

Original Research Article

A study of outcomes in patients undergoing nerve preserving surgery in colorectal cancers

Sandeep Chandrakar¹, Rajendra Ratre¹, Ashutosh Gupta², Harsh M. Agrawal^{1*}, Avinash R.¹

¹Department of General Surgery, ²Department of Onco-Surgery, Pt. Jawaharlal Nehru Memorial Medical College and Dr B. R. Ambedkar Memorial Hospital, Raipur, Chhattisgarh, India

Received: 27 October 2022

Revised: 29 November 2022

Accepted: 13 December 2022

***Correspondence:**

Dr. Harsh M. Agrawal,

E-mail: harshuji@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Colorectal cancers are third most commonly diagnosed cancer globally. Its management consist mainly of surgical intervention to achieve an oncologic cure but also to preserve function. Introduction of nerve-preserving TME technique, spares the nerve and plexus pivotal for urinary and sexual function. The study assessed the urinary and sexual function after nerve sparing colorectal surgery. Aims and objective were to check functional outcomes after nerve preservation in patient undergoing colorectal cancer surgery, in terms of urinary and sexual function.

Methods: A prospective observational study conducted from January 2019 to July 2020, in the department of surgery and oncosurgery, Dr. BRAM Hospital, Raipur, Chhattisgarh.

Results: According to IPSS score, post-operatively, 57.5% showed fair urinary function, 22.5% showed good urinary function and 20% showed poor urinary function at 1 month. At 3 months, 80% showed good urinary function, 15% showed fair urinary function and 5% showed poor urinary function. According to IIEF score in males, post-operatively, at 1 month, 52% had a fair score, 40% had a poor score and 8% had a good score. At 3 months, 68% had a good score, 24% had a fair score and 8% had a poor score. According to FSFI score in females, post-operatively, at 1 month, 40% had a good score, 26.6% had fair score and 33.33% had a poor score. At 3 months, 66.67% had a good score, 13.33% had a fair score and 20% had a poor score.

Conclusions: Nerve preserving surgery in colorectal cancer significantly preserves urinary and sexual function.

Keywords: Colorectal cancer, Nerve preserving surgery, Total mesorectal excision

INTRODUCTION

Colorectal cancers are the third most commonly diagnosed form of cancer globally, comprising 11% of all cancer diagnoses and 9% of all cancer deaths.^{1,2}

The incidence of colorectal cancer depends on various aspects like Race and ethnicity, sex and various risk factors like diet rich in red meat, smoking, alcohol abuse, inflammatory bowel disease, hereditary mutations, prior abdominal radiations.³

The management of colorectal cancer consist mainly of surgical intervention aiming for an oncologic clearance.

The surgical management of colorectal cancer started when Jacques Lisfranc, in 1826, performed the first perineal resection.⁴ The surgical management further evolved with introduction of abdominoperineal resection with en block lymphadenectomy performed by Miles in 1908 which was later replaced by anterior resection (AR) in 1950. But these all were associated with severe urinary and sexual dysfunction.⁵ However introduction of the “total mesorectal excision” (TME)-technique by Heald, in 1982 was a major breakthrough, which involved en bloc resection of the tumour and the mesorectal tissue in the avascular plane which reduced the risk of excessive perioperative blood loss and postoperative functional disorders.⁶

Surgical management for rectal cancer is challenging due to the narrow pelvis and its extreme proximity to contiguous organs and important neural tissues which are vital for various urinary and sexual function of both male and female.⁷

Since the introduction of total mesorectal excision (TME), the oncologic outcome has improved greatly in terms of local recurrence and cancer-specific survival.⁸ However, there are still concerns regarding functional outcomes such as sexual and urinary dysfunction, even among experienced colorectal surgeons.⁹

Currently, the rate of urinary dysfunction after rectal surgery ranges from 33% to 70%. Many factors other than nerve preservation play a role in minor incontinence.^{10,11} Male sexual function shows impotence rates ranging from 20% to 46%.^{12,13} In women, information on sexual function is not easily obtained, and varying degree of sexual dysfunction is seen in them as well.

The nerve-preserving TME technique which was introduced in 1995, by Enker which is considered a gold standard treatment for lower and middle third of carcinoma rectum includes identification and preservation of the superior hypogastric plexus nerve, bilateral hypogastric nerves, pelvic plexus, and neurovascular bundles.⁹ These structures have a key role in urinary and sexual function of both men and women.

The high quality of TME should fulfil two clinical measurements: absence of impotence or incontinence and at least single digit i.e., less than 10%, 5-year cumulative recurrence rate regardless of adjuvant therapy.¹⁴

Aims and objective

To check the functional outcome after nerve preservation in patient undergoing colorectal cancer surgery, to assess the urinary function in the patient postoperatively and to assess the sexual function in the patient postoperatively.

METHODS

The following was a Prospective Observational study conducted in Dr. BRAM Hospital, Raipur, Chhattisgarh, from January 2019 to July 2020.

Inclusion criteria

All patient undergoing curative colorectal surgery, with age >18 years and who gave consent to get included in study.

Exclusion criteria

Patients with previous major abdominal or pelvic surgery or abnormal preoperative baseline genitourinary function.

Patients were explained regarding the surgical procedures and the nature of study, and informed consents was obtained. A baseline preoperative assessment of urinary and sexual function was done in all patient. Post operatively the patients were followed up and assessment of urinary and sexual function was again done at 1 month and 3-month interval. The study received clearance from the scientific and ethical committees of Pt. J.N.M medical college, Raipur. This was a time bound study, which included all patients with colorectal cancer admitted between January 2019 to July 2020.

Assessment of urinary function

Evaluation was on the basis of questionnaire-based interview.

International prostate symptom score (IPSS), which included incomplete bladder emptying, frequency, intermittency, urgency, weak stream, straining, and nocturia. The scoring system for voiding function described above is based on a 0 to 5 scale, as follows: 0, not at all; 1, less than one time in five; 2, less than half the time; 3, approximately half the time; 4, more than half the time; 5, almost always.

IPSS was calculated by adding the item scores; good (IPSS, 0-7); fair (IPSS, 8-14), and poor (IPSS, 15-35).

Assessment of sexual function

In male patients

The sexual function was evaluated on the basis of potency and erectile function, measured on the basis of the international index of erectile function (IIEF), which contains five index domains (erectile function, orgasm function, sexual desire, intercourse satisfaction, and overall satisfaction) and 15 items. Each item was scored on a 5- or 6-point Likert score. Total score range was 5 to 75. We classified the male potency function as good (IIEF, 60-75), fair (IIEF, 44-59), and poor (IIEF, 5-43).

Items 1, 2, 3, 4, 5 and 15 of IIEF together constitute the erectile function. The severity of erectile dysfunction (ED) was classified into five categories: no ED (EF score 26 to 30), mild (EF score 22 to 25), mild to moderate (EF score 17 to 21), moderate (EF score 11 to 16), and severe (EF score 6 to 10).

In female patients

The sexual function was evaluated on the basis of the female sexual function index (FSFI), which is a 19-item validated questionnaire.

The scale is divided into six domains: desire, arousal, lubrication, orgasm, satisfaction, and pain. Each item is scored with a 5- or 6- point Likert scale. The scales for

each domain are variable, and the total score range is 4 to 95.

For the present study, we classified the female sexual function as good (FSFI, 76-95), fair (FSFI, 58-75), and poor (FSFI, 4-57).

Data collected was charted onto an excel sheet with quantitative and continuous variable was presented as mean±standard deviation, while qualitative or categorical variable is prescribed as frequency or percentage.

The final result and significance between the proposed surgical procedure and favorable sexual/urinary outcomes was obtained by using SPSS v20.0 software.

RESULTS

The study consisted of a total of 40 patients who underwent colorectal cancer surgery.

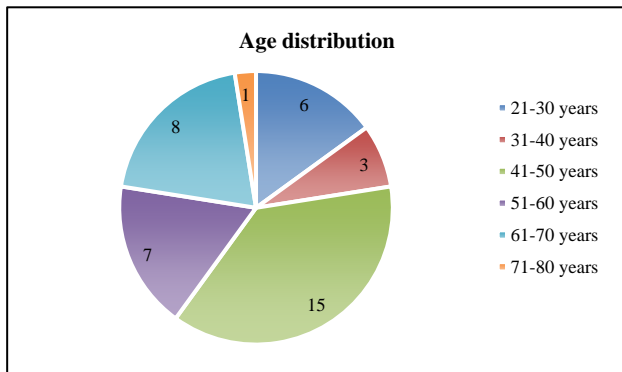


Figure 1: Age distribution.

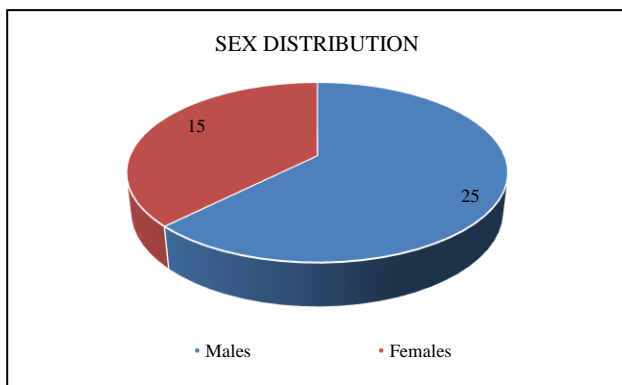


Figure 2: Sex distribution.

In this study, we found that of 40 colorectal cancer cases, maximum of cases, 37.5% (15 cases) aged between 41-50 years and 20% (8 cases) were in age group of 61-70 years, Age distribution was from 24-75 years with mean of 49 years. 40 colorectal cancer patients, 62.5% (25 cases) of the cases were males and 37.5% (15 cases) of the cases were female.

Of the 40 patients, 62.5% (25 cases) had low rectal cancer, 30% (12 cases) had middle rectal cancer and 7.5% (3 cases) had high rectal cancers. Also, 30 cases belonged to TNM stage IIIa, IIIb and IIIc, 9 cases belonged to stage II and 1 case belonged to stage I and 57.5% (23 cases) of cases with colorectal cancers received neo-adjuvant chemotherapy /radiotherapy.

Among the surgical interventions employed, the laparoscopic APR was the most common type of surgery employed in 65% (29 cases), Open APR was done in 10% (4 cases), Laparoscopic LAR was done in 10% (4 cases), laparoscopic anterior resection was done in 10% (4 cases), sigmoidectomy and laparoscopic ultra low resection was done in 2.5% each (1 case). Also, 92.5% (37 cases) had their peripheral autonomic nerve preserved.

According to IPSS score, there was no urinary dysfunction in all cases pre-operatively. 57.5% (23 cases) showed fair urinary function, 22.5% (9 cases) showed good urinary function and 20% (8 cases) showed poor urinary function at 1 month. At 3 month, 80% (32 cases) showed good urinary function, 15% (6 cases) showed fair urinary function and 5% (2 cases) showed poor urinary function. There was a significant co-relation between urinary function and duration (p<0.0001 HS).

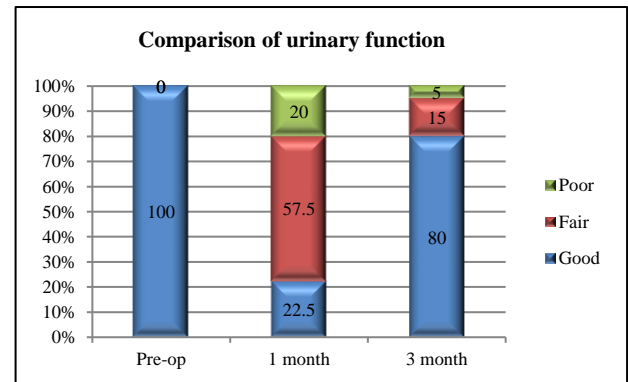


Figure 3: Urinary function.

According to IIEF score in males, pre-operatively 88% (22 cases) had a good score and 12% (3 cases) had a fair score. At 1 month, 52% (13 cases) had a fair score, 40% (10 cases) had a poor score and 8% (2 cases) had a good score. At 3 month, 68% (17 cases) had a good score, 24% (6 cases) had a fair score and 8% (2 cases) had a poor score. There was a significant co-relation between sexual function and duration (p<0.0001 HS).

According to erectile dysfunction severity in males, pre-operatively 44% (11 cases) had normal function, 20% (5 cases) had mild dysfunction, 28% (7 cases) had mild to moderate dysfunction, 8% (2 cases) had moderate dysfunction and there were no cases having severe dysfunction. At 1 month, 8% (2 cases) had normal function, 8% (2 cases) had mild dysfunction, 20% (5 cases) had mild to moderate dysfunction, 48% (12 cases)

had moderate dysfunction and 16% (4 cases) had severe dysfunction. At 1 month, 24% (6 cases) had normal function, 8% (2 cases) had mild dysfunction, 40% (10 cases) had mild to moderate dysfunction, 20% (5 cases) had moderate dysfunction and 8% (2 cases) had severe dysfunction. There was a highly significant co-relation between sexual function and duration.

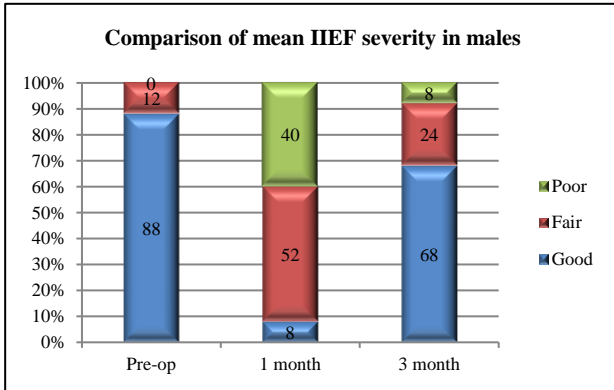


Figure 4: Male sexual function.

According to FSFI score in females, pre-operatively 100% (15 cases) had a good score. At 1 month, 40% (6 cases) had a good score, 26.6% (4 cases) had fair score and 33.33% (5 cases) had a poor score. At 3 month, 66.67% (10 cases) had a good score, 13.33% (2 cases) had a fair score and 20% (3 cases) had a poor score. There was a significant co-relation between sexual function and duration (p<0.012 S).

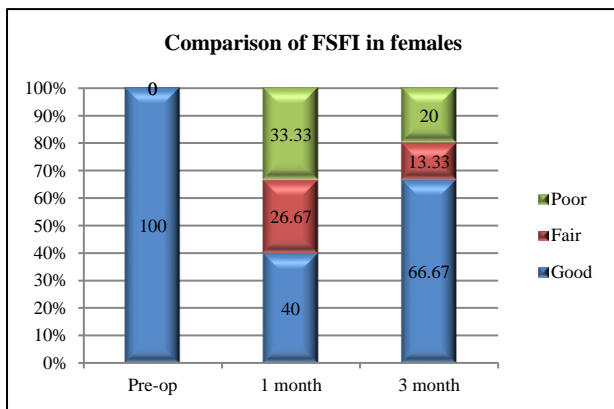


Figure 5: Female sexual function.

According to IPSS score, among patients aged less than 50 years, pre-operatively 100% (21 cases) had a good score. At 1 month 42.6% (9 cases) had a good score and 57.14% (12 cases) had a fair score. At 3 month 90.48% (19 cases) had a good score, 4.76% (1 case) had a fair score and 4.76% (1 case) had a poor score. Among patients aged more than 50 years, pre-operatively 100% (19 cases) had a good score. At 1 month 10.53% (2 cases) had a good score, 57.83% (11 cases) had a fair score and 31.58% (6 cases) had a poor score. At 3 month 68.42% (13 cases) had a good score, 26.32% (5 case) had a fair

score and 5.26% (1 case) had a poor score. There was a highly significant correlation between age and urinary dysfunction (p value <0.0001 HS).

According to IPSS score, among males, pre-operatively 100% (25 cases) had a good score. At 1 month 24% (6 cases) had a good score, 52% (13 cases) had a fair score and 24% (6 cases) had a poor score. At 3 month 76% (19 cases) had a good score, 20% (5 case) had a fair score and 4% (1 case) had a poor score. Among females, pre-operatively 100% (15 cases) had a good score. At 1 month 20% (3 cases) had a good score, 66.67% (10 cases) had a fair score and 13.33% (2 cases) had a poor score. At 3 month 86.67% (13 cases) had a good score, 6.67% (1 case) had a fair score and 6.67% (1 case) had a poor score. There was a highly significant co-relation between gender and urinary dysfunction (p value <0.0001 HS).

DISCUSSION

In this study, we found that of 40 colorectal cancer cases, maximum of cases, 37.5% (15 cases) aged between 41-50 years and 20% (8 cases) were in age group of 61-70 years, Age distribution was from 24-75 years with mean of 49 years. Dar et al, conducted a study on 47 patients and the age distribution was from 20-76 years with mean of 50 years, majority of patients were above 50years of age.¹⁵ Kenneth et al conducted a study on 2313 cases and among all the patients aged between 1 to 98 years, the mean was 63 years.¹⁶

In this study, we found that out of 40 colorectal cancer patients, 62.5% (25 cases) of the cases were males and 37.5% (15 cases) of the cases were female. Strek el al, conducted a study on 52 patients and found that of the Fifty-two patients, 36 were male and 16 were female.¹⁷ Vironen et al, conducted a study on 82 cases and found that 52 cases (63.4%) were males and 30 cases (36.6%) were females.¹⁸

In this study, we found that the most common complaint among patients with colorectal cancer was bleeding per rectum in 67.5% (27 cases) patients, followed by altered bowel habit in 22.5% (9 cases) patients. Dar et al conducted a study on 47 patients and found that 40 (85%) patients presented with history of bleeding per rectum and 7 (15%) patients with history of altered bowel habits as major complaint.¹⁵ Majumdar et al conducted a study on 197 patients and found that the most common symptoms were rectal bleeding (58%), abdominal pain (52%), and change in bowel habits (51%); the majority had anemia (57%) and occult bleeding (77%).¹⁹

In this study, we found that in 40 cases of colorectal cancer, hypertension was found to be the most common co-morbidity in 12.5% (5 cases) patients, followed by smoking in 7.5% (3 cases) patients. Kenneth et al conducted a study on 2313 cases and found that the most commonly found systemic diseases were cardiovascular

disease in 37%, respiratory disease in 12%, and renal in 6.6%. The combination of diseases and a primarily older age group meant additional medical problems, more complicated surgical procedures, and reduced long-term survival.¹⁶

In this study, we found that of the 40 cases with colorectal cancer, 62.5% (25 cases) had low rectal cancer, 30% (12 cases) had middle rectal cancer and 7.5% (3 cases) had high rectal cancers. Dar et al conducted a study on 47 patients and found that 4.2% (2 cases) had low rectal cancers, 78.7% (35 cases) had middle rectal cancers and 21.2% (10 cases) had high rectal cancers.¹⁵ Kim et al conducted a study on 68 patients and found that 36.7% (25 cases) had low rectal cancer, 32.3% (22 cases) had middle rectal cancer and 30.8% (21 cases) had high rectal cancers.²⁰

Table 1: Comparison based on IPSS score.

Author	No. of patients	Urinary dysfunction (%)	Sexual dysfunction (%)
Our study	40	20	32
Havenga	138	32	17
Mass	47	28	11
Maurer	60	24	24
Nesbakken²¹	49	13	28
Kim²⁰	68	26	25
Pocard	9	0	44
Sterk¹⁷	49	23	38
Ameda²³	52	30	88

In this study, we found that among 40 cases of colorectal cancers, 30 cases belonged to TNM stage III, 9 cases belonged to stage II and 1 case belonged to stage I. Vironen et al, conducted a study on 82 cases and found that there were 39% (32 cases) with stage I, 40% (33 cases) with stage II, 19.5% (14 cases) with stage III and 1.2% (one case) with stage IV.¹⁸ Dar et al conducted a study on 47 patients and found that there were 25.5% (7 cases) with stage I, 29.7% (14 cases) with stage II, 48.9% (23 cases) with stage III, and 6.3% (3 cases) with stage IV.¹⁵

In this study, we found that, according to IPSS score, there was no urinary dysfunction in all cases pre-operatively. Post-operatively, 57.5% (23 cases) showed fair urinary function, 22.5% (9 cases) showed good urinary function and 20% (8 cases) showed poor urinary function at 1 month. At 3 month, 80% (32 cases) showed good urinary function, 15% (6 cases) showed fair urinary function and 5% (2 cases) showed poor urinary function. There was a significant co-relation between urinary function and duration ($p < 0.0001$ HS). Dar et al conducted a study on 47 patients and found that there was urinary dysfunction in 89.7% (42 cases) at 1 month, 27.6% (13 cases) at 3 months.¹⁵ Vironen et al, conducted a study on 82 cases and found that there was mild urinary

dysfunction seen in 46 cases (56%).¹⁸ Kim et al conducted a study on 68 patients and found that urinary dysfunction in their studies were 26%.²⁰

In this study, we found that, according to IIEF score in males, pre-operatively 88% (22 cases) had a good score and 12% (3 cases) had a fair score. At 1 month, 52% (13 cases) had a fair score, 40% (10 cases) had a poor score and 8% (2 cases) had a good score. At 3 months, 68% (17 cases) had a good score, 24% (6 cases) had a fair score and 8% (2 cases) had a poor score. There was a significant co-relation between sexual function and duration ($p < 0.0001$ HS). Dar et al conducted a study on 47 patients and found that preoperatively normal IIEF was noticed in only 33% (14 cases) and 35% (15 cases) were having mild dysfunction and mild to moderate dysfunction was present in 30% (13 cases). Resultant sexual dysfunction was found in 30% (13 cases).¹⁵ Ling et al, conducted a study on 112 cases and found that 93% (41 cases) had good score, 4.5% (2 cases) had fair score and 2.2% (1 case) had poor score.²²

In this study, we found that, according to erectile dysfunction severity in males, pre-operatively 44% (11 cases) had normal function, 20% (5 cases) had mild dysfunction, 28% (7 cases) had mild to moderate dysfunction, 8% (2 cases) had moderate dysfunction and there were no cases having severe dysfunction. At 1 month, 8% (2 cases) had normal function, 8% (2 cases) had mild dysfunction, 20% (5 cases) had mild to moderate dysfunction, 48% (12 cases) had moderate dysfunction and 16% (4 cases) had severe dysfunction. At 3 month, 24% (6 cases) had normal function, 8% (2 cases) had mild dysfunction, 40% (10 cases) had mild to moderate dysfunction, 20% (5 cases) had moderate dysfunction and 8% (2 cases) had severe dysfunction. There was a highly significant co-relation between sexual function and duration. Dar et al conducted a study on 47 patients and found that pre-operatively 34.8% (15 cases) had normal function, 27.9% (12 cases) had mild dysfunction, 25.5% (11 cases) had mild to moderate dysfunction, 11.6% (5 cases) had moderate dysfunction and there were no cases having severe dysfunction. At 1 month, 6.9% (3 cases) had normal function, 11.6% (5 cases) had mild dysfunction, 18.6% (8 cases) had mild to moderate dysfunction, 48.8% (21 cases) had moderate dysfunction and 13.9% (6 cases) had severe dysfunction. At 3 months, 20.9% (9 cases) had normal function, 23.2% (10 cases) had mild dysfunction, 37.2% (16 cases) had mild to moderate dysfunction, 16.2% (7 cases) had moderate dysfunction and 2.3% (1 cases) had severe dysfunction.¹⁵ Nesbakken et al, conducted a study on 49 patients and found that six of 24 men reported some reduction in erectile function and one became impotent. Two men reported retrograde ejaculation. All the complications were seen in the TME group.²¹ Strek el al, conducted a study on 52 patients and found that postoperatively, eight of the 29 men were impotent and two of the 29 men experienced retrograde ejaculation. Therefore, 30% of the preoperatively potent men had

sexual dysfunction postoperatively. There was no correlation between the postoperative impotence and the age of the patients at the time of surgery.¹⁷

In this study, we found that, according to FSFI score in females, pre-operatively 100% (15 cases) had a good score. At 1 month, 40% (6 cases) had a good score, 26.6% (4 cases) had fair score and 33.33% (5 cases) had a poor score. At 3 month, 66.67% (10 cases) had a good score, 13.33% (2 cases) had a fair score and 20% (3 cases) had a poor score. There was a significant correlation between sexual function and duration ($p < 0.012$ S). Vironen et al, conducted a study on 82 cases and found that 15 females were sexually active pre-operatively, of which 6 cases (20%) failed to answer the questions and of remaining 9 cases, 8 cases (88.8%) reported sexual dysfunction.²¹ Ling et al, conducted a study on 112 cases and found that 85.7% (36 cases) had good score, 9.5% (4 cases) had fair score and 4.7% (2 cases) had poor score post-operatively.²²

In our study, among 40 patients with colorectal cancer, according to IPSS score, among patients aged less than 50 years, pre-operatively 100% (21 cases) had a good score. At 1 month 42.6% (9 cases) had a good score and 57.14% (12 cases) had a fair score. At 3 months 90.48% (19 cases) had a good score, 4.76% (1 case) had a fair score and 4.76% (1 case) had a poor score. Among patients aged more than 50 years, pre-operatively 100% (19 cases) had a good score. At 1 month 10.53% (2 cases) had a good score, 57.83% (11 cases) had a fair score and 31.58% (6 cases) had a poor score. At 3 months 68.42% (13 cases) had a good score, 26.32% (5 case) had a fair score and 5.26% (1 case) had a poor score. There was a highly significant co-relation between age and urinary dysfunction (p value < 0.0001 HS). In our study, among 40 patients with colorectal cancer, according to IPSS score, among males, pre-operatively 100% (25 cases) had a good score. At 1 month 24% (6 cases) had a good score, 52% (13 cases) had a fair score and 24% (6 cases) had a poor score. At 3 month 76% (19 cases) had a good score, 20% (5 case) had a fair score and 4% (1 case) had a poor score. Among females, pre-operatively 100% (15 cases) had a good score. At 1 month 20% (3 cases) had a good score, 66.67% (10 cases) had a fair score and 13.33% (2 cases) had a poor score. At 3 month 86.67% (13 cases) had a good score, 6.67% (1 case) had a fair score and 6.67% (1 case) had a poor score. There was a highly significant correlation between gender and urinary dysfunction (p value < 0.0001 HS).

CONCLUSION

Nerve preserving total mesorectal excision not only provides adequate oncologic clearance, but also preserves urinary and sexual function among the patients, significantly increasing quality of life by decreasing the morbidities that are faced with conventional anterior resection.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2018;68(6):394-424.
2. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. Global cancer observatory: cancer today. Lyon, France: International Agency for Research on Cancer; 2018.
3. Rawla P, Sunkara T, Barsouk A. Epidemiology of colorectal cancer: incidence, mortality, survival, and risk factors. *Przegląd Gastroenterol.* 2019;14(2):89.
4. Lisfranc J. Memoir on the excision of the lower part of the rectum which has become carcinomatous. *Me'm Acad R Chir.* 1833;3:291-302.
5. Miles WE. A method of performing abdominoperineal excision for carcinoma of the rectum and of the terminal portion of the pelvic colon (1908). *CA Cancer J Clin.* 1971;21(6):361-4.
6. Hida J, Yasutomi M, Maruyama T, Fujimoto K, Uchida T, Okuno K. Lymph node metastases detected in the mesorectum distal to carcinoma of the rectum by the clearing method: justification of total mesorectal excision. *J Am Coll Surg.* 1997;184:584-8.
7. Chew MH, Yeh YT, Lim E, Seow-Choen F. Pelvic autonomic nerve preservation in radical rectal cancer surgery: changes in the past 3 decades. *Gastroenterol Rep.* 2016;4(3):173-85.
8. Heald RJ, Ryall RD. Recurrence and survival after total mesorectal excision for rectal cancer. *Lancet.* 1986;327(8496):1479-82.
9. Kim NK, Kim YW, Cho MS. Total mesorectal excision for rectal cancer with emphasis on pelvic autonomic nerve preservation: expert technical tips for robotic surgery. *Surg Oncol.* 2015;24(3):172-80.
10. Leveckis J, Boucher NR, Parys BT, Reed MW, Shorthouse AJ, Anderson JB. Bladder and erectile dysfunction before and after rectal surgery for cancer. *Br J Urol.* 1995;76(6):752-6.
11. Fowler JW, Bremner DN, Moffat LE. The incidence and consequences of damage to the parasympathetic nerve supply to the bladder after abdominoperineal resection of the rectum for carcinoma. *Br J Urol.* 1978;50(2):95-8.
12. Maas CP, Moriya Y, Steup WH, Kranenbarg EK, Van De Velde CJ. A prospective study on radical and nerve-preserving surgery for rectal cancer in the Netherlands. *Eur J Surg Oncol.* 2000;26(8):751-7.
13. Banerjee AK. Sexual dysfunction after surgery for rectal cancer. *Lancet.* 1999;353:1900-1.

14. Gwang-wook S. Anterior rectal mesenteric resection and autonomic nerve conservation. *J Korean Soc Gastroenterol.* 2006;47(4):254-9.
15. Dar MS, Parray FQ, Bhat AH, Chowdri NA, Wani ML. Impact of total mesorectal excision on bladder and sexual function in rectal cancer. *Cancer Surg.* 2016;2:110.
16. McSherry C, Cornell G, Glenn F. (1969) Carcinoma of the colon and rectum. *Ann Surg.* 1969;169:502-9.
17. Sterk P, Shekarriz B, Günter S, Nolde J, Keller R, Bruch HP, et al. Voiding and sexual dysfunction after deep rectal resection and total mesorectal excision. *Int J Colorect Dis.* 2005;20(5):423-7.
18. Vironen JH, Kairaluoma M, Aalto AM, Kellokumpu IH. Impact of functional results on quality of life after rectal cancer surgery. *Dis Colon Rectum.* 2006;49(5):568-78.
19. Majumdar SR, Fletcher RH, Evans AT. How does colorectal cancer present? Symptoms, duration, and clues to location. *Am J Gastroenterol.* 1999;94:3039-45.
20. Kim NK, Aahn TW, Park JK, Lee KY, Lee WH, Sohn SK, et al. Assessment of sexual and voiding function after total mesorectal excision with pelvic autonomic nerve preservation in males with rectal cancer. *Dis Colon Rectum.* 2002;45(9):1178-85.
21. Nesbakken A, Nygaard K, Bull-Njaa T, Carlsen E, Eri LM. Bladder and sexual dysfunction after mesorectal excision for rectal cancer. *Br J Surg.* 2000;87(2):206-10.
22. Liang JT, Lai HS, Lee PH, Chang KJ. Laparoscopic pelvic autonomic nerve-preserving surgery for sigmoid colon cancer. *Ann Surg Oncol.* 2008;15(6):1609-16.
23. Ameda K, Kakizaki H, Koyanagi T, Hirakawa K, Kusumi T, Hosokawa M. The long-term voiding function and sexual function after pelvic nerve-sparing radical surgery for rectal cancer. *Int J Urol.* 2005;12(3):256-63.

Cite this article as: Chandrakar S, Ratre R, Gupta A, Agrawal HM, Avinash R. A study of outcomes in patients undergoing nerve preserving surgery in colorectal cancers. *Int Surg J* 2023;10:53-9.