Salient CT features of acute bowel ischemia: A pictorial review of cases seen in an Emergency Teleradiology Practice

Authors: Dr Anurita Menon, Dr Pallavi Rao, Dr Anjali Agrawal, Dr Arjun Kalyanpur
Institution: Image Core Lab and Teleradiology Solutions

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Aims and Objectives:

Bowel ischemia has varied imaging findings on CT, depending on the underlying etiology, time of imaging, and complications.

The objectives of this study are:

- Recognize multifarious CT findings of bowel ischemia
- Facilitate appropriate and timely management
- Efficacy of identification on NCCT

Acute bowel ischemia

- Vascular and GI emergency
- Disease affecting the small and large bowel due to a sudden reduction in blood flow → ischemia → cellular damage → intestinal necrosis → death

- Incidence: < 1 per 1000 hospital admissions*
- F>M, >60yrs, medical comorbidities
- High mortality 10-90% #, 1st hr 10-20%
- Catastrophic consequences: sepsis, bowel infarction and death

ACT FAST!

Improved survival rates: Heightened awareness, improved and early radiological diagnosis, aggressive operative intervention and endovascular management

*Stoney RJ, Cunnungham CG. Acute mesenteric ischemia. Surgery 1993;114:489-90
Acosta S, et al. J Gastrointest Surg. 2010;14(4)
#Kassahun WT, et al.Langenbecks Arch Surg. 2008;393(2)

Role of imaging

Early detection of ischemia before infarction

Variable imaging appearance

Knowledge of imaging findings is important – CT Findings

Arterial/Venous occlusion /thrombosis

Ileus-Arterial ischemia

Thin wall- arterial occlusion, intermediate phase

Thick wall-reperfusion stage of arterial ischemia-submucosal edema, hemorrhage, heterogeneous enhancement

Thick wall, halo sign – venous occlusion-submucosal edema and mucosal hemorrhage

Mesenteric congestion in venous insufficiency, fat stranding in reperfusion injury

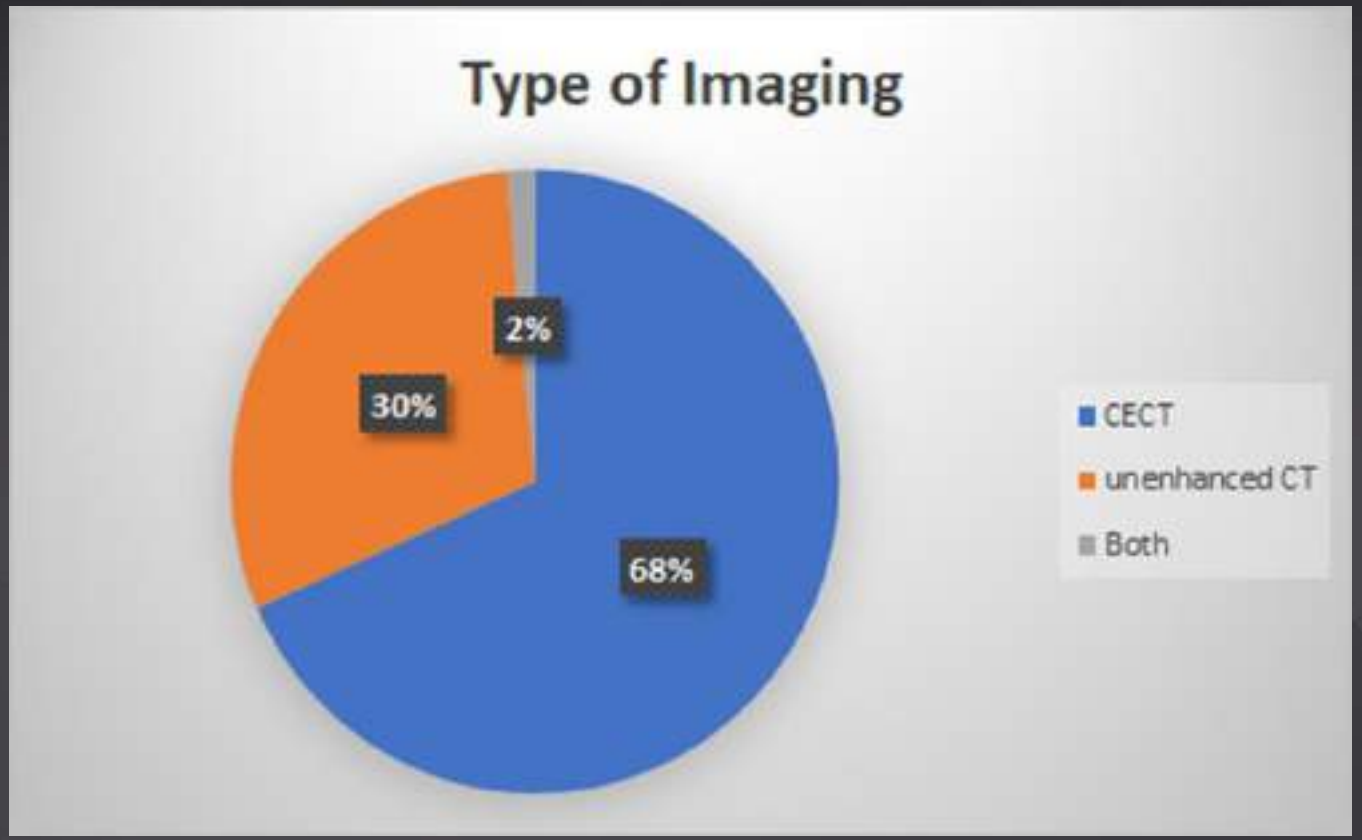
Pneumatosis, porto-mesenteric venous gas –late phase

No direct correlation between bowel wall findings and a confirmed diagnosis of ischemia or infarction*

*S. Romano, et al. Ischemia and infarction of the small bowel and colon: spectrum of imaging findings. Abdom Imaging (2006) 31

Materials and methods:

- 450 CT abdomen and pelvis examinations
- Radiological diagnosis of bowel ischemia on Teleradiology reports
- Retrospective evaluation
- CECT 68% and NECT 30%
- **Most common clinical presentations** -abdominal pain and distension.



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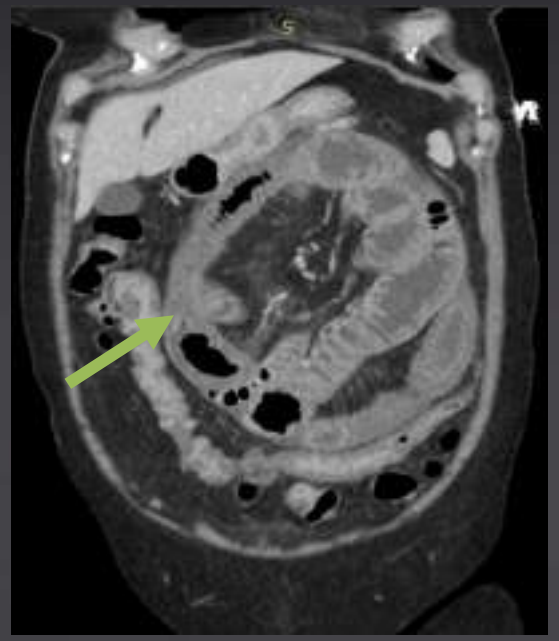
Parameters used in evaluation of CT Images for features of bowel ischemia:

- Bowel wall thickening – site and location
- Bowel dilatation
- Appearance of the mesentery – congestion/ fat stranding
- Mesenteric vasculature – Thrombosis/occlusion/ narrowing
- Pneumatosis intestinalis
- Porto-mesenteric venous gas
- Peritoneum – Free air, Free fluid

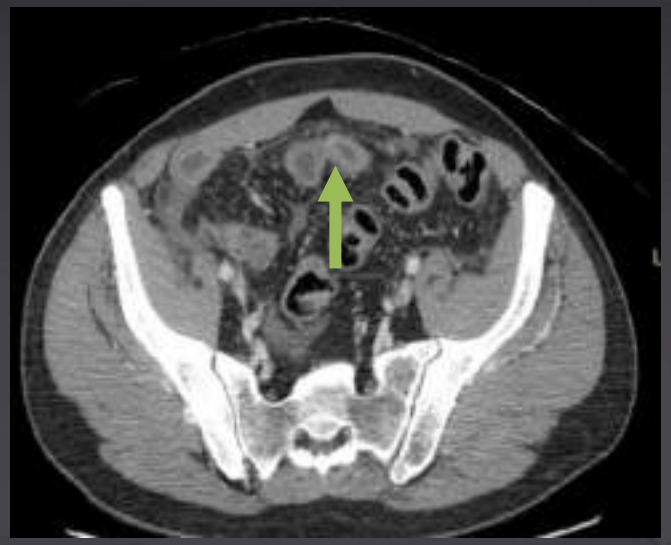
1) Bowel wall Thickening

Case 1



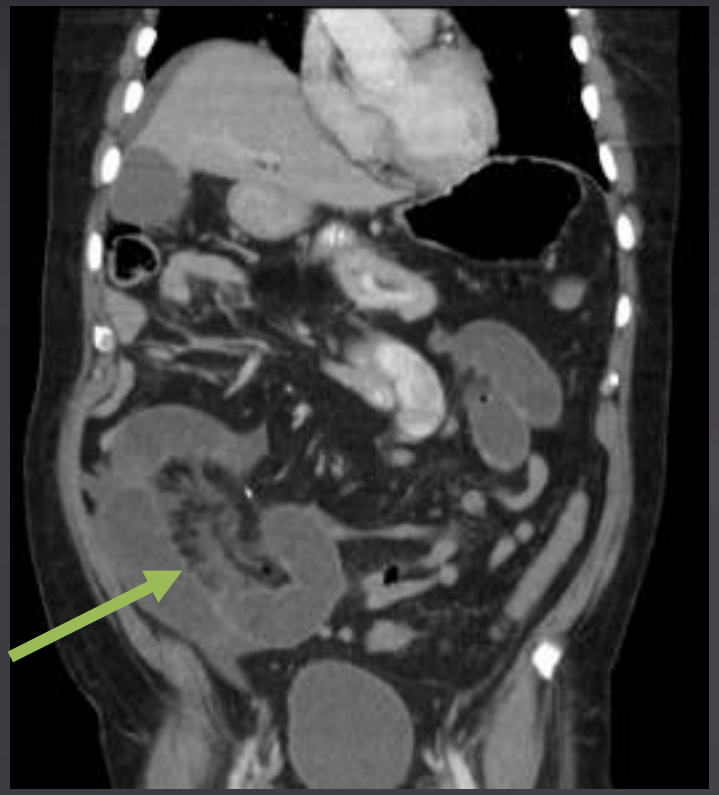
Clinical history: Diffuse abdominal pain but pain mainly lies at the left hypochondriac and epigastric region * 2 days
Halo sign-venous ischemia

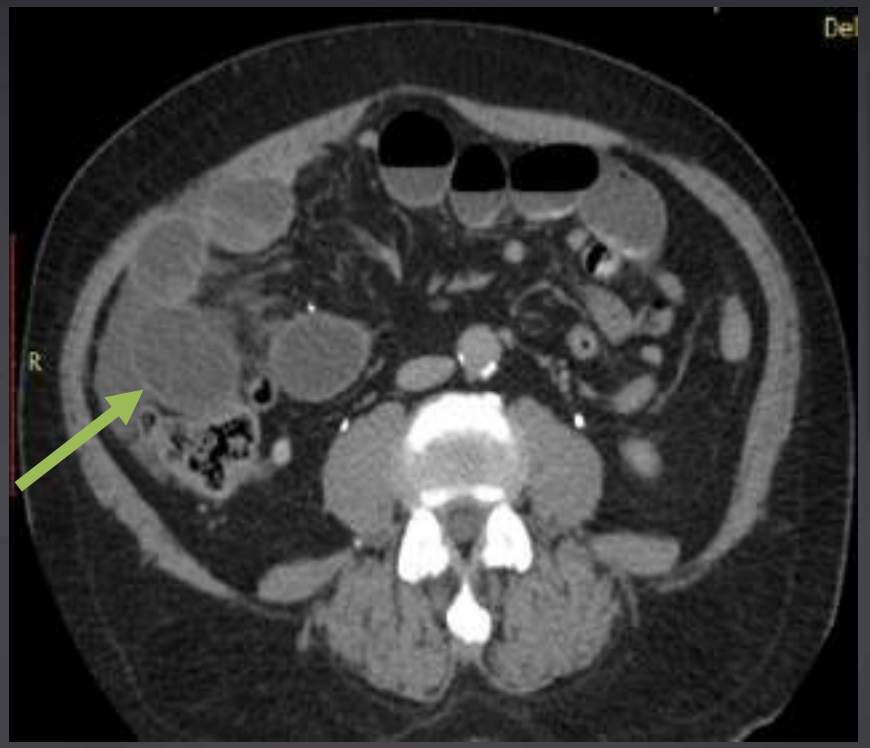
Case 2



Clinical history: Abdominal pain
Arterial ischemia reperfusion stage-heterogenous enhancement

2) Bowel dilatation: Associated mesenteric fat stranding and minimal free fluid.

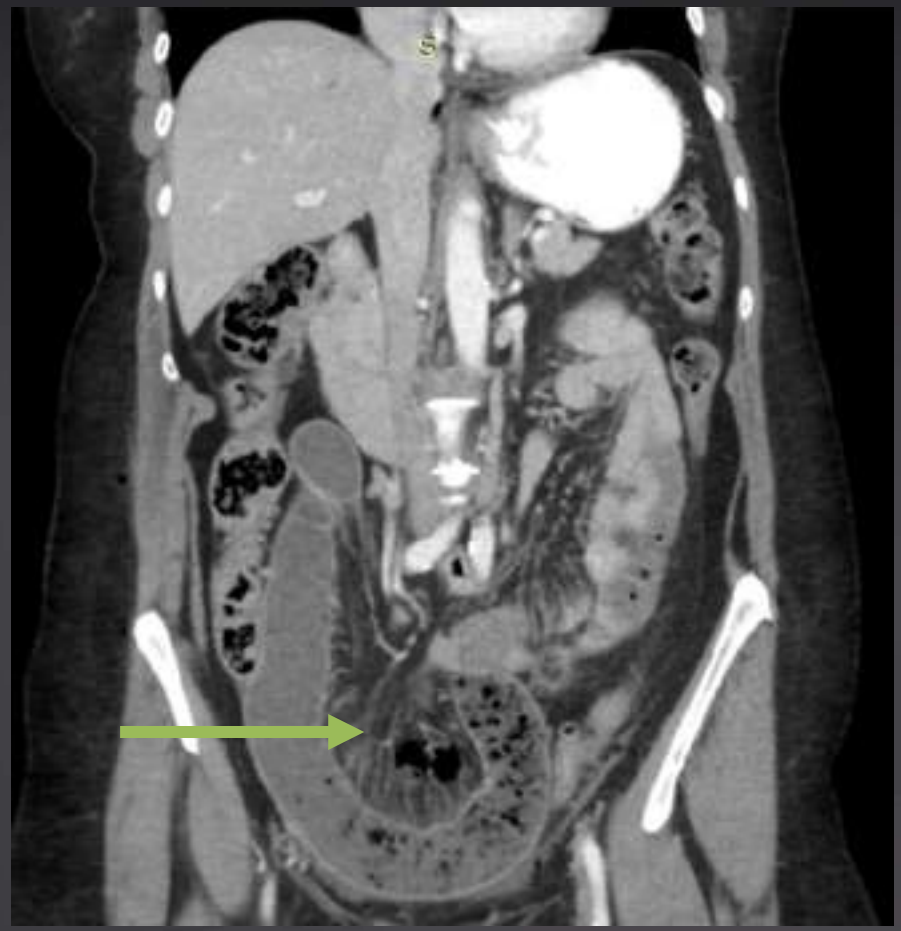




Clinical history: RLQ and epigastric pain

Thin wall ,reduced enhancement- arterial ischemia

3) Mesenteric edema/congestion and bowel dilatation:



Clinical history: Status post recent surgery hysterectomy.

Reperfusion injury-mesenteric edema/fat-stranding

4) Pneumatosis intestinalis:

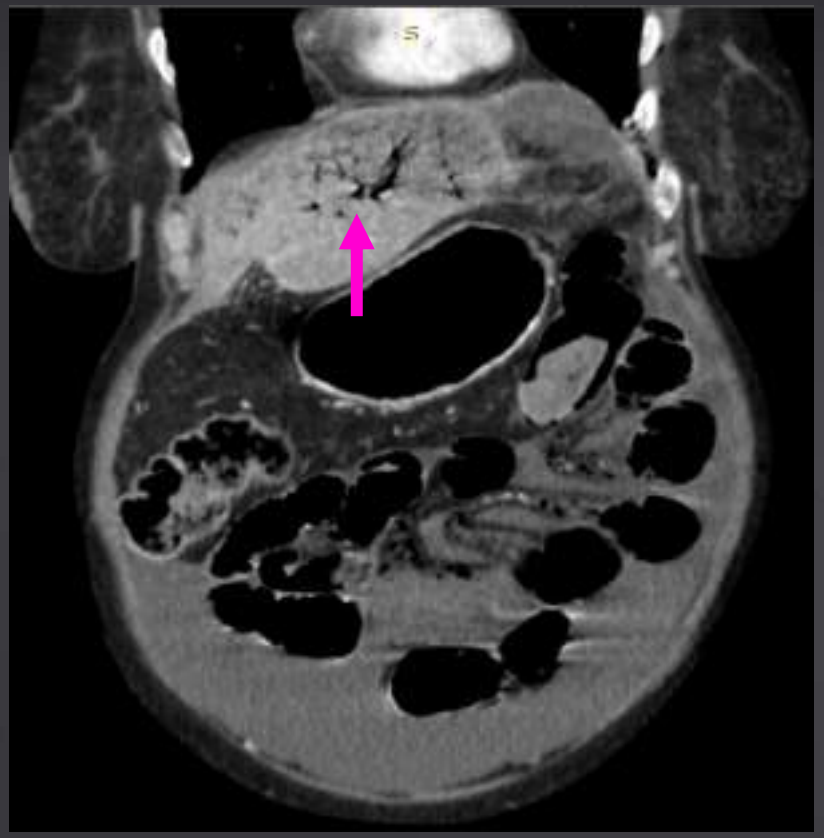
a) Pneumatosis in the gastric wall with portal venous gas

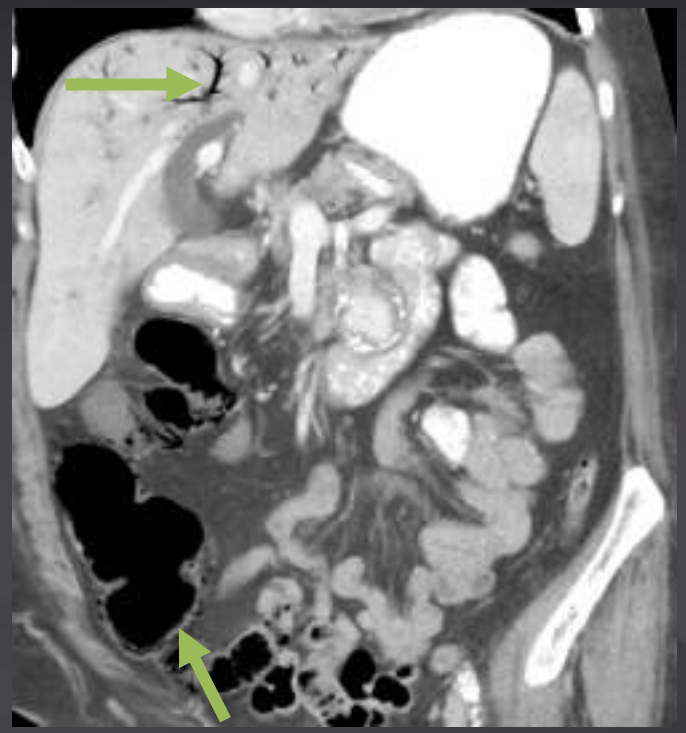
Clinical history: Right side abdominal pain, vomiting.
Late ischemic injury

b) Pneumatosis intestinalis with ascites and bowel dilatation

Clinical history: Abdominal pain, vomiting
Late ischemic phase

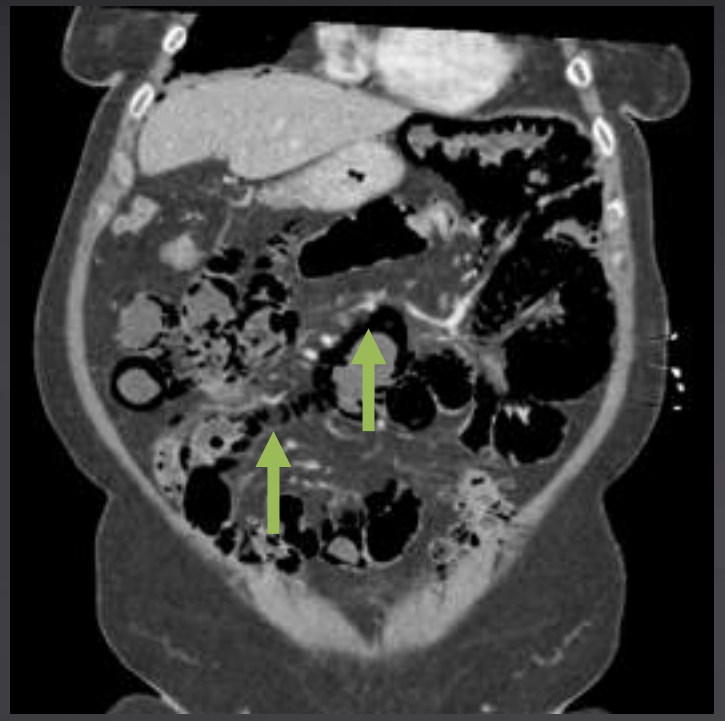
5) Intravascular gas – Porto mesenteric gas
Associated Pneumatosis intestinalis with bowel dilatation

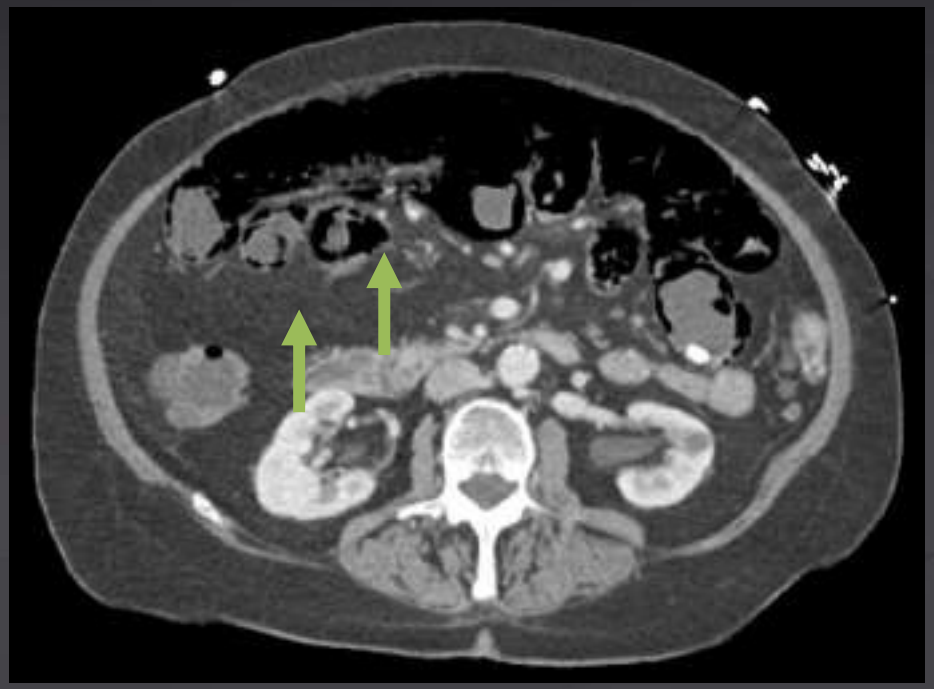




Clinical history: Abdominal pain/distension.
Late ischemic phase

b) Pneumatosis intestinalis with gas in the mesenteric venules and pneumoperitoneum





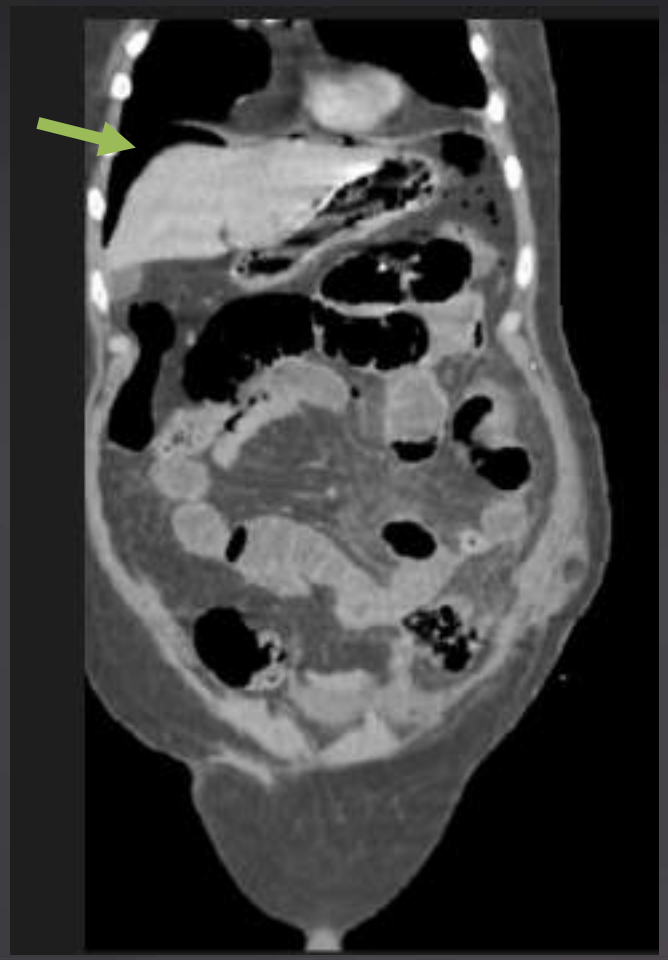
Clinical history: Abdominal pain, nausea, vomiting.
Late ischemic phase

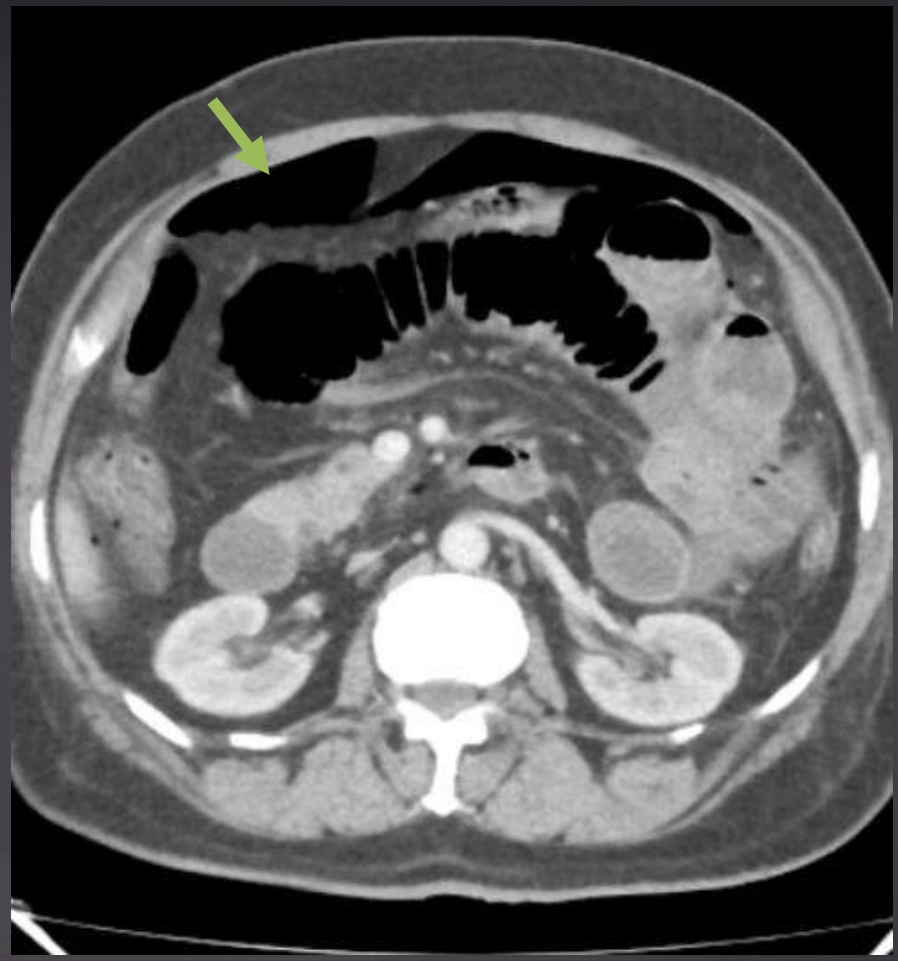
6) Complications
a) Free fluid – associated bowel wall thickening and mild bowel dilatation

Clinical history: Tachypnea, tachycardia, recent surgery. Non enhancing bowel wall thickening-venous ischemia

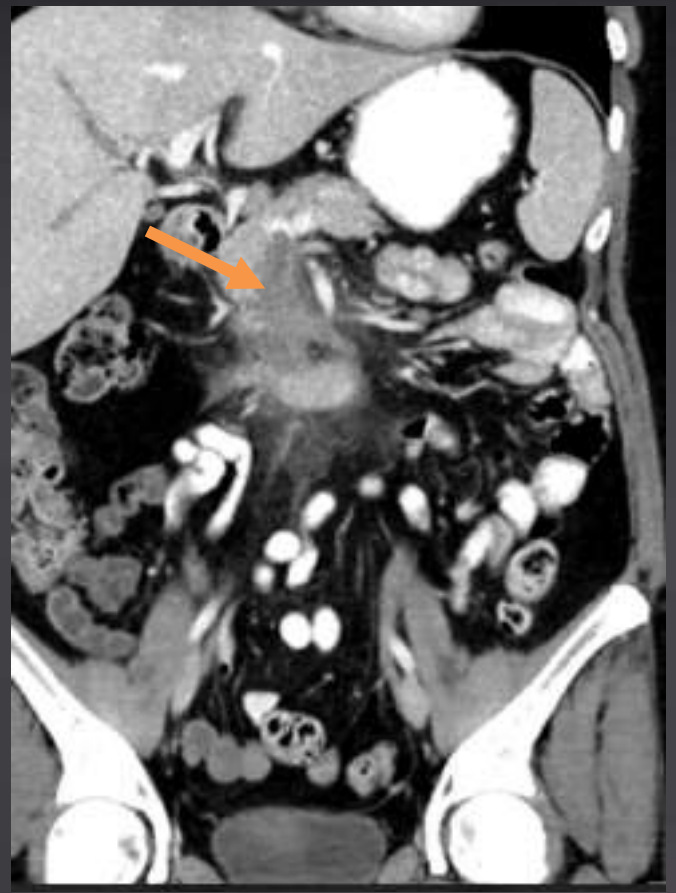
b) Perforation - pneumoperitoneum

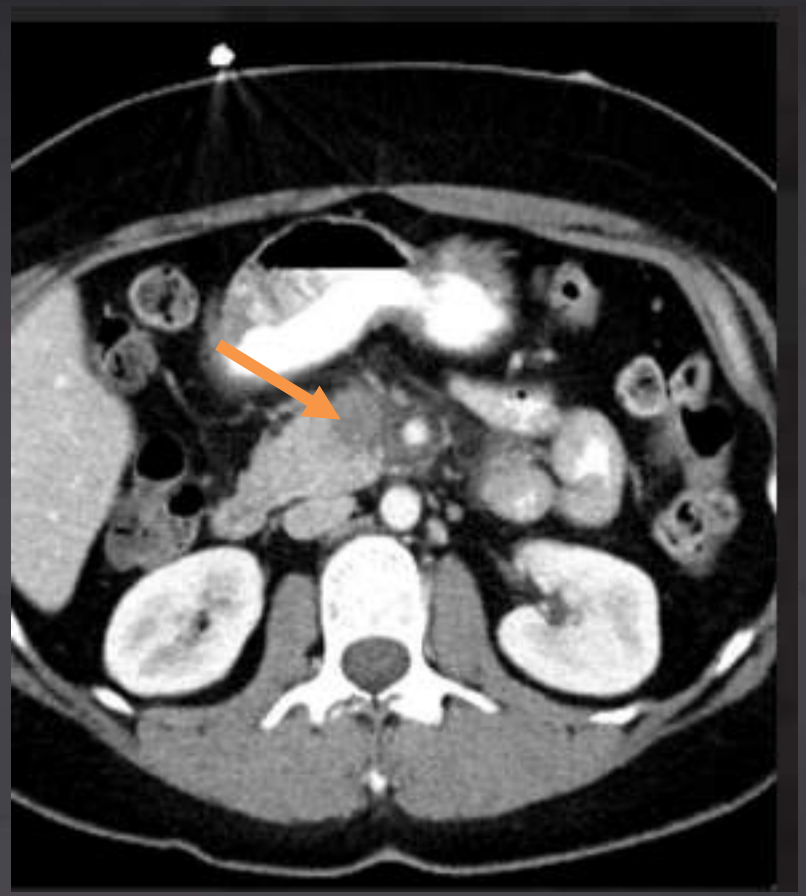
Clinical history:
Abdominal pain and distension.
Ischemic bowel with perforation.



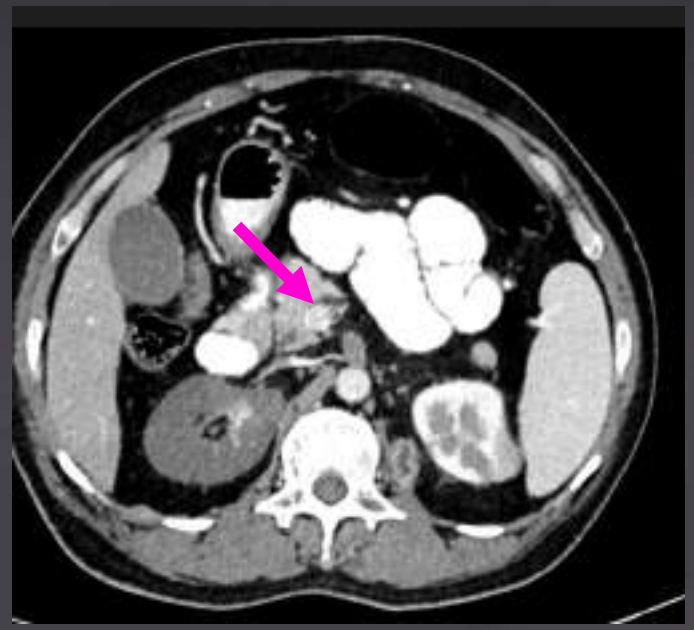


Causative factors
a) Mesenteric venous thrombosis





b) Mesenteric arterial occlusion-SMA thrombosis

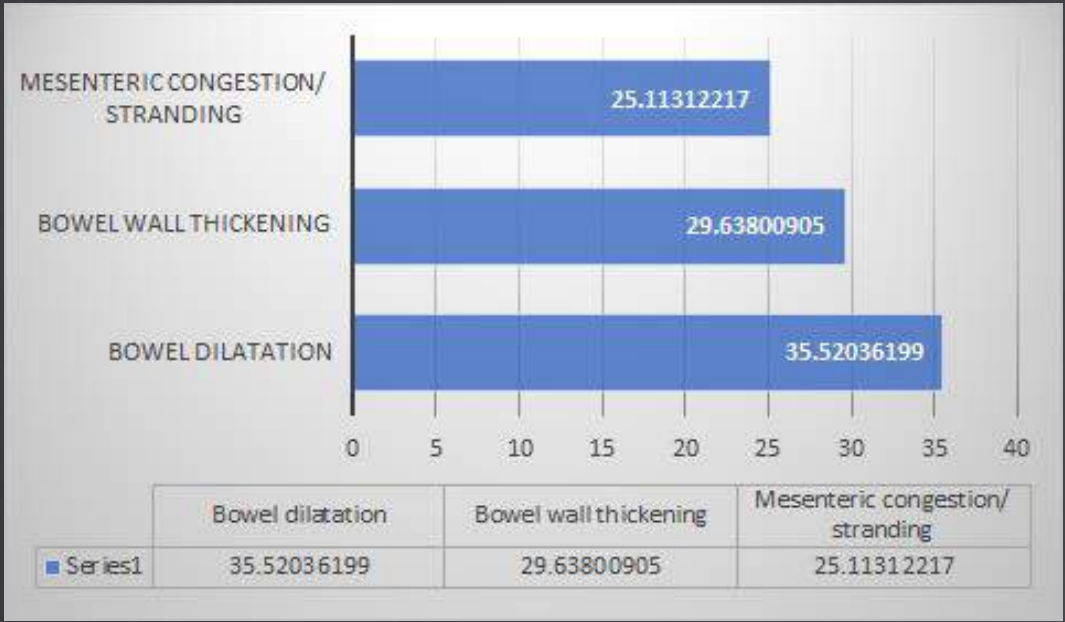


Associated features – bowel obstruction

Clinical history: Abdominal pain/distension
Ischemic bowel with obstruction

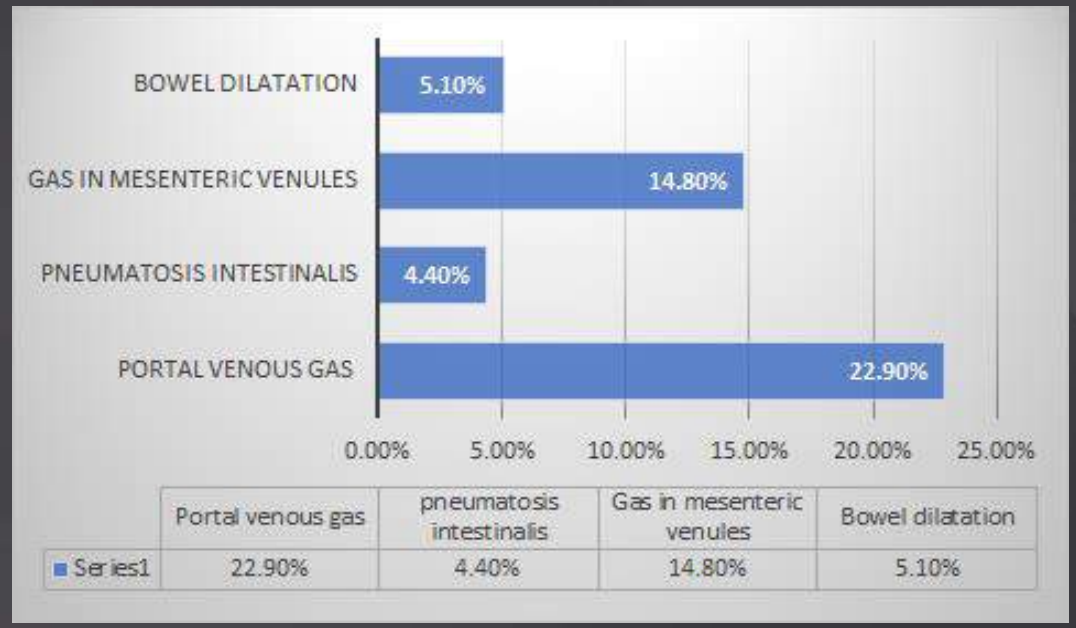
Most common features on CECT

- Bowel dilatation - 35.5%
- Bowel wall thickening - 29.6%
- Mesenteric hyperemia and congestion - 25.1%



Common Features on Non-Contrast CT

- Bowel dilatation - 5.10%
- Gas in the mesenteric venules – 14.80%
- Pneumatosis intestinalis – 4.40%
- Portal venous gas - 22.90%



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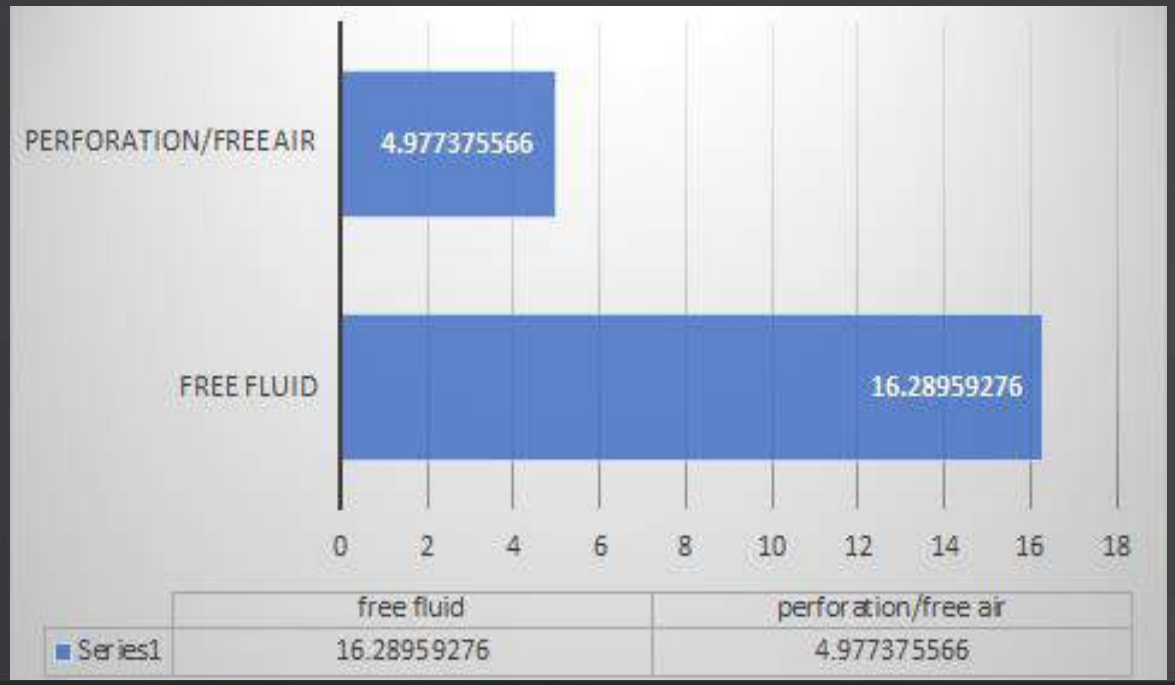
Complications and Causative factors

Complications

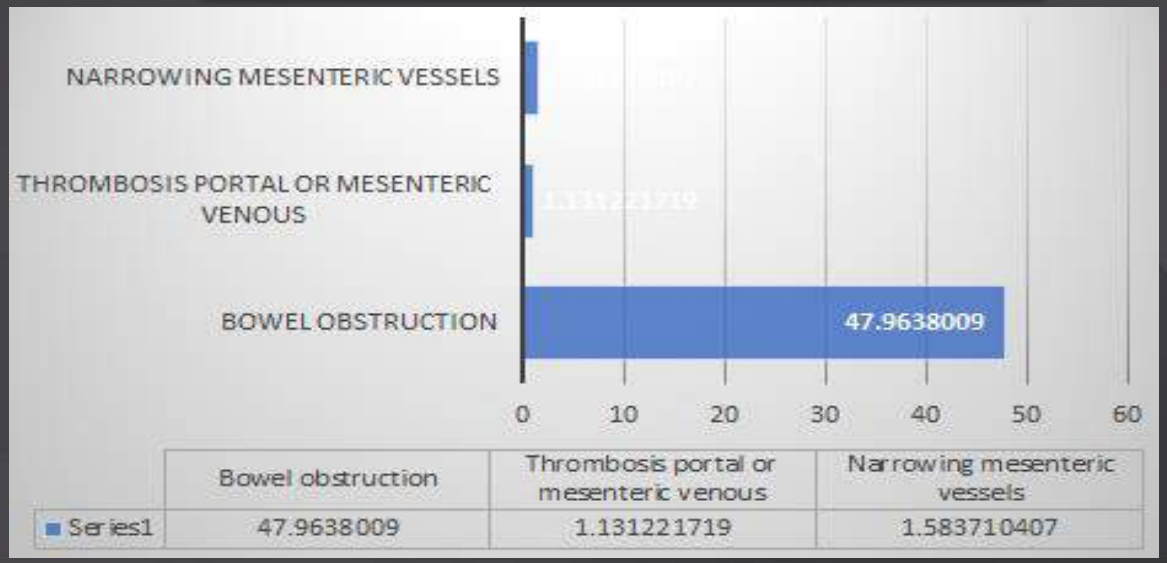
- Free fluid –16.2%
- Free air - 4.9%



Causative factors

Causative factors included:

- Bowel obstruction – 47.9%
- Thrombosis of the mesenteric? - 1.13
- Portal veins and mesenteric arterial occlusion or narrowing - 1.5%



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Discussion:

CT abdomen is the modality of choice and diagnosis of bowels/mesenteric ischemia.

A combination of findings on CT images contribute to an accurate diagnosis of bowel ischemia.

NCCT - is a useful in confirming diagnosis of bowel ischemia and cases where IV-contrast is not possible or contraindicated

CECT – dual phase is the modality of choice to diagnose bowel ischemia.

The direct vascular findings, associated occlusion/thrombosis / narrowing are definitively diagnosed on CECT.

Conclusion and Take Home Points:

Conclusion :

- Ischemic bowel is a condition of critical significance that can have catastrophic consequences.
- Needs emergent surgical/endovascular intervention.
- Timely diagnosis and management significantly reduce the morbidity and mortality.

Take Home Points:

- Systematic approach is required to interpret CT images with high clinical suspicion of mesenteric ischemia.
- Mesenteric ischemia mimics like a dynamic ileus, inflammatory/infectious bowel wall thickening, pseudo pneumatosis.
- Location of disease and careful evaluation of vascular structures lead to diagnosis of acute bowel ischemia.
- Small bowel obstruction with strangulation should be differentiated from ischemic bowel .

References

1. Wiesner Walter, Khurana Bharti, Ji Hoon. et al.CT of Acute Bowel Ischemia. Radiology. 2003; 226:635–650.

2. Fitzpatrick Laura A, Rivers-Bowerman Michael. et al.Pearls, Pitfalls, and Conditions that Mimic Mesenteric Ischemia at CT. RadioGraphics 2020; 40.

3. Kanasaki Shuzo, Furukawa Akira. et al. Acute Mesenteric Ischemia: Multidetector CT Findings and Endovascular Management. RadioGraphics 2018; 38:945–961.

4. Bala Miklosh, Kashuk Jeffry .et al. Acute mesenteric ischemia: guidelines of the World Society of Emergency Surgery. World Journal of Emergency Surgery (2017) 12:38.

Thank You