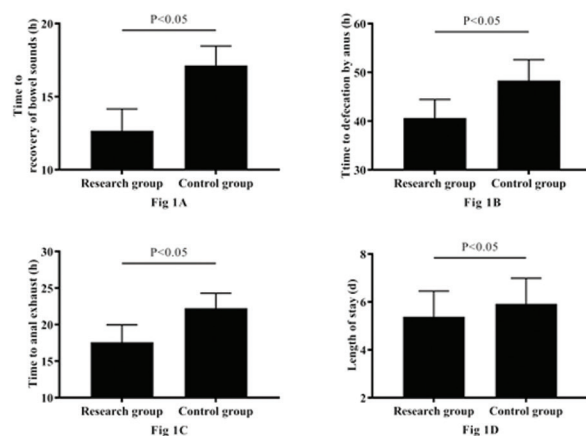

Figure 2. Comparison of Visual Analogue Scale (VAS). A, VAS before surgery. B, VAS 24h after surgery. C, VAS 48h after surgery. D, VAS 72h after surgery. E, the change curve of VAS after surgery, a,b,c,d's indicate statistically significant differences from VAS before surgery, 24h and 48h after surgery, respectively ($P < .05$).
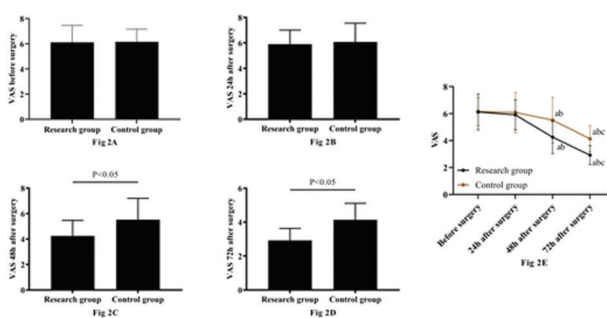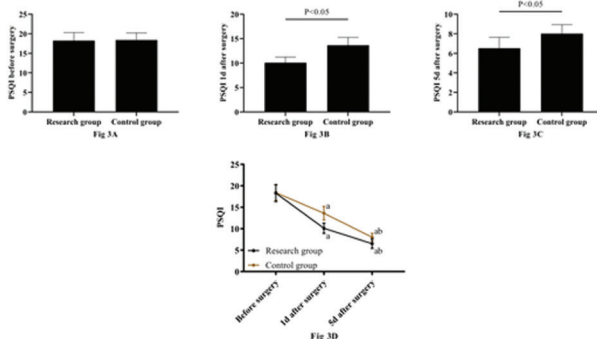

Figure 3. Comparison of Pittsburgh Sleep Quality Index (PSQI). A, PSQI before surgery. B, PSQI 1d after surgery. C, PSQI 5d after surgery. D, the change curve of PSQI after surgery, a,b's indicate statistically significant differences from PSQI before surgery and 1d after surgery, respectively ($P < .05$).

who were satisfied and unsatisfied with nursing between the two groups (P = .216, .079); however, a larger number of patients who were very satisfied with nursing and a smaller number of patients who thought their nursing should be

Figure 4. Comparison of changes in psychological status. A, self-rating anxiety scale (SAS). B, self-rating depression scale (SDS). a,b's indicate statistically significant differences from PSQI before the nursing and research group, respectively ($P < .05$).
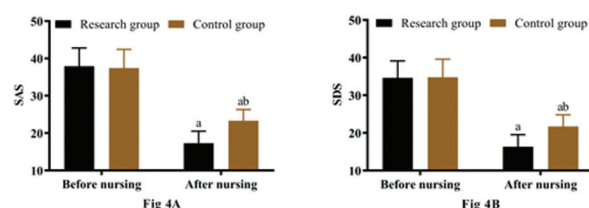

Table 2. Nursing satisfaction

Group	n	Very satisfied	Satisfied	Needs improvement	Dissatisfied
Research	52	35(67.31)	15(28.85)	2(3.85)	0(0)
Control	52	18(34.62)	21(40.38)	10(19.23)	3(5.77)
χ^2		11.12	1.529	6.029	3.089
P value		.001	.216	.014	.079

Table 3. Postoperative complications

Group	n	Intestinal adhesions	Incisional infection	Bleeding	Abdominal pain	Overall incidence
Research	52	0(0)	0(0)	1(1.92)	1(1.92)	3.85
Control	52	1(1.92)	1(1.92)	2(3.85)	4(7.69)	15.38
χ^2						3.983
P value						.046

improved were observed in the research group ($P = .001, .014$, Table 2).

Comparison of postoperative complications

Postoperative complications were counted in both groups. The overall incidence was 3.85% in the research group and 15.38% in the control group, which was significantly lower in the research group ($P = .046$, Table 3).

DISCUSSION

AP is a prevalent and sudden disease, and although surgery can be effective in treating it, post-surgical care is of great importance in improving the patient's recovery.[15] Although routine nursing meets the basic nursing needs of patients, inadequate or untimely nursing may occur and affect the surgery and postoperative recovery.[16] Therefore, more efficient nursing interventions should be actively explored to facilitate the early recovery of patients. In this study, the time to recovery of bowel sounds, time to defecation by anus, time to anal exhaust, and length of stay were significantly shorter in the research group than in the control group after surgery, suggesting that FMEA allows the patients with AP recover from surgery in a shorter time. Similarly, it is also suggested in previous studies that FMEA-based nursing improves the recovery of patients with severe pneumonia and ischemic stroke,[17-19] which is consistent with our findings. In addition, postoperative VAS, SAS, SDS, and PSQI scores decreased more significantly in the research group than those in the control group, indicating that FMEA-based nursing better improves the postoperative recovery experience of patients with AP.

FMEA is a risk prediction method that combines theoretical knowledge with practical experience; each member of the FMEA team actively participates in the discussion based on their own work experience and professional knowledge to conduct in-depth analysis around factors that may affect postoperative recovery, then formulates workflow and identifies potential failure modes, and develops and implements corrective measures, so as to ensure that safe and effective nursing and management are provided to patients during hospitalization.[20,21] Studies have shown that FMEA-based nursing intervention improves patient satisfaction with nursing during stroke recovery,[22,23] which also supports the results of this study. It is believed that, in implementing the FEMA-based nursing, negative psychological emotions and poor compliance of patients should be identified as potential failure modes affecting postoperative recovery, and potential failure causes (e.g., fear of surgery, postoperative pain, inadequate patient cognition) should be analyzed; based on the causes above, target nursing measures are developed and implemented by medical staff, including introducing relevant knowledge about surgery to patients, answering patients' questions, actively communicating with patients and comforting them, guiding them to achieve pain relief through attention diversion, massage, or other methods, organizing psychological counseling or lecture in departments, etc., which significantly improves patients' understanding of the disease and surgery, alleviates their fears, and enhances their trust in nursing staff and self-confidence in overcoming the disease, so that patients will actively cooperate with nursing work; in addition, the reduction of pain is beneficial to the alleviation of patients' negative emotions.[19,24] FMEA-based nursing emphasizes the implementation of corrective measures. Patients receive standardized and meticulous nursing during hospitalization so that the nurse-patient relationship is closer and the patients are physically and mentally protected, further contributing to patients' satisfaction with nursing and a better recovery experience. Therefore, the improvement of patient satisfaction with nursing in the research group was also expected.

Last, it was found that the incidence of postoperative complications was significantly lower in the research group than in the control group, indicating that FMEA-based nursing can significantly reduce the incidence of postoperative complications in patients with AP. FMEA analysis is a reliable prospective analysis method that predicts certain hidden risks of surgery by combining AP surgery theory with clinical experience and prompts active preventive measures.[25] In this study, FMEA indicated that inappropriate diet, poor or falling off of drainage tube, unclean surgical incision, and poor postoperative exercise may cause postoperative complications. Hence, these causes were analyzed, and corresponding nursing measures were formulated and fully implemented, including postoperative diet planning, guidance, and assistance on patient turning over and movement, maintenance of unobstructed drainage tube and change of drainage bag every day, regular change of incision dressing, maintenance of dry dressing, encouragement to patients on early ambulation,

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which significantly reduces the incidence of postoperative incision infection, ileus adhesive, abdominal abscess, etc.[26] The treatment safety of AP surgery is also significantly improved, making AP surgery more popular.

However, due to the small number of cases and the short study period, the findings of this study exhibit a certain degree of contingency. Since many outcome measures in the study were scales scored subjectively, results deviation may exist, and more observation and comparison of objective indicators will be supplemented in the future. Moreover, there is still room for optimization of specific implementation details of FMEA-based nursing, which is worthy of in-depth analysis.

CONCLUSION

The implementation of FMEA-based nursing for patients with AP during hospitalization significantly relieves anxiety and depression, improves nursing satisfaction, reduces the occurrence of postoperative complications, shortens the length of stay, improves their treatment experience, and allows a better environment for the implementation of AP surgery, which is of great clinical significance. In the future, it is recommended that the use of FMEA-based nursing after AP surgery be popularized to provide better medical services for patients.

ETHICAL APPROVAL
Not applicable.

CONSENT TO PUBLISH
All authors gave final approval of the version to be published.

AVAILABILITY OF DATA AND MATERIALS
The data that support the findings of this study are available from the corresponding author upon reasonable request.

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