

ROLE OF CT IN DIFFERENTIATION OF MUCINOUS AND NON-MUCINOUS CARCINOMAS OF THE RECTUM

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ABSTRACT

BACKGROUND

Colorectal carcinomas can broadly be classified as either non-mucinous or mucinous. Usually, mucinous adenocarcinomas present at a more advanced stage, have more aggressive local spread and have an increased incidence of lymph node involvement. Those cancers occurring in the rectum are considered more aggressive and require careful planning for treatment. Screening Computed Tomography (CT) is widely used for the initial evaluation of these tumours.

The aim of the study is to retrospectively analyse the CT images of rectal adenocarcinomas and suggest parameters to aid differentiation of mucinous and non-mucinous tumours.

MATERIALS AND METHODS

The CT images of 24 cases of mucinous and 26 cases of non-mucinous adenocarcinoma were retrospectively reviewed and evaluated for parameters like morphology, wall thickness, size, pattern and degree of enhancement and the presence or absence of calcification. Also, evaluated was involvement of adjacent structures, lymph nodes and distant metastases.

RESULTS

All the parameters were analysed for significance using the chi-square test. Mucinous adenocarcinomas of the rectum showed a greater propensity for eccentric bowel thickening, heterogenous enhancement and calcification with a p value less than 0.05. Heterogenous enhancement showed the greatest sensitivity (75%) and calcification the greatest specificity (83.3%). The other parameters did not show any difference between the two groups.

CONCLUSION

CT features most likely to suggest rectal mucinous carcinoma are heterogenous contrast enhancement, eccentric wall thickening and intratumoural calcification. As mucinous carcinomas follow an aggressive course, if a diagnosis of mucinous carcinoma of the rectum can be suggested on the staging CT, it may influence patient management.

KEYWORDS

CT, Carcinoma, Rectum.

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BACKGROUND

Colorectal carcinoma has been classified into various histological subtypes by the World Health Organization, but broadly they can be classified as either non-mucinous or mucinous. Mucinous adenocarcinomas are considered more aggressive and have a poorer prognosis. Furthermore, those mucinous adenocarcinomas occurring in the rectum are especially unsafe owing to proximity to important structures like the anal sphincter. Differentiation between mucinous and non-mucinous adenocarcinomas has a great impact on further management. Attempts have been made to differentiate between these two broad subtypes on the basis of the initial imaging.

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MATERIALS AND METHODS

Twenty six patients of biopsy proven mucinous carcinoma of the rectum over a period of five years were selected for this retrospective study. As a control group, 31 patients of biopsy proven non-mucinous adenocarcinoma of the rectum were selected from the same period using simple random sampling. Two patients of mucinous adenocarcinoma and 5 patients of non-mucinous adenocarcinoma who either did not have preoperative helical CT or had equivocal findings on preoperative helical CT were excluded from the study group. Thus, all patients had positive preoperative CT scans and pathologically-proven disease. The pathological basis of the diagnosis of mucinous carcinoma was that at least 50% of the tumour should be composed of extracellular mucin. The study population (n=50) consisted of 31 males and 19 females with an age range of 23 to 67 years and a mean age of 46.2 years.

CT examination had been performed using a Somatom Sensation 4 scanner (Siemens Medical Solutions). Patient had been administered 1000 mL oral contrast. In addition, 150 mL contrast had also been administered per rectum. Images were obtained with helical acquisition from the top

of the diaphragm to the anal verge using exposure factors of 120/165/0.5 (kV/mAs/rotation time) and a slice collimation of 2 mm and reconstruction intervals of 5 mm and 2 mm. IV contrast enhancement was performed with 100 mL of non-ionic contrast material (iopromide 300) (Ultravist - Schering) through the antecubital vein at a rate of 3 mL/sec and a delay time of 50 secs. Both enhanced and unenhanced scans were routinely performed.

The CT images of these patients were retrospectively reviewed and evaluated for morphology (annular wall thickening or mass lesion), wall thickness, size of mass lesion (volume), pattern of enhancement (homogenous or heterogenous), degree of enhancement (mild, moderate or intense) and the presence or absence of calcification. The degree of enhancement was graded as mild if less than that of uninvolved bowel, moderate if equal to uninvolved bowel and intense if greater than uninvolved bowel.

Other parameters evaluated were adjacent fat infiltration more than 1 cm, lymph node involvement, involvement of adjacent structures and distant metastases. These parameters were corroborated with the histopathology.

RESULTS

A comparison of the characteristics of mucinous and non-mucinous carcinomas is shown in Table 1. All parameters were assessed using the chi-square test. Both types could present either as annular wall thickening or as mass lesions with the former being more common. There was no significant difference in the size of the mass lesions between mucinous carcinoma and non-mucinous adenocarcinoma. In the annular wall thickening type, the mean wall thickness was not significantly different between mucinous carcinoma and non-mucinous adenocarcinoma. However, mucinous carcinomas were significantly more likely to show eccentric wall thickening than non-mucinous adenocarcinomas. Another typical feature was heterogenous contrast enhancement, which was much more common in mucinous carcinomas as compared to non-mucinous adenocarcinomas. There was no significant difference in the degree of enhancement between the two types. Calcification was seen in this study largely in the mucinous variety though it was associated with only a small percentage.

There was no significant difference between the two types with regard to adjacent fat infiltration, lymph node involvement, adjacent organ involvement and distant metastases.

The sensitivity and specificity of the various CT parameters that showed a statistically significant difference between mucinous carcinoma and non-mucinous adenocarcinoma are shown in Table 2. Heterogenous contrast enhancement showed the highest sensitivity (75%) with a specificity of 81.8%. Intratumoural calcification showed the highest specificity (83.3%) with a sensitivity of 20.8%.

Parameter	Mucinous Carcinomas (n=24)	Non-Mucinous Carcinomas (n=26)	P value
Morphology			>0.05
Annular wall thickening	17	21	
Mass lesion	7	5	
Mean wall thickness (cm)	2.4	2.0	>0.05
Size of mass lesion (cm ³)	14.8	15.5	>0.05
Pattern of wall thickening			<0.05
Concentric	10	18	
Eccentric	14	8	
Enhancement pattern			<0.05
Homogenous	6	22	
Heterogenous	18	4	
Degree of enhancement			>0.05
Mild	10	9	
Moderate	11	15	
Intense	3	2	
Calcification	5	1	<0.05

Table 1. CT Features of Mucinous and Non-Mucinous Carcinomas of the Rectum

Parameter	Sensitivity (%)	Specificity (%)
Eccentric wall thickening	41.7	66.7
Heterogenous enhancement	75	81.8
Calcification	20.8	83.3

Table 2. Sensitivity and Specificity of Various Parameters Suggestive of Mucinous Carcinoma of the Rectum



Figure 1. Contrast-Enhanced CT Pelvis Showing Concentric Thickening of Rectum with Homogenous Enhancement- Non-Mucinous Carcinoma

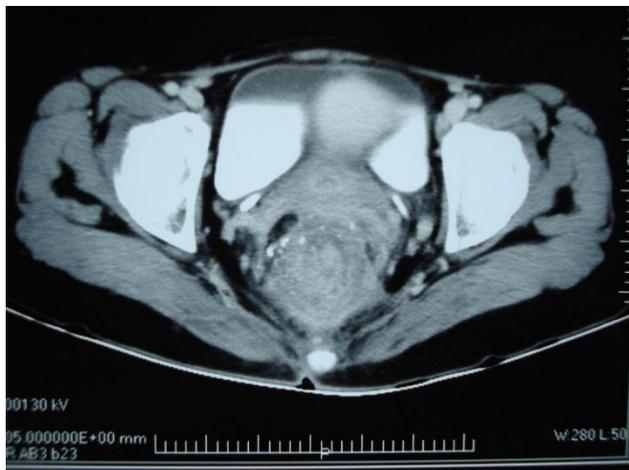


Figure 2. Contrast-Enhanced CT Pelvis Showing Eccentric Thickening of Rectum with Heterogenous Enhancement and Multiple Calcific Foci- Mucinous Carcinoma



Figure 3. Contrast-Enhanced CT Pelvis Showing Eccentric Thickening of Rectum with Heterogenous Enhancement and Invasion of Levator Ani Sling and Right Ischiorectal Fossa- Mucinous Carcinoma

DISCUSSION

Of the various histological types of colorectal carcinoma-adenocarcinoma, mucinous adenocarcinoma, signet ring carcinoma, adenosquamous carcinoma and undifferentiated carcinoma (medullary), adenocarcinoma accounts for the vast majority. This is followed by mucinous adenocarcinoma. Usually, mucinous adenocarcinomas present at a more advanced stage, have a greater propensity for extensive pararectal spread, an increased incidence of lymph node involvement leading to a poorer prognosis.^{1,2} Along with signet ring adenocarcinomas mucinous adenocarcinomas also show an increased tendency to metastasise.³ In addition, the site of colorectal mucinous adenocarcinoma also influences the prognosis. Those cancers occurring in the rectum are more aggressive than other adenocarcinomas of the same site.⁴

The accepted definition of mucinous carcinoma is that at least 50% of the lesion must be mucinous on histopathological examination, although some authorities have suggested that a mucin content more than 10% may be enough to label a carcinoma as mucinous.⁵ Therefore, it

is useful to classify colorectal carcinomas into two broad subgroups non-mucinous carcinomas and mucinous carcinomas. Due to the aggressive nature of mucinous carcinomas, this broad classification helps in planning treatment and prognostication.

The rectum is the commonest site for cancers of the large intestine with approximately 40% occurring in this location. This location also requires careful planning with a customised approach for each case in order to achieve satisfactory results both from an oncological as well as functional consideration. This is important as increasingly a large number of patients are being offered curative resection and also preservation of anal sphincteric function.⁶

Primarily, once a colorectal lesion is detected, it is evaluated by colonoscopy. A biopsy is then taken from the lesion, which is evaluated by histopathology, which confirms malignancy and determines whether it is mucinous or non-mucinous. However, biopsy at this stage may not conclusively demonstrate the lesion to be mucinous, even though a subsequent biopsy may show a mucinous tumour.⁷ After this imaging is usually performed to assist staging of the lesion, which is done by determining three main factors - depth of tumour penetration (T), status of regional lymph nodes (N) and presence of distant metastases (M).

Various workers have studied the imaging characteristics of mucinous tumours as compared to non-mucinous tumours using MRI. Mucinous tumours have a higher signal on T2 weighted images. These high signals are thought to be due to pools of extracellular mucin and have been shown to have higher tumour to muscle, tumour to fat and tumour to urine signal intensity ratios on fast spin echo T2 weighted images. Therefore, these appearances are similar to necrosis or fluid collections. Consequently, MRI allows diagnosis of mucinous tumours on MRI with high degree of accuracy.^{8,9,10}

However, Computed Tomography (CT) is more widely used for the initial evaluation and staging of colorectal carcinoma. There have been attempts by various workers to differentiate between the mucinous and non-mucinous varieties of gastric and colorectal tumours using CT.^{7,11}

Colorectal neoplasms are especially common in the rectum. Nearly, 40% of colorectal carcinomas occur in this location. Additionally, due to the peculiar anatomical location along with proximity to various structures like the levator ani sling and anal sphincters, rectal carcinomas require painstaking planning with a tailored approach for each patient. Nowadays, increasing number of patients are being offered sphincter preservation in addition to curative resection.⁶

Currently, CT of abdomen has the best spatial resolution of any modality, although with the disadvantage of low soft tissue contrast. On routine CT, the primary lesion (polypoid or annular) can be detected and characterised along with associated findings like lymphadenopathy, peritoneal implants and spread of tumour through the bowel wall. It is also used to detect metastases to the liver and other sites. Due to this, CT is widely used for preoperative assessment of colorectal carcinoma.¹²

Mucinous carcinomas of the colorectal region have been attributed the following differentiating features on CT as compared to non-mucinous carcinomas- greater wall thickening and tumour size, eccentric wall thickening, heterogenous enhancement with decreased enhancement of solid component, large hypoattenuating area and calcification.^{7,12}

According to our results both mucinous adenocarcinoma and non-mucinous adenocarcinoma of the rectum can present as either annular wall thickening lesions or mass lesions with the former being more common, there was no statistically significant difference between the mean wall thickness of mucinous and non-mucinous tumours. Also, rectal tumours presenting as mass lesions did not show a statistically significant difference between the size of the lesion in the mucinous and non-mucinous varieties. Though the reasons for this are not clear, it is possible that due to the proximity of the rectum to critical structures like the levator ani, rectal tumours present at an earlier stage. It is also possible that due to the smaller lumen of the rectum, mass lesions, especially those which have a predominantly intraluminal polypoid component cause symptoms earlier in the natural course of the disease. These findings appear to be at variance with the findings of previous workers who found mucinous tumours to have a greater mean wall thickness. They also noted a larger size in case of mass lesions, though this was not considered statistically significant.⁷

Furthermore, our results showed that mucinous carcinomas showed a greater propensity for eccentric bowel wall thickening. This finding is consistent with previous reports.⁷ This maybe in part due to the fact that extracellular mucin could act as a pathway for tumour spread. It has been suggested that the mucin in mucinous carcinoma contributes to extensive local invasion through tissue stroma, especially in varieties showing less differentiation.¹³ Extracellular mucin could dissect preferentially in a particular part of the tumour. This is more likely to happen in a tumour of histologically higher grade where the cells are less tightly packed.

Heterogenous contrast enhancement was more commonly seen in mucinous carcinomas. This is likely to be due to the hypoattenuating pools of extracellular mucin, which have been reported by various workers in mucinous tumours of different sites.^{7,8,9} We did not observe large hypoattenuating areas and one explanation of this could be due to the smaller circumference of the rectum as compared with the rest of the colon.

The degree of enhancement, though was not statistically different between enhancing parts of mucinous and non-mucinous adenocarcinoma. As such, the degree of enhancement could not be considered a useful parameter for differentiating the two types of carcinoma. However, a limitation of this study was its monophasic design. A three-phase helical CT might show differences in degree of enhancement between the two types of carcinomas.

In our study, calcification was seen only in the mucinous carcinomas and that too in a very small percentage.

As some workers have suggested colorectal mucinous carcinomas form a distinct group of neoplasms with an aggressive clinical course, which correlated with the percentage of mucin component independently of the histological grade.¹⁴ Therefore, these parameters would assist in suggesting a diagnosis of mucinous adenocarcinoma of the rectum.

CONCLUSION

To summarise, the CT features most likely to suggest rectal mucinous carcinoma are heterogenous contrast enhancement, eccentric wall thickening and intratumoural calcification. Thus, it may be possible to differentiate between mucinous and non-mucinous carcinomas of the rectum using CT. Even though, further studies are required to assess whether the mucinous character of adenocarcinoma of the rectum can be considered an independent prognostic factor, if a diagnosis of mucinous carcinoma of the rectum can be suggested on the staging CT it may influence patient management.

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