

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

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Abstract: Background: The bowel preparation remains a significant barrier for patients who need to undergo colonoscopy. Inadequate bowel preparations occur in about 10–25% of colonoscopies. So the inadequate nursing intervention leads to inadequate bowel preparation, and serious complications for the patient undergoing colonoscopy. **Aim:** to examine pre-colonoscopy nursing education and its effect on bowel clearance and colonoscopy complications among patients Undergoing colonoscopy. **Design:** a quasi-experimental research design was utilized. **Setting:** Gastrointestinal Endoscopy Unit of Menoufia University Hospital. **Sample:** Consecutive sample of 60 patients undergoing colonoscopy were assigned randomly into two equal groups, 30 patients for each group: Study group (I): received pre-colonoscopy nursing education along with routine hospital care. Control group (II): received routine hospital care only. **Instruments** (1): Structured interviewing questionnaire (2): Boston Bowel Preparation Scale (BBPS) (3): Colonoscopy Selected Complications Assessment Sheet. **Results:** The findings revealed that there were highly significant differences were existed between study and control groups regarding their degree of bowel clearance ($P < 0.001$) in addition to there were significant differences between study and control groups regarding incidence of problems and complications of abdominal pain and abdominal distention. **Conclusions:** Pre colonoscopy nursing education significantly improves the quality of bowel clearance among study group subjects compared to control group subjects. Moreover; pre colonoscopy nursing education had a positive effect on reducing incidence of patient's problems and complications among study group subjects compared to control group subjects. **Recommendations:** designing pre-colonoscopy nursing education programs to help the patients in the preparation of colon for colonoscopy to reduce incidence of problems and complications in addition to; training program for nurses to improve their skills patients' education regarding colonoscopy preparation and the importance for seeking rapid medical advice.

Key Words: Pre-colonoscopy Nursing Education, Bowel Clearance, Complications and Colonoscopy.

Introduction

Colonoscopy is a procedure that allows surgeons to examine the colon to diagnose the disease before further therapeutic interventions can be decided. Bowel preparation is essential to ensure good visualization so that a safe and high-quality colonoscopy can be achieved. Poor bowel preparation

may contribute to decreased polyp detection and removal, thus leading to missed or delayed diagnosis and treatment. In patients with poor bowel preparation, the procedure might be abandoned in view of an increased risk of complications. As a result, this translates into higher medical costs as

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

the procedure must be postponed or alternative investigations need to be arranged (Janahiraman, et al., 2020).

Although colonoscopy is generally safe and well tolerated, particularly when a conscious sedation is performed, nearly one third of patients complain of transient gastrointestinal symptom and different complications may occur during the examination, mostly related to the procedure. These complications range from asymptomatic and self-limiting to serious, requiring a prompt medical, colonoscopic or surgical intervention (Manta, Tremolaterra, et al., 2015)

Despite the importance of bowel preparation, a low bowel preparation rate was reported 20 to 25% for all colonoscopies. It is well known that adequate colon preparation is essential for successful and safe colonoscopy, whereas inadequate cleansing usually leads to procedural difficulties, operation related complications, a lower cecal intubation rate, higher procedural time and number of missed lesions, in addition to patient dissatisfaction, the reduced interval to follow up, which may require early repeat colonoscopy, ultimately increasing overall healthcare expenditures (Bernstein, Kong, et al., 2019).

Moreover, preparing for a colonoscopy can be frustrating for the patients; so, it is the role of the care providers to take time for explaining how exactly they should approach in order to avoid any failures and repeat exams which can be agonizing for the patient (Wexner and Beck, 2016).

Pre-colonoscopy nursing education regarding bowel preparation is another critical aspect for adequate bowel preparations. Instructions usually provided by nursing staff either in verbal or written form have been shown to be relatively ineffective.

Consequently, there has been increased interest in developing ways to communicate effectively to patients regarding bowel preparation procedures. Direct personalized education by nurses, cartoon pictures, phone calls, social media applications, and smartphone applications have been developed to enhance the standard instructions received by patients (Millien and Mansour, 2020)

A prospective randomized controlled trial conducted by Elvas, Brito, et al., (2017) illustrated the impact of personalized patient education on bowel preparation for colonoscopy. A total of 229 patients were assigned randomly as 113 to the control group and 116 to the intervention group. In intention-to treat analysis, bowel preparation was adequate in 62% of colonoscopies in the intervention group and in 35% of colonoscopies in the control group ($p < 0.001$). According to the results of this study, personalized patient education on bowel preparation for colonoscopy significantly improved the quality of bowel preparation.

Moreover; the results of another controlled trial conducted by Chang, Shih, et al., (2015) revealed that the implementation of an educational intervention before colonoscopy significantly improved bowel preparation ($P < 0.001$). Evidence from these randomized controlled trials shows that a brief counseling session with patients before colonoscopy ensures better bowel preparation.

Therefore, the current study aimed to examine pre-colonoscopy nursing education and its effect on bowel clearance and complications among patients undergoing colonoscopy

Significance of the Study

The number of colonoscopies is increasing worldwide, and concerns about associated adverse events are

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

growing. An estimated 11-13 million colonoscopies are performed in the United States annually (Smith, Andrews, et al., 2019). Inadequate bowel preparation effects on patient satisfaction toward colonoscopy. Unsatisfactory colonoscopy screening experience may discourage repeat screening (Brotons, Guilabert, et al., 2019).

Bowel preparation is inadequate in about 10% to 25% of colonoscopies (Millien and Mansour 2020), and have impacts on colonoscopy quality, lengthens procedure times and results in shorter surveillance intervals, incomplete screening colonoscopy and increased costs. Colonoscopic examinations of these patients were associated with increased technical difficulty and patient discomfort (Shah, Zhou, and Parikh, 2019).

Purpose of the Study

The purpose of the current study was to examine pre-colonoscopy nursing education and its effect on bowel clearance and complications among patients undergoing colonoscopy.

Research Hypothesis:

- Patients who received pre-colonoscopy nursing education exhibit more improvement in bowel clearance (study group) than patients who follow routine medical care alone (control group).
- Patients who received pre-colonoscopy nursing education experience fewer complications (study group) than patients who follow routine medical care only (control group)

Subjects & Methods:-

Research design:

A quasi experimental research design (study and control) was utilized to achieve the purpose of this study.

Research Setting:

The study was carried out at Gastrointestinal Endoscopy Unit of Menoufia University Hospital.

Sampling:

Consecutive sample of 60 adult patients of both gender scheduled for colonoscopy divided randomly and alternatively into two equal groups 30 patients in each (study and control group).

Study group (1): Patients received a detailed education about proper technique of colon preparation for colonoscopy by using designed educational booklet and video illustrates all instructions and activities along with routine medical care.

Control group (2): received routine hospital care only such as oral and written instruction.

Sampling Technique:

The sample of the study estimated by using the following power analysis equation: $n = [(Z\alpha/2 + Z\beta)^2 \times \{(p_1(1-p_1) + p_2(1-p_2))\}]/(p_1 - p_2)^2$ based on this assumption, the sample size was estimated to be 60 at confidence interval 80%.

Inclusion criteria

- Conscious patients aged 18-65 years
- Patients who scheduled for colonoscopy for the first time.

Exclusion criteria

Emergency cases such as patients who presented with intestinal obstruction, patients with chronic constipation, severe toxic mega colon and fulminant colitis to avoid perforation.

Instruments:

Four instruments were used by the researchers for collecting the necessary data, these instruments were:

Instrument I: Structured Interviewing Questionnaire:

It was developed by the researchers based on pertinent literature and guidance of expertise to collect sociodemographic data. It consisted of three parts as the following:-

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

- **Part one:** Sociodemographic data: It was comprised of six questions includes data related to patient's age, gender, marital status, occupation, level of education and residence.
- **Part two:** Medical data: It includes questions about medical history, family history, and reason for colonoscopy.

Instrument II: Knowledge assessment sheet:

It used to assess the pre procedure knowledge level of patients in order to determine educational need for each patient. It includes questions related to colonoscopy as definition, aim, time for preparation, etc.

Scoring system:

Each one of correct answers given one mark and the incorrect answer or don't know given zero. The total knowledge score categorized into three categories:

- Satisfactory level of knowledge \geq (>65%).
- Average or fair level of knowledge (50% – 65%)
- Unsatisfactory level of knowledge (<50%)

Instrument III: Boston Bowel Preparation Scale (BBPS):

This scale was developed by the section of gastroenterology at Boston Medical Center (BMC) adopted by Lai, Calderwood and Jacobson, (2011) to distinguish various degrees of bowel cleanliness. In this scale, the colon is divided in three segments as following: The right side (including cecum and ascending colon),

The transverse colon (including the hepatic and splenic flexures)

The left sided colon, which includes the descending colon, sigmoid and rectum.

Scoring system: Four point scoring system applied to each of the three broad regions of the colon. The points are assigned as follows:

- 0 = Un prepared colon segment with mucosa not seen due to solid stool that cannot be cleared.
- 1 = Portion of mucosa of the colon segment seen, but other areas of the colon segments not well seen due to staining, residual stool or opaque liquid.

2 = Minor amount of residual staining, small fragments of stool or opaque liquid, but mucosa of colon segment seen well.

- 3 = Entire mucosa of colon segment seen well with no residual staining, small fragments of stool or opaque liquid
- The maximum BBPS score for a perfectly clean colon without any residual liquid is 9 and the minimum BBPS score for an unprepared colon is 0.

Total scoring system for BBPS as the following:

BBPS	Score
The maximum BBPS score for a perfectly clean colon without any residual liquid	9
The minimum BBPS score for an unprepared colon	0
Excellent BBPS score	(≥ 7 degrees)
Fair	(4-6 degrees)
Poor	(≤ 3 degrees)

Instrument IV: Colonoscopy Selected Complications Assessment Sheet:

This tool developed by the researchers, based on previous review of literature. It used to assess post colonoscopy complications such as abdominal pain, abdominal distension, hypoxia, chest pain, tachycardia, respiratory

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

depression, hypertension, hypotension, vomiting, and fever. All patients were seen in the clinic after seven days or contacted on phone to determine any complications. Measures taken to resolve these complications

Scoring system: - for post colonoscopy problems and complications assessment sheet will be as the following: If the problem present give it score one if not present give it score Zero

Complications	Yes	No
Abdominal pain		
Abdominal distension		
Hypoxia		
Chest pain		
Tachycardia		
Respiratory depression		
Hypertension		
Hypotension		
Vomiting		
Fever		

Methods:

Written approval:

A written approval from ethical committee was obtained to carry out the study; then an official letter from Faculty of Nursing Menoufia University was delivered to the responsible authorities of hospital chief executive and the director of Gastrointestinal Endoscopy Unit (hospital administrators and the head nurses of unit) to obtain written approval to conduct this study from them after explaining the aim of the study.

Validity:

All instruments were tested for its content validity by jury of five experts in the field of medical surgical nursing, Faculty of Nursing, Menoufia University and modifications were done to ascertain relevance and completeness.

Reliability:

All instruments were tested using a test retest method and a Pearson correlation coefficient formula was used. The period between each test was two weeks. It was 0.97, 0.89 and 0.80 for first, second and third instrument respectively

Ethical Consideration:

A written and verbal consent was obtained from all patients' to participate in this study after explanation of the purpose of the study. Each patient was reassured that any information obtained would be confidential and would only be used for the study purpose. The researchers emphasized that participation in the study was entirely voluntary and anonymity of the patients were assured through coding of data. Patients were also informed that refusal to participate in the study wouldn't affect their care.

Pilot study:

It was conducted prior to the actual study on 10% of the study sample (6 patients) to test the clarity and applicability of the tools and estimate the time needed to collect data. Data obtained from the pilot study was excluded from the current study.

Data collection procedure:

1. Data collection extended over a period of five months from beginning of October 2019 to end of February 2020.
2. Each patient who fulfills the inclusion criteria and agrees to participate in the study was interviewed individually by the researchers in the waiting area of endoscopy unit immediately on admission day. Session took about 20: 30 minutes.
3. The researchers introduced themselves to each patient, explain the aim of the study, and describe the instruments for patients prior to data collection.

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

4. The subjects were divided randomly into two equal groups, study group (I) and control group (II).
5. The researchers collect the data from the control group (II) firstly then the study group (I) to avoid the contamination of data collection.
6. Pre study data (Sociodemographic data) assessed by the researchers using part one of instrument (I) for both study and control groups at the time of admission.
7. Medical data was taken before the beginning of the preparation by using part two of instrument (I) for both groups I and II on admission day.
8. Knowledge assessment sheet was taken before preparation by using instrument (II) for both group I and II on admission day.
9. Each patient of study group (I) scheduled individually for one teaching session using pre-colonoscopy education materials. It took about 20:25 minutes for instructions and about 5:10 minutes for discussion and feedback.
10. During the session, study group (I) received instructions through educational booklet and video illustrates the instructions for more clarifications, which include structure and function of the colon, definition of colonoscopy, colon preparation before colonoscopy, etc. The instructions were given such as the followings:
 - Instruct patient to stop vitamins, supplements and anti-inflammatory medications temporarily (ibuprofen/Aspirin).
 - The contents of a proper diet before colonoscopy, adequate hydration (water or recommended fluids) after taking the laxatives.
 - Before a few days (three to four day) of the colonoscopy procedure, start eating a low-fiber diet that are easy to digested and eliminated from the colon quickly before the procedure.
- Patients instructed to avoid eating solid food for 24 hours before the test and inform patient to have clear liquids such as sports drinks, clear juice like apple and clear broth. Soda, coffee and tea, but without cream, gelatin and ice pops, but stay away from anything colored red, blue, or purple.
- Patients were encouraged to drink a lot of fluids and to continue clear liquids up until two hours before their scheduled time for procedure.
- Instruct patient that the colon is fully empty and ready for screening if bowel movement becomes watery and clear.
- An enema prescribed in cases where the large intestine is not fully empty following colonoscopy preparation, for example due to constipation.
11. The researchers took a feedback from discussion to make sure that they successfully mastered and give a direct insight into what is working well and what needs further improvement.
12. Reinforcement of teaching performed according to patient's needs to ensure their understanding.
13. Finally, each patient in the study group (I) were get a copy of the video.
14. Control group (II) exposed to routine hospital care only such as oral and written instructions.
15. Quality of Bowel clearance for colonoscopy assessed by the researchers during procedure using instrument II (Boston Bowel Preparation Scale (BBPS)) for both study and control groups
16. Patient's problems and complications were assessed after procedure (All patients seen in the clinic after seven days or contacted

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

on phone to determine any complications). By using the instrument IV (Colonoscopy Selected Complications Assessment Sheet) for both study and control groups.

Statistical Analysis

Data were collected, tabulated, statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 22 (SPSS, Inc, Chicago, Illinois, USA). where the following statistics were applied: - Two types of statistics were done:

- 1) Descriptive statistics: in which quantitative data were presented in the form of mean, standard deviation (SD), range, and qualitative data were presented in the form numbers and percentages.
- 2) Analytic statistics: used to find out the possible association between studied factors and the targeted disease. The used tests of significance included:
 - Chi-square test (χ^2): was used to study association between two qualitative variables.
 - Fischer exact test for 2 x 2 tables when expected cell count of more than 25% of cases was less than 5.
 - Student t-test: is a test of significance used for comparison between two groups having quantitative variables.
 - Mann-Whitney test (nonparametric test): is a test of significance used for comparison between two groups not normally distributed having quantitative variables.
 - Kruskal-Wallis test (nonparametric test): is a test of significance used for comparison between three or more groups not normally distributed having quantitative variables.

P-value at 0.05 was used to determine significance regarding:

- P-value > 0.05 to be statistically insignificant.
- P-value ≤ 0.05 to be statistically significant.
- P-value ≤ 0.001 to be highly statistically significant.

Results

Table 1: Illustrated that, the mean age of study and control groups were 48.7 ± 10.4 and 45.9 ± 8.78 years respectively. About two thirds of both studied groups were male and lives in rural areas, around two third (63.3%) of study group were single compared to 46.7% of control group. In relation to educational level, more than one third of both groups were illiterate. In addition to more than half of both studied groups were worked. 46.7% and 50.0% of both studied groups respectively were smokers. The mean body mass index of study group was 27.2 ± 3.36 while in control group was 26.8 ± 3.44 . There were no statistically significant differences between both study and control group regarding to all socio-demographic characteristics.

Table 2: This table shows that; the mean score of knowledge among study group was 7.30 ± 2.97 and 7.16 ± 2.88 . 66.7% and 70.0 % represent the percentage of patients having unsatisfactory knowledge level for both study and control group respectively.

Table 3: The findings showed that, there were statistically significant differences were existed between study and control groups regarding degree of bowel clearance. 83.3%, 63.3% and 46.7% of colon preparation for study group subjects had seen well for ascending, transverse and descending colon respectively compared to control group subjects.

Figure 1: showed that there were highly statistically significant differences between study and control groups regarding their total bowel

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

clearance scores at P value < 0.001, 80.0 % of study group subjects had excellent scores while 6.70 % had bad scores for bowel preparation compared to 16.7% of control group subjects had excellent scores and 50% had poor scores for bowel clearance.

Table 4: The results showed that, 13.3% of study group subjects compared to 46.7% of control group subjects canceled and repeated colonoscopy. The results showed that, more than two thirds of control group subjects complained from abdominal pain and abdominal distention (76.7% and 63.3%) compared to 20.0% and 23.3% of study group respectively. The findings showed that, there were significant differences between study and control groups regarding incidence of problems and complications of

abdominal pain and abdominal distention. Moreover, there was no significant difference between study and control group regarding complications of colonoscopy such as difficulty breathing, chest pain, tachycardia, hypotension, changes in temperature.

Table 5: showed that, there were significant relationship between bowel clearance score and complications of abdominal pain and abdominal distention. 91.7% of study group subjects with excellent bowel preparation don't had abdominal distention. Moreover, there was no statistical significant difference existed between both groups as regards difficult of breathing, chest pain, tachycardia, hypotension and nausea.

Table 1: Distribution of the studied sample according to their Socio-demographic characteristics

Socio demographic characteristics	Study group n=30		Control group n=30		Test of sig.	P value
	No.	%	No.	%		
Age / years	Mean ±SD 48.7±10.4		Mean ±SD 45.9±8.78		t-test 1.08	0.283
Gender					χ^2 0.077	0.781
Male	21	70.0	20	66.7		
Female	9	30.0	10	33.3		
Marital status					χ^2 1.68	0.194
Single	19	63.336	14	46.7		
Married	11	.7	16	53.3		
Residence					χ^2 0.287	0.592
Rural	20	66.7	18	60.0		
Urban	10	33.3	12	40.0		
Educational level					χ^2 0.902	0.825
Illiterate	13	43.3	14	46.7		
Basic	8	26.7	10	33.3		
Secondary	5	16.7	3	10.0		
University	4	13.3	3	10.0		
Occupation					χ^2 0.271	0.602
Work	16	53.3	18	60.0		
Not work	14	46.7	12	40.0		
Smoking					χ^2 0.067	0.796
Yes	14	46.7	15	50.0		
No	16	53.3	15	50.0		
BMI	Mean ±SD 27.2±3.36		Mean ±SD 26.8±3.44		t-test 0.448	0.656

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

Table (2): Total knowledge levels Pre-Colonoscopy among the studied groups

Total knowledge	Study group (N=30)		Control group (N=30)		Test of sig.	P value
	No.	%	No.	%		
Mean \pm SD	7.30 \pm 2.97		7.16 \pm 2.88		U 0.149	0.882
Unsatisfactory knowledge (<50%)	20	66.7	21	70.0	χ^2 0.120	0.943
Fair knowledge (50% – 65%)	6	20.0	5	16.7		
Satisfactory knowledge (>65%)	4	13.3	4	13.3		

U: Mann Whitney test NS: Non significant

Table (3): Distribution of studied groups according to bowel clearance degree (N=60)

Studied variables	Study group N=30		Control group N=30		χ^2	P value
	No.	%	No.	%		
Ascending colon preparation					19.8	<0.001*
Un prepared	2	6.70	5	16.7		
Partial portion was seen	1	3.30	6	20.0		
Minor of residual staining	2	6.70	11	36.6		
Seen well	25	83.30	8	26.7		
Transverse colon preparation					28.5	<0.001*
Un prepared	1	3.30	10	33.3		
Partial portion was seen	1	3.40	10	33.3		
Minor of residual staining	9	30.0	8	26.7		
Seen well	19	63.3	2	6.70		
Descending colon preparation					25.6	<0.001*
Un prepared	3	10.0	12	40.0		
Partial portion was seen	1	3.30	11	36.6		
Minor of residual staining	12	40.0	5	16.7		
Seen well	14	46.7	2	6.70		

**: Significant at P value \leq 0.05*

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

Figure (1): Distribution of the studied groups according to total bowel clearance scores

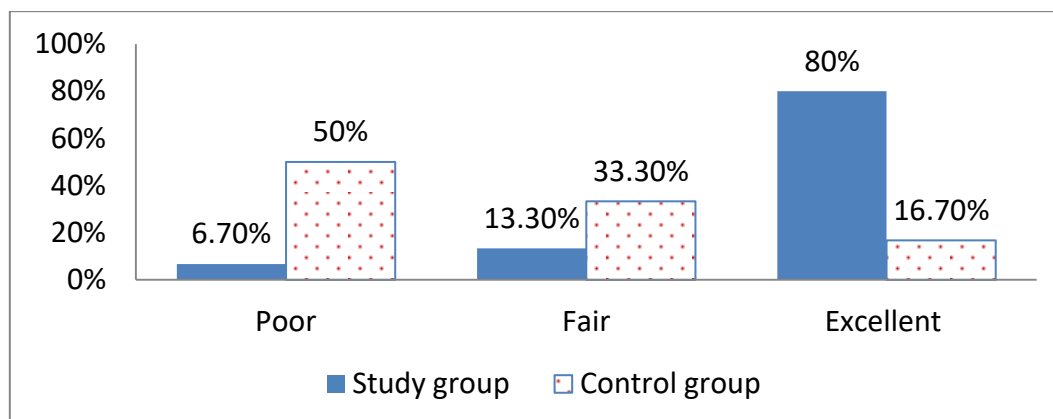


Table (4): Distribution of post colonoscopy problems and complications among studied groups (N=60)

Colonoscopy Problems and Complications	Study group N=30		Control group N=30		χ^2	P value
	No.	%	No.	%		
Problems						
Cancelled and repeated colonoscopy						
Yes	4	13.3	14	46.7	7.93	0.005*
No	26	86.7	16	53.3		
Adverse events						
Abdominal pain						
Yes	6	20.0	23	76.7	19.2	<0.001*
No	24	80.0	7	23.3		
Abdominal distension						
Yes	7	23.3	19	63.3	9.77	0.002*
No	23	76.7	11	36.7		
Nausea						
Yes	5	16.7	9	30.0	1.49	0.222
No	25	83.3	21	70.0		
Complications						
Difficulty in breathing						
Yes	4	13.3	9	30.0	2.45	0.117
No	26	86.7	21	70.0		
Chest pain as verbatbed by patient						
Yes	4	13.3	7	23.3	1.00	0.317
No	26	86.7	23	76.7		
Tachycardia						
Yes	3	10.0	5	16.7	f** 0.577	0.448
No	27	90.0	25	83.3		
Hypotension						
Yes	5	16.7	3	10.0	f** 0.580	0.706
No	25	83.3	27	90.0		
Changes in temperature						
Normal	27	90.010	26	86.713	0.162	0.688
Hypothermia	3	.00	4	.30		

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

Hyperthermia	0	0.00	0.00	0.00		
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**f: Fisher exact test *: significant

Table (5): Relation between bowel clearance score and post colonoscopy complications among study group subjects (n=30)

Complications	Study group						χ^2	P value
	BBPS							
	Poor N=2		Fair N=4		Excellent N=24			
	No.	%	No.	%	No.	%		
Abdominal pain								
Yes	2	100	4	100	0	0.00	30.0	0.001*
No	0	0.00	0	0.00	24	100		
Abdominal distension								
Yes	2	100	3	75.0	2	8.30	15.5	0.001*
No	0	0.00	1	25.0	22	91.7		
Difficulty in breathing								
Yes	0	0.00	0	0.00	4	16.7	1.15	0.562
No	2	100	4	100	20	83.3		
Chest pain as verbated by patients								
Yes	0	0.00	0	0.00	4	16.7	1.15	0.562
No	2	100	4	100	20	83.3		
Tachycardia								
Yes	0	0.00	1	25.0	2	8.30	1.29	0.523
No	2	100	3	75.0	22	91.7		
Hypotension								
Yes	1	50.0	0	0.00	4	16.7	2.40	0.301
No	1	50.0	4	100	20	83.3		
Nausea								
Yes	0	0.00	1	25.0	4	16.7	0.600	0.741
No	2	100	3	75.0	20	83.3		

*: Significant

Discussion:

Regarding to Socio-demographic characteristics of the studied sample: The result of the present study revealed that, there was no statistical significant difference between studied groups regarding their socio-demographic characteristics and this was consistent with Janahiraman, Tay, et al. (2020); Ahmed (2016) and Liu, Song, et al (2018) who reported that the studied groups didn't differ significantly at baseline regarding bio-sociodemographic characteristics. The results of the current study illustrated a highly statistical significant difference between study

and control groups regarding the degree of bowel clearance, as the majority of the study group subjects had higher degree of colon clearance than control group subjects. Regarding to total bowel clearance scores among studied groups, the findings revealed that there were highly statistically significant differences between study and control groups regarding their total bowel clearance scores at P value < 0.001. From the researcher's point of view, these results may be related to using video assisted education about preparation before colonoscopy was

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

more effective on improving quality of bowel preparation.

This result was agree the results of Ergen, Pasricha, et al (2016) and Park, Kim, et al (2016) who reported that the use of pre colonoscopy education such as a booklet and educational videos, as a means of education, was associated with improved quality of bowel preparation.

Conversely, a randomized controlled trial of 969 patients that aimed to investigate the effect of visual aid on bowel preparation found no statistically significant impact of visual aid on quality of bowel preparation; a 91% rate of adequate bowel preparation was noted in the experimental group and 89% adequate bowel preparation rate in the control group ($P = .43$) (Calderwood, Lai, et al 2011).

Liu, Song, et al (2018) mentioned that an pre colonoscopy education followed by asking the patient to retell the process of bowel preparation immediately after regular instructions at the colonoscopy appointment is a convenient and feasible intervention, which could enhance patient compliance with bowel preparation instructions and improve bowel preparation quality.

Moreover, Hayat, Lee, et al., (2016) and Cho and Kim (2015) reported that patients who received pre colonoscopy education had significantly higher rates of satisfactory bowel preparation rates as compared with the patients who did not see the video

Additionally, this result was in the same line with Ahmed (2016) who revealed that, the educational group exhibited better bowel preparation (mean Ottawa total score: 3.03 ± 1.9) than the non-educational group (4.21 ± 1.9 ; $P < 0.001$) and had good bowel preparation for colonoscopy (total Ottawa score < 0.001). Therefore, in

addition of pre colonoscopy education recommended improving the quality of bowel preparation in comparison with standard preparation methods.

So, The first hypothesis which revealed that patients received pre colonoscopy nursing education exhibit more improvement in bowel clearance (study group) than patients who follow routine medical care alone (control group) was accepted through the current study research findings.

Regarding to the patients problems and complications, the results of the current study revealed that, about two third of control group had difficult visualization of colon during colonoscopy and so, nearly half of these patients canceled the procedure and repeated colonoscopy was performed later. More than two third of patient of control group were complained from abdominal pain and about two third complained from abdominal distention. These result consistent with Samuel, Hovsepian and Gupta (2017) who reported that inadequate bowel preparation affects as many as 30% of all colonoscopy procedures in many facilities and the consequences of poor bowel preparation include, higher complication rates, difficult visualization of colon, procedure cancellations and reduced polyp detection rates.

According to Chan, Saravanan and Manikam (2011) and David (2014) were support these findings who revealed that unfortunately, up to 20%-25% of all colonoscopies are reported to have an inadequate bowel preparation, that lead to problems and complications. More over; Ahmed (2016) reported that, the majority of the patients in both groups of the study were complained from abdominal pain and discomfort.

Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

The current study also supported these results of Weilan (2015) who mentioned that abdominal pain or distension may be developed and increased in their intensity after colonoscopy by the insufflated air for good visualization of the colon, American Association of Gastrointestinal Endoscopy (2011) also cleared that the most commonly reported minor complications of colonoscopy are abdominal distension (bloating) (25%) and abdominal pain and/or discomfort 5% to 11%. Appropriate techniques, such as avoiding and reducing endoscope looping and minimizing air insufflation should help reduce these symptoms.

So, the second hypothesis which revealed that, patients who follow the pre colonoscopy nursing education experience fewer complications (study group) than patients who follow routine medical care only (control group) was supported through the current study research findings.

Regarding to relation between degree of bowel clearance and complications after colonoscopy among the study group subjects, the findings revealed that, there were significant relationship between degree of bowel clearance and complications of abdominal pain and abdominal distention. Zuccala (2015) agrees these findings who mentioned that, adequate bowel preparation is associated with decrease complications of long procedure time and complete visualization of the entire colon (enabling a successful procedure).. These results were in line with Chan and Goh (2012) who mentioned that, high quality of bowel preparation is essential for a successful colonoscopy, as improper bowel preparation leads to patient's dissatisfactions, problems of repeating procedure and increases cost. It can be concluded that pre colonoscopy nursing education

significantly improve the quality of bowel clearance and reduce incidence of problems and complications among study group subjects compared to control group subjects.

Conclusions:

Based on the findings of current study, it can be concluded that:

- 1) Pre colonoscopy nursing education significantly improves the quality of bowel clearance among study group subjects compared to control group subjects.
- 2) Pre colonoscopy nursing education had a positive effect on reducing incidence of patient's problems and complications among study group subjects compared to control group subjects.

Recommendations:

A) Recommendations for patients:

pre-colonoscopy nursing education to patients about colonoscopy and preparation for enhancing quality of bowel clearance and encourage the patients for bowel preparation and reduce incidence of problems and complications

B) Recommendations for nurses:

Training programs for nurses in order to improve their skills in patients' education regarding colonoscopy preparation and the importance for seeking rapid medical advice.

C) Recommendations for future studies:

Replication of this study using larger probability sample from different geographical areas to attain more generalizable results

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Pre-colonoscopy Nursing Education: It's Effect on Bowel Clearance and Complications among Patients Undergoing Colonoscopy

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