Effect of Clinical Pathway Application on Health Outcomes of Patients Undergoing Colorectal Surgery

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Abstract

Colorectal cancer is a disease with a major worldwide burden. Care for colorectal cancer patients undergoing surgery tends to be suitable for clinical pathway development because of high-cost of the procedure and the predictable course of events and complications that may occur during hospitalization. **Objective:** Determine the effect of clinical pathway application on health outcomes of patients undergoing colorectal surgery. **Setting:** The study was conducted in the Colon and Rectal Surgical Unit at Alexandria Main University Hospital. **Subjects:** A convenience sample of 50 adult patients with colon or rectal cancer or both undergoing colorectal surgery was included. They were equally and randomly recruited into two groups: a control group and a study 25 each. **Tools:** Three tools were used for data collection. I: Perioperative Colorectal Surgery Patient Assessment. II: Clinical Pathway Variance Observational Checklist, and III: Colorectal Surgical Patient's Satisfaction tool. **Results:** There were statistical significant differences between control and study group with whom the (clinical pathway was implemented) as they showed better post colorectal outcomes in relation to wound healing, pain control, achieving criteria for discharge. **Conclusion:** Patients undergoing colorectal surgery on whom the clinical pathway was applied exhibited improved postoperative outcomes than those on whom it was not. **Recommendations:** It is recommended that colorectal surgery clinical pathway be used rather than the traditional delivery of care.

Keywords: Colorectal Cancer, Health Outcomes, Clinical Pathway.

Introduction

Colorectal cancer (CRC) is a disease with a major worldwide burden. CRC is considered the third most common cancer worldwide after lung and breast cancers with two thirds of all gastrointestinal cancers occurring in the more developed regions of the world. It affects men and women of all racial and ethnic groups **(El sayed, 2013).**

In Egypt, colorectal cancer is the third most common malignancy in males after urinary bladder and lymphopoietic malignancies, while in females it ranks the fifth after breast, lymphopoietic, cervix and urinary bladder. According to Alexandria

Institute of Medical Research, there were 344 patients were admitted to hospitals suffering from colon or rectal cancer throughout 2013. For colon cancer, there were 144 male patients and 100 females patients while rectal cancer was 73 for males and 29 for females **(Hawkey et al., 2012; Punder, 2010).**

Colon cancer is a mucosal disease that drives from mucosal lining of the bowel wall. While the incidence of colorectal cancer varies widely from country to country throughout the world, adenocarcinoma is the most common colorectal cancer **(El sayed, 2013).** The cause of colorectal cancer has not been established. The disease mainly occurs in people over the age of 50, although specific form of hereditary colorectal cancer is lynch syndrome or hereditary non polyposis colorectal cancer (HNPCC) characterized by early age of onset. People most at risk include those with disorders in the intestinal tract, especially ulcerative colitis and familial polyposis. Other risk factors are smoking, alcohol consumption, physical inactivity, obesity and a diet high in saturated fat or red meat, as well as inadequate intake of fruits and vegetables **(Kamel et al., 2010).**

Cancer of the colon and rectum is predominantly (95%) adenocarcinoma, which arise from epithelial lining of the intestines. It may start as a benign polyp but may become malignant, invade and destroy normal tissue, and extend into surrounding structures. Cancer cell may migrate away from the primary tumor and spread to other parts of the body as liver, lungs and

peritoneum **(Cancer research UK, 2010).**

Symptoms of colorectal cancer are mild and vague. The most common presenting symptom is a change in the bowel habits. The passage of blood in or on the stool is the second most common symptom. Unexplained anemia, anorexia, weight loss and fatigue may also be present **(Zeen eldin et al., 2012).**

Along with an abdominal and rectal examination, the most important diagnostic procedures for cancer of the colon are fecal occult blood testing, double contrast barium enema, proctosigmoidoscopy, and colonoscopy. Treatment of colorectal cancer depends on the stage of the disease and consists of surgical removal of the affected portion of the intestine or tumor, supportive and adjuvant therapy **(National Cancer Institute (NCI), 2012; Zeen eldin et al., 2012).**

Surgery is the primary treatment for most colon and rectal cancers. It may be curative or palliative. Advances in surgical techniques can enable the patient with cancer to have sphincter-saving devices that restore continuity of the GI tract. The type of surgery recommended depends on the location and size of the tumor. Cancers limited to one site can be removed through the colonoscope. Laparoscopic colotomy with polypectomy minimizes the extent of surgery needed in some cases **(Gado et al., 2013).**

Acolostomy is the surgical creation of an opening (stoma) into the colon. It can be created as a temporary or permanent fecal diversion. It allows the drainage or evacuation of colon contents to the outside of the body. The

consistency of the drainage is related to the placement of the colostomy, which is dictated by the location of the tumor and the extent of invasion into surrounding tissues. With improved surgical techniques, colostomies are performed on less than one third of patients with colorectal cancer **(Cancer research UK, 2010; Kamel et al., 2010).**

Caring for patients undergoing colorectal surgery requires multidimensional approach. Colorectal surgery is a prime example with high volumes of major procedures, significant morbidity, prolonged hospital stay and unplanned readmission **(Cancer research UK, 2010; Kamel et al., 2010).**

The major goals for the patients undergoing colorectal surgery include attainment of optimal level of nutrition, maintenance of fluid and electrolyte balance, reduction of anxiety level, learning about diagnosis, surgical procedures, and self-care after discharge; maintenance of optimal tissue healing; protection of peristomal skin; learning how to change the appliance; expressing feeling and concerns about the colostomy and avoidance of complications **(Hinkle et al., 2014).**

Clinical pathways are standardized, evidence based interdisciplinary care management plans, which identify an appropriate sequence of clinical interventions, time frames, milestones and expected outcomes for a comparable patient group by diagnosis or surgical procedures **(Barbra and Nancy, 2010).**

The provision of high quality care for patients undergoing colorectal surgery presents several challenges. Coordinated care by specialist staff is associated with reduction of mortality, complications, dependency and length of stay in hospital. There is increasing pressure to incorporate recent research evidence into clinical practice and introduce management practice which streamline the process of care to increase effectiveness or produce cost saving. One way of achieving these objectives is to introduce clinical pathway, a project network technique which is gaining increasing popularity in the health care delivery **(Williams and Hopper, 2003).**

Deviation from the expected pathway of care is called variance which is useful for early identification and resolution of problems affecting outcomes or the time required to achieve the goals. Clinical pathways are also referred to integrated care pathways, care pathway, clinical map, anticipated pathway of recovery, and management care pathway or practice guidelines in different settings **(Ignotavicius and Workman, 2002).**

Development of clinical care pathway is an interdisciplinary task. Steps in its development include formation of a team of appropriate professionals, research to determine the current practice to identify evidence for best practices, and production of preliminary pathway. This pathway is then implemented in a target group of patients to assess applicability and refine interventions before production of the final agreed pathway **(Ignotavicius and Workman, 2002; Williams and Hopper, 2003).**

Aim of the study:

The present study aimed to determine the effect of clinical pathway application on health outcomes of patients undergoing colorectal surgery.

Research hypothesis

- Patients undergoing colorectal surgery on whom the clinical pathway is applied will exhibit improved post operative outcomes than those on whom it is not applied.

Materials and Method

Materials

A. **Research Design:** A quasi experimental design was used to conduct this study.

B. **Settings of the study:** The study was conducted in the Colon & Rectal Surgery Unit at Alexandria Main University Hospital. This unit is divided into 4 rooms; 2 rooms comprising 22 beds in the male department and 2 rooms comprising 22 beds in the female.

C. **Subjects of the study:** A convenience sample of 50 adult patients with colon or rectal cancer or both undergoing colorectal surgery was included. The subjects were classified randomly into two equal groups of control and study group 25 patients, each.

Inclusion criteria: Subjects of the study were selected according to the following criteria:

- Adult age range from 21- 60 years old of both sexes.

- Able and willing to communicate and cooperate.

- Having no past history of other organ cancer.

- Without vital organ failure (cardiac, hepatic, renal).

D. Tools of the study: Three tools were used to collect necessary data in order to fulfill the study's aim.

Tool I: Perioperative Colorectal Surgery Patient Assessment:

This tool was developed by the researcher based on a thorough literature review (Ward and Lunevicius, 2013). It included the following parts: [Preoperative, Intraoperative and Postoperative Assessment].

- **Pain assessment**: The Numerical Rating Scale was used to assess intensity of pain. that comprises 10 points from zero to ten.

- **Wound assessment:** The total score value of patient's wound observations ranged between 7-26. The lower the score the higher the indicator for wound healing.

Type of wound: its score ranged from one to three, score one for closed wound, score two for semi-open wound, and score three for open wound.

Exudates amount: its score ranged from one to five, score one for none (dry wound), score two for scant, score three for mild, score four for moderate, and score five for large amount.

Wound edges: its score ranged from one to four.

Skin color surrounding wound: its score ranged from one to five, score one for pink or normal, score four for dark red or purple &/or non-blanchable, and score five for Black or hyper pigmented color.

Swelling surrounding wound: its score ranged from one to five.

Drain discharge: its score ranged from one to two, score one for absent, and score two for present discharge.

- **Stoma assessment:** This included type, location, color, size, opening, surface, length, sensation, function, output and fecal control.

- **Peristomal skin assessment:**

Discoloration: Size of discoloration, Severity of discoloration and Size of erosion.

Scoring system: scores ranged from zero to fifteen points, the highest score, the worst peristomal skin condition.

- **Post operative complications:** This part included assessment of the patient for absence of: paralytic illues, bleeding, fluid & electrolyte imbalance, wound healing disorders, bowel obstruction, anastmosis leakage and peritonitis and respiratory complications.

- **Achieving criteria for discharge:** Those criteria included tolerance of oral intake, Recovery of lower gastrointestinal functions, adequate pain control and ability to mobilize and self-care.

Tool II: Clinical Pathway Variance Observational Checklist:

This tool was developed by the researcher based on reviewing of the related literature (Pritts et al., 1999; Bleser et al., 2006),it aimed to measure variations of performances. Observations of performance were checked while patient care was rendered. It was applied to the study subjects in a form of observational checklist related to items of patients' care which are assessment/ monitoring, psychological care, vital signs, medications, nutrition, mobility, elimination, pain management, teaching, health education and prevention of complications.

Scoring system: Variations of clinical pathway performance were checked according to the researcher's observations on 3 points likert scale. The score ranged from one to three with a total score value ranging between 10-30, as follows:

- Three equal to "done adequately" if the activity followed was safe, "complete", "accurate" step and performed on time, with the required frequency.

- Two equal to "done inadequately" if the activity not followed safely, completely, and accurately or not performed on time, without the required frequency.

- One equal to "not done" if the activity was not performed at all.

Tool III: Colorectal Surgical Patient's Satisfaction tool:

This tool was adopted from **Salisbury et al., (2005).** It was translated to Arabic language and tested for validity and reliability by

Abd El-Aziz, (2011). Its internal consistency reliability was (r = 0.840)

Scoring system

Each patient's response about satisfaction related to the caring process was expressed on a 3 point Likert scale ranging from 1 to 3; a score(1) dissatisfied, (2) neutral, (3) satisfied. The total score value ranged between 15 - 45.The higher the score the higher the patient's satisfaction level. Total patient's satisfaction was calculated by sum of his own responses related to all care process items. For more convenience, patient's total score ranged from 15 to 25 was considered very dissatisfied, from 26 to 35 was considered neutral and from 36 to 45 was considered satisfied.

METHOD

- An official approval to conduct the study was obtained after explanation of the purpose of the study.

- The developed tools were tested for its content validity by 6 professors from Faculty of Nursing and 1 professor from Faculty of Medicine.

- A pilot study was carried out on 5 patients and necessary modifications were done accordingly

- The researcher explained the aim of the study to patients and obtained their verbal consent to participate in the study. Every patient was interviewed at his/her room individually for a period of 45-60 minutes.

- **Development of colorectal surgery clinical pathway (with or without colostomy):** was developed by the researcher throughout four phases **(Amr, 2014).**

Phase one: Assessment of the Current Practice:

- Study of hospital routine as baseline for clinical pathway development: Nurses performance related to pre and post colorectal surgery care in colorectal surgery unit was watched for a period of one month, before establishing the clinical pathway.

- **Data collection of the control group:** Data collection started with control subjects who were managed according to hospital routine. Preoperative assessment of every patient was done preopratively using (Tool I part I). Subsequent assessment using part (II) "Intraoperative assessment" was carried out during surgery by the anesthesiologist. using tool I part III " Post operative assessment" was utilized by the researcher daily for seven days post operatively in order to evaluate patient's health outcomes. Tool III was utilized by the researcher to assess patients satisfaction before discharge from the study setting.

Phase two: Clinical pathway development:

The researcher prepared a colorectal surgery clinical pathway with or without colostomy which starts with personal data in addition to date and time of admission and discharge. The template format was prepared in a matrix form that included horizontal

raw and vertical columns. Patient goals were previously assigned. The time frame of colorectal surgery pathway was written horizontal raw as follow: Preoperative period, Intraoperative, and period from the day of surgery to the 7th day post operatively. Content validity of clinical pathway was ascertained by 9 experts in medical surgical nursing, colorectal surgery and necessary modifications were done.

Development of colostomy care illustrated educational material:

A handout in a form of an illustrated colored educational booklet for patients undergoing colorectal surgery with colostomy was developed in Arabic by the researcher to help the patient and his family to know how to care for colostomy during hospitalization and after discharge. It included clear, simple and brief explanation about digestive system, definition of colostomy, causes, sites, types of colostomy, characteristics of healthy colostomy, pre and post operative preparations, care of stoma and peristomal skin, types of pouches and appliances, changing, emptying appliance and changing pouch, colonic irrigation, colostomy and nutrition, work, clothes, praying, exercise, travel, sexual relation, danger signs, minor colostomy complications and how to manage, in addition to surgical complications.

A collaborative team of experts (including 6 faculty members of medical surgical nursing, two colorectal surgeons, one nursing educator, were involved in the jury for establishing of the colorectal surgery clinical pathway. Also the educational materials were submitted to the jury

members to assure their content validity, clarity and completeness.

Phase three: Clinical Pathway Implementation and Data collection of the study group: Data collection from the study group who were subjected to the clinical pathway implemented by the researcher was carried out after completion of control group data collection. Before patient discharge patient's satisfaction (tool III) (Colorectal Surgical Patient's Satisfaction tool) was assessed Variance tracking: Variances from colorectal surgery clinical pathway observational checklist were observed and recorded using tool II (Clinical Pathway Variance Observational Checklist).

Phase four: Clinical Pathway Evaluation Statistical Analysis:

Evaluating the clinical pathway consisted of comparing the outcomes of both groups using Tool I, II and III in relation to (postoperative pain relief, wound condition, stoma condition, patient's satisfaction, post operative complications as nausea, vomiting, anastmosis leakage and respiratory complications, length of hospital stay, achieving criteria for discharge as well as hospital readmission within 4 weeks of discharge.

Analytical statistics:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. Quantitative data were described using mean and standard deviation for normally distributed data. Comparison between different groups regarding categorical

variables was tested using Chi-square test Fisher's Exact test or Monte Carlo. The level of significance was judged at the $p \leq 0.05$.

Ethical Considerations:

Informed written consent of the patients was obtained after explanation of the aim of the study. Privacy and anonymity were maintained for all participants. Confidentiality of the collected data was assured. Participation in the research was voluntary and right to withdraw from the study at any time was confirmed.

Results:

Table (1) shows preoperative assessment of patients undergoing colorectal surgery in control and study groups in relation to patients' profile. This table reveals that more than half of the control (60.0%) and study group (68.0%) were from 46-60 years of age, two thirds of control group (72.0 %) were female, the highest percentage in both control and study group were illiterate (40.0%, 44.0%) respectively and the highest percentages (64.0%, 68.0%) respectively were married.

Table (2) illustrates the distribution of the study and control group regarding to their medical data. It observed that (60.0%) of the control group and the majority (80.0%) of the study were diagnosed with colon cancer, the majority of both the control and study group (80.0%. 72.0%) were nonsmokers respectively, more than half of patients of both the control and study group had no associated medical diseases (68.0%, 56.0%) respectively. Also, the majority of both control and study group (84.0%, 88.0%) had no

family history of cancer respectively with no statistical significant difference regarding medical data and physical assessment.

Table (3) shows differences in wound healing of the control and study group. The total wound healing score of the mean ± SD were (9.99±0.70) in control group compared to mean ± SD = (8.85± 0.58) in the study group with statistical significant difference as (P = 0.001*).

Table (4) illustrates the comparison between the study and control group regarding the presence of post operative complications. It was observed that none of the control and study groups were experienced any post operative complications.

Table (5) displays the comparison between the study and control group regarding to length of hospital stay and readmission. Statistical significant differences between both groups was found (P = 0.005*). Also, it was observed that the majority of patients in the control group and the entire study group weren't readmitted to the hospital within 4 weeks after discharge.

Table (6) demonstrates the variances in the clinical pathway performance of the studied patients undergoing colorectal surgery. This table reveals that the seven items of the clinical pathway; assessment/ monitoring, psychological care, medications, nutrition, mobility, health education and elimination were "done adequately" for 100% of patients of the study group.

Table (7) shows comparison of total satisfaction in caring process between control and study group. The table shows that, the mean patients' satisfaction in the control group (53.57 ± 24.42), while in the study group the mean score was (96.14 ± 7.28) with a statistical significant difference between the mean scores of the control and study groups (P = 0.001*) in which the study group was more satisfied than the control group.

Discussion

Clinical Pathway is a systemic approach to manage health care that involves a high degree of collaboration between patients, nurses and various health care team professionals. It serves as reminders of interventions that clinical physicians, nurses and health care staff believe are most likely to be needed by the patient **(Choo and Cheah 2000).**

In Egypt, there is a lack of experimental evidence to verify the benefits of clinical pathway application on colon or rectal cancer patients undergoing surgical treatment.

Concerning sex, the findings of the current study showed that the majority of patients in both control and study groups were female. This is consistent with **Gado et al., (2013)** who found that more than half of the study group that diagnosed with colorectal cancer were females. On the other hand, this finding was contradicting with **Lawrence, et al, (2007) and Weige et al. (2009)** who found that women are less likely than men to develop cancer, as estrogen hormone reduces the incidence of cancer in women. Generally, estrogen appears to be protective against colorectal cancer development in women.

The present study showed that higher proportions of studied patients were from rural area. This finding is far away from Miller, et al and Amey, et al., (2012) who stated that, behavioral factors such as increased prevalence of tobacco use and environmental pollution are considered as risk factors for cancer especially in urban area.

This study showed that a profound impact of clinical pathway application on the study group wound condition. This may be related to daily dressing using aseptic technique, continuous wound assessment, wound support during cough, early ambulation, and early removal of wound drains, psychological care and use of prophylactic antibiotics. This result is in line with **Van Dam et al. (2013)** who concluded that wound assessment and dressing under aseptic technique can enhance wound healing process. Similarly, Rotter et al. (2010) reported that compared with usual care, clinical pathways were associated with a reduction in wound infections and edema.

Postoperative pain was significantly lower among the study group than the control group. Pain intensity began to decrease by the 2nd day post operative in the study group. These findings may be related to intense nursing interventions introduced to study group including continuing pain assessment and management including relaxation techniques as deep breathing exercise, positioning and proper wound

management. Also, the findings in the present study are in line with **Shalaby, (2010)** who found a significant correlation between postoperative pain and pathway implementation for patients undergoing valvular surgery.

Colorectal surgeries are accompanied with major post operative complications as nausea, vomiting, wound complications, pulmonary complications, paralytic illus, bleeding, fluid and electrolyte imbalance and colostomy complications. Proper preoperative preparation, continuous assessment and monitoring of vital signs, level of consciousness, bowel sound and electrolyte level; recording intake and output, wound care, early ambulation and exercises can control the incidence of post operative complication. In the present study, no significant difference could be detected between the control and study group regarding post operative complications. This is congruent with **DeOliveira et al. (2006)** who found that continuous assessment and monitoring of patients' physical and psychological condition can eliminate the risk for post operative complications.

Regarding achieving criteria for discharge, the results of the present study showed statistical significant differences between the control and study group regarding achieving criteria for discharge. These may be related to the proper preoperative preparations as bowel preparation, continuing assessment and monitoring of pain, wound condition, vital signs, intake and output. In addition to post operative early ambulation, controlling of nausea and vomiting **(Halaszynski et al., 2004).**

Regarding ability to mobilize, self care and carrying out activities of daily living which are considerd an extensive indicator for good recovery, the results of the present study showed a statistical significant difference between the control and study group. These may be related to proper pain control measures, psychological care, and preventive strategy for post operative complications as deep breathing and coughing exercise for prevention of pulmonary complications and ankle exercise for avoidance of deep vein thrombosis. These findings are in harmony with **DeOliveira et al., (2006) and Law et al., (2004)** who found that prevention of complications, controlling discomforts and continuous monitoring of pain and encouraging the patient to participate in the plan of care can improve the patient tolerance and ability to participate in activity of daily living.

The average length of stay (LOS) in hospitals is often used as an indicator of efficiency of care provided. The current study revealed that the clinical pathway for patients undergoing colorectal surgery with or without colostomy had a beneficial impact on the duration of hospitalization **(Abd El-Aziz, 2011).**

Patients of the study group were more satisfied with the health information that were given by physicians and the researcher. These results are in line with **Nagata et al. (2007)** who mentioned that a therapeutic patient relationship involves listening and addressing specific needs had a positive impact on the patient's satisfaction level. It can be noted that, the education of

patient and their families and giving written instructions in form of illustrated manual educational booklet about the colostomy care preoperative and postoperative had a positive impact on patients' satisfaction **(Abass, 2014).**

These results could be explained by a focused comprehensive care and thorough continuous education that introduced to study group patients and their families about the plan of care and involving them in its implementation throughout the whole perioperative period. Significant pain reduction, enhancing patients' mobility, and shorter length of hospital stay most probably played an important role in the increasing satisfaction level of the patients in the study group. Thus, nurses who respond quickly and show respect for patient and family concerns may be viewed as more understanding and caring, and this response can lead to higher levels of patient satisfaction.

Also, the results of the present study exhibited that all the required care was done correctly concerning the seven items of clinical pathway. In this regard, **Amr, (2014**) found that practice variations were reduced significantly following implementation of the clinical pathway for diabetic patients undergoing lower limb amputation. These findings, however may be far away from **Abass, (2014)** who found no variances in a clinical pathway for patients undergoing percutaneous coronary intervention.

The forgoing discussion highlights the importance of comprehensive nursing interventions which are associated with higher patients' satisfaction, fewer discomfort and clinical problems experienced by patients, and fewer unscheduled readmission to hospitals.

Therefore, there is a great need to replace traditional practice with the clinical pathway model to ensure that nurses can deliver care in a safe and competent manner in line with international standards.

Conclusion

Patients undergoing colorectal surgery on whom the clinical pathway was applied exhibited significantly better health outcomes compared with their control group, in relation to:

- Wound healing, pain control and achieving criteria for discharge, better colostomy care, healthy peristomal skin and average length of stay in the hospital than those receiving traditional hospital nursing care and patients satisfaction about caring process.

Recommendations

- Arabic and English versions of the clinical pathway must be available for all health team personnel as well as patients.
- Training workshops and courses for nurses about implementation of clinical pathway are required

Table (1): Preoperative assessment of patients undergoing colorectal surgery in the control and study groups in relation to patients' profile.

Patient profile	Control (n= 25)		Study (n= 25)		χ^2	p
	No.	%	No.	%		
Age (year)						
20 – 45	10	40.0	8	32.0	0.347	0.556
46 – 60	15	60.0	17	68.0		
Sex						
Male	7	28.0	10	40.0	0.802	0.370
Female	18	72.0	15	60.0		
Educational level						
Illiterate	10	40.0	11	44.0		
Read and write	2	8.0	1	4.0		
Primary education	8	32.0	7	28.0	0.695	1.000
Preparatory education	5	20.0	6	24.0		
Secondary education	0	0.0	0	0.0		
University	0	0.0	0	0.0		
Marital status						
Single	4	16.0	3	12.0		
Married	16	64.0	17	68.0	0.838	[MC]p=
Divorced	2	8.0	1	4.0		1.000
Widow	3	12.0	4	16.0		
Occupation						
Manual	6	24.0	4	16.0		
Employee	1	4.0	3	12.0	1.795	0.678
Housewife	16	64.0	17	68.0		
Not working	2	8.0	1	4.0		
Residence						
Urban	7	28.0	9	36.0	0.368	0.544
Rural	18	72.0	16	64.0		

χ^2: Chi square test   MC: Monte Carlo testt

Table (2): Distribution of the control and study group regarding to their medical data

Medical data	Control (n= 25)		Study (n= 25)		χ^2	p
	No.	%	No.	%		
Diagnosis						
Colon cancer	15	60.0	20	80.0		
Rectal cancer	4	16.0	1	4.0	2.767	^{MC}p= 0.237
Colorectal cancer	6	24.0	4	16.0		
Smoking						
Smoker	2	8.0	5	20.0		
Non smoker	20	80.0	18	72.0	1.589	0.612
Quitter	3	12.0	2	8.0		
Associated diseases						
None	17	68.0	14	56.0		
Hypertension	2	8.0	4	16.0	1.225	^{MC}p= 0.823
Diabetes Mellitus	4	16.0	5	20.0		
HTN + cardio	2	8.0	2	8.0		
Previous hospitalization						
No	10	40.0	9	36.0	0.085	0.771
Yes	15	60.0	16	64.0		
Family history of cancer						
No	21	84.0	22	88.0	0.166	^{FE}p= 1.000
Yes	4	16.0	3	12.0		
BMI						
Min. ± Max.	17.58 – 39.44		17.58 – 39.44		t=	0.637
Mean ± SD.	26.06 ± 6.86		27.01 ± 7.23		0.475	
Abdominal assessment						
Intact	21	84.0	21	84.0	χ^2=	^{FE}p=
Old scar	4	16.0	4	16.0	0.000	1.000
Other treatment modalities						
No	21	84.0	21	84.0		
Radiotherapy	2	8.0	1	4.0	χ^2= 0.679	^{MC}p= 1.000
Chemotherapy	2	8.0	3	12.0		

χ^2: Chi square test   MC: Monte Carlo test   FE: Fisher Exact test

Table (3): Differences in wound healing of the control and study group:

Total Wound healing	Control (n = 25)	Study (n = 25)	t	p
Average wound score				
Min. – Max.	8.33 - 10.83	7.83- 9.83		
Mean ± SD.	9.99±0.70	8.85± 0.58	6.280*	<0.001*
Median	10.0	9.0		

t: Student t-test   *: Statistically significant at $p \leq 0.05$

Table (4): **Comparison between the control and study group regarding the presence of post operative complications**

Presence of post operative complications	Day of surgery		1st day		2nd day		3rd day		4th day		5th - 7th day	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Control group												
No	25	100.0	25	100.0	25	100.0	25	100.0	25	100.0	25	100.0
Paralytic illeus	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bleeding	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Fluid and electrolyte imbalance	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Wound healing disorders	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bowel obstruction	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Anastomosis leakage	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Study group												
No	25	100.0	25	100.0	25	100.0	25	100.0	25	100.0	25	100.0
Paralytic illeus	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bleeding	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Fluid and electrolyte imbalance	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Wound healing disorders	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Bowel obstruction	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Anastomosis leakage	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
χ^2	-		-		-		-		-		-	
p	-		-		-		-		-		-	

χ^2: Chi square test

Table (5): **Comparison between the control and study group regarding to length of hospital stay and readmission**

	Group type				χ^2	p
	Control		Study			
	No.	%	No.	%		
Length of hospital stay						
4 – 7	2	8.0	6	24.0		
8 – 12	13	52.0	18	72.0	10.289*	0.005*
More than 12	10	40.0	1	4.0		
Readmission						
Yes	3	12.0	0	0.0	3.191	0.235
No	22	88.0	25	100.0		

Table (6):   Variances in the clinical pathway performance of the studied patients undergoing colorectal surgery

Variance items	Not done		Done inadequately		Done adequately	
	No	%	No	%	No	%
• Assessment/ monitoring	0	0.0	0	0.0	25	100%
• Psychological care	0	0.0	0	0.0	25	100%
• Vital signs	0	0.0	5	20.0	20	80.0
• Medications	0	0.0	0	0.0	25	100%
• Nutrition	0	0.0	0	0.0	25	100%
• Mobility	0	0.0	0	0.0	25	100%
• Elimination	0	0.0	0	0.0	25	100%
• Pain management	0	0.0	4	16.0	21	84.0
• Teaching and health education	0	0.0	0	0.0	25	100%
• Prevention of complications	0	0.0	4	16.0	21	84.0

Table (7):   Comparing Total Satisfaction with the Caring Process in the Control and Study Groups Subjects.

Satisfaction	Control (n = 25)	Study (n = 25)	t	p
Total satisfaction				
Min. – Max.	22.0 – 42.0	37.0 – 42.0		
Mean ± SD.	29.0 ± 6.84	40.92 ± 2.04		
Median	27.0	42.0		
Percent satisfaction			8.353[*]	<0.001[*]
Min. – Max.	28.57 – 100.0	82.14 – 100.0		
Mean ± SD.	53.57 ± 24.42	96.14 ± 7.28		
Median	46.43	100.0		

t: Student t-test   *: Statistically significant at $p \leq 0.05$

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