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A Study to Assess the Effectiveness of Pelvic Floor Muscle Strengthening Exercises on Erectile Dysfunction in Rectal Cancer Survivors at Tertiary Cancer Hospital, TMH, Mumbai

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Abstract

Objectives: —A study to assess the effectiveness of pelvic floor muscle strengthening exercises on erectile dysfunction in rectal cancer survivors at tertiary cancer hospital, TMH, Mumbai.

Methodology: Single arm prospective study approach was used for the study. It was considered to be the most suitable method here. The research design used for the present study was self-controlled trial design. The desired sample for the present study was 39 participants. The proposed sample size was 39 for approval to regulatory authorities. The sample selected were 39 participants who will be receiving an intervention of pelvic floor muscle strengthening exercises in the selected areas of Tata Memorial Hospital. Data gathered was analyzed using descriptive and inferential statistics.

Results of the studies: For this study 39 participants were enrolled. All participants had filled pre-intervention SHIM questionnaire having 5 different questions in terms of Confidence, erection, penetration, difficulty and satisfaction. Patients had been taught Pelvic floor muscle strengthening exercises on Day 0, which were asked to carry out 3 times a day for a period of 10 weeks. After 10 weeks of exercises , patient had taken for Post- intervention SHIM score of all 39 participants. In pre-intervention SHIM questionnaire, Mean score and Standard Deviation among 5 questions were Confidence (2.6154±0.5901), Erection (2.5128±0.6014), Penetration (2.1764±0.3888) , Difficulty(2.2564±0.5964) and satisfaction(2.2821±0.5595). In Post intervention SHIM score among 5 questions were Confidence (3.0513±0.6047), Erection(2.8974±0.6804), Penetration(2.3590±0.6277), Difficulty(2.3590±0.6277) and satisfaction(2.6410±0.6684) The confidence, erection, satisfaction post intervention were statistically highly significant in participants (P< 0.001) and in term of Difficulty it was statistically significant (P 0.005).

The Wilcoxon signed rank test explains that there was a significant increase seen in the scores of confidence (4.123), erection (3.873) and satisfaction (3.500). They were highly statistically significant (P< 0.001).

There was a significant increase seen in the scores of penetration (4.123) and difficulty (3.873). They were statistically

significant (p 0.001 and 0.046) respectively. Hence the pelvic floor muscle strengthening exercises were helpful in improving erectile dysfunction among rectal cancer survivors.

Conclusion: It could be concluded that null hypothesis H0 is rejected and H1 hypothesis is accepted. Pelvic floor muscle strengthening exercises in rectal cancer survivors helped to improve erectile dysfunction among men. As the study is done for 10 weeks. The result for better outcome in terms of penetration and difficulty needs monitoring or follow up to 6 months with continuous exercises taught to patient

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Introduction

The rectum is the last part of the large intestine and connects the sigmoid colon to the anal canal[1]. The rectum begins at the height of S2-S3 and ends at the perineum. It is subdivided into three parts,the upper third lies intraperitoneally, the middle third retroperitoneal, The lower third under the pelvic diaphragm, and therefore extra peritoneal. [1]The pelvic autonomic nerves, superior hypogastric plexus, and their nerve endings run medially to the ureters to connect to the inferior hypogastric plexus. Inferior hypogastric plexus run to the bladder and sexual organs via the neurovascular bundles at the lateral border of Denonvillier's fascia, where they are also in close contact with the anterior wall of the rectum. The nerves innervating levator ani originate from a common trunk with the pelvic splanchnic nerves and extend down to the levator ani muscle. [1]Erection of the penis is by five main phases: initial filling, partial erection, full erection, rigid erection, and return to a flaccid state. Cognitive and bodily stimulation makes arterial smooth muscle relaxation, which improves blood flow to the penis in the filling phase. Full erection is obtained. During the return to a flaccid state, contractions of muscles increase venous outflow, decrease penile length and girth. The dorsal nerve, a branch of the pudendal nerve

gives primary innervation. The cavernosal nerves, part of the autonomic nervous system incorporates sympathetic and parasympathetic nerve fibers. The nerves run parallel to the prostate gland and enter the corpora cavernosa and corpus spongiosum to regulate blood flow during erection and detumescence. The dorsal somatic nerves are responsible for penile sensation.[6] Maintainance of erection depends on the penile innervation and peripheral nerves, good vascular supply, and biochemical signaling within the corpora. The autonomic nervous system is involved in erection, orgasm, and tumescence. The parasympathetic nervous system is primarily involved in sustaining and maintaining an erection (S2 to S4 nerve roots).[6] Every year 145,000 new cases are registered of which one-third is in the account of rectal cancers. Colorectal cancer is estimated to be the fourth most commonly diagnosed cancer in U.S. men and women age 30 to 39. [16]Rectal cancer will attribute to 52,980 deaths (28,520 men and 24,460 women) this year. Rectal cancer is the second leading cause of cancer death in the United States for men and women combined. It is the third leading cause of cancer death in men and women. [1]The 95 percent of rectal cancers are adenocarcinomas which typically start as a polyp or a growth in the lining of the rectum. [1]Adeno means gland, and in adenocarcinoma, the cancerous growth happens in the gland which is most common among all different types of rectal cancer. Less common types of colorectal cancer include primary colorectal lymphomas, gastrointestinal stromal tumors, leiomyosarcomas, carcinoid tumors, and melanomas.Two subtypes of adenocarcinomas are mucinous(60-70%) and signet ring carcinoma(< 1%). Both are very aggressive but signet ring carcinoma is difficult to treat. National Cancer Institute Surveillance, Epidemiology, and End Results (SEER) Program explains that 4.1 percent of people may develop rectal cancer during their life. The cause of rectal cancer is unknown, but the risk of developing the disease increases with age. People with a genetic history of colorectal cancer or certain hereditary cancer syndromes such as HNPCC, Familial Adenomatous Polyposis(FAP) have a higher risk. Both HNPCC and FAP are autosomal dominant syndromes. Another rare genetic syndrome such as Gardner's syndrome, Turcot's syndrome, and Peutz-Jeghers. [52] Six types of standard treatment are used; Surgery, Radiation therapy, Chemotherapy, Active surveillance, Targeted therapy, and Immunotherapy. Surgery is usually the main treatment for rectal cancer. Radiation and chemotherapy are often given before or after surgery. The type of surgery used depends on the stage (extent) of cancer, where it is, and the goal of the surgery. Local excision if cancer is found in mucosal layers of the rectum and not spread into the wall of the rectum. Low anterior resection (LAR), some stage I rectal cancers, and most stage II or III cancers in the upper part of the rectum. Abdominoperineal resection (APR) is to treat some stage I cancers and many stage II or III cancers in the lower part of the rectum. It's often needed if the cancer is growing into the anal sphincter muscle or the nearby levator ani muscles responsible for sexual functioning can cause erectile dysfunction which is underdiagnosed and undertreated. The sympathetic nerves are at risk during presacral and ventrolateral dissection of the mesorectum and central arterial ligation, and the parasympathetic nerve supply is especially at risk during deep dissection of the lateral planes. low rectal cancer increases the risk of combined damage to the pelvic splanchnic nerves and levator ani nerves, due to the small surgical margin deep in the pelvis.[37] Pelvic floor exercises are very effective in treating erectile dysfunction. The Ischiocavernous and bulbocavernosus muscles are superficial pelvic floor muscles that are active during erection and which enhance rigidity. The bulbocavernosus muscle encircles 33–50% of the base of the penis and has three functions: it is responsible for preventing blood from escaping during an erection by exerting pressure on the deep dorsal vein; it is active and pumps during ejaculation, and it empties the bulbar urethra by reflex action after micturition.[23] Erectile dysfunction in rectal cancer operated patients specifically Low Anterior resection,

is common due to surgical interventions and involvement of pelvic nerves. Even in nerve- sparing surgeries handling of nerves also gives incidences of erectile dysfunction. Dysfunctions in the pelvic floor musculature often occur due to a lack of activation, control, or strength. Reduction in tone and alterations in contractile patterns (as identified by ultrasound) have been linked to incontinence and may directly impact erectile strength and the ejaculatory process stated by Gokce Ayelin. [41]

Criteria of selection of sample

Inclusion criteria:

- Age> 18 years and < 65 years of rectal cancer patients. Gender- Male Patients.
- Patients who had undergone Rectal Surgeries such as AnteriorResection (AR), Abdomino- Perineal Resection (APR), Inter Sphincteric Resection (ISR).
- Post surgery follow up patients after 6 months. Patients who can perform exercises.
- Patient who can read, write and speak English.

Exclusion criteria:

Patients with previous history of erectile dysfunction prior to treatment. Extended Total Mesorectal Excision patients Patients who are not willing to participate in study.Patients with neurological deficits such as Cerebro-vascular Accidents, multiple sclerosis, spinal cord injury or Parkinson's disease

Data collection tool

SHIM Questionnaire:

The SHIM is intended to serve as a screening and diagnostic aid and to complement, not suppliant, clinical judgment. The SHIM is intended to enhance the decision making of clinicians who are likely to perform more detailed evaluations in individual cases.

Number of items: 5

Question items:

1. Confidence of Erection 2.Erection hard enough for penetration 3. Maintainance of erection during sexual intercourse 4. Difficulty in maintaining erection during sexual intercourse. 5. Satisfaction Interpretation- 22-25 -No ED, 17-21 -Mild ED, 12-16 -Mild-to-moderate ED, 8-11 -Moderate ED 1-7 -Severe ED.

Intervention

Pelvic Floor Muscle Strengthening Exercises:

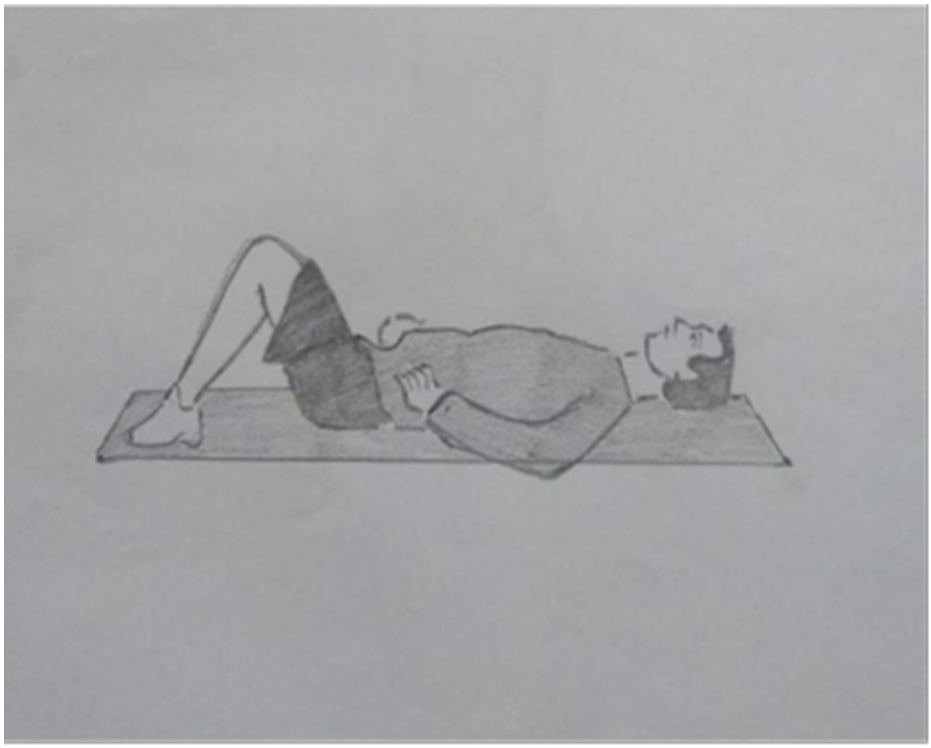
Total time required for 3 Pelvic Floor Exercises- 4 min

1. Kegel exercises for men.
2. Supine leg raises.
3. Pelvic curl/ bridge.

Total time required for 3 yoga asanas-8 min

1. Paschimottasana (Forward Bend Pose).
2. Baddhakonasanas(Bound Angle Pose)
3. Virbhadra Asanas 3(warrior pose 3).

1. Kegel exercises for men.

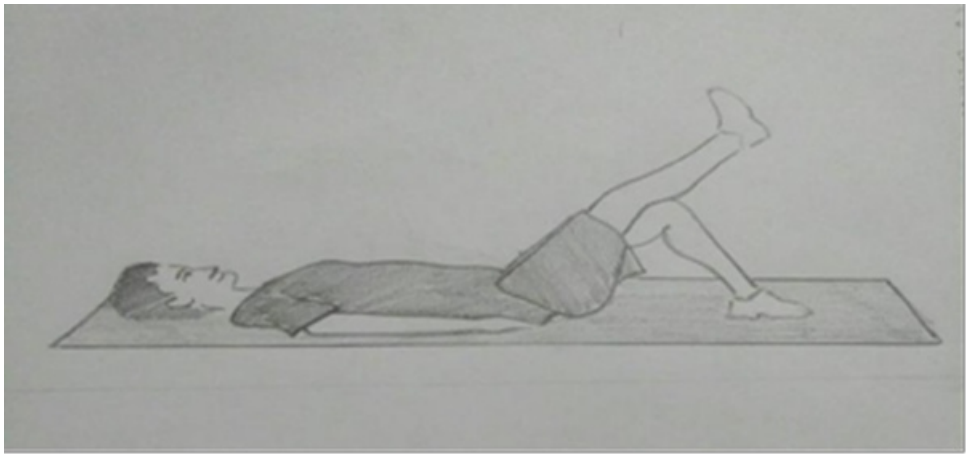


Steps:

1. Lie comfortably.
2. Exhale
3. Contract perineal muscle and anal muscle for 3 seconds and relax

4. Inhale.
5. Repeat 5 times.
6. Total Time required: 1 min
7. In a day this exercise is repeated for 3 times.

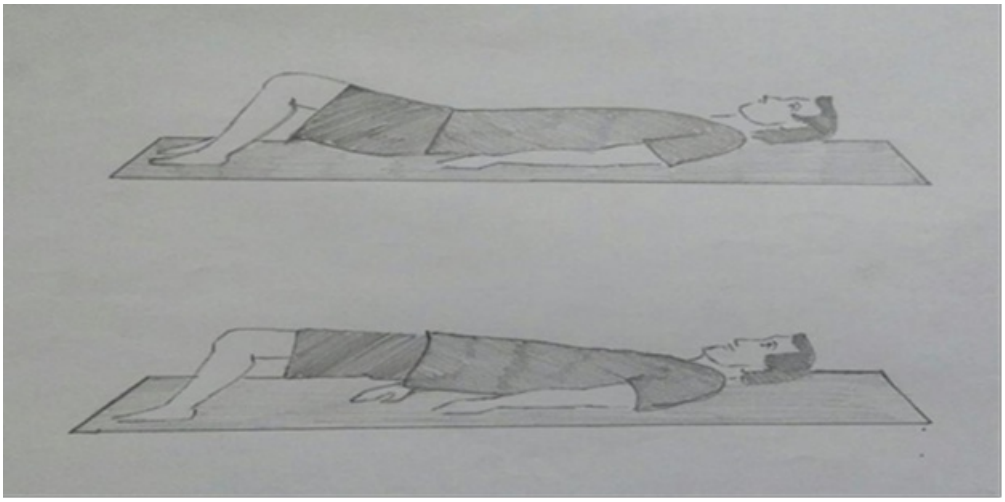
2. Pilates Exercises-Supine leg raises:



Steps:

1. Start by lying on the floor with both knees bent and your feetflat on the ground.
2. Exhale
3. Lift right foot straight into the air to create a 45 degree angle.
4. Contract the perineal and anal muscles for 3 seconds and then release.
5. Gently place it back on the ground.repeat this exercise 5 times for right leg.
6. Same steps to repeat for left leg.
7. Total time required: 2 min. In a day this exercise is repeated for 3 times.

3. Pelvic curl/ bridge.



Steps:

1. First lie down with knees bent.
2. Make your feet flat on floor.
3. Now keep your spinal coloumn in supine position.
4. Exhale Lift the pelvis as much as possible.
5. Contract and hold the perineal and anal muscles for 3 seconds and relax.
6. Inhale
7. Bring the pelvis back to floor.
8. Repeat for 5 times
9. Total time required 1 min.10. In a day this exercise is repeated for 3 times

1. Paschimottanasanas (Forward Bend Pose):

Steps:

Sit up with the legs stretched out straight in front of you on the floor.Keep the spine erect and toes flexed towards you. Bring the respiration to normal.Breathing in, slowly raise both the arms straight above your head and stretch up. Slowly breathe out and bend forward. Try to hold toes and pull on them. Focus on perineal and anal muscles, contract the muscle. Continue with this pose for one to three minutes. Relax and release your body slowly. Repeat for 5 times Total time required is 45 sec to 1 minute.

2. Baddha Konasana:

Steps:

1. Sit on mat with legs extended in front of you.
2. Exhale and bend your knees
3. Pulling heels toward pelvis one at a time.
4. Drop your knees to either side
5. Use your first and second fingers to grab your big toes or ankles with the hands.
6. Contract the perineal and anal muscles together
7. Stay in this position for 1 min.
8. Repeat this for 5 times.
9. Total time required - 6 min (70 sec x 5 =350 sec) = 6 min

3. Virbhadra Asanas 3 (warrior pose 3).

Steps:

Stand in erect position keep a distance of 3-4 feet between two legs. Breathe in and lift up your both hands. Keep your hands parallel to the floor or ground. Turn your head to the right side. During breathing out gently turn right feet at the angle of 90 degrees to the right side. Now gently bend your right knee little bit downward to the ground. Ensure that your right thigh ought to be parallel to the floor or ground. Remain in this Pose for 30 seconds and breathe deeply about 3 to 4 times. After that breathe out and slowly down your hands and come to the standing position and breathe normally. Rest for a while. After this attempt repeat the same steps with your left leg by turning your head to the left side. Repeat this for 5 times. Total time required is 1 min(10 x 5= 50 sec/1 min).

Data Analysis and Interpretation

Section I Part – A

Table-I. DISTRIBUTION OF PARTICIPANTS ACCORDING TO AGE
(N=39)

Demographic variables	No. of Study participants	Percentage
Age Group (yrs)		
18 – 25	0	0.0
26 – 35	9	23.1
36 – 45	18	46.2
46 – 55	12	30.8
56 – 65	0	0.0
Total	39	100.0

The table shows that 46.2% of participants were in the 36-45 years of age group, 23.1% participants were in the age group of 26-35 years, 30.8% participants were in the age group of 46-55 years.

Table II. DISTRIBUTION OF PARTICIPANTS ACCORDING TO MARIATAL STATUS
(N=39)

Demographic variables	No. of study participants	Percentage
Marital Status		
Unmarried	2	5.1
Married	37	94.9
Total	39	100

Out of 39 participants, 37 were married and 2 were unmarried.

Table III. DISTRIBUTION OF PARTICIPANTS ACCORDING TO NUMBER OF CHILDREN
(N=39)

CLINICAL DATA	NO OF CHILDREN TO STUDY PARTICIPANTS	PERCENTAGE
	3	5 %
	2	49 %
	1	35 %
	0	11 %

Among 39 participants, 49 % were having 2 children, 35% were having 1 child, 11% were having no children and 5% were having 3 children.

Table IV. DISTRIBUTION OF PARTICIPANTS ACCORDING TO TYPE OF SURGERY
(N=39)

CLINICAL DATA	NO OF STUDY PARTICIPANTS	PERCENTAGE
Types of Surgery	No of participants	Percentage
Anterior Resection	31	79.5
Abdomino-Perineal resection	8	20.5

In the type of surgery, 79.5% of participants had undergone Anterior resection surgery and 20.5% of participants had undergone Abdominoperineal resection.

Table V. DISTRIBUTION OF PARTICIPANTS ACCORDING TO TYPE OF TYPE OF ADJUVANT THERAPY
(N=39)

CLINICAL DATA	NO OF STUDY PARTICIPANTS	PERCENTAGE
Adjuvant therapy		
FOLFIRINOX	1	2.6
CAPOX/ FOLFOX/	13	33.4
Total	14	36

In adjuvant chemotherapy, 36 % of participants had taken adjuvant chemotherapy out of which, 33.4% had CAPOX/ FOLFOX, Capeciitabine Chemotherapy regimen, and 2.6 % had FOLFIRINOX chemotherapy regimen.

Table VI. DISTRIBUTION OF PARTICIPANTS ACCORDING TO RADIATION THERAPY
(N=39)

RADIATION THERAPY	NO Of STUDY PARTICIPANTS	PERCENTAGE
NACTRT	34	87.2
Nil	5	12.8
Total	39	100

In neoadjuvant radiation therapy, 87.2% of participants had undergone neo-adjuvant radiation therapy and 12.8% were without neo-adjuvant radiation therapy.

Table VII. DISTRIBUTION OF PARTICIPANTS ACCORDING TO DOSE OF RADIATION THERAPY
(N=39)

DOSE OF RADIATION THERAPY	NO OF CHILREN TO STUDY PARTICIPANTS	PERCENTAGE
Dose of Radiation therapy		
<50GY/ 25#	7	20.6
≥50GY/ 25#	27	79.4

The above figure shows that 79.4 % participants had > 50Gy/ 25# radiation dose and 20.6% participants had < 50Gy/ 25# radiation dose.

Table VIII. DISTRIBUTION OF PARTICIPANTS ACCORDING TO TNM STAGING
(N=39)

TNM STAGE	NO OF CHILDREN TO STUDY PARTICIPANTS	PERCENTAGE
Stage-1 (T1N0M0/T2N0M0)	7	17.9
Stage-2 (T3N0M0/T4N0M0)	8	20.5
Stage-3 (T1-4 N1-2 M0)	23	59.0
Stage-4 (T1-4 N 1-2 M1/2)	1	2.6
Total	39	100.0

In the Staging of rectal cancer, 59% of participants had stage 3rectal cancer, 20.5% of participants had stage II rectal cancer, 17.9% participants had stage I rectal cancer, and only 2.6% participants had stage IV rectal cancer.

Table IX. DISTRIBUTION OF PARTICIPANTS ACCORDING TO COMORBIDITY
(N=39)

CO-MORBIDITY	NO OF CHILDREN TO STUDY PARTICIPANTS	PERCENTAGE
Diabetes	1	2.6
Hypertension	1	2.6

In co-morbid conditions, 2.6 % of participants had co-morbidities like Diabetes and Hypertension respectively.

Section II

II a. Comparison of participants according to the type of erectile dysfunction in pre- intervention and post-intervention rectal cancer participants using SHIM questionnaire.

Table X. COMPARISON OF PARTICIPANTS ACCORDING TO SEVERITY OF ERECTILE DYSFUNCTION IN PRE-INTERVENTION AND POST- INTERVENTION PATIENTS.

Table 10 shows that,In pre-intervention program, Among 39 participants, 0% participants had no erectile dysfunction (22-25), 2.6 % participant had mild erectile dysfunction (17-21), 48.7% participants had mild to moderate erectile dysfunction (12-16), 48.7 % participants had moderate erectile dysfunction (8-11) and 0% participants had severe erectile dysfunction (22- 25).

In post-intervention program, Among 39 participants, 0% participants had no erectile dysfunction (22-25), 7.7 % participant had mild erectile dysfunction (17-21), 71.8 % participants had mild to moderate erectile dysfunction (12-16), 20.5 % participants had moderate erectile dysfunction (8-11) and 0% participants had severe erectile dysfunction (22- 25).

The pelvic floor muscle strengthening exercises were found statistically significant in participants by Chi-square value was 7.205 and P value was 0.027. (N=39)

Table X.

Intervention	SHIM Score											
	No ED (22-25)	Mil ED (17 – 21)	Mild ED (17 – 21)	Moderate ED (17 – 21)	Severe ED (1 –7)	Total						
	F	F	F	%	F	%	F	%	F	%	F	%
Pre Intervention	0	1	1	48.7	19	48.7	19	48.7	0	0.0	39	100.0
Post Intervention	0	3	3	20.5	28	71.8	8	20.5	0	0.0	39	100.0
Chi-square Test	7.205*											
P-Value	0.027											
Sig. at 5% level	Yes											

**Statistically Significant at 5% level i.e., P<0.05*

IB.

THIS SECTION DEALS WITH THE EFFECTIVENESS OF PELVIC FLOOR MUSCLE STRENGTHENING EXERCISES ON ERECTILE DYSFUNCTION.

Table XI. ANALYSIS OF PELVIC FLOOR MUSCLE STRENGTHENING EXERCISES ON ERECTILE DYSFUNCTION SHIM SCORE IN PRE-TEST VS POST-TEST

Table XI shows that,

In the pre-intervention SHIM questionnaire, the Mean score and Standard Deviation among 5 questions were Confidence (2.6154±0.5901), Erection (2.5128±0.6014), Penetration (2.1764±0.3888),

Difficulty (2.2564±0.5964) and satisfaction (2.2821±0.5595).

In Post intervention SHIM score among 5 questions were Confidence (3.0513±0.6047), Erection (2.8974±0.6804), Penetration (2.3590±0.6277), Difficulty (2.3590±0.6277) and satisfaction (2.6410±0.6684)

The confidence, erection, satisfaction post-intervention were statistically highly significant in participants (P< 0.001), and in terms of Difficulty, it was statistically significant (P 0.005).

The Wilcoxon signed-rank test explains that there was a significant increase seen in the scores of confidence (4.123), erection (3.873), and satisfaction (3.500). They were highly statistically significant (P< 0.001). There was a significant increase seen in the scores of penetration (4.123) and difficulty (3.873). They were statistically significant (p 0.001 and 0.046) respectively.

(N=39)

Table XI.

Parameter	Pre Intervention	At 10 weeks	Wilcoxon Signed rank test	P-Value	Sig. at 5% level		
	Mean±SD	Median	Mean±SD	Median			
Confidence	2.6154±0.5901	3.0	3.0513±0.6047	3.0	4.123**	<0.001	Yes
Erection	2.5128±0.6014	2.0	2.8974±0.6804	3.0	3.873**	<0.001	Yes
Penetration	2.1764±0.3888	2.0	2.4872±0.5559	2.0	3.464*	0.001	Yes
Difficulty	2.2564±0.5964	2.0	2.3590±0.6277	2.0	2.000*	0.046	Yes
Satisfaction	2.2821±0.5595	2.0	2.6410±0.6684	3.0	3.500**	<0.001	Yes
Total Score	11.8462±1.9539	12.0	13.4359±2.3708	1300	4.437**	<0.001	Yes

**Statistically significant at 5% level i.e., P<0.05*

***Statistically highly Significant at 0.1% level i.e., P<0.001 Conclusion:*

Hence the pelvic floor muscle strengthening exercises helped improve erectile dysfunction among rectal cancer survivors.

This table shows that the Null Hypothesis (H0) was rejected and the Research hypothesis (H1) is accepted.

Section III

This section deals with the incidence of erectile dysfunction in rectal cancer survivors.

Table XII. INCIDENCE OF ERECTILE DYSFUNCTION IN PRE-INTERVENTION AND POST-INTERVENTION RECTAL CANCER PARTICIPANTS USING SHIM QUESTIONNAIRE.

Table XII shows that,

Among 39 participants, 0% participants had no erectile dysfunction (22-25), 2.6 % participant had mild erectile dysfunction (17-21), 48.7% participants had mild to moderate erectile dysfunction (8-11), 48.7 % participants had moderate erectile dysfunction and 0% participants had severe erectile dysfunction (22-25).

(N=39)

Table XII.

Intervention	SHIM Score											
	No ED (22 – 25)	Mild ED (17 – 21)	Mild to Moderate ED (12 – 16)	Moderate ED (8 – 11)	Severe ED (1 – 7)	Total						
	F	%	F	%	F	%	F	%	F	%	F	%
Incidence of Erectile dysfunction	0	0.0	1	2.6	19	48.7	19	48.7	0	0.0	39	100.0

This section deals with the association between selected demographic variables (age, clinical diagnosis, and type of surgery, type of adjuvant therapy, radiation therapy details, and comorbidities) and erectile dysfunction.

Table XIII. ASSOCIATION OF VARIABLES OF PRE INTERVENTION SHIM SCORE WITH DEMOGRAPHIC VARIABLES

Table XIII depicts that,

There was no association between age group and erectile dysfunction.

There was no significant association between marital status and erectile dysfunction There was no significant association between no of children and erectile dysfunction There was no association between surgery and erectile dysfunction

There was no significant association between radiation therapy and erectile dysfunction There was no significant association between staging and erectile dysfunction

Demographic Variables	No ED (22-25)	Mild ED (17 – 21)	Mild to Moderate ED (12 – 16)	Moderate ED (8 – 11)	Severe ED (22-25)	Total	Chisquare test	P-Value	Sig. at 5% level
Age Group (yrs)									
26 – 35	0	1	4	4	0	9	3.991	0.407	Not
36 – 45	0	0	10	8	0	18			
46 – 55	0	0	5	7	0	12			
Total	0	1	19	19	0	39			
Marital Status									
Unmarried	0	0	1	1	0	2	0.055	0.973	Not
Married	0	1	18	18	0	37			
Total	0	1	19	19	0	39			
No. of Children									
0	0	1	1	2	0	4	8.815	0.184	Not
1	0	0	7	6	0	13			
2	0	0	9	9	0	18			
3	0	0	1	1	0	2			
Total	0	1	18	18	0	37			
Types of Surgery									
Anterior Resection	0	1	13	17	0	31	2.847	0.241	Not
Abdomino-Perineal Resection	0	0	6	2	0	8			
Total	0	1	19	19	0	39			
Radiation therapy details-Dose									
NACTRT	0	1	16	17	0	34	0.386	0.824	Not
Nil	0	0	3	2	0	5			
Total	0	1	19	19	0	39			
Radiation therapy									
<50GY/ 25#	0	0	4	3	0	7	0.540	0.764	Not
≥50GY/ 25#	0	1	12	14	0	27			

(N=39)

	Total	0	1	16	17	0	34			
	TNM Stage									
	Stage-1 (T1N0M0/T2N0M0)		0	3	4		7	2.579	0.860	Not
	Stage-2 (T3N0M0/T4N0M0)		0	3	5		8			
	Stage-3 (T1-4 N1-2 M0)		1	12	10		23			
	Stage-4 (T1-4 N 1-2 M1/2)		0	1	0		1			
	Total		1	19	19		39			

Discussion

Erectile dysfunction in rectal cancer survivors appeared as a significant adverse effect due to surgery as well as radiation therapy.

This quasi-experimental study was aimed to assess the effect of pelvic floor muscle strengthening exercises on erectile dysfunction in rectal cancer survivors. Thirty-nine samples were selected through the convenient sampling method.

In this study, interventions consisted of 6 exercises out of which three were physical exercises and 3 were yoga asanas. Three pelvic exercises were Kegels exercises, supine leg raise, and pelvic curl. Yoga asanas were consisted of Paschimottasanas, Baddhakonasanas and Virbhadra asanas type 2. All these exercises were for 15 min which was carried out three times a day with 5 repetitions. Patients were asked to perform these exercises for 10 weeks. And follow up was taken on the 10th week.

Attaallah W (2018) carried out a prospective study in 187 rectal cancer patients in Turkey, 117 patients with radical resection in the pelvic cavity faced difficult sexual dysfunction post- surgery. In male patients, sexual dysfunction raised from 4% to 41% post-surgery. Advanced stage of disease and adjuvant chemotherapy had more percentage of sexual dysfunction in terms of erection. Sexual function was also a major indicator of the quality of life in male patients. This study explained that sexual dysfunction in rectal cancer patients after radical treatment is most common. In total, 4% of male patients had moderate or severe ED preoperatively which drastically gone up to 41% post-surgery (pZ<0.001). This means that ED has developed after surgery in 38% of the male patients. ED reported by only two (6%) of 30 patients who

had laparoscopic rectal surgery, 50% of patients had undergone open surgery (P < 0.001). N2 stage nodal involvement has a higher rate of erectile dysfunction than N0 involvement. [30% vs 1%, respectively; p Z 0.004]. 49% of patients with adjuvant radiotherapy reported ED compared to those without ED.[49% vs 20%, respectively; p Z 0.003].

This study revealed that, 0% participants had no erectile dysfunction (22-25), 2.6 % participant had mild erectile dysfunction (17-21), 48.7% participants had mild to moderate erectile dysfunction(8-11), 48.7 % participants had moderate erectile dysfunction and 0% participants had severe erectile dysfunction (22-25).

This study results showed that 46.2% of participants were in the 36-45 age group, 23.1% participants were in the age group of 26-35 years, 30.8% participants were in the age group of 46-55 years. 37 participants were married and 2 were unmarried. Out of 39, 46.2% participants had 2 children, 33.3% participants had 1 child,10.3% participants had no children and 5.1% participants had 3 children. In the type of surgery, 79.5% of participants had undergone Anterior resection surgery and 20.5% participants had undergone Abdominoperineal resection. Among 39 participants, 36 % participants had taken adjuvant chemotherapy out of which, 33.4% had CAPOX/ FOLFOX, Capeciitabine Chemotherapy regimen, and 2.6 % had FOLFIRINOX chemotherapy regimen. In neoadjuvant radiation therapy, 87.2% of participants had undergone neoadjuvant radiation therapy and 12.8% were without neo-adjuvant radiation therapy. 79.4 % participants had > 50Gy/ 25# radiation dose and 20.6% participants had < 50Gy/ 25# radiation dose.

Among all participants, 59% of participants had stage 3rectal cancer, 20.5% participants had stage II rectal cancer, 17.9% participants had stage I rectal cancer, and only 2.6% participants had stage IV rectal cancer. In co-morbid conditions,2.6 % participants had co-morbidities like Diabetes and Hypertension respectively.

According to a previous study, Kim JY (2018) Carried out a randomized controlled trial in 71 patients (Exercise group-37, control group-34) The home-based exercise program having unsupervised walking, stationary bike, or swimming for aerobic exercise, and resistance exercise DVDs, a pedometer, and an exercise log. The Functional Time Exercise Questionnaire tool was used to assess QOL, fatigue, depression, and physical activity levels. The change in the QOL between the intervention and control groups was insignificant. However, QOL was dramatically improved in the exercise group (QOL, p = 0.024). Sub- domain of QOL, emotional well-being, and trial outcome index-physical/functional/rectal (p= 0.015 and p = 0.035, respectively) were improved in the exercise group. Post 12 week exercise, PA was significantly increased (97.0 ± 188.5 vs. 332.6 ± 306.1, p < 0.001), and the change significantly differed compared with the control group (mean change 235.6 vs. 16.3, p< 0.001). He Concluded that a home-based exercise program may improve the QOL and psychological health in rectal cancer survivors.

In this study, 10 weeks of exercises were carried out. Post 10 weeks exercises the confidence, erection, satisfaction post interventions were statistically highly significant in participants (P< 0.001), and in terms of Difficulty it was statistically significant (P 0.005). The pelvic floor muscle strengthening exercises were found statistically significant in participants by Chi- square value was 7.205 and P value was 0.027.

Helena C (2018) conducted a non-randomized controlled feasibility study in which the rehabilitation group received an 8-week, bi-weekly education and exercise program which also included exercise diaries and telephone coaching sessions.

Feasibility measures, functional exercise capacity, muscle strength, physical activity levels, pelvic floor symptoms, anxiety and depression, health-related quality of life (HRQoL), and self-efficacy were measured at baseline (time 1), immediately post-intervention (time 2) and at 6 months post- baseline (time 3) and compared within- and between groups. The consent rate of the intervention arm was 24%. Eighty-one percent(85– 100%) of the intervention arm attended 16 scheduled sessions. 96% of patients of the intervention arm program had overall satisfaction. Functional exercise capacity, handgrip strength, bowel symptoms, physical activity levels, depression, and HRQoL was statistically significant in the intervention arm ($p < 0.05$) at immediately post-intervention (time 2) which remained improved at 6 months post- baseline (time 3) ($p < 0.05$) than the control arm.

In this study, participants visiting follow-up OPD were selected. All participants were included after their consent for inclusion in this study. Preintervention erectile dysfunction score was assessed by SHIM questionnaire. Pelvic floor muscle strengthening exercises were taught to participants on day 0 OPD day. Redemonstration of learned exercises from participants was taken. Participant's adherence to exercises was by video calls thrice a week on mobile phones and also pamphlets were distributed among participants. Participants were assessed post 10 weeks in OPD for post-intervention Erectile dysfunction score. The pelvic floor muscle strengthening exercises were found statistically significant in participants by Chi-square value was 7.205 and P value was 0.027.

This study showed that pelvic floor muscle strengthening exercises improved erectile dysfunction among men after 10 weeks of intense and regular follow-up of participants. Erectile dysfunction post-intervention improved among 39 participants.

There was no association between erectile dysfunction and demographic data and erectile dysfunction and clinical data.

Merilyn M (2011) Urinary and sexual dysfunction Postoperative sexual dysfunction range from 10% to 50%, depending on the assessments used. Duran et al20 noted a 17.8% decrease in the sexual function of men compared with the preoperational period after abdominoperineal resection and low anterior resection. Both erection and ejaculation were impaired significantly.

In this study, that there was a significant increase seen in the scores of confidence (4.123), erection (3.873), and satisfaction (3.500). They were highly statistically significant($P< 0.001$). There was a significant increase seen in the scores of penetration (4.123) and difficulty (3.873). They were statistically significant (p 0.001 and 0.046) respectively. The confidence, erection, satisfaction post-intervention were statistically highly significant in participants ($P< 0.001$), and in terms of Difficulty, it was statistically significant (P 0.005).

The barrier related to this study was During the follow-up period due to the covid-19 situation patients were sometimes unable to contact and adherence to exercises was disturbed in between which was later established after frequent follow-up and phone calls.

Conclusion

The demographic characteristics of participants were analyzed using frequency and percentage. All the responses of the participants to intervention at two-point were assessed using frequency and percentage. Descriptive assessment of Erectile dysfunction was represented in terms of mean, median, standard deviation, range, and percentage.

References

1. Tortora G, Derrickson B, Principles of anatomy and physiology, 14th edit. 2014:523- 546, 886-940
2. Sharma KS. Nursing research and statistics, India: Elsevier publications. 2013:30,93,125,158-160.
3. Basavanthappa BT. Nursing research, 2nd edition. New Delhi: Jaypee brother medica publisher private limited.2010: 560
4. Sharma KS. Nursing research and statistics, India: Elsevier publications. 2013: 30, 93,125,225-227.
5. Langhorne M, Otto S, Fulton J. Oncology nursing, 5th edition, Mosby Elsevier publications; 2007:125-126.
6. Andersson K. Erectile physiological and pathophysiological pathways involved in erectile dysfunction. J Urol. 2003;170: S6–S13.
7. Ellis R, Smith A, Wilson S, Warmington S, Ismail T. The prevalence of erectile dysfunction in post-treatment colorectal cancer patients and their interests in seeking treatment: a cross-sectional survey in the west-midlands. Journal of sex medicine. 2010;7: 1488–1496.
8. Voznesensky M, Annam K, Kreder K. Understanding and managing erectile dysfunction in patients treated for cancer. Journal of Oncology Practice. 2016; 12(4): 292-304.
9. Evenoa C, Lamblinb A, Mariette C, Pocarda M, Sexual and urinary dysfunction after proctectomy for rectal cancer, Journal of Visceral Surgery;2010:21-30.
10. Cabilan C, Hines S. The short-term impact of colorectal cancer treatment on physical activity, functional status and quality of life: a systematic review; 2017: 517-567
11. George D, Ismail T, Greenfield S, Clifford S, Hancock B, Wilson S. Men's experience of erectile dysfunction after treatment for colorectal cancer: qualitative interview study; 2011:343-345
12. Althof S, Parish S. Clinical interviewing techniques and sexuality questionnaires for male and female cancer patients. Journal of sex med. 2013; 10(1):35–42.
13. Jennifer Y, Christopher J, Jonathan B, Ashman, Nishin A. Daniel T, et all. Radiation therapy for rectal cancer: executive summary of an astro clinical practice guideline. Practical radiation oncology; 2020:1-13
14. Malekzadeh R. The global, regional, and national burden of colorectal cancer and its attributable risk factors in 195 countries and territories, 1990–2017: a systematicanalysis for the Global Burden of Disease Study 2017 Lancet Gastro enteral Hepatol. 2019;(4): 913–33
15. Falk S, Dizon D. Sexual health issues in cancer survivors: seminars in oncology nursing.2020: 1-5
16. ICMR, NCDIR. National cancer registry program in India.2020.Available form: https://ncdirindia.org/All_Reports/Report_2020/Factsheet/Fact_Sheet_2020.pdf
17. Saito S, Fujita S, Mizusawa J, Kanemitsu Y, Saito N, Kinugasa Y et all. Male sexual dysfunction after rectal cancer surgery: results of a randomized trial comparing mesorectal excision with and without lateral lymph node dissection for

patients with lower rectal cancer: Eur j Surg Oncol. 2016; 42(12):1851-1858.

18. Costa P, Joao M, Cardoso J, Louro H, Dias J, Costa L, et all. Impact on sexual function of surgical treatment in rectal cancer; Int Braz J Urol. 2018; 44: 141-9.
19. Hur H, Sung U, Kim N, Min B, Baik S, Lee K. Comparative study of voiding and male sexual function following open and laparoscopic total mesorectal excision in patients with rectal cancer; a journal of surgical oncology. 2013;108:572–578.
20. Kim J, Lee M, Lee D ,Kang D, Min J, Lee J, et all. Effects of a 12-week home-based exercise program on quality of life, psychological health, and the level of physical activity in colorectal cancer survivors: a randomized controlled trial; Supportive Care in Cancer.2019; 27: 2933–2940.
21. Helena C, Frawley H, Lin K, Granger C, Higgins R, Butler M, Denehy L. An allied health rehabilitation program for patients following surgery for abdominopelvic cancer: a feasibility and pilot clinical study Supportive Care in Cancer. 2019: 1-19
22. Sellar C, Bell G, Haennel R, Au H, Chua N, Courneya K. Feasibility and efficacy of a 12-week supervised exercise intervention for colorectal cancer survivors. Appl. Physiol. Nutr. Metab.2014; 39: 715–723.
23. Dorey G, Speakman MJ, Feneley RC, Swinkels A, Dunn CD. Pelvic floor exercises for erectile dysfunction. BJU Int. 2005 ; 96(4):595-7.
24. Dorey G, Speakman M, Feneley R, Swinkels A, Dunn C, Ewings P. Randomised controlled trial of pelvic floor muscle exercises and manometric biofeedback for erectile dysfunction. Br J Gen Pract. 2004 ;54(508):819-25.
25. Culligan P, Scherer J, Dyer K, Priestley J, Guingon-White G, Delvecchio D, Vangeli M. A randomized clinical trial comparing pelvic floor muscle training to a Pilates exercise program for improving pelvic muscle strength Int Urogynecol J.2010; 21:401–408.
26. Ooijen S, Carli F, Dalton S, Thomas G, Bojesen R, Leguen M, et all. Multimodal prehabilitation in colorectal cancer patients to improve functional capacity and reduce postoperative complications: the first international randomized controlled trial for multimodal prehabilitation.BMC Cancer.2019; 19:98:1-11
27. Myers C, Smith M. Pelvic floor muscle training improves erectile dysfunction and premature ejaculation: a systematic review.2019;105: 235–243.
28. Grensman A, Acharya B, Wändell P, Nilsson G,Torkel F, Sundin O, et all. Effect of traditional yoga, mindfulness–based cognitive therapy, and cognitive behavioral therapy, on health-related quality of life: a randomized controlled trial on patients on sick leave because of burnout. Complementary and Alternative Medicine.2018;18(80):1-16.
29. Lavoisier P, Roy P, Dantony E, Watrelot A, Ruggeri J, Dumoulin S. Pelvic-floor muscle rehabilitation in erectile dysfunction and premature ejaculation. 2014; 19(4):1731-1743.
30. Brotto L ,Mehak L, Kit C.Yoga and Sexual Functioning: A Review Journal of Sex & Marital Therapy. 2009;35(5): 378-390.
31. Dhikav V, Karmarkar G, Verma M, Gupta R, Gupta S, Mittal D, Anand K. Yoga in male sexual functioning: a noncomparative pilot study; j sex medicine.2010:1-8.
32. Son H, Son Y, Kim H, Lee Y. Effect of psychosocial interventions on the quality of life of patients with colorectal cancer: a systematic review and meta-analysis. Health and quality of life outcomes.2018; 16(119): 1-12.

33. Denlinger C, Andrea M, Barsevick A. The challenges of colorectal cancer survivorship. J natl compr canc netw. 2009; 7(8): 883–894.
34. Panteleimonitis S, Ahmed J, Harper M, Parvaiz A. Critical analysis of the literature investigating urogenital function preservation following robotic rectal cancer surgery. World J Gastrointest Surg. 2016; 8(11):744-54.
35. Ali Z, Tareq S. Total mesorectal excision for the treatment of rectal cancer.2015; 7(8): 1666–1672.
36. Luca F, Valvo M, Ghezzi T, Zuccaro M, Cenciarelli S, Trovato C, et all. Impact of robotic surgery on sexual and urinary functions after fully robotic nerve-sparing total mesorectal excision for rectal cancer. Annals of surgery. 2013; 257(4):672-678.
37. Oudsten B, Traa M, ThongM, Martijn H, DeHingh I, Bosscha K, Poll-Franse L. Higher prevalence of sexual dysfunction in the colon and rectal cancer survivorscompared with the normative population: A population-based study European Journal of Cancer. 2012; 48:3161–3170.
38. Stephanie O. Breukink S, Donovan K. Physical and psychological effects of treatment on sexual functioning in colorectal cancer survivors. J sex med. 2013; 10(1):74–83.
39. Sorensson M, Asplund D, Matthiessen P, Rosenberg J, Hallgren T, Rosander C, Gonzalez E, Bock D, Angenete D. Self-reported sexual dysfunction in patients with rectal cancer colorectal Disease. 2020;22(5):500-512.
40. Silva A, Sousa N, Azevedo L, Martins C. Physical activity and exercise for erectile dysfunction: systematic review and meta-analysis.Br J Sports Med 2016;1–7.
41. Gokçe A, Ozkan H. Erectile dysfunction after surgery for rectal cancer: a prospective study Turk J Surg. 2019; 35 (4): 293-298.
42. Attaallah W, Ertekin S C, Yegen C. Prospective study of sexual dysfunction after proctectomy for rectal cancer Asian Journal of Surgery. 2018; 41: 454-461.
43. Duran E, Tanriseven M, Ersoz Nail, Oztas M, Ozerhan I H, Kilbas Z, Demirbas S. Urinary and sexual dysfunction rates and risk factors following rectal cancer surgery: Int J Colorectal Disease, 2015:1-9.
44. Ramos N, Ramos R, Silva E. Anterior resection of the rectum vs radical prostatectomy. Are there any differences in sexual rehabilitation? DOI: 10.1590/0100- 6991e-20202469
45. Polit F. Beck C. Nursing research: Generating and assessing evidence for nursing practice, 9th edition. New Delhi: Wolters Kluwer Lippincott Williams, reprint 2013;473:556-557.
46. Bernier, Francie. Relationship of a pelvic floor rehabilitation program for urinary incontinence to Orem's self-care deficit theory of nursing: part 1." urologic nursing, vol. 22, no. 6, 2002:378-83, 390.
47. Rajsekhar S. Philominathan P. Chinnathambi V. research methodology htttp://arxiv.org/pdf/physics/060 1009.pdf 14oct 2013(cited 2021july 30).In: research methodology. Research methodology: An introduction (serial online) (cited Feb 20) available online from: http://www.limat.org/data/research%20 Methodology.pdf
48. Sendur M, Aksoy S, Ozdemir N, Yaman S, Yazici O, Bulent A, et all. Evaluation of erectile dysfunction risk factors in young male survivors of colorectal cancer, JBUON. 2014; 19(1): 115-123.
49. Reese J, Handorf E, Haythornthwaite J. A sexual quality of life, body image distress, and psychosocial outcomes in colorectal cancer: a longitudinal study. Supportive Care in Cancer.
50. Daniel F, Temple L. Functional consequences of colorectal cancer management. Surgical Oncology Clin N Am

23.2014: 127–149.

51. Kim J, Kim N, Lee K, Hur H, Min B, Kim J. A comparative study of voiding and sexual function after total mesorectal excision with autonomic nerve preservation for rectal cancer: laparoscopic versus robotic surgery. Ann surgical oncology .2012; 19:2485–2493.
52. Salonia A, Castagna G, Sacca A, Ferrari M, Umberto C, Fabio C, et all. Is erectile dysfunction a reliable proxy of general male health status? He case for the international index of erectile function—erectile function domainjsm_2869 1.8 Andrea. Journal of sexual medicine: 1-8
53. Gao J, An Y, Wang D, Yao H, Zhang Z. Current status of research on short-term quality of life after sphincteric-saving surgery in rectal cancer patients. Zhonghua Wei Chang Wai Ke Za Zhi. 2020; 23(4): 415-420. Chinese. doi: 10.3760/cma.j.cn.441530- 20190525-00219. PMID: 32306613.
54. Kinugasa Y, Murakami G, Uchimoto K, Takenaka A, Yajima T, Sugihara K. Operating behind Denonvilliers' fascia for reliable preservation of urogenital autonomic nerves in total mesorectal excision: a histologic study using cadaveric specimens, including a surgical experiment using fresh cadaveric models. Dis Colon Rectum. 2006;49(7):1024-32.
55. Merilyn M Lange and Cornelis J. H. van de Velde urinary and sexual dysfunction after rectal cancer treatment Volume 8, January 2011:51-57.
56. Capogrosso P, Pozzi E. Celentano V. Sanchez-Salas R. Salonia A. Erectile recovery after radical pelvic surgery; methodological challenges and recommendations for data reporting journal of sexual medicine. 2019: 1-10
57. Show-Ing S, Yu-Hua L, Chiung-Yu H, Chia-Chan K, Shu-Ling H, Hsing-Yu Y, Hong-Yu T. Sexual dysfunction in males following low anterior resection; Journal of Clinical Nursing. 2016:1-9
58. Ma B, Gao P, Wang H, Xu Q, Song Y, Huang X, Sun J, Zhao J, Luo J. Sun Y, Wang Z, What has preoperative radio(chemo)therapy brought to localized rectal cancer patients in terms of perioperative and long-term outcomes over the past decades? A systematic review and meta-analysis based on 41,121 patients, International journal of cancer: 1-32.
59. Celentano V. Cohen R. Warusavitarne J. Faiz O. Chand M. Sexual dysfunction following rectal cancer surgery Int J Colorectal Dis.2017; 32:1523–1530
60. Yann P, Massarat Z, Zalinski S, Ruppert R, Furst A, Fazio V. Preoperative radiotherapy is associated with worse functional results after coloanal anastomosis for rectal cancer dis colon rectum. 2009; 52: 2004–2015.
61. Kirby M. The circle of lifestyle and erectile dysfunction. Sex med rev. 2015; 3: 169– 182.

Bibliography

1. Andersson J, Abis G, Gellerstedt M, Angerås A, Cuesta M, Jess P, Rosenberg J, Bonjer H, Haglind E. Patient-reported genitourinary dysfunction after laparoscopic and open rectal cancer surgery in a randomized trial; Br J Surg. 2014; 101: 1272–9.
2. Asplund D, Heath J, González E, Ekelund J, Rosenberg J, Haglind E, et al. Self- reported quality of life and functional outcome in patients with rectal cancer – QoLiRECT; Dan Med J. 2014; 61: A4841.
3. Asplund D, Prytz M, Bock D, Haglind E, Angenete E. Persistent perineal morbidity is common following

abdominoperineal excision for rectal cancer; Int J Colorectal Dis. 2015; 30: 1563–70.

4. Banerjee AK. Sexual dysfunction after surgery for rectal cancers; Lancet. 2000; 353(9168):1900–1902
5. Berry L, Davis S, Godfrey Flynn A, Landercasper J, Deming K. Is it time to reconsider the term "cancer survivor"; J Psychosoc Oncol. 2019; doi:10.1080.07347332.2018.1522411
6. Broholm M, Pommergaard H, Gogenur I. Possible benefits of robot-assisted rectal cancer surgery regarding urological and sexual dysfunction: a systematic review and meta-analysis. Colorectal Dis. 2015; 17: 375–81.
7. Dulk M, Krijnen P, Marijnen C, Rutten H, Poll-Franse L, Putter H , et all. Improved overall survival for patients with rectal cancer since 1990: the effects of TME surgery and pre-operative radiotherapy; Eur J Cancer. 2008; 44: 1710–6.
8. Edwards B, Ward E, Kohler B, Eheman C, Zauber A, Anderson R, Ries L. Annual report to the nation on the status of cancer, 1975–2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. Cancer. 2010; 116(3):544–573
9. Heriot A, Tekkis P, Fazio V, Neary P, Lavery I. Adjuvant radiotherapy is associated with increased sexual dysfunction in male patients undergoing resection for rectal cancer: a predictive model; Ann Surg .2005; 242: 502–10.
10. Hendren S, O'Connor B, Liu M, Asano T, Cohen Z, Swallow C, Mcleod R. Prevalence of male and female sexual dysfunction is high following surgery for rectal cancer; Ann Surg. 2005; 242(2):212–223
11. Ho V, Lee Y, Stein S, Temple LK. Sexual function after treatment for rectal cancer: a review; Dis Colon Rectum. 2011; 54: 113–25.
12. Hur H, Bae S, Kim N, Min B, Baik S, Lee K, Choi Y. Comparative study of voiding and male sexual function following open and laparoscopic total mesorectal excision in patients with rectal cancer; J Surg Oncol.2014; 108(8):572–578
13. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et all. Cancer incidence and mortality worldwide; IARC Cancer Base No. 11 [Internet]. Lyon: IARC, 2012.
14. Greene F, Page D, Fleming I American Joint Committee on Cancer Cancer Staging Manual. 6th ed. New York: Springer-Verlag. 2002.
15. Kapiteijn E, Velde C. The role of total mesorectal excision in the management of rectal cancer. Surg Clin North Am 82(5):995–1007. https ://doi.org/10.1016/s0039 - 6109(02)00040
16. Kodeda K, Johansson R, Zar N, Birgisson H, Dahlberg M, Skullman S, et al. Time trends, improvements and national auditing of rectal cancer management over 18 years. Colorectal Dis 2015; 17: O168–79.
17. Lange M, Marijnen C, Maas C, Putter H, Rutten H, Stiggelbout A, Velde C. Risk factors for sexual dysfunction after rectal cancer treatment; Eur J Cancer. 2000; 45(9):1578–1588
18. Lindsey I, Guy RJ, Warren BF, Mortensen N. Anatomy of Denon Villiers fascia and pelvic nerves, impotence, and implications for the colorectal surgeon. Br J Surg. 2000; 87(10):1288–1299
19. Marinez A, González E, Holm K, Bock D, Prytz M, Haglind E, et al. Stoma-related symptoms in patients operated for rectal cancer with abdominoperineal excision. Int J Colorectal Dis. 2016; 31: 635–41.
20. Miller K, Nogueira L, Mariotto A, Rowland J, Yabroff K, Alfano C, Jemal A, Kramer J, Siegel R; Cancer treatment and survivorship statistics. 2019. CA Cancer J Clin. 2019; 69(5):363-385.
21. Morino M, Parini U, Allaix ME, Monasterolo G, Contul RB, Garrone C. Male sexual and urinary function after laparoscopic total mesorectal excision; Surg Endosc. 2008; 23(6):1233–1240

22. Nitori N, Hasegawa H, Ishii Y, Endo T, Kitajima M, Kitagawa Y. Sexual function in men with rectal and rectosigmoid cancer after laparoscopic and open surgery; Hepatogastroenterology. 2008; 55(85):1304–1307
23. Pietrangeli A, Pugliese P, Perrone M, Sperduti I, Cosimelli M, Jandolo B. Prevalence of male and female sexual dysfunction is high following surgery for rectal cancer. Ann Surg. 2005; 242: 212–23.
24. Quah H, Jayne D, Eu K, Seow-Choen F. Bladder and sexual dysfunction following laparoscopically assisted and conventional open mesorectal resection for cancer; Br J Surg. 2002; 89(12):1551–1556
25. Sun V, Grant M, Wendel C, McMullen C, Bulkley J, Herrinton L, Hornbrook M, Krouse R. Sexual function and health-related quality of life in long-term rectal cancer survivors; J Sex Med . 2016; 13: 1071–9.
26. Siegel R, Miller K, Jemal A. Cancer statistics, 2019. CA Cancer J Clin. 2019;69:7-34.
27. Siegel RL, Jemal A, Ward EM (2009) Increase in incidence of colorectal cancer among young men and women in the United States. Cancer Epidemiol Biomark Prev 18(6):1695–1698
28. Stamopoulos P, Theodoropoulos G, Papailiou J, Savidis D, Golemati C, Bramis K, et all. Prospective evaluation of sexual function after open and laparoscopic surgery for rectal cancer; Surg Endosc. 2009; 23(12):2665–2674
29. Steineck G, Bergmark K, Henningsohn L, Al-Abany M, Dickman PW, Helgason A. Symptom documentation in cancer survivors as a basis for therapy modifications; Acta Oncol. 2002; 41: 244–52.
30. Verdecchia A, De Angelis G, Capocaccia R. Estimation and projections of cancer prevalence from cancer registry data; Stat Med. 2002;21:3511-3526.
31. Wiltink L, Chen T, Nout R, Kranenbarg E, Fiocco M, Laurberg S, et all. Health- related quality of life 14 years after preoperative short-term radiotherapy and total mesorectal excision for rectal cancer; report of a multicenter randomized trial; Eur J Cancer. 2014; 50: 2390–8.