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Radiopathological and PET-CT Correlation Of Tumour Regression Grading In Rectal Carcinoma Post Neoadjuvant CRT

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Abstract

Objectives*:* To determine the relationship between MR-derived parametersmrTRG, PET-CT SUV value and the pathological tumour regression grade pTRG.

Methods*:* Prospective analysis was performed in 50 patients for a period of 1year fromJune2019 to June 2020.An informed consent was taken from all the patients who underwent the study. Patients satisfying the inclusion criteria were enrolled i.e, (i) histologically confirmed rectal carcinoma within 10 cm of the anal verge; (ii) locally advanced rectal cancer (T3–T4) as seen on pre-CRT MR imaging; (iii) performance of 1.5 Tesla (T) rectal MR imaging before and after CRT; and (iv) receipt of neoadjuvant CRT. For calculation of sample size Mahajan's allowable error formula was applied. Pre- CRT and post-CRT MR imaging was performed using Siemens Avanto 1.5 Tesla MRunit by surface coil. For each patient, experienced radiologist, specialized in pelvic MR imaging investigated the short-axis T2-weighted images. Each MR parameter was compared by MR imaging before CRT(pre-CRT) and after CRT(post-CRT).Percentage reduction rates for tumour diameter was calculated. Tumour regression grading on MRI was calculated as: TRG 1: Complete radiologic response TRG 2: Good response, TRG 3: Moderate response, TRG 4: Slight response, TRG 5: No response. Pathological tumour regression score was calculated using Modified Ryan's scheme as: score 0 (complete response), score 1 (near complete response), score 2 (partial response), score 3 (poor or no response).Both the MR based tumour regression grading and pathological score was compared and concordance/discordance was evaluated along with other variousparameters. PETCT SUV data was compared in pre and post NACRT patient, keeping the cutoff value of SUVmax >64% to differentiate responders from non responders.

Result: The results are presented in frequencies, percentages and mean±SD. The Chi-square test was used to compare the categorical variables. The receiving operating (ROC) was carried out. The area under the curve (AUC) with its 95% confidence interval (CI) was calculated. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) with its 95%CI was calculated. The p-value <0.05 was considered significant.

CONCLUSION

There was a response rate of 62% post neo adjuvant chemoradiotherapy. The concordance was also high (76%).CRT response assessment by MRI analysis showed a high predictive ability. The cutoff value of SUV>64% correctly identified responders among 60% patients with sensitivity and specificity of 96.8% (95%CI=90.6-103.0) and specificity of 94.7% (95%CI=84.7-104.8).

Keywords: Colorectal cancer,FDG-PET CT,SUV max,Tumour regression grade(TRG),NACRT.

INTRODUCTION

Colorectal cancer is the 4th commonest cancer in the world with 1.3 million new cases each year and a 5-year prevalence rate of 3.2 million. There have been associated 693,333 deaths due to colorectal cancer (CRC) in 2012 (Ferlay et al, 2013; Bray et al, 2013)[1,2]. In India, it is the fifth commonest cancer following

breast, cervix/uteri, lip/oral cavity, and lung cancer (Ferlay et al, 2013)[1]. It is thought that ―the westernized lifestyle‖ of physical inactivity, poor diet, obesity, and increased alcohol consumption and smoking attributes to the current higher burden (Center et al, 2009; American Cancer Society, 2014)[3,4]. The major bulk of food in India is lower in calories and consists more of vegetables. This combined with a better level of physical activity interprets to a smaller blubber rates. Sadly, India's low incidence rate is additionally related to low 5-year survival rate (National Cancer Registry Programme, 2010; Pathy et al, 2012)[5,6]. In USA, the incidence and mortality rates are decreasing. Mortality rates have conjointly declined, from 2005 to 2014, by 2.5% annually (American Cancer Society, 2014)[4]. The article by Patil et al (2017)[7]showed that India origin patients resembled the same symptoms as in the USA viz rectal bleeding, pain, or a change in bowel habits. Once CRC is identified, its staging must be determined. This is often achieved with the help of a CT of the chest, abdomen, and pelvis and an MRI of the pelvis or endoscopic ultrasound. In additionally CEA and biomarkers of the cancer are obtained. Pathy et al (2012)[6] found that higher CEA levels were related to higher TNM stage, tumour size, and microsatellite instability (MSI) status

Due to recent advances in the treatment of CRC and early detection including colonoscopy, fecal occult blood testing, CT colonography, flexible sigmoidoscopy or DNA stool testing, the survival rates have increased tremendously in the USA, with a 5-year survival of 65% leading to recent decline in CRC rates in the USA (Ferlay et al, 2013; Center et al, 2009)[1,3]. In India, the incidence still remains low. Nonetheless, the rate of CRC in India is rising. In India, it is forseen to rise approximately by 80% in 2035, with an incidence of 114,986 new cases and a death rate of 87,502 (Ferlay et al, 2013)[1]. Approach to rectal cancer has evolved brilliantly over the past years. The emphasis on MRI and even more on PET-CT suitable for predicting CRT response is constantly increasing. In this regard, the role of [18F] - fluorodeoxyglucose positron emission tomography/computed tomography ([18F] FDG-PET/CT) is still quite questionable in staging, treatment planning and in measuring treatment response of rectal cancer (Calvo et al, 2013; Deantonio et al, 2016; Alongi et al, 2017)[8,9,10]. On the other hand, the type and remission rate to neoadjuvant CRT remains variable. While some patients show no response, other patients show downstaging, and 15–25% have surgical specimens sans viable cancer cells, a condition referred to as pathologic complete response (ypCR) (Bateman et al, 2009)[11]. Complete pathological response is good for locoregional management as it provides an increase in survival for stage I values, that is, 90% at 5 years. Based on these data, policy of ―wait and see is advocated and surgical resection is reserved only for cases of ―tumour escape resulting in survival rates equal to or greater than those achieved in ypCR patients with resection (HabrGama and Oliva Perez, 2009; de Campos-Lobato et al, 2011)[12,13]. While there are enough information available regarding the relationship between ypCR and improved oncologic outcomes, the prognostic significance of ―near complete response to CRT has not been extensively studied. Hence, the objective of this study was to ensure if the association of ypCR with near complete response maintains same prognostic of ypCR alone in patients with LARC (Lee et al, 2013)[14].

Advanced functional MRI techniques (for example, DWMRI) allows for the measurement of microcirculation, vascular permeability, and tissue cellularity and thus may be quite valueable for determining response to neoadjuvant treatment (NAT) and restaging patients with rectal cancer (van der Paardt et al, 2013; Hötker et al, 2014; Lambregts et al, 2015)15,16,17. CRT produces a pathological complete response (pCR) and prolongs survival in selected patients besides downstaging in the cancer. The absence of residual cancer in resected specimens follow NAT (YpT0) has led some authors to suggest ―wait and watch policy with close surveillance. MRI, despite its final resolution, is inaccurate in preoperative staging of rectal cancer after NAT (Hiotis et al, 2002; Kuo et al, 2005)18,19. PET/CT scans are used to discriminate between benign and malignant tissue based on the increased glucose metabolism and 18F-FDG uptake in cancer cells by measuring the standardized uptake value (SUV) resection. A further correlation of pathological response to neoadjuvant regimens with the tumour regression grade (TRG) helps in identifying patients with incomplete response that may impact treatment outcome and evaluation of nodal metastases (Mandard et al, 1994; Swisher et al, 2005)20,21. The present study was conducted to study

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the radiopathological and PET-CT correlation of tumour regression grading in rectal carcinoma post neoadjuvant CRT.

AIM

The aim of this study is to determine the relationship between MR-derived parameters mrTRG, PET-CT SUV value and the pathological tumour regression grade pTRG.

MATERIAL AND METHODS

• STUDY SITE - The study was conducted in the department of Radio-diagnosis, Rajiv Gandhi cancer Institute and Research Centre, Rohini, New Delhi

The study was approved by institutional ethical committee.

• STUDY DESIGN- A prospective, analytical study

• STUDY POPULATION –50

• DURATION- One year

Sample size:- The sample size was calculated as follows:

• For calculation of sample size Mahajan's allowable error formula was applied. • N = 4pq/e2 • Where p = % of population = Target population/Total population×100 q = 1-p e = Allowable error - 20% of p

As per MRI room register over last 1year.

• Minimum no. of MRI rectum cases at our hospital/month = 18

• Maximum no. of MRI rectum cases coming after exclusion criteria/month = 13

• Minimum no. of MRI rectum cases at our hospital/year =216

• Maximum no. of cases coming after exclusion criteria/year = 156

• So, p = 156/216×100 = 72.2 • q = 27.8 • e = 20% of p = 14.4 • N = 4×72.2x27.8/(14.4)2 = 38.7 • The minimum sample size thus calculated should be 39.

• 50 cases done as sample size.

STATISTICAL ANALYSIS:

All continuous variables were expressed as mean ± standard deviation or median with interquartile range as per the distribution of data. Categorical variables were expressed as number and their respective percentage. To compare two independent groups, Student's t-test or the Mann-Whitney U test was used for continuous variables, while Chi-square test or Fisher's exact test was used for categorical variables. All the reported p-values were be two-sided and p-values <0.05 were considered to indicate statistical significance. All data entries and statistical analysis was performed by using SPSS® Version 23.0 software.

METHODOLOGY

Patient population-Prospective analysis was performed in 50 patients for a period of 1year from June 2019 to June 2020.An informed consent was taken from all the patients who underwent the study. Patients satisfying the inclusion criteria were enrolled i.e, (i) histologically confirmed rectal carcinoma within 10 cm of the anal verge; (ii) locally advanced rectal cancer (T3–T4) as seen on pre-CRT MR imaging; (iii) performance of 1.5 Tesla (T) rectal MR imaging before and after CRT; and (iv)

recipient of neoadjuvant CRT. Treatment for some high rectal cancer is still debated so such cases of high rectal cancer were excluded. Preoperative CRT All patients undergone three dimensional conformal treatment planning using computed tomography simulation. In pelvic region, Preoperative radiotherapy was given. Chemotherapy was administered concomitantly with radiotherapy. MRI technique-Pre-CRT and post-CRT MR imaging was performed using Siemens Avanto 1.5 Tesla MR unit by surface coil. Executing (2D) FSE T2-weighted sequences without fat suppression is the standard rectal MRI protocol in the assessment of rectal cancer, using a small FOV and a section thickness less than 3 mm (high-resolution protocol) (Beets-Tan et al, 2018)[22]. Images in this sequence were obtained in the (a) oblique axial plane (perpendicular to the tumour), as incorrect plane obliquity leads to blurring of the muscularis propria leading to incorrect T staging (Hoeffel et al, 2014)[23]; (b) sagittal plane, which was determined by the longitudinal tumour axis; and (c) oblique coronal plane (parallel to the anal canal), which was important to illustrate distal rectal tumours and to better assess their association with the anal sphincter. Oblique axial, sagittal and oblique coronal plane povides high diagnostic accuracy ranging from 90% and 100%, for the assessment of infiltration of tumour into the

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mesorectal fascia and are advised by the (MERCURY) group (Patel et al, 2011)[24]. Fast spin echo T2-weighted MRI with a large FOV without fat suppression was obtained in the axial plane of the entire pelvis, from the bifurcation of aorta to the sphincteric region, for distant lymph node chains evaluation (eg, inferior mesenteric, lateral, and inguinal). In the sagittal plane, from interpubic fibrocartilage to the anal canal i.e; from one side of the pelvic wall to the other, FSE T2-weighted images allows for the localization of the primary tumour, enabling the measurement of craniocaudal length and its relationship to the anal verge (Jhaveri and Hosseini-Nik, 2015) [25].The total imaging time was approximately 30 min.

MR Image Analyses-For each patient, experienced radiologist, specialized in pelvic MR imaging investigated the short-axis T2-weighted images. Tumour diameter was measured: A line stretching from the center of the rectal lumen to the largest tumour area as seen at the cross section. Tumour area was calculated: covering a ROI on the cross-section imaging showing the largest area of tumour. Each MR parameter was compared by MR imaging before CRT (pre-CRT) and after CRT (postCRT). The

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percentage reduction rates for tumour diameter was calculated as follows: [(pre-CRT value) – (post-CRT value)] / (pre-CRT value) x 100.

Tumour regression grading on MRI was calculated as:

TRG 1 Complete radiologic response: no evidence of treated tumour

TRG 2 Good response: dense fibrosis (>75%); no obvious residual tumour, signifying minimal residual disease, or no tumour.

TRG 3 Moderate response: >50%fibrosis or mucin* and visible intermediate signal intensity

TRG 4 Slight response: little areas of fibrosis or mucin,* but mostly tumour TRG 5 No response: intermediate signal intensity; same appearance as that of the original tumour. Note—TRG = tumour regression grade (Jhaveri and Hosseini-Nik, 2015)[25].

Modified Ryan scheme for tumour regression score (P staging):

0 (complete response): no viable cancer cells

1 (near complete response): single cells or rare small groups of cancer cells

2 (partial response): residual cancer with evident tumour regression but more than single cells or rare small groups of cancer cells

3 (poor or no response): extensive residual cancer with no evident tumour regression. Ethical committee approval: The study was conducted after necessary approval from the Institutional review board and ethics committee. Magnetic resonance imaging is radiation free modality.

RESULTS AND OBSERVATIONS

The present study was conducted with the objective to determine the relationship between MR-derived parameters mrTRG, PET-CT SUV value and the pathological tumour regression grade pTRG.This study has been approved by Institutional ethical Committee. The study group comprised of 50 patients.

The major findings of this study were:

• Grade 2 and Grade 4 was the most common mrTRG on HPE after NACRT each constituted 28 $^{0}/_{0}$ followed by Grade 3 (24%) and Grade 1 (20%). Grade 1 was the most common pTRG on HPE after NARCT constituting 34% followed by Grade 2 (24%), Grade 0 (22%) and Grade 3 (20%).

Tumour stage t3 on MRI at baseline was present in more than one third of patients (44%) followed by t2 (22%), t4 (20%) and t1 (14%).

• The concordance was among majority of patients (76%).

• The response of NACRT was found to be highest among the patients of age >50 years (69.6%) and was lowest among patients of age 30-40 years (40%). However, there was no significant (p>0.05) association of responder and non-responder of NACRT with age.

• The response of NACRT was found to be higher among female patients (72.2%) than males (56.2%). However, there was no significant (p>0.05) association of responder and non-responder of NACRT with gender.

• The response of NACRT was found to be highest among patients whom size of lesion (Craniocaudal in cm) on MRI at baseline was 2-3cm (75%) and lowest among patients of 4-5cm (45.7%). However, there was

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no significant (p>0.05) association of responder and non-responder of NACRT with size of lesion (craniocaudal) on MRI at baseline.

• The response of NACRT was found to be highest among patients whom distance of lowest tumour margin from anal verge on MRI at baseline was <5cm (63.6%). However, there was no significant (p>0.05) association of responder and non-responder of NACRT with distance of lowest tumour margin from anal verge on MRI at baseline.

• The response of NACRT was found to be highest among patients whom circumferential tumour location on MRI at baseline was partial (65.2%). However, there was no significant (p>0.05) association of responder and non-responder of NACRT with circumferential tumour location on MRI at baseline.

• The cutoff value of SUVmax >64% correctly identified responders among 60% patients with sensitivity and specificity of 96.8% (95%CI=90.6-103.0) and specificity of 94.7%(95%CI=84.7-104.8).

DISCUSSION

Few studies reported that in the evaluation of pathological complete response to pCRT in LARC, role of MRI based on semi-quantitative parameters such as initial slope, initial peak, late slope, and area under time intensity curve or kinetic features is invaluable (Tong et al, 2015)129. Martens et al (2015)26concluded that ―late slope derived from MRI analysis using a semiquantitative approach could predict before the beginning of pCRT which tumours are likely going to respond.

Using a Ktrans threshold value of 0.66 reaching the 100% of sensitivity, MRI could differentiate between pathological complete and incomplete pCRT response (Tong et al, 2015)27.

Furthermore, PET evaluation can predict pathologic tumour response and outcome after preoperative CRT in LARC patients (Huh et al, 2015; Aiba et al, 2014)28,29. The present study objective was to determine the relationship between MR-derived parameters mrTRG, PET-CT SUV value and the pathological tumour regression grade pTRG.

In this study, more than one third of patients were >50 years (46%) followed by 41-50 (26%), <30 (18%) and 30-40 (10%).

This study observed that about one third of patients had size of lesion (craniocaudal in cm) on MRI was >5cm (34%) followed by 4-5cm (30%), 2-3 (24%) and <2cm (12%) at baseline.

In the present study, more than half of patients had ≥5cm distance of lowest tumour margin from anal verge on MRI at baseline (56%). The mean lowest tumour margin from anal verge on MRI at baseline was 5.17±2.48. Santos et al (2013) found that tumour distance from anal verge was >6 cm in 48.9% patients and ≤6 cm in 51.9% patients. In the study by Metser et al (2015)30, the mean distance from the tumour to the anal verge was 67 ± 27 mm. In the study by Sharma et al (2019)31 disease was <5 cm from anal verge in 64% of patients.

This study showed that complete circumferential tumour location on MRI at baseline was among54% patients.

This study revealed that T2WI of primary tumour was intermediate among 48% patients and hypointense in 46% patients. Hyperintense T2WI of primary tumour was only in 6% patients.

This study found that diffusion restriction of primary tumour was present among majority of patients (84%).

In the present study, the mean SUV at baseline and post NACRT was 23.63±7.25 and 7.01±3.47 respectively.

The present study showed that the response of neoadjuvant chemoradiotherapy was found to be among more than half of patients (62%). This finding is higher than the study by Suzuki et al (2017)[32] in which they found that pathological complete response (pCR) was found in 31patients (15.7%).

Distal margin on HPE after neoadjuvant chemoradiotherapy was free among all patients (100%) in this study.

This study found that Grade 1 was the most common pTRG on HPE after neoadjuvant chemoradiotherapy constituting 34% followed by Grade 2 (24%), Grade 0 (22%) and Grade 3 (20%). This study showed that Grade 2 and Grade 4 was the most common mrTRG on HPE after neoadjuvant chemoradiotherapy each constituted 28 followed by Grade 3 (24%) and Grade 1 (20%).

In this study, the concordance was among majority of patients (76%).

In this study, the response of neoadjuvant chemoradiotherapy was found to be highest among thepatients of age >50 years (69.6%) and was lowest among patients of age 30-40 years (40%). However,

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there was no significant (p>0.05) association of responder and non-responder of neoadjuvant chemoradiotherapy with age.

In the present study, the response of neoadjuvant chemoradiotherapy was found to be higher among female patients (72.2%) than males (56.2%). However, there was no significant (p>0.05) association of responder and non-responder of neoadjuvant chemoradiotherapy with gender.

Thus, none of the study parameters were significantly (p>0.05) associated with response rate. Similar observation was found by Sharma et al (2019)[31] in which they did not find any statistically significant correlation between various age groups, distance of tumour from anal verge, either a male or a female and even TNM staging. However, they found a statistically significant correlation between post neoadjuvant chemoradiotherapy nodal staging and TRG with P = 0.031. Petrillo et al (2017) also found no significant differences between pathological responders and non-responders could be found regarding patients characteristics.

In this study, the cutoff value of SUV >64% correctly identified responders among 60% patients with sensitivity and specificity of 96.8% (95%CI=90.6-103.0) and specificity of 94.7% (95%CI=84.7-104.8). The AUC was 0.99 (95%CI=0.98-1.001). Sharma et al (2019) found that ROC curve analysis for an AUC of 0.447 did not reach a statistical significance P = 0.583. Similar to this study, Petrillo et al (2017) reported that ΔSUV, between basal and pre-surgery SUV values, showed a significant correlation to TRG (AUC= 0.71) with a sensitivity of 67.3% and a specificity of 75.0%. Leccisotti et al (2015)33 evaluated metabolic modifications in the tumour in 124 patients during and after pCRT affected by LARC. To describe complete pathological response a reduction of 61.2% of SUV was the best threshold obtaining 85.4% of sensitivity and 65.2% of specificity while they did not commented on the most favourable cut-off for the late response after pCRT. Kim et al (2013)34 demonstrated that post-CRT SUV had a sensitivity of 60.4%, a specificity of 65.0%, and an accuracy of 55.9 %. Palma et al (2010)35 reported that post- CRT SUV had a sensitivity of 45.0%, a specificity of 70.0%, and an accuracy of 60.0%. Similar results were observed on advanced esophageal cancer (Wiederet al, 2004)36.

CONCLUSION

There was a response rate of 62% post neo adjuvant chemoradiotherapy. The concordance was also high (76%).CRT response assessment by MRI analysis showed a high predictive ability. The cutoff value of SUV>64% correctly identified responders among 60% patients with sensitivity and specificity of 96.8% (95%CI=90.6-103.0) and specificity of 94.7% (95%CI=84.7-104.8).

Table 1: Distribution of patients according to Size of lesion (craniocaudal in cm) on MRI atbaseline.

Size of lesion (craniocaudal) on MRI at baseline	No. (n=50)	%
<2	6	12.0
2-3	12	24.0
4-5	15	30.0
>5	17	34.0
Mean±SD (Range)	4.30±2.30 (1.00-13.00)	

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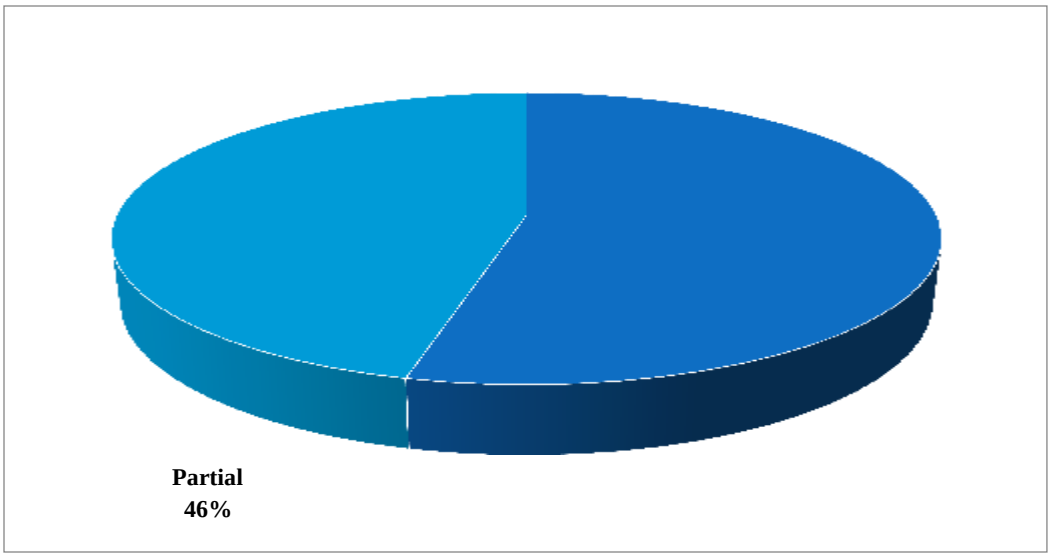

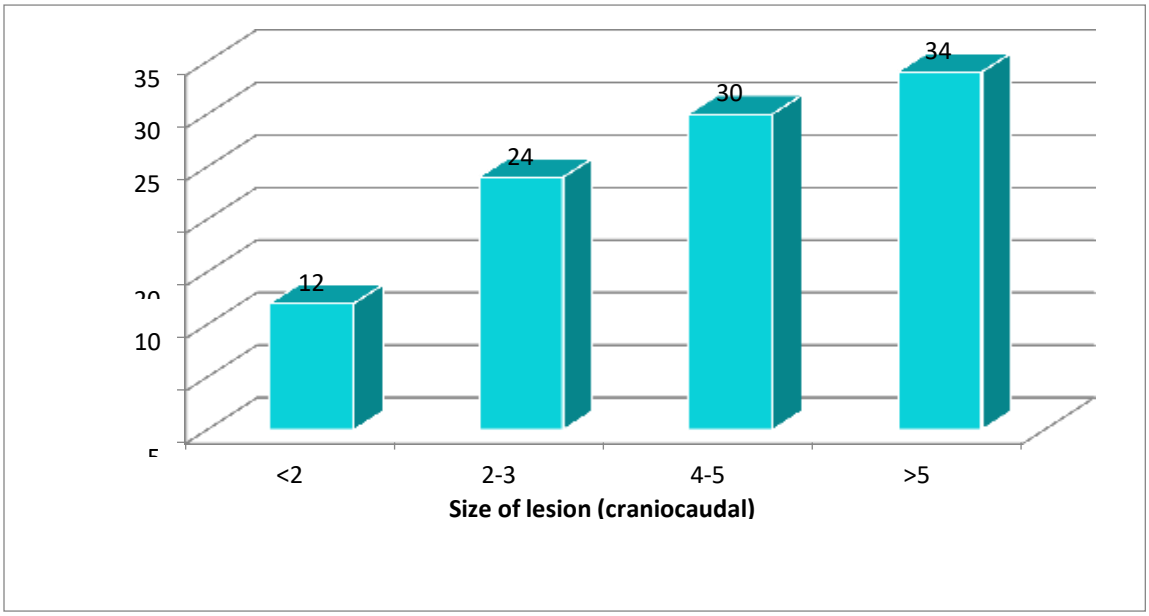

Figure. 1: Distribution of patients according to Size of lesion (craniocaudal) on MRI at Table 1 & Figure 1 shows the distribution of patients according to size of lesion (craniocaudal) on MRI at baseline. About one third of patients had size of lesion (craniocaudal in cm) on MRI was>5 (34%) followed by 4-5 (30%), 2-3 (24%) and <2 (12%) at baseline

Table 2: Distribution of patients according to circumferential tumour location on MRI atbaseline.

Circumferential tumour location on MRI at baseline	No. (n=50)	%
Complete	27	54.0
Partial	23	46.0

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Figure. 2: Distribution of patients according to circumferential tumour location on MRI atbaseline.

Table 3: Distribution of patients according to Tumour stage on MRI at baseline.

Tumour stage on MRI at baseline	No. (n=50)	%
t1	7	14.0
t2	11	22.0
t3	22	44.0
t4	10	20.0

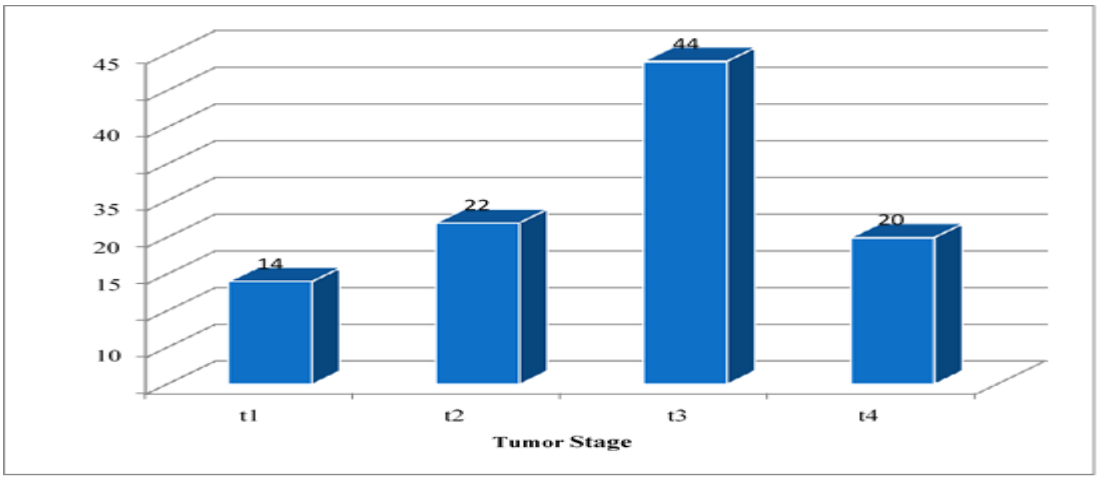

Figure. 3: Distribution of patients according to Tumour stage on MRI at baseline.

Table-3 & Fig.3 shows the distribution of patients according to tumour stage on MRI at baseline.The tumour stage t3 on MRI at baseline was below among more than one third of patients (44%) followed by t2 (22%), t4 (20%) and t1 (14%).

Table 4: Comparison of SUVmax from baseline to post NACRT.

SUVmax	Mean±SD
Baseline	23.63±7.25
Post-NACRT	7.01±3.47
Absolute mean change	16.62±4.75
%age mean change	71.34±8.24
p-value[1]	0.0001*

[1]Paired t-test, *Significant

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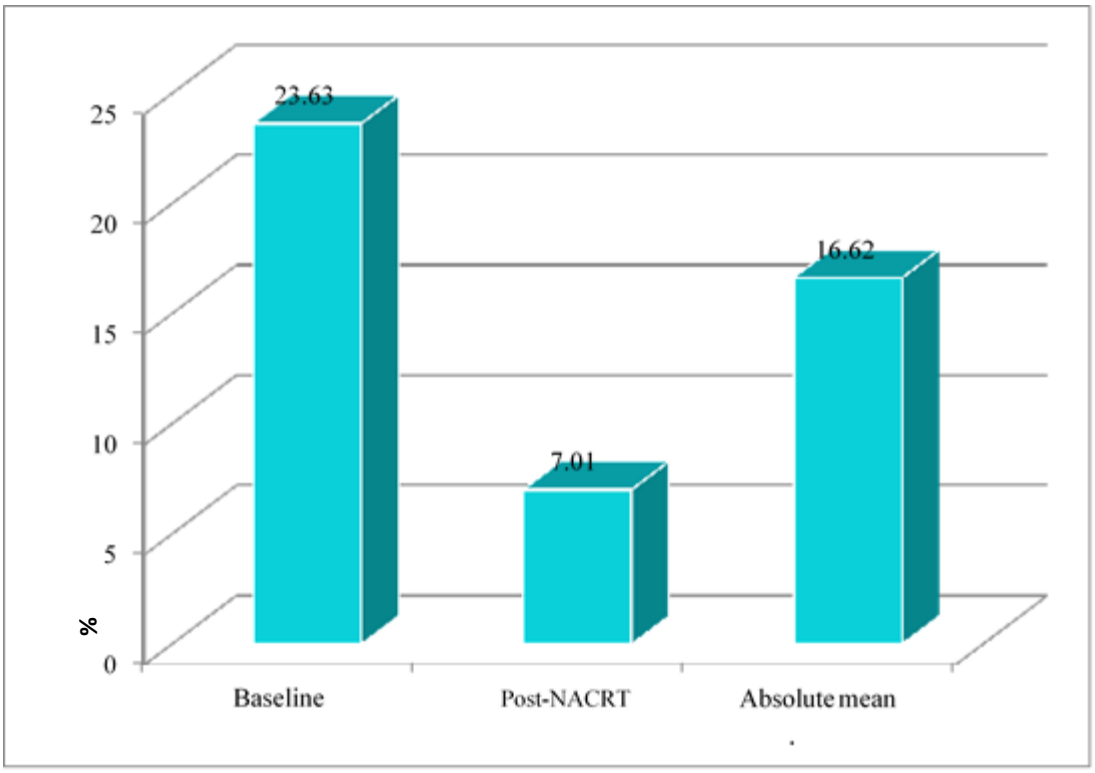

Fig. 4: Comparison of SUV from baseline to post NACRT.

Table 4 & Figure. 4 shows the comparison of SUVmax from baseline to post NACRT. The mean SUVmax at baseline and post NACRT was 23.63±7.25 and 7.01±3.47 respectively. The mean absolute reduction in SUVmax from baseline to post NACRT was 16.62±4.75. The mean percentage reduction in SUVmax from baseline to post NACRT was 71.34±8.24%. The mean change in SUVmax from baseline to post NACRT was statistically significant (p=0.0001).

Table 5: Distribution of patients according to mrTRG on MRI after NACRT.

mrTRG	No. (n=50)	%
Grade 1	10	20.0
Grade 2	14	28.0
Grade 3	12	24.0
Grade 4	14	28.0

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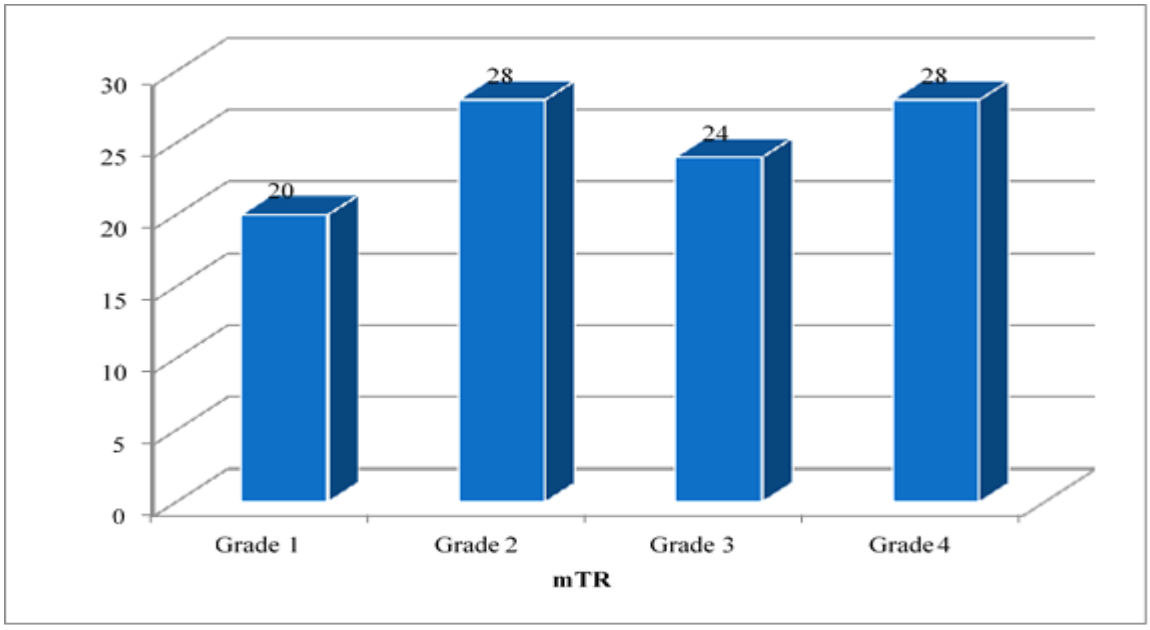

Figure. 5: Distribution of patients according to mrTRG on PET-MRI after NACRT

Table-5 & Fig.5 shows the distribution of patients according to mrTRG on HPE after NACRT.Grade 2 and Grade 4 was the most common mrTRG on HPE after NARCT each constituted 28 followed by Grade 3 (24%) and Grade 1 (20%).

Table 6: Comparison of responder and non-responder with Size of lesion (craniocaudal)on MRI at baseline.

Size of lesion (craniocaudal in cm) on MRI at baseline	No. of patients	Responders		Non-responders		p-value[1]
		No.	%	No.	%	
<2	6	3	50.0	3	50.0	0.35
2-3	12	9	75.0	3	25.0	
4-5	15	7	46.7	8	53.3	
>5	17	12	70.6	5	29.4	

[1]Chi-square test

%

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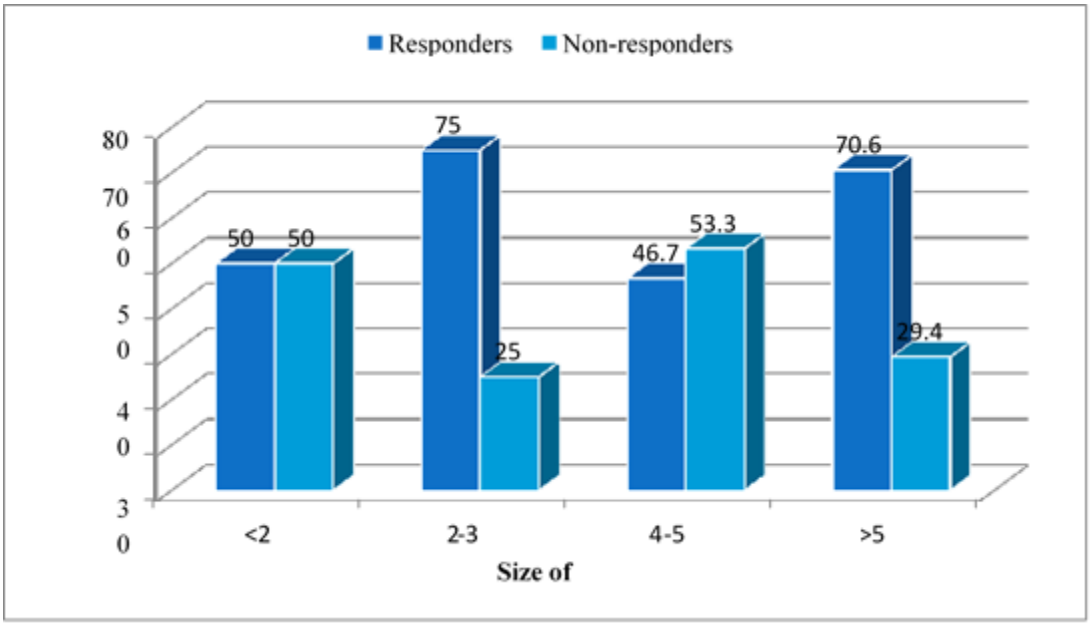

Figure. 6: Comparison of responder and non-responder with Size of lesion (craniocaudal incm) on MRI at baseline.

Table-6 & Fig.6 shows the comparison of responder and non-responder with size of lesion (craniocaudal in cm) on MRI at baseline. The response of NACRT was found to be highest among patients whom size of lesion (craniocaudal in cm) on MRI at baseline was 2-3 (75%) and lowest among patients of 4-5 (45.7%). However, there was no significant (p>0.05) association ofresponder and non-responder of NACRT with size of lesion (craniocaudal in cm) on MRI at baseline.

Table 7: SUVmax cutoff value for responders.

Overall percent change in SUVmax (%)	**Responders**		**Non-responders**		**Total**	
	No.	**%**	**No.**	**%**	**No.**	**%**
>64.00	30	60.0	1	2.0	31	62.0
≤64.00	1	2.0	18	36.0	19	38.0
Total	31	62.0	19	38.0	50	100.0
Diagnostic values, % (95%CI)						
AUC	0.99 (0.98-1.001)					
Sensitivity	96.8 (90.6-103.0)					
Specificity	94.7 (84.7-104.8)					
PPV	96.8 (90.6-103.0)					
NPV	94.7 (84.7-104.8					

%age is from total no. of cases

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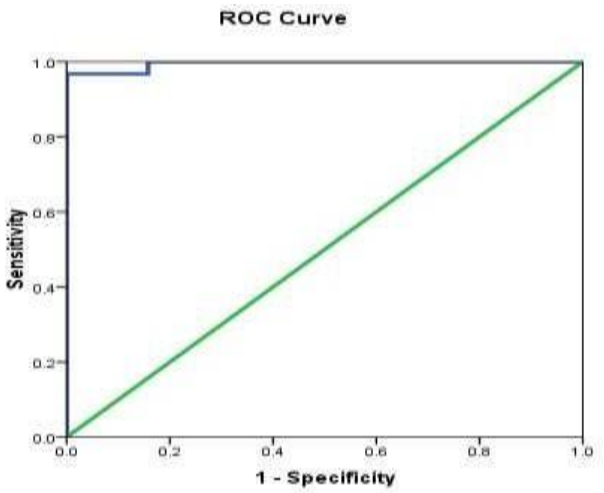


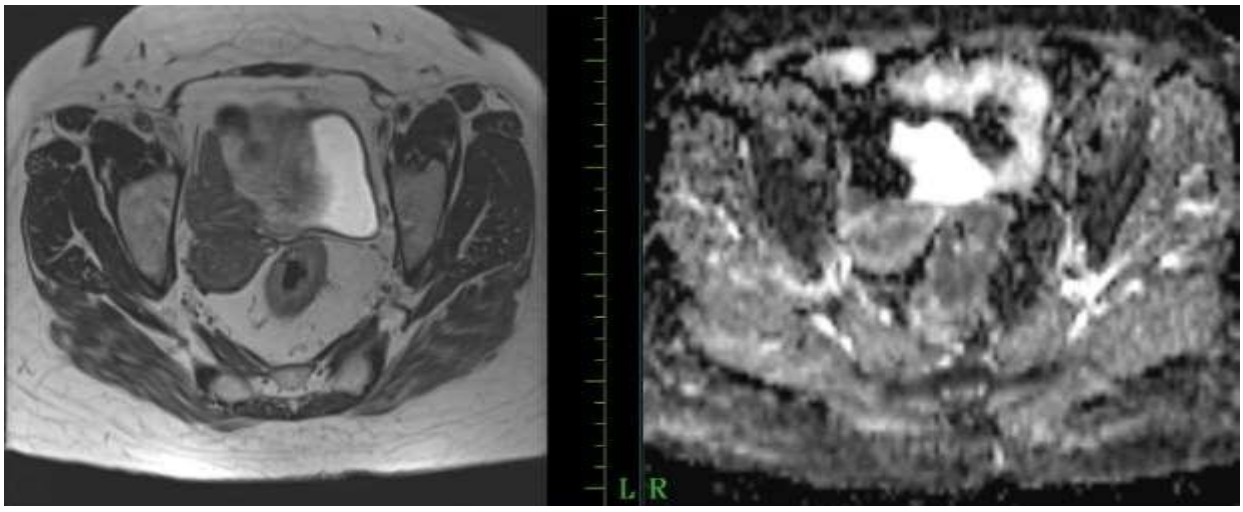
Figure.7: ROC curve showing sensitivity and specificity of SUVmax cutoff value for responder.

Table-7 & Fig.7 shows the SUVmax cutoff value for responders. The cutoff value of SUVx>64% correctly identified responders among 60% patients with sensitivity and specific of96.8% (95%CI=90.6-103.0) and specificity of 94.7% (95%CI=84.7-104.8).v

CASE 1

Figure a) MRI axial T2W and MRI ADC diffusion images depicting completely circumferential mass showing true diffusion restriction on ADC images which on histopathology classified as moderately differentiated adenocarcinoma. Figure b) MRI axial T2W and MRI sagittal T2W images show distal rectal mass in stage -T3b with extramural depth of tumour invasion ≤ 5 mm and entirely below anterior peritoneal reflection.ed

***a*)**



***b*)**

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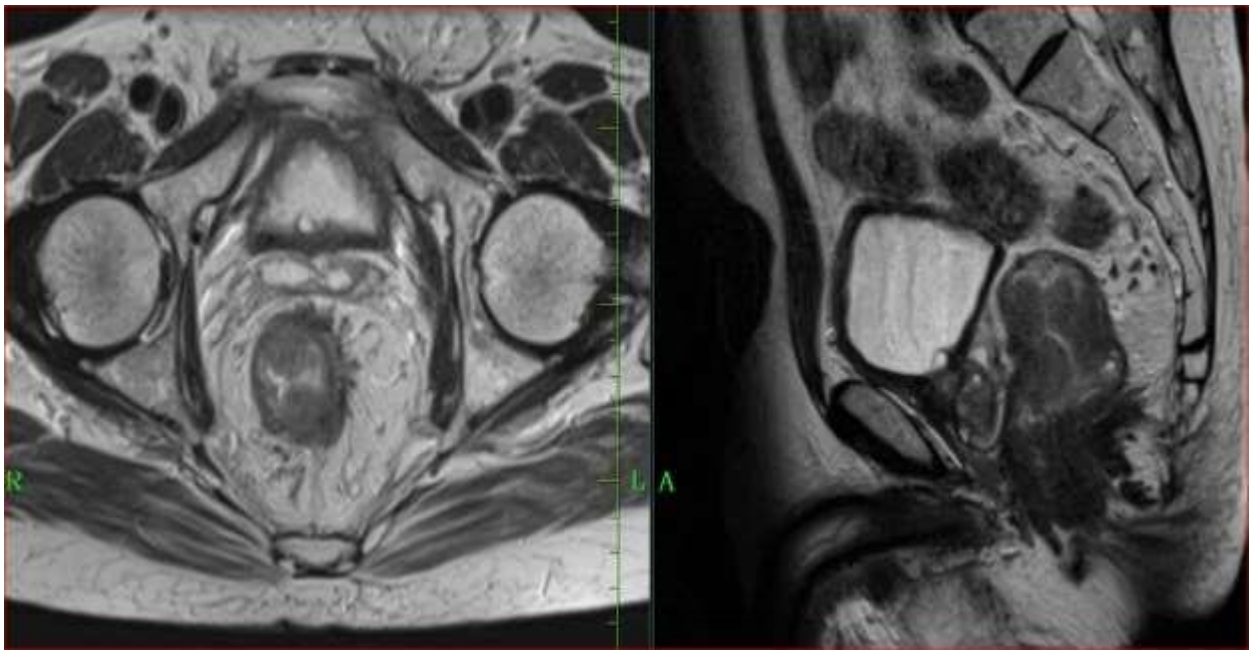
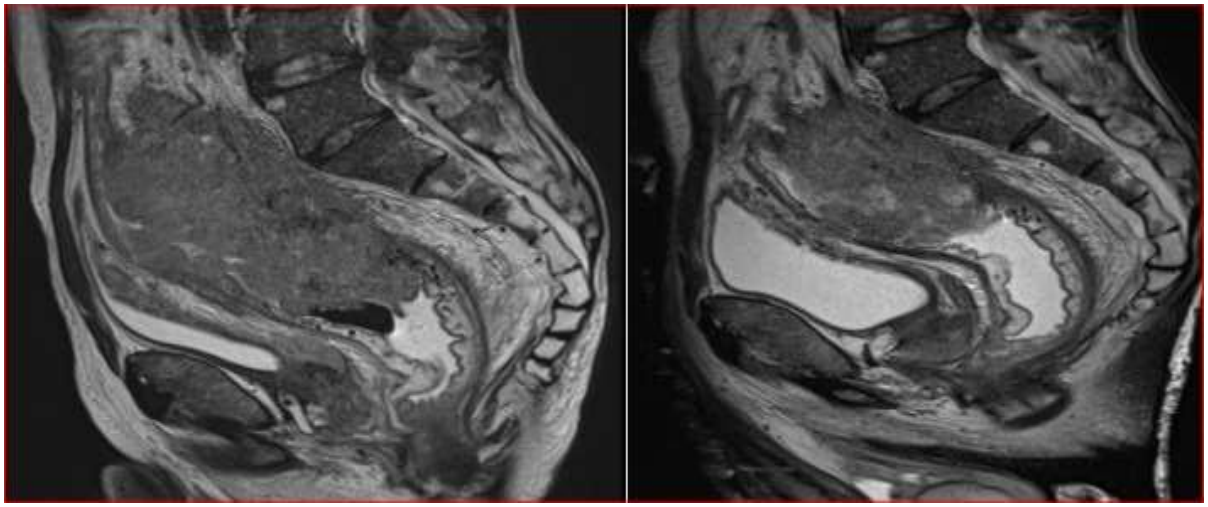


CASE *2*

Figure a) MRI sagittal T2W images, Figure b) PETCT axial images show rectum mass completely encircling lumen with tumour above and below the anterior peritoneal reflection showing significant reduction in volume post neoadjuvant CRT.

a)



b)

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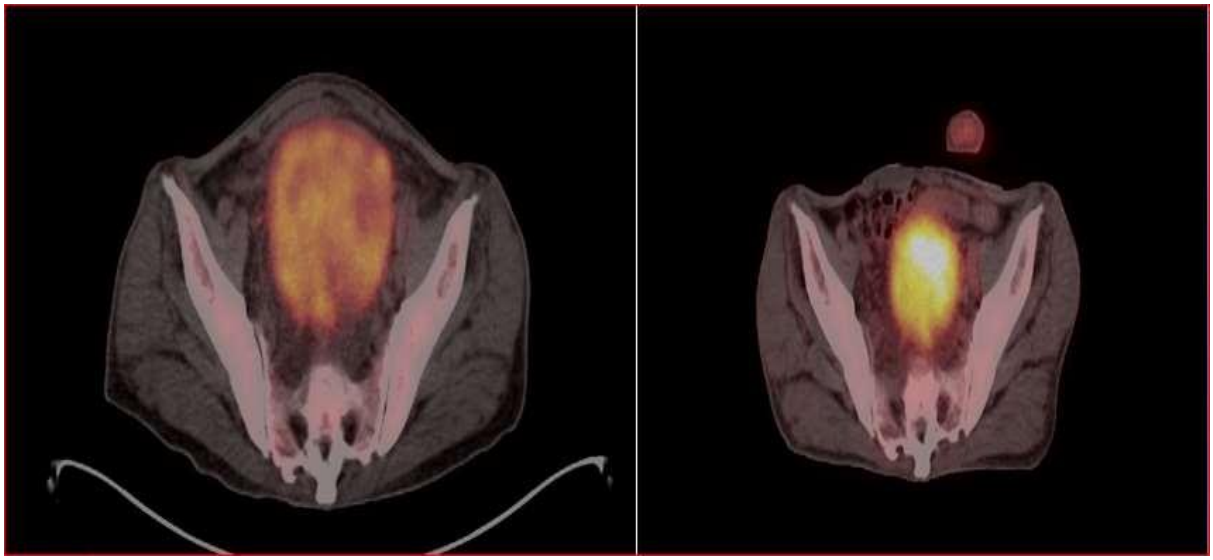

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