The role of multiple detector computed tomography in differentiating the primary small bowel neoplasms

Poster No.:	C-1963
Congress:	ECR 2019
Type:	Scientific Exhibit
Authors:	H. Le, D. T. Vo, C. Phan, T. T. Nguyen, T. T. L. Nguyen; Ho Chi Minh/VN
Keywords:	Abdomen, Oncology, Gastrointestinal tract, CT, MR, Ultrasound, Biopsy, Ablation procedures, Barium enema, Lymphoma, Cancer, Eating disorders
DOI:	10.26044/ecr2019/C-1963

Aims and objectives

Primary small bowel tumors are rare, account for 3-5% of all gastrointestinal tumors and have been estimated to be 1 per 100,000 people [1-4]. Because of the rarity and the variaty of histological subtypes, small bowel neoplasm has been less studied than the rest of gastrointestinal tract.

It is often diagnosed in late-stage due to clinical features are nonspecific or asymptomatic until some complications develop. The small intestine has been difficult to be approached for investigation. Most of the cases are diagnosed mainly based on imaging examinations in stead of histologic evidence. Multiple detector computed tomography (MDCT) has been the most important modality in evaluating and staging small bowel neoplasms [5].

Few research about small bowel imaging is just describing the imaging features of each histological subtype but not comparing it to others [6-10]. The purpose of this study was to analyze the ability of MDCT in differentiating the primary small bowel neoplasms.

Methods and materials

Patient population: In this retrospective study of patient data from January 2015 to May 2018 in University medical center and Cho Ray hospital at Ho Chi Minh city, Vietnam. The inclusion criteria were as follows: pathologically proven primary small bowel neoplasms and MDCT performed with intravenous contrast media before biopsy or surgery. Gastrointestinal stromal tumors (GISTs) were defined in this study as CD117-positive [11]. The periampullary tumors and lipomas were excluded. Lipomas are benign and able to make a definitive diagnosis based on CT density of less than 10 Hounsfield units, regardless of other imaging features. This retrospective study was approved by the institutional review board of our institution, which waived the requirement for informed consent from the patients.

Data acquisition: The protocols varied, depending on the reason of examination. All studies were at least venous phase, delay time to obtain images of approximately 60-70 seconds after injection. The images were acquired from the diaphragm to the perineum. All patients received an IV injection of 80-100 mL of non-ionic iodinated contrast material containing 300 mg I/mL at a rate of 3-4 mL per second. We did not use any oral contrast material or water to achieve small bowel distention.

Data analysis: The MDCT images were independently reviewed by two radiologists with 8 and 15 years of clinical experience in abdominal CT interpretation. The radiologists were blinded to the pathological information. The MDCT features of small bowel tumors were analyzed including anatomical distribution, pattern of growth, enhancement, hyperplasia vascular on tumor surfaces, size and lymph node characteristics. Then, comparing each finding to pathology report to evaluate the specificites, sensitivites and positive predictive value (PPV).

Statistical analysis: All statistical analyses were performed with the STATA. The used statistical tests were #2, Fisher, Kruskal-Wallis, Wilcoxon-rank-sum. A p value < 0.05 was considered statistically significant.

Results

Data of 83 patients met the criteria for including in the study. The study included 53 males (64%) and 30 females (36%). Median age at presentation was 56 years. The most common tumors were GISTs (36.1%), followed by lymphomas (26.5%), adenocarcinomas (24.1%), and others (13.3%; including 4 inflammatory fibroid polyps, 2 leiomyomas, 1 adenoma, 1 schwannoma, 1 leiomyosarcoma, 1 NET and 1 cavernous hemangioma).

The anatomical distribution of the small bowel tumor was 21 duodenum, 18 jejunum, 44 ileum. About half of adenocarcinomas (11/20) were located in the duodenum, in contrast to most lymphomas (21/22) were located in the jejunum and ileum. GISTs occurred in all parts of small bowel. Consequently, anatomical location cannot help to rule out any tumor in clinical practice. Therefore, location is not a potential finding in differentiating among small bowel neoplasm (Table 1).

The pattern of growth was classified according to prominent growth as extramural growth, bowel wall thickening and polypoid lesion (Figure 1). The extramural growth pattern is reliable prediction of GISTs, with PPV of 82.3%. None of adenocarcinoma and lymphoma presented this pattern. Bowel wall thickening was the common pattern of adenocarcinomas and lymphomas. Apple-core-like (figure 2), shoulder defect (figure 3) and focal involvement being less than or equal to 5 centimeter were probably findings of adenocarcinomas, with PPV of 81.8%, 71.4% and 76.9%, respectively. While on the contrary, aneurysmal dilatation of the lumen (figure 4) and marked thickening of wall bowel equal or greater than 25 mm could strongly suggest lymphoma, with PPV of 87.5% and 72.7%, respectively. (Table 2, 3)

All of GISTs showed moderate to avid enhancement [12]. Tumor density of greater than 110 HU on venous phase was likely to be GISTs, with PPV of 84.9%. Proliferation of blood vessels on tumor surfaces (figure 5) could help discriminate GISTs from the others, with PPV of 92%. Enhancement of adenocarcinoma and lymphoma were variable. But, they seldom enhanced more than 110 HU and not presented the proliferation of blood vessels on tumor surfaces. (Table 4, 5, 6)

Enlarged lymph node with shorter axis greater than 20mm or multiple lymph nodes fused together forming a bulky mass were likely to be lymphoma, with specificity of 100%. (Table 7)

	Adeno-carcinoma	Lymphoma	GIST	Others	Total
Deodenum	11	1	8	1	21
Jejunum	2	2	11	3	18

Ileum	7	19	11	7	44
Total	20	22	30	11	83

Table 1: Distribution of small bowel tumors by pathology and anatomical distribution.

	Adeno-carcinoma	Lymphoma	GIST	Others	Total
Polypoid lesion	2	4	2	5	13
Extramural growth	0	0	28	5	33
Bowel wall thickening	18	18	0	1	37
Total	20	22	30	11	83

Table 2: The pattern of growth of small bowel tumors.

	Adeno-carcinoma	Lymphoma	GIST	Others	Total
Shoulder defect	10	4	0	1	15
Apple-core-like	9	2	0	0	11
Aneurysmal dilatation	2	14	0	0	16
Focal involvement	10	2	0	1	13
Marked thickening	3	8	0	0	11

Table 3: Specific patterns of bowel wall thickening.

	Adeno-carcinoma	Lymphoma	GIST	Others	Total
Moderate to avid	16	14	30	5	65
Mild	4	8	0	6	18
Total	20	22	30	11	83

Table 4: Enhancement feature in small bowel tumors.

	GISTs	Non GISTs	Total
> 110 HU	13	8	21
# 110 HU	17	45	62
Total	30	53	83

Table 5: Enhancement threshold 110HU on venous phase

	Adeno-carcinoma	Lymphoma	GIST	Others	Total
BVoTS (+)	0	0	23	2	25
BVoTS (-)	20	22	7	9	58
Total	20	22	30	11	83

Table 6: Proliferation of blood vessels on tumor surfaces (BVoTS).

	Adeno-carcinoma	Lymphoma	GIST	Others	Total
Enlarged lymph nodes	12	20	0	0	32
Shorter axis >20mm	0	7	0	0	7
Multiple lymph nodes fused together	0	10	0	0	10

Table 7: Lymph nodes in small bowel tumors.

Images for this section:

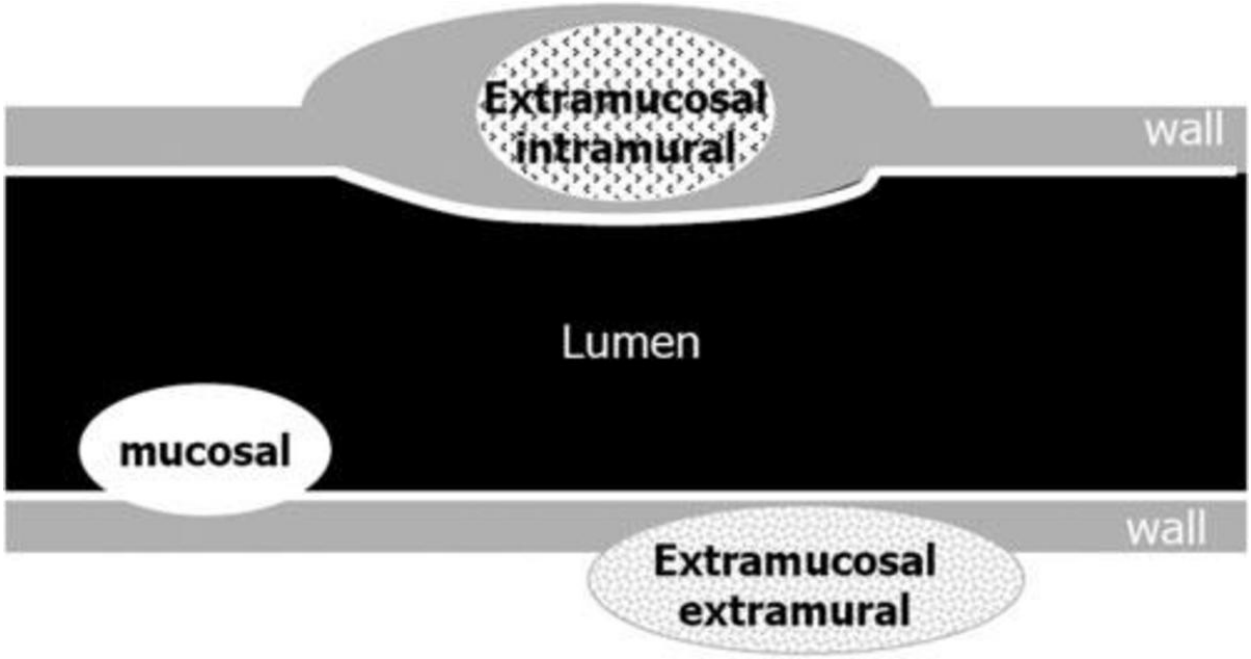

Fig. 1: The pattern of growth. [13]

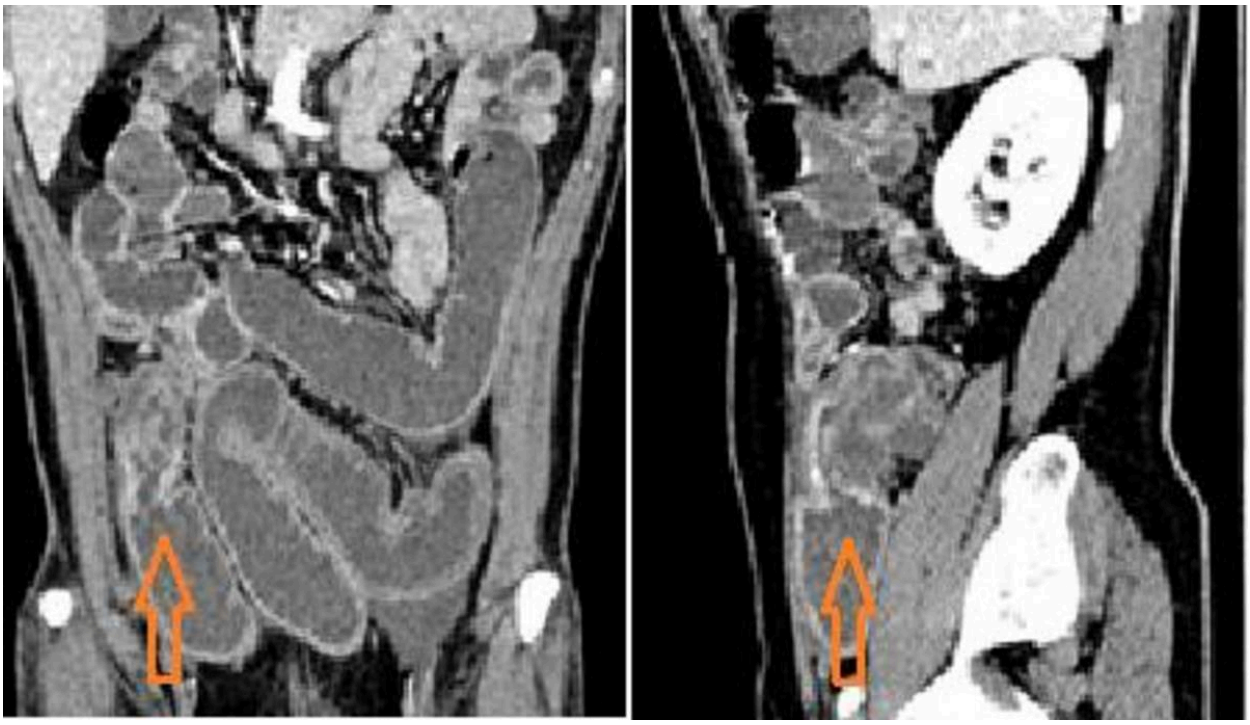

Fig. 2: Ileal wall thickening caused significant stenosis bowel lumen (arrow) like apple-core sign in barium enema.

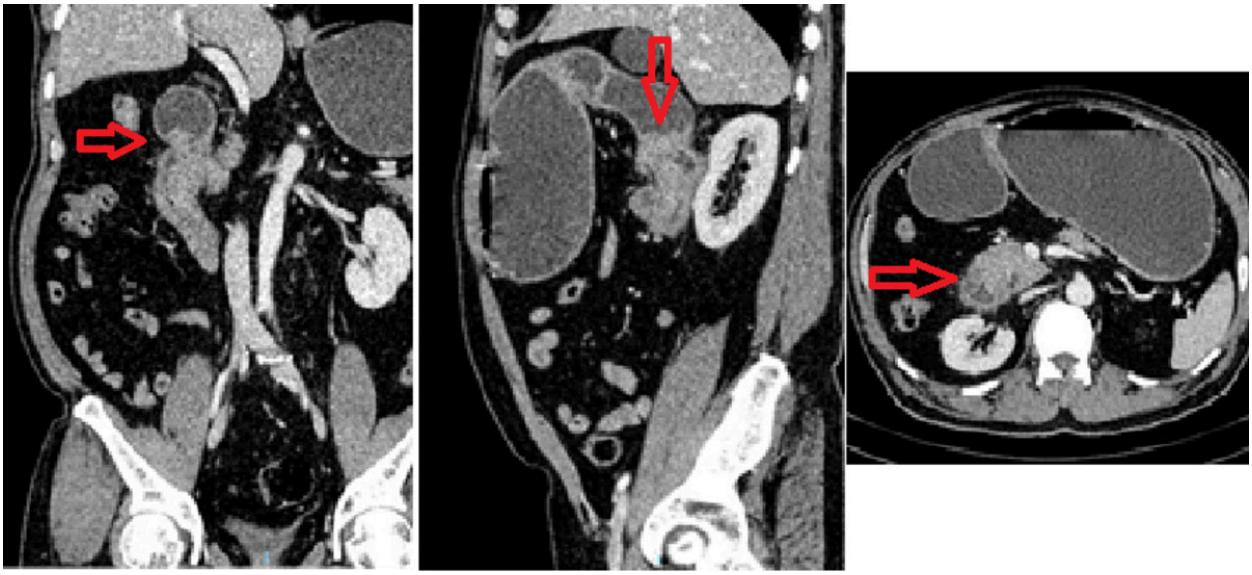

Fig. 3: Bowel wall thickening with clear transition zone between normal tissue and tumor, tumor protrusion into lumen creating shoulder defect sign.

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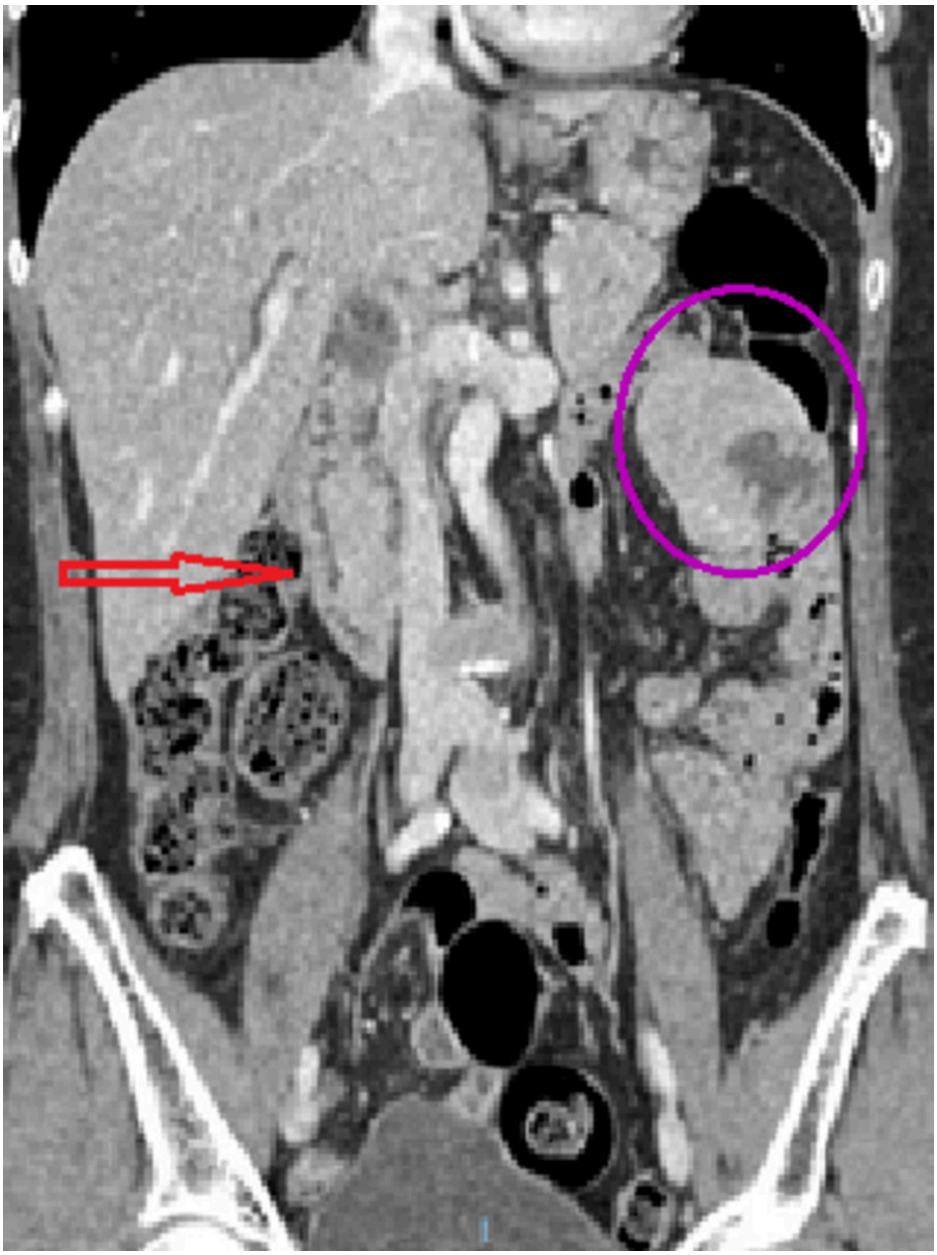

Fig. 4: Multiple site involvement lymphoma. Duodenal wall thickening (arrow) involving the ampulla of Vater lead to biliary dilatation. Another lesion in jejunum (circle) presented wall thickening but caused dilatation of bowel lumen instead of stenosis, call aneurysmal dilatation.

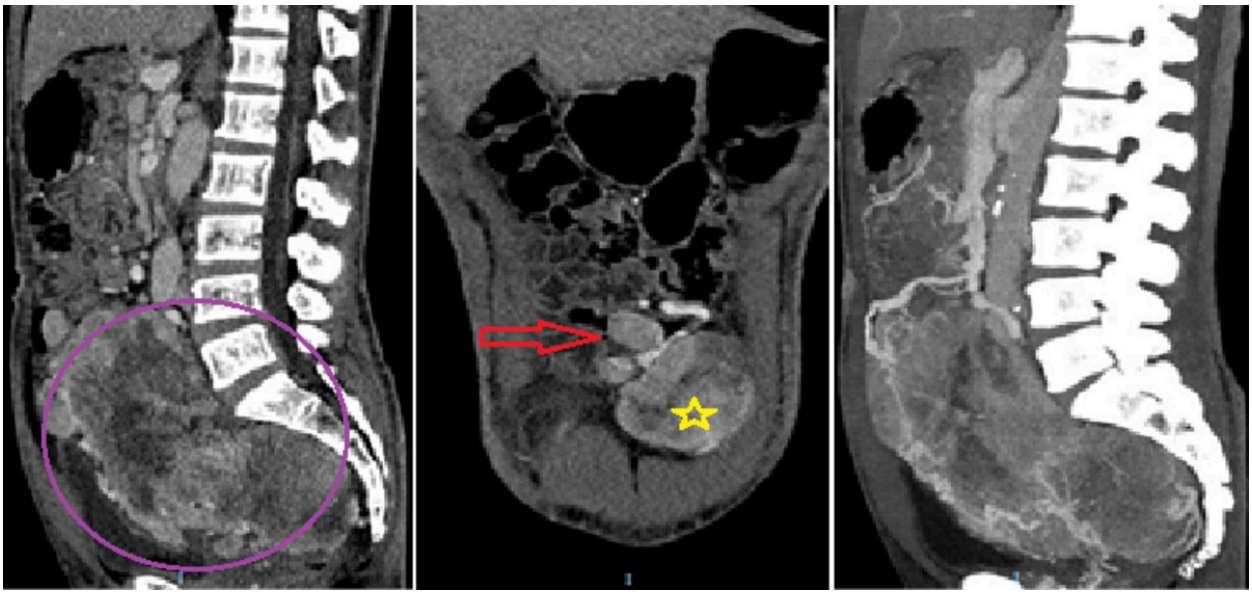

Fig. 5: Ileal GIST (in circle) consists of two part: polypoid lesion (arrow) and extramural growth more prominent (star). Proliferation of blood vessels on tumor surface is obvious on MIP image.

Conclusion

MDCT findings could potentially be useful to differentiate the primary small bowel neoplasms based on analyzing specific imaging characteristics of each kind of tumor.

Our study had some limitations. First of all, this was retrospective study, so we could not control the protocol. The protocols were variable due to nonspecific clinical scene. But, it was actual daily practice, radiologist usually have to face with nonoptimal imaging like inadequate luminal distention. Secondly, we only gathered patients had symptoms and were diagnosed small bowel tumors. Therefore, small tumors or tumors not causing any symptom were not included. Finally, polypoid lesions presented in a relatively small number and were still a challenge to imaging.

In conclusion, we believe that the prominent growth pattern is the most valuable characteristic to approach a small bowel neoplasm. That can be used to narrow the differential diagnosis. Then, some specific imaging features can help to suggest the pathology of this small bowel neoplasm (Figure 6).

Images for this section:

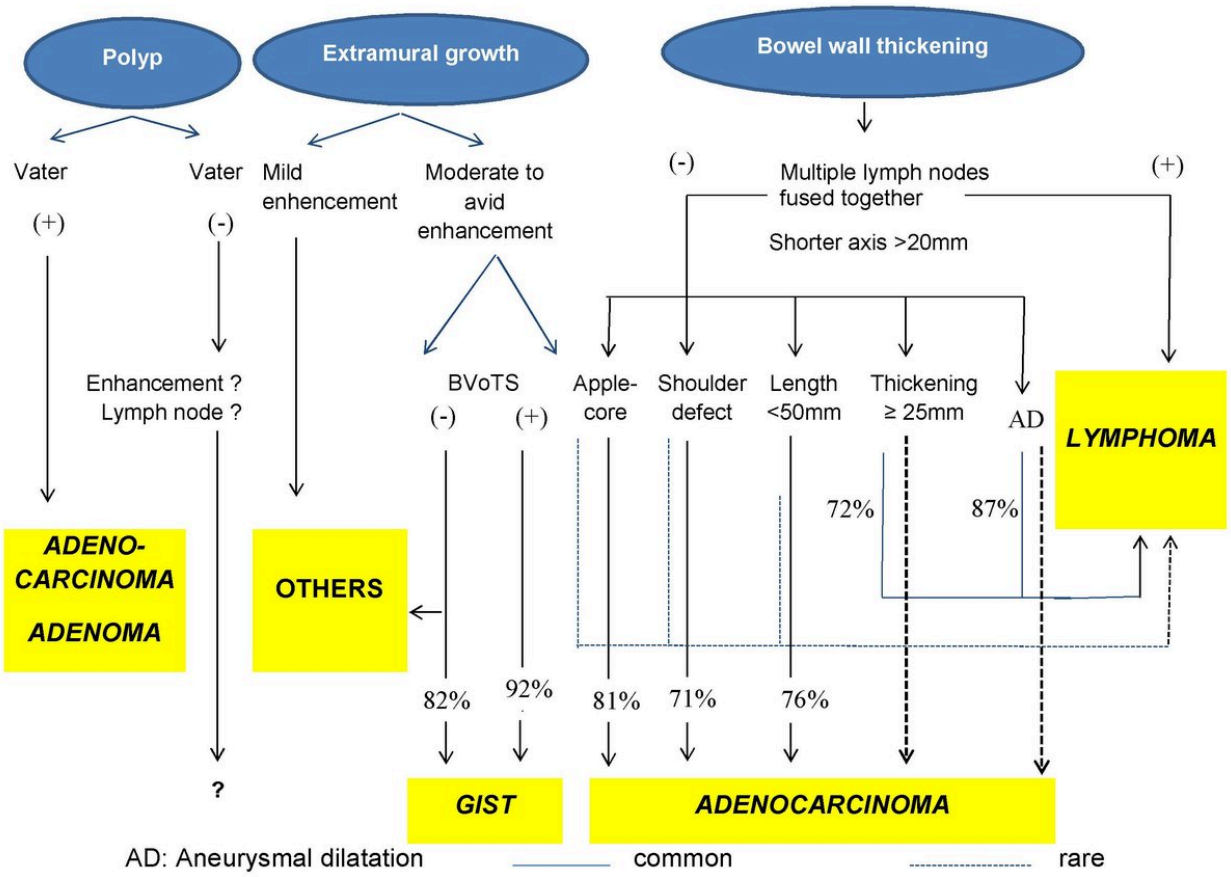

Figure 6: The imaging approach to a small bowel neoplasm.

Fig. 6

References

1.

6. Anzidei M., Napoli A., et al. (2011), "Malignant tumours of the small intestine: a review of histopathology, multidetector CT and MRI aspects"*. Br J Radiol*, 84 (1004), pp. 677-690.