

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Walsh DW, Bender GN, Timmons H. Comparison of computed tomography-enteroclysis and traditional computed tomography in the setting of suspected partial small-bowel obstruction. <i>Emerg Radiol</i> 1998; 5(1):29-37.	Observational-Dx	36 patients	To compare the value of CT enteroclysis with conventional CT in evaluation of suspected partial SBO.	Overall, CT enteroclysis was more sensitive (89%; 16/18 patients) in diagnosing partial SBO than was traditional CT (50%; 9/18). This was especially evident when considering only patients who presented with a history of malignancy. Of these patients, CT enteroclysis was 100% sensitive (8/8), whereas traditional CT was only 25% sensitive (2/8). The specificity of each modality was almost equivalent (100% for CT enteroclysis vs 94% for CT). Of the patients with malignancy, CT enteroclysis was able to identify tumor involvement of the small bowel with 100% sensitivity (7/7), as compared with only 57% (4/7) for traditional CT. In patients with malignancy, CT enteroclysis was found to be superior to traditional CT in identifying partial SBO and in identifying small bowel intraluminal or intramural disease. The greater strength of CT enteroclysis is its superiority in excluding disease of the small bowel, a desired trait in the management of patients with malignancy.	3
2. Frager D, Medwid SW, Baer JW, Mollinelli B, Friedman M. CT of small-bowel obstruction: value in establishing the diagnosis and determining the degree and cause. <i>AJR</i> 1994; 162(1):37-41.	Observational-Dx	85 patients	Prospective study to determine whether CT is superior to clinical-radiographic evaluation in diagnosing and assessing the cause of SBO. Gold standard for diagnosis was surgical findings in 61 cases and clinical course in 29 cases.	For combined clinical-radiographic findings, diagnosis was complete obstruction in 21/46 cases (sensitivity 46%). For CT, diagnosis was established in all 46 cases (sensitivity 100%). For combined clinical-radiographic findings, partial obstruction of the small bowel was diagnosed in 6/20 cases (sensitivity 30%), whereas all cases were detected with CT. CT is sensitive for diagnosing complete obstruction of the small bowel and for determining the location and cause of obstruction while the traditional clinical and plain film evaluation is relatively insensitive.	3

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3. Fukuya T, Hawes DR, Lu CC, Chang PJ, Barloon TJ. CT diagnosis of small-bowel obstruction: efficacy in 60 patients. <i>AJR</i> 1992; 158(4):765-769; discussion 771-762.	Observational-Dx	60 patients	Retrospectively compare the CT findings in patients with and without surgically proved SBO to evaluate the role of CT in diagnosing the presence and cause of obstruction. In patients with obstruction, CT findings were compared with findings on plain abdominal radiographs and contrast studies of the small intestine.	CT correctly detected SBO in 90%. Radiographs showed SBO in 80%. CT provided more info than contrast studies regarding cause of obstruction. CT scanning accurately shows the presence of HG SBO and may be the technique of choice when extraluminal abnormalities are suspected or when prompt, efficient, and comprehensive evaluation is required.	3
4. Matsuo Y. Degree of bowel distension on plain-radiographs--a surgical-radiological study of new criteria in mechanical intestinal obstruction. <i>Jpn J Surg</i> 1978; 8(3):222-227.	Review/Other-Dx	360 cases	To assess the utility of small bowel diameter/inter-pedunculate distance ratio for diagnosing mechanical obstruction.	Small bowel distension of above 1.0 (ratio) together with obvious gas fluid level usually indicates SBO, while large bowel distension of above 1.5 (ratio) together with obvious gas fluid level usually indicates large bowel obstruction.	4
5. Shrake PD, Rex DK, Lappas JC, Maglinte DD. Radiographic evaluation of suspected small bowel obstruction. <i>Am J Gastroenterol</i> 1991; 86(2):175-178.	Review/Other-Dx	117 consecutive patients	Abdominal radiographs and enteroclysis studies were reviewed blindly in patients undergoing enteroclysis for suspected SBO.	For patients with normal or abnormal nonspecific radiographs, SBO was shown by enteroclysis in 22%. For patients with obstruction on radiographs, 42% had either normal enteroclysis studies or only minor adhesions. Enteroclysis correctly predicted the presence of obstruction in 100%, the absence of obstruction in 88%, the level (proximal vs distal) of obstruction in 89%, and the etiology of obstruction in 86% of operated patients. Enteroclysis is recommended in patients with clinical uncertainty about the diagnosis of SBO.	4
6. Maglinte DD, Reyes BL, Harmon BH, et al. Reliability and role of plain film radiography and CT in the diagnosis of small-bowel obstruction. <i>AJR</i> 1996; 167(6):1451-1455.	Observational-Dx	78 patients	Blinded retrospective analysis to compare the reliability and define the role of radiography and CT in the assessment of SBO.	Radiography: sensitivity 69%, specificity 57%, accuracy 67%. CT: sensitivity 64%, and specificity 79%, accuracy 67%. High-grade partial obstruction, radiography and CT: sensitivity 86%, specificity 82%. Low grade partial obstruction: radiography and CT: sensitivity 56%, specificity 50%. CT revealed the cause of the SBO in 95% of those patients who CT correctly showed the obstruction.	2

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7. Heinberg EM, Finan MA, Chambers RB, Bazzett LB, Kline RC. Postoperative ileus on a gynecologic oncology service--do abdominal X-rays have a role? <i>Gynecol Oncol</i> 2003; 90(1):158-162.	Observational-Dx	84 patients	Review records of patients to estimate role of abdominal radiographs in management of patients with GI dysfunction after gynecologic surgery.	At least one set of abdominal X-rays was obtained for 56 (66.7%) patients, of which 24 (42.9%) were considered radiographically diagnostic. A lower preoperative American Society of Anesthesiologists (ASA) physical status score correlated with a greater likelihood of having abdominal films (P=0.005). No single clinical finding correlated with either the decision to obtain films or X-ray diagnosis of ileus or bowel obstruction. Use of any nonsurgical treatment modality was not significantly different for patients who had films vs those who did not. Mean length of hospital stay was significantly prolonged for patients who had abdominal X-rays. 7 patients were subjected to reoperation; however, no association was found between X-ray diagnosis of ileus or bowel obstruction and the need for reoperation.	3
8. Ko YT, Lim JH, Lee DH, Lee HW, Lim JW. Small bowel obstruction: sonographic evaluation. <i>Radiology</i> 1993; 188(3):649-653.	Observational-Dx	54 patients	Retrospective study to compare US with radiographs in detection and characterization of SBO.	SBO correctly diagnosed: US 89%, radiographs 71%. Level correctly localized: US 76%, radiographs 51%. US may be helpful in confirmation of the presence of obstruction, in determination of the level of obstruction, and in identification of the cause of obstruction.	3
9. Thompson WM, Kilani RK, Smith BB, et al. Accuracy of abdominal radiography in acute small-bowel obstruction: does reviewer experience matter? <i>AJR</i> 2007; 188(3):W233-238.	Observational-Dx	90 patients/6 reviewers	Retrospective study to determine the accuracy of abdominal radiography in the detection of acute SBO, to assess the role of reviewer experience, and to evaluate individual radiographic signs of SBO.	29 of the patients had proven SBO. Sensitivity for SBO among 6 reviewers ranged from 59% to 93%. The senior staff members were significantly more accurate. The mean sensitivity, specificity, and accuracy for all 6 reviewers were 82%, 83%, and 83%, respectively. Three radiographic signs were highly significant (P<0.001): two or more air-fluid levels, air-fluid levels wider than 2.5 cm, and air-fluid levels differing more than 5 mm from one another in the same loop of small bowel. ROC analysis showed that senior staff is significantly more accurate than the other groups in the detection of acute SBO.	3

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10. Anderson CA, Humphrey WT. Contrast radiography in small bowel obstruction: a prospective, randomized trial. <i>Mil Med</i> 1997; 162(11):749-752.	Experimental-Dx	64 patients	Prospective randomized trial comparing immediate oral barium contrast studies with abdominal radiographs in patients presenting with signs and symptoms of SBO.	Barium contrast studies: sensitivity 100% for diagnosing complete obstruction. Radiographs: sensitivity 82%. Among those going to operation, the time from admission to operation was 8.2 hours in the contrast group and 12.4 hours in the plain radiograph group, but this result did not reach statistical significance (P=0.25). Total hospital days were similar between the two groups (8 vs 12 days, P=0.40). There were no complications resulting from the oral administration of barium. Small bowel contrast studies using barium are safe and may shorten the time to operation in patients presenting with signs and symptoms of SBO.	2
11. Caroline DF, Herlinger H, Laufer I, Kressel HY, Levine MS. Small-bowel enema in the diagnosis of adhesive obstructions. <i>AJR</i> 1984; 142(6):1133-1139.	Review/Other-Dx	60 patients	To determine the role of small-bowel enema as an alternative technique in diagnosing adhesive obstruction.	Radiographic diagnosis of adhesive obstruction was correct in 36 (87.8%) of 41 patients in whom a surgical diagnosis could subsequently be made, but an incorrect radiologic diagnosis of obstruction by metastases was made in 5 patients.	4
12. Maglinte DD, Burney BT, Miller RE. Lesions missed on small-bowel follow-through: analysis and recommendations. <i>Radiology</i> 1982; 144(4):737-739.	Review/Other-Dx	42 small bowel lesions	To analyze potential sources of error accounting for missed pathology on small-bowel follow-through.	30 lesions (71%) were not seen in retrospect; this was attributed to technical inadequacies. 12 lesions (29%) were seen in retrospect. Of these, 2 (17%) of the lesions had been missed originally because of perceptive errors, 7 (58%) because of combined perceptive and technical errors, and 3 (25%) because of interpretive errors.	4
13. Kendrick ML. Partial small bowel obstruction: clinical issues and recent technical advances. <i>Abdom Imaging</i> 2009; 34(3):329-334.	Review/Other-Dx	N/A	To review the clinical issues and technical advances of partial SBO.	No results stated in abstract.	4

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14. Delabrousse E, Lubrano J, Jehl J, et al. Small-bowel obstruction from adhesive bands and matted adhesions: CT differentiation. <i>AJR</i> 2009; 192(3):693-697.	Observational-Dx	67 consecutive patients	Retrospective study to evaluate CT findings that can help to differentiate SBO due to adhesive bands from SBO caused by matted adhesions.	Compared with SBO cases from matted adhesions, significantly more SBO cases that were due to adhesive bands showed a beak sign (P=0.0001) and fat notch sign (P=0.0001). The small-bowel feces sign was more frequently seen in cases of SBO from matted adhesions (P=0.014). Bowel ischemia and bowel necrosis were more frequent findings with adhesive bands than with matted adhesions (P=0.011 and P=0.049, respectively). The location in the pelvis of the adhesive structure (P=0.039) and a higher rate of accidental bowel perforation (P=0.031) were associated with matted adhesions. CT is useful for differentiating SBO caused by adhesive bands from SBO due to matted adhesions.	3
15. Delabrousse E, Lubrano J, Sailley N, Aubry S, Manton GA, Kastler BA. Small-bowel bezoar versus small-bowel feces: CT evaluation. <i>AJR</i> 2008; 191(5):1465-1468.	Observational-Dx	46 consecutive patients: 27 CT exams. 2 reviewers	Retrospective study to evaluate the accuracy of CT for differentiating small-bowel bezoar from small-bowel feces in cases of SBO.	In cases of SBO, although some CT features of bezoars and small-bowel feces overlap, a well-defined mass mottled with gas bubbles associated with an encapsulating wall, the newly described “floating fat-density debris” sign, and a lesion in the stomach that appears similar to the obstructing mass is typical of a small-bowel bezoar; an isolated amorphous mass mottled with gas bubbles is typical of small-bowel feces.	4
16. Desser TS, Gross M. Multidetector row computed tomography of small bowel obstruction. <i>Semin Ultrasound CT MR</i> 2008; 29(5):308-321.	Review/Other-Dx	N/A	Review role of MDCT in the evaluation of patients with uncomplicated and complicated SBO.	CT has become a mainstay in the evaluation of patients with known or suspected SBO during the past two decades. Current generation MDCT scanners, with their isotropic resolution, now permit high-quality reformatted images to be obtained in multiple planes and facilitate identification of the transition point and other findings in SBO.	4

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17. Gazelle GS, Goldberg MA, Wittenberg J, Halpern EF, Pinkney L, Mueller PR. Efficacy of CT in distinguishing small-bowel obstruction from other causes of small-bowel dilatation. <i>AJR</i> 1994; 162(1):43-47.	Observational-Dx	75 patients (27 obstruction 16 other surgical diagnosis, and 32 no surgery)	Retrospective review to evaluate efficacy of CT in distinguishing SBO from other causes of small-bowel dilatation.	Observer A: correct in 89%, 88%, and 72% of cases in the obstruction, other surgical diagnosis, and no surgery groups, respectively. Observer B: correct in 78%, 81%, and 69% of cases in the obstruction, other surgical diagnosis, and no surgery groups, respectively. CT can be useful for evaluating small-bowel dilatation and can aid both the diagnosis of SBO and its differentiation from other conditions resulting in small-bowel dilatation.	3
18. Gollub MJ. Multidetector computed tomography enteroclysis of patients with small bowel obstruction: a volume-rendered "surgical perspective". <i>J Comput Assist Tomogr</i> 2005; 29(3):401-407.	Review/Other-Dx	N/A	To examine use of MDCT enteroclysis in patients with SBO.	MDCT enteroclysis with the use of positive oral contrast allows volume-rendered type images of the intestines to provide a unique perspective on the location and relations of the various causes of SBO not previously available.	4
19. Hodel J, Zins M, Desmottes L, et al. Location of the transition zone in CT of small-bowel obstruction: added value of multiplanar reformations. <i>Abdom Imaging</i> 2009; 34(1):35-41.	Observational-Dx	69 consecutive patients	To assess the additional value of MPR in comparison with axial images alone for location of the transition zone in CT of mechanical SBO.	Accuracy of transition zone location for reader 1 and reader 2 was 86% and 84% with axial slices alone, and by using MPR 93% (significant: P=0.03) and 90% (not significant: P=0.08), respectively. Mean confidence score was significantly increased for both readers using MPR: 0.3 higher (P=0.0001) and 0.37 higher (P=0.0001) respectively. MPR can increase both accuracy and confidence in the location of the transition zone in CT of SBO.	2
20. Jaffe TA, Martin LC, Thomas J, Adamson AR, DeLong DM, Paulson EK. Small-bowel obstruction: coronal reformations from isotropic voxels at 16-section multi-detector row CT. <i>Radiology</i> 2006; 238(1):135-142.	Observational-Dx	100 consecutive patients: 3 blinded reviewers	To retrospectively assess the added value of coronal reformations using 16-section MDCT for the diagnosis of SBO.	Mean sensitivity and specificity of CT scout alone, transverse CT alone, and transverse plus coronal CT for the diagnosis of SBO were 88% and 86%, 87% and 87%, and 87% and 90%, respectively. Coronal reformations add confidence to the diagnosis and exclusion of SBO.	2
21. Megibow AJ, Balthazar EJ, Cho KC, Medwid SW, Birnbaum BA, Noz ME. Bowel obstruction: evaluation with CT. <i>Radiology</i> 1991; 180(2):313-318.	Observational-Dx	84 (64 intestinal obstruction)	Retrospective study to assess CT in diagnosing and characterizing bowel obstruction.	CT had sensitivity of 94%, specificity 96%, and accuracy 95%. Cause of obstruction was correctly predicted in 47 64 cases (73%). CT useful in patients with a history of abdominal malignancy and patients who have not been operated on and who have signs of infection, bowel infarction, or a palpable abdominal mass.	3

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22. Branco BC, Barmparas G, Schnuriger B, Inaba K, Chan LS, Demetriades D. Systematic review and meta-analysis of the diagnostic and therapeutic role of water-soluble contrast agent in adhesive small bowel obstruction. <i>Br J Surg</i> 2010; 97(4):470-478.	Review/Other-Dx	14 prospective studies	Meta-analysis was performed to assess the diagnostic and therapeutic role of water-soluble contrast agent in adhesive SBO.	The appearance of contrast in the colon within 4-24 hours after administration had a sensitivity of 96% and specificity of 98% in predicting resolution of SBO. Water-soluble contrast agent administration was effective in reducing the need for surgery (OR 0.62; P=0.007) and shortening hospital stay (weighted mean difference -1.87 days; P<0.001) compared with conventional treatment.	4
23. Hong SS, Kim AY, Byun JH, et al. MDCT of small-bowel disease: value of 3D imaging. <i>AJR</i> 2006; 187(5):1212-1221.	Review/Other-Dx	N/A	To show the various clinical applications of MDCT enterography for evaluating small-bowel disease, with a focus on the added value of 3D imaging.	MDCT and refined 3D imaging processes can offer a full examination of the small bowel as well as powerful information about the bowel and its surrounding structures.	4
24. Shah ZK, Uppot RN, Wargo JA, Hahn PF, Sahani DV. Small bowel obstruction: the value of coronal reformatted images from 16-multidetector computed tomography--a clinicoradiological perspective. <i>J Comput Assist Tomogr</i> 2008; 32(1):23-31.	Observational-Dx	30 patients	Retrospective study to assess performance of 16-MDCT for SBO with surgery as standard of reference. To assess the impact of coronal reformats on reader confidence, and to address management perspective and surgeon's assessment of coronal images.	Results showed that the recorded accuracies were slightly higher for etiology, transition site, and complications using the combination data set; this reached statistical significance for etiology only (P=0.08). There was no significant increase in scan evaluation time with addition of coronal images. Surgeon considered the coronal images more informative as compared with the axial images in 76.6% of cases. Coronal images generated at the scanner console are complementary to axials and improve reader confidence. Surgeons find coronal images more helpful than axial images for management.	3
25. Colon MJ, Telem DA, Wong D, Divino CM. The relevance of transition zones on computed tomography in the management of small bowel obstruction. <i>Surgery</i> 2010; 147(3):373-377.	Observational-Dx	200 patients; 150 had RTZ (75 required operative intervention; 58 had RTZ and 17 did not have RTZ)	To determine the surgical predictive value and intraoperative accuracy of RTZ. A retrospective review of patients with SBO who underwent abdominal CT at a single institution.	The presence of RTZ was not associated with increased probability of operative vs nonoperative management (OR=1.19; 95% CI [0.61-2.32]). The mean time to operative intervention was 3.6 days. Immediate operative intervention (<24 hours) was equivalent in patients with vs without RTZ (57% vs 53%; P=N/S) as was intervention for failed nonoperative management (43% vs 47%; P=N/S). For patients who required operative intervention, RTZ correlated with intraoperative site of obstruction in only 31 (63%) patients.	4

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26. Atri M, McGregor C, McInnes M, et al. Multidetector helical CT in the evaluation of acute small bowel obstruction: comparison of non-enhanced (no oral, rectal or IV contrast) and IV enhanced CT. <i>Eur J Radiol</i> 2009; 71(1):135-140.	Observational-Dx	99 patients	To compare accuracy of nonenhanced CT (no oral or IV contrast) and enhanced CT (IV enhanced only) to diagnose SBO and evaluate reviewer's experience impact.	Mechanical obstruction was present in 56% (59/105). The average sensitivity, specificity, NPV and PPV and accuracy values for nonenhanced CT were 88.1% (CI: 80%-96%), 77% (CI: 65%-89%), 83.0% (CI: 72%-95%), 83% (CI: 74%-92%), and 83% (CI: 76%-90%) with no significant difference between three reviewers. The corresponding numbers for enhanced CT were 87.6% (CI: 79%-96%), 75% (CI: 63%-88%), 82.6.0% (CI: 71%-94%), 82.1% (CI: 73%-92%), and 82% (CI: 75%-90%) (P>0.5). Area under curve of ROC curves of three reviewers did not show significant statistical difference (P>0.5).	2
27. Balthazar EJ, Liebeskind ME, Macari M. Intestinal ischemia in patients in whom small bowel obstruction is suspected: evaluation of accuracy, limitations, and clinical implications of CT in diagnosis. <i>Radiology</i> 1997; 205(2):519-522.	Observational-Dx	100 patients	Prospective study to determine the accuracy of CT in the diagnosis of intestinal ischemia in patients with possible SBO.	CT had sensitivity 83%, specificity 93%, accuracy 91%, PPV 79%, NPV 95%. CT helps in the accurate detection of bowel ischemia, especially when SBO is present.	3
28. Donckier V, Closset J, Van Gansbeke D, et al. Contribution of computed tomography to decision making in the management of adhesive small bowel obstruction. <i>Br J Surg</i> 1998; 85(8):1071-1074.	Observational-Dx	54 patients	Prospective study to evaluate the contribution of CT to decision making in the management of adhesive SBO.	CT demonstrated signs of strangulation or volvulus in 19 patients, including 3 with signs of peritoneal irritation. Within this group, urgent laparotomy was performed in 17 patients and confirmed the CT diagnosis in 16. 37 patients without clinical or CT signs of complications had initial conservative treatment; among them, 7/12 with a distal obstruction determined by CT required a delayed operation for persisting obstruction, compared with 2/25 patients with a proximal obstruction (P<0.01).	4

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29. Frager D, Baer JW, Medwid SW, Rothpearl A, Bossart P. Detection of intestinal ischemia in patients with acute small-bowel obstruction due to adhesions or hernia: efficacy of CT. <i>AJR</i> 1996; 166(1):67-71.	Observational-Dx	60 patients	To determine whether CT can be used to diagnose ischemia of the small intestine in patients with SBO due to adhesions or hernia. Prospective determination was made based on the CT as to whether there was any associated intestinal ischemia.	Ischemia was prospectively diagnosed on the basis of CT findings in 68% of the patients. Sensitivity 100%, specificity 61%. The multivariate analysis corroborated the prospective results by showing high sensitivity (90%) and diminished specificity (50%-64%). Bowel-wall thickening and high attenuation of the bowel wall were the most important signs of ischemia on unenhanced CT scans, whereas abnormal bowel-wall enhancement and mesenteric fluid correlated best on enhanced CT examinations.	3
30. Ha HK, Kim JS, Lee MS, et al. Differentiation of simple and strangulated small-bowel obstructions: usefulness of known CT criteria. <i>Radiology</i> 1997; 204(2):507-512.	Observational-Dx	84 patients	Retrospective review to evaluate the usefulness of known CT criteria for the differentiation of simple and strangulated SBO.	CT findings that enabled the detection of strangulated obstructions were poor or no enhancement of bowel wall (sensitivity 34%, specificity 100%) and a serrated beak (sensitivity 32%, specificity 100%).	3
31. Zalcman M, Sy M, Donckier V, Closset J, Gansbeke DV. Helical CT signs in the diagnosis of intestinal ischemia in small-bowel obstruction. <i>AJR</i> 2000; 175(6):1601-1607.	Observational-Dx	144 exams in 142 patients	To prospectively determine the value of helical CT in detecting signs of ischemia complicating SBO.	CT had sensitivity of 96%, specificity 93%, NPV 99%. Reduced enhancement of the bowel wall had a sensitivity of 48% and specificity of 100%, mural thickening had a sensitivity of 38% and specificity of 78%, mesenteric fluid had a sensitivity of 88% and specificity of 90%, congestion of mesenteric veins had a sensitivity of 58% and specificity of 79%, and ascites had a sensitivity of 75% and specificity of 76%.	3
32. Elsayes KM, Menias CO, Smullen TL, Platt JF. Closed-loop small-bowel obstruction: diagnostic patterns by multidetector computed tomography. <i>J Comput Assist Tomogr</i> 2007; 31(5):697-701.	Review/Other-Dx	N/A	To review the imaging features of closed-loop bowel obstruction and various underlying conditions. Special emphasis is placed on the technique of MDCT and its role in diagnosing this entity.	MDCT is a highly accurate method in evaluating high-grade intestinal obstruction.	4

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33. Sheedy SP, Earnest Ft, Fletcher JG, Fidler JL, Hoskin TL. CT of small-bowel ischemia associated with obstruction in emergency department patients: diagnostic performance evaluation. <i>Radiology</i> 2006; 241(3):729-736.	Observational-Dx	60 patients	Retrospective study to evaluate the diagnostic performance of CT for detection of ischemic complications of SBO in emergency department patients and compare prospective interpretation with retrospective interpretation using surgical or pathologic findings as the reference standard.	Sensitivity and specificity for the diagnosis of ischemia were, respectively, 14.8% and 94.1% for prospective interpretations, 29.6% and 91.2% for reader 1, 40.7% and 85.3% for reader 2, and 51.9% and 88.2% for the consensus review. Decreased segmental enhancement was the most specific sign for small-bowel ischemia. Diagnostic performance assessment of CT for diagnosis of ischemic complication of SBO revealed poor prospective interpretation sensitivity.	3
34. Wiesner W, Mortelet K. Small bowel ischemia caused by strangulation in complicated small bowel obstruction. CT findings in 20 cases with histopathological correlation. <i>JBR-BTR</i> 2011; 94(6):309-314.	Review/Other-Dx	20 patients	To analyze the CT findings in cases of complicated SBO with surgically and histopathologically proven small bowel ischemia, caused by extrinsic venous outflow obstruction of the affected bowel loops and to discuss the question, if bowel wall thickening, abnormal bowel wall enhancement, ascites and mesenteric stranding correlate with the severity of bowel wall damage.	Small bowel wall thickening, local mesenteric stranding and ascites were equally common in both groups of patients, regardless of whether obstruction and strangulation related small bowel ischemia was transmural or only partial mural. Out of those patients who were examined by contrast enhanced studies no patient showed lack of enhancement along the ischemic bowel loops.	4
35. Jang KM, Min K, Kim MJ, et al. Diagnostic performance of CT in the detection of intestinal ischemia associated with small-bowel obstruction using maximal attenuation of region of interest. <i>AJR</i> 2010; 194(4):957-963.	Observational-Dx	60 patients	Retrospective study to assess the diagnostic performance of CT in the detection of intestinal ischemia associated with SBO using the maximal attenuation of a region of interest. Two reviewers were blinded.	The sensitivity, specificity, PPV, NPV, and accuracy of visual assessment for intestinal ischemia were 91.7% (33/36), 66.7% (16/24), 80.5% (33/41), 84.2% (16/19), and 81.7% (49/60), respectively. The quantification of bowel wall enhancement using the maximal attenuation of a region of interest was a reliable and useful method for the diagnosis of intestinal ischemia and showed good correlation with pathology results.	2
36. Kim JH, Ha HK, Kim JK, et al. Usefulness of known computed tomography and clinical criteria for diagnosing strangulation in small-bowel obstruction: analysis of true and false interpretation groups in computed tomography. <i>World J Surg</i> 2004; 28(1):63-68.	Observational-Dx	136 patients; 3 reviewers	Analysis of CT scans to evaluate the use of clinical criteria in the interpretation of CT scans as a means of improving diagnostic accuracy of CT in strangulated obstruction.	Diagnostic accuracy of CT criteria for distinguishing simple obstructions from strangulated SBO was 73%-80%. The use of clinical criteria when CT findings are equivocal, may overcome the inherent limitations of CT for diagnosing strangulated obstruction.	3

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37. Jancelewicz T, Vu LT, Shawo AE, Yeh B, Gasper WJ, Harris HW. Predicting strangulated small bowel obstruction: an old problem revisited. <i>J Gastrointest Surg</i> 2009; 13(1):93-99.	Observational-Dx	192 adult patients	Retrospective study to determine which clinical indicators in patients with SBO can be used to independently predict the presence of strangulated intestine.	44 patients had bowel strangulation requiring bowel resection, and 148 had no strangulation. The most significant independent predictor of bowel strangulation was the CT finding of reduced wall enhancement, with a sensitivity and specificity of 56% and 94% [likelihood ratio 9.3]. Regression analysis of multiple preoperative criteria demonstrates that reduced wall enhancement on CT, peritoneal signs, and elevated white blood cells are the only variables independently predictive of bowel strangulation in patients with SBO.	3
38. Mallo RD, Salem L, Lalani T, Flum DR. Computed tomography diagnosis of ischemia and complete obstruction in small bowel obstruction: a systematic review. <i>J Gastrointest Surg</i> 2005; 9(5):690-694.	Review/Other-Dx	15 studies: 11 studies reported on CT diagnosis of ischemia and included 743 patients, 7/15 studies evaluated CT classification of complete obstruction based on 408 patients	Systematic study to describe the diagnostic performance of CT in assessing bowel ischemia and complete obstruction in SBO.	The aggregated performance characteristics of CT for ischemia in SBO were sensitivity of 83% (range, 63%-100%), specificity of 92% (range, 61%-100%), PPV of 79% (range, 69%-100%), and NPV of 93% (range, 33.3%-100%). The aggregated performance characteristics of CT for complete obstruction were sensitivity of 92% (range, 81%-100%), specificity of 93% (range, 68%-100%), PPV of 91% (range, 84%-100%), and NPV of 93% (range, 76%-100%). Review shows the high sensitivity of CT for ischemia in the setting of SBO and suggests that a CT scan finding of partial SBO is likely to reflect a clinical condition that will resolve without surgical intervention.	4
39. Qalbani A, Paushter D, Dachman AH. Multidetector row CT of small bowel obstruction. <i>Radiol Clin North Am</i> 2007; 45(3):499-512, viii.	Review/Other-Dx	N/A	To review the value of MDCT in the evaluation of SBO and related conditions in adults and emphasize the benefits of advanced CT applications.	The ability of CT to determine if bowel obstruction is present, to localize the obstructive site, to determine degree of obstruction, to diagnose the presence of closed-loop obstruction, and to identify ischemia or perforation of the involved bowel is well established.	4

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40. Kato K, Mizunuma K, Sugiyama M, et al. Interobserver agreement on the diagnosis of bowel ischemia: assessment using dynamic computed tomography of small bowel obstruction. <i>Jpn J Radiol</i> 2010; 28(10):727-732.	Observational-Dx	115 patients	To evaluate the accuracy and interobserver variability of dynamic CT for diagnosis of SBO.	13 cases were surgically confirmed small bowel ischemia. Sensitivity, specificity, PPV, and NPV for the diagnosis of ischemia were 85%, 96%-97%, 73%-79%, and 97%-98%, respectively, for radiologists and 69%-93%, 93%-95%, 63%-64%, and 96%-99%, respectively, for residents. For agreement in the interpretations of reduced early enhancement of bowel wall, closed loop obstruction, and presence of bowel ischemia, the values were 0.62, 0.71, and 0.80, respectively, between radiologists and 0.57-0.70, 0.63-0.74, and 0.56-0.68, respectively, between radiologists and residents.	2
41. Duda JB, Bhatt S, Dogra VS. Utility of CT whirl sign in guiding management of small-bowel obstruction. <i>AJR</i> 2008; 191(3):743-747.	Observational-Dx	453 patients; 194 patients received a diagnosis of SBO	Retrospective review of patients to examine the relation between the CT whirl sign and outcome among patients with a clinical and radiologic diagnosis of SBO.	The whirl sign was identified on the CT scans of 40/194 patients. 32/40 patients had SBO necessitating surgery, for a PPV of 80%; 133/154 patients did not need surgery, for a NPV of 86%. 53/194 patients either underwent surgery or died of SBO during conservative therapy. The whirl sign was present on the CT scans of 32/53 patients, for a sensitivity of 60%. 133/141 patients did not need surgery and did not have a whirl sign, for a specificity of 94%. The OR for the whirl sign in predicting the presence of SBO necessitating surgery was 25.3 (95% CI, 10.3-62.3). Results suggest an important role of the whirl sign in assessment of treatment options for patients with clinical and radiologic signs of SBO.	3

Suspected Small Bowel Obstruction
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Hwang JY, Lee JK, Lee JE, Baek SY. Value of multidetector CT in decision making regarding surgery in patients with small-bowel obstruction due to adhesion. <i>Eur Radiol</i> 2009; 19(10):2425-2431.	Observational-Dx	128 patients	Prospective study to evaluate the value of use of MDCT to predict the need for subsequent surgery in patients with SBO due to adhesion.	Sensitivities, specificities, PPV and NPV, and risks for the use of MDCT to predict the need for surgery were 100%, 46.1%, 43%, 100%, and 1.9 (1.5 ≤95% CI ≤2.2) for a high-grade obstruction; 100%, 23%, 34.5%, 100%, and 1.3 (1.2 ≤95% CI ≤1.5) for the presence of a transition zone; and 70.2%, 90.1%, 74.2%, 88.1%, and 7.1 (3.7 ≤95% CI ≤13.7) for the presence of an abnormal course of the mesenteric vessels, respectively. The presence of a high degree of SBO and an abnormal vascular course around transition zone are useful indicators on MDCT to predict the need for surgery in patients with an SBO due to adhesion.	3
43. O'Daly BJ, Ridgway PF, Keenan N, et al. Detected peritoneal fluid in small bowel obstruction is associated with the need for surgical intervention. <i>Can J Surg</i> 2009; 52(3):201-206.	Observational-Dx	88 consecutive patients: 58 managed conservatively and 30 had surgery	Retrospective study to determine whether the presence of radiologically detected peritoneal fluid on a CT scan in patients with clinical SBO was associated with an increased need for surgical intervention.	Peritoneal fluid detected on a CT scan (n=37) was associated more frequently with surgery than conservative management (46% vs 29%, P=0.046, chi(2)). Logistical regression identified peritoneal fluid detected on a CT scan as an independent predictor of surgical intervention (OR 3.0, 95% CI: 1.15-7.84). The presence of peritoneal fluid on a CT scan is an independent predictor of surgical intervention and should alert the clinician that the patient is 3 times more likely to require surgery.	3
44. Rocha FG, Theman TA, Matros E, Ledbetter SM, Zinner MJ, Ferzoco SJ. Nonoperative management of patients with a diagnosis of high-grade small bowel obstruction by computed tomography. <i>Arch Surg</i> 2009; 144(11):1000-1004.	Observational-Tx	145 patients with HGSBO	Retrospective study to determine the natural history and treatment of HGSBO.	Nonoperative management was associated with a higher recurrence rate (24% vs 9%; P<.005) and shorter time to recurrence (39 days vs 105 days; P<.005) compared with operative intervention. Patients with HGSBO by CT can be managed safely with nonoperative therapy; however, they have a significantly higher rate of recurrence requiring readmission or operation within 5 years.	2

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
45. Zielinski MD, Eiken PW, Bannon MP, et al. Small bowel obstruction—who needs an operation? A multivariate prediction model. <i>World J Surg</i> 2010; 34(5):910-919.	Observational-Dx	100 consecutive patients	Retrospective study to identify preoperative risk factors associated with strangulating SBO and to develop a model to predict the need for operative intervention in the presence of an SBO. Hypothesis was that free intraperitoneal fluid on CT is associated with the presence of bowel ischemia and need for exploration.	Combination of vomiting, no “small bowel feces sign,” free intraperitoneal fluid, and mesenteric edema had a sensitivity of 96%, and a PPV of 90% (OR 16.4, 95% CI: 3.6-75.4) for requiring exploration. Clinical, laboratory, and radiographic factors should all be considered when making a decision about treatment of SBO. The 4 clinical features—intraperitoneal free fluid, mesenteric edema, lack of the “small bowel feces sign,” history of vomiting—are predictive of requiring operative intervention during the patient’s hospital stay and should be factored strongly into the decision-making algorithm for operative vs nonoperative treatment.	3
46. Deshmukh SD, Shin DS, Willmann JK, Rosenberg J, Shin L, Jeffrey RB. Non-emergency small bowel obstruction: assessment of CT findings that predict need for surgery. <i>Eur Radiol</i> 2011; 21(5):982-986.	Observational-Dx	129 patients	To identify CT findings predictive of surgical management in non-emergency SBO.	Degree of obstruction was the only predictor of need for surgery. Whereas, 18.0% of patients with low-grade partial obstruction (n=50) underwent surgery, 32.5% of patients with high-grade partial obstruction (n=77) and 100% of patients with complete obstruction (n=2) required surgery (P=0.004). The small bowel feces sign was inversely predictive of surgery (P=0.018).	3

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
47. Zielinski MD, Eiken PW, Heller SF, et al. Prospective, observational validation of a multivariate small-bowel obstruction model to predict the need for operative intervention. <i>J Am Coll Surg</i> 2011; 212(6):1068-1076.	Observational-Dx	100 patients	To validate and refine the model predictive of the need for exploration in SBO. Study hypothesized that the model would be predictive, would prevent delayed management of strangulation, and would be successfully improved.	Overall mortality was 8%. 29 patients had all 4 clinical features, 22 of whom required operative exploration (concordance index 0.75), confirming the validity of the old model. Intraoperative free fluid (OR: 2.6, 95% CI: 1.0 to 6.9) and vomiting (OR: 1.5, 95% CI: 0.5 to 4.5) were not predictive of operative exploration; however, mesenteric edema (OR: 4.2, 95% CI: 1.1 to 15.8) and lack of the small-bowel feces sign were (OR: 3.5, 95% CI: 1.4 to 8.8). Obstipation was associated with the need for exploration (OR: 2.8, 95% CI: 1.2 to 6.6), but absence of colonic gas was not. A new model was equally predictive of the need for exploration: mesenteric edema (OR: 5.6, 95% CI: 1.5 to 20.7), lack of the small-bowel feces sign (OR: 5.1, 95% CI: 1.9 to 13.6), and obstipation (OR: 3.2, 95% CI: 1.2 to 8.3). The concordance index for this new model was 0.77.	3
48. Boudiaf M, Jaff A, Soyer P, Bouhnik Y, Hamzi L, Rymer R. Small-bowel diseases: prospective evaluation of multi-detector row helical CT enteroclysis in 107 consecutive patients. <i>Radiology</i> 2004; 233(2):338-344.	Observational-Dx	107 consecutive patients	To prospectively evaluate MDCT enteroclysis for the depiction of small bowel disease.	Sensitivity, specificity, accuracy, PPV, and NPV of MDCT enteroclysis were 100%, 95%, 97%, 94%, and 100%, respectively. MDCT enteroclysis allows depiction of a variety of small bowel diseases in patients suspected of having small bowel disease.	2
49. Maglinte DT, Herlinger H, Turner WW, Kelvin FM. Radiologic management of small bowel obstruction: a practical approach. <i>Emerg Radiol</i> 1994; 1(3):138-149.	Review/Other-Dx	N/A	Review radiographs, contrast studies, and cross-sectional imaging for SBO. Roles of enteroclysis and CT are discussed.	Begin with radiographs; decision as to enteroclysis vs CT depends on clinical factors.	4
50. Engin G. Computed tomography enteroclysis in the diagnosis of intestinal diseases. <i>J Comput Assist Tomogr</i> 2008; 32(1):9-16.	Review/Other-Dx	N/A	Review the technique and clinical applications of CT enteroclysis; its advantages and limitations compared with the other imaging techniques and capsule endoscopy are discussed.	CT enteroclysis is becoming the first-line modality for the evaluation of advanced and complicated small bowel Crohn's disease. CT enteroclysis can also become an important complementary imaging technique to capsule endoscopy in the assessment of small bowel neoplasms and occult GI hemorrhage.	4

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. Kohli MD, Maglinte DD. CT enteroclysis in incomplete small bowel obstruction. <i>Abdom Imaging</i> 2009; 34(3):321-327.	Review/Other-Dx	N/A	Review the role of CT enteroclysis in the evaluation of patients with suspected SBO. The technique of examination is described and an overview of its clinical applications and imaging controversy are presented.	Despite losing ground in the clinical evaluation of small bowel disease to recent advances in wireless capsule endoscopy and double balloon enteroscopy CT enteroclysis retains benefit in the evaluation of small bowel obstruction due to the ability to challenge bowel wall distensibility and uncover sub-clinical or low-grade obstruction. Polyps, masses, and inflammatory changes are readily recognized or excluded in the setting of luminal distention of a long tubular structure with an unpredictable course. Direct infusion into the small bowel has several advantages over passive oral ingestion of contrast regardless of the volume.	4
52. Mankanjuola D. Computed tomography compared with small bowel enema in clinically equivocal intestinal obstruction. <i>Clin Radiol</i> 1998; 53(3):203-208.	Observational-Dx	49	Compare the findings in CT and small bowel enema in clinically equivocal SBO.	CT: sensitivity 83%, specificity 67%, PPV 94%, NPV 36%. CT superior for detection of the cause of SBO and also for the presence of strangulation.	3
53. Roediger WE, Marshall VC, Roberts S. Value of small bowel enema in incomplete intestinal obstruction. <i>Aust N Z J Surg</i> 1982; 52(5):507-509.	Review/Other-Dx	11 patients	To assess usefulness of small bowel enema in patients with suspected partial SBO.	In 1 patient intubation of the jejunum was unsuccessful. In 6 patients the suspected obstruction was confirmed and information obtained about the site of obstruction. The small bowel enema X-ray examination was normal in 3 patients and subsequent clinical outcome was uneventful. In 1 patient, with normal findings on small bowel enema X-ray examination, acute obstruction developed after 2 days, necessitating operation.	4

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
54. Brown S, Applegate KE, Sandrasegaran K, et al. Fluoroscopic and CT enteroclysis in children: initial experience, technical feasibility, and utility. <i>Pediatr Radiol</i> 2008; 38(5):497-510.	Observational-Dx	112 FE and 74 CT enteroclysis studies performed in 175 children	Retrospective review to evaluate the feasibility, safety, and techniques of FE and CT enteroclysis, and to review their indications and findings in children.	FE and CT enteroclysis studies were performed most commonly for evaluation of known Crohn disease (FE 38%, CT enteroclysis 29%) and abdominal pain (FE 26%, CT enteroclysis 26%). The findings were normal in 54% of the FE studies and 46% of the CT enteroclysis studies. Most common small bowel diagnoses were Crohn's disease (FE 34%, CT enteroclysis 28%) and partial SBO (FE 3%, CT enteroclysis 10%). Overall, 14 and 21 patients had surgery as a result of the findings of FE and CT enteroclysis, respectively. FE and CT enteroclysis are safe, feasible, and accurate in depicting small-bowel pathology in children.	3
55. Hong SS, Kim AY, Kwon SB, Kim PN, Lee MG, Ha HK. Three-dimensional CT enterography using oral gastrografin in patients with small bowel obstruction: comparison with axial CT images or fluoroscopic findings. <i>Abdom Imaging</i> 2010; 35(5):556-562.	Observational-Dx	18 patients	To evaluate the feasibility of 3D CT enterography using oral gastrografin in patients with SBO, focusing on improving diagnostic performance as compared with the use of axial CT images and fluoroscopic findings.	All patients (100%) well tolerated the administration of oral gastrografin. The use of 3D CT enterography significantly improved diagnostic confidence for the interpretation of the level, cause of SBO, and the assessment of the interpretability of each image as compared with the use of axial CT images (P<0.05). 3D CT enterography was superior as compared to fluoroscopic examination (P<0.05).	2
56. Czechowski J. Conventional radiography and ultrasonography in the diagnosis of small bowel obstruction and strangulation. <i>Acta Radiol</i> 1996; 37(2):186-189.	Observational-Dx	96 patients	Patients with clinically acute abdomen were examined by abdominal radiography and US during a period of one year.	19 cases of mechanical obstruction were observed. Strangulation: positive findings for US 91%, positive findings for radiography 30%. Simple obstruction: 89% for US; 78% for radiography.	3
57. Schmutz GR, Benko A, Fournier L, Peron JM, Morel E, Chiche L. Small bowel obstruction: role and contribution of sonography. <i>Eur Radiol</i> 1997; 7(7):1054-1058.	Observational-Dx	123 patients	Prospective study to determine whether US provides additional clinical information in patients suspected of SBO.	US confirmed the SBO in 82 cases with 5 false positives, resulting in a specificity of 82.1 %. US examinations were negative in 27 cases with 4 false negatives and a sensitivity of 95 %. The accuracy was 91.7% when the 'gassy' patients were excluded and 81.3% overall. The etiology of the ileus was detected by US in 13 cases of paralytic ileus (54.1 %) and in 57 cases of mechanical ileus (71.4 %).	3

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
58. Wold PB, Fletcher JG, Johnson CD, Sandborn WJ. Assessment of small bowel Crohn disease: noninvasive peroral CT enterography compared with other imaging methods and endoscopy--feasibility study. <i>Radiology</i> 2003; 229(1):275-281.	Observational-Dx	23 patients	Comparative study to evaluate two biphasic CT enterography protocols, a noninvasive CT technique with water administered perorally and CT enteroclysis with methylcellulose administered through a nasojejunal tube.	Arterial phase imaging was noncontributory in 22/23 cases. Noninvasive per-oral water CT enterography protocol had similar accuracy (12/15 cases, 80%) for enabling the detection of active Crohn disease in comparison with CT enteroclysis with nasojejunal tube (7/8, 88%) and fluoroscopic small bowel examination (17/23, 74%). No fistulas were missed with use of either CT technique. Noninvasive per-oral portal venous phase CT enterography with use of water is accurate and feasible.	2
59. Jang TB, Schindler D, Kaji AH. Bedside ultrasonography for the detection of small bowel obstruction in the emergency department. <i>Emerg Med J</i> 2011; 28(8):676-678.	Observational-Dx	76 patients	To compare bedside US and x-ray for the detection of SBO.	In all, 76 patients were enrolled and evaluated with US for SBO. A total of 33 (43%) were diagnosed as having SBO. Dilated bowel on US had a sensitivity of 91% (95% CI: 75%-98%) and specificity of 84% (95% CI: 69%-93%) for SBO, compared to 27% (95% CI: 14%-46%) and 98% (95% CI: 86%-100%) for decreased bowel peristalsis on US. X-ray had a sensitivity of 46.2% (95% CI: 20.4%-73.9%) and specificity of 66.7% (95% CI: 48.9%-80.9%) for SBO when diagnostic, but was nondiagnostic 36% of the time.	2
60. Suri S, Gupta S, Sudhakar PJ, Venkataramu NK, Sood B, Wig JD. Comparative evaluation of plain films, ultrasound and CT in the diagnosis of intestinal obstruction. <i>Acta Radiol</i> 1999; 40(4):422-428.	Observational-Dx	32 patients	Prospective study to compare value of radiographs, US, and CT in the evaluation of intestinal obstruction.	Out of 32 patients, 30 had mechanical intestinal obstruction (22 had SBO and 8 had large bowel obstruction). Of the remaining 2 patients, 1 had adynamic ileus and the other had a mesenteric cyst. CT had high sensitivity (93%), specificity (100%) and accuracy (94%) in diagnosing the presence of obstruction. The comparable sensitivity, specificity and accuracy were, respectively; 83%, 100% and 84% for US and 77%, 50% and 75% for plain radiography. The level of obstruction was correctly predicted in 93% on CT, in 70% on US and in 60% on plain films. CT was superior (87%) to both US (23%) and plain radiography (7%) in determining the etiology of obstruction.	2

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
61. Pracros JP, Sann L, Genin G, et al. Ultrasound diagnosis of midgut volvulus: the "whirlpool" sign. <i>Pediatr Radiol</i> 1992; 22(1):18-20.	Review/Other-Dx	24 patients	Present US findings in patients with proved complicated midgut malrotation: volvulus in 18 and occlusive Ladd's bands in 6. All 24 patients have had US prior to surgery.	The US "whirlpool" pattern of the superior mesenteric vein and mesentery around the superior mesenteric artery was detected in 15/18 patients with midgut volvulus, and was best seen using Doppler color.	4
62. Ikeda H, Matsuyama S, Suzuki N, Takahashi A, Kuroiwa M, Hatakeyama S. Small bowel obstruction in children: review of 10 years experience. <i>Acta Paediatr Jpn</i> 1993; 35(6):504-507.	Review/Other-Dx	32 patients	Review of cause of post-neonate SBO, and methods of detection.	Intussusception (most frequent cause of obstruction) was seen in 17 patients (53.1%). Causative lesions were identified in 5 patients, (4 ileal duplication cysts in four and one Meckel's diverticulum). Incarcerated inguinal hernia and mesenteric cysts resulted in bowel obstruction in 6 and 3 patients, respectively. US was useful in differential diagnosis.	4
63. Chou CK, Liu GC, Chen LT, Jaw TS. The use of MRI in bowel obstruction. <i>Abdom Imaging</i> 1993; 18(2):131-135.	Review/Other-Dx	9 patients	To examine use of MRI (plus rectal air insufflation) to assess level and cause of bowel obstruction.	The administered air successfully distended the colon and the small bowel distal to the obstruction in 7/9 cases. The air-filled small bowel loops were useful in delineating the obstruction sites and adjacent lesions in these 7 cases. The diagnosis was established by means of surgery in 6 cases and by clinical course in 3 cases. The causes of obstruction included 4 peritoneal carcinomatoses, and 1 each of supravescical hernia, intussusception, adhesive band, benign granulomatous stricture, and radiational stricture. The site of obstruction was the distal small bowel in 8 cases, and the rectosigmoid colon in 1 case.	4

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
64. Lee JK, Marcos HB, Semelka RC. MR imaging of the small bowel using the HASTE sequence. <i>AJR</i> 1998; 170(6):1457-1463.	Review/Other-Dx	50 patients	Retrospective study to establish the normal MRI appearance of small bowel on HASTE sequence and to determine the ability of HASTE to reveal small-bowel disease.	In the 50 patients with normal small bowel, no fluid was seen in the jejunum and ileum loops in 4 (8%). Fluid was present in <25% of small-bowel loops in 20 patients (40%), 25%-50% of small-bowel loops in 20 patients (40%), and 50%-75% of small-bowel loops in 6 patients (12%). Equal amounts of fluid were present in the jejunum and ileum in 30 patients (60%). More fluid was seen in the jejunum than the ileum in 16 patients (32%) and the reverse was true in 4 patients (8%). The mean diameter of the jejunum was 2.1 cm (SD=0.34 cm) and of the ileum, 1.9 cm (SD=0.41 cm). The thickness of the small-bowel wall and valvulae conniventes averaged 2 mm. Findings of dilatation of the bowel lumen and increased thickness of the bowel wall and valvulae conniventes were identified in 18 patients with small-bowel abnormalities.	4
65. Matsuoka H, Takahara T, Masaki T, Sugiyama M, Hachiya J, Atomi Y. Preoperative evaluation by magnetic resonance imaging in patients with bowel obstruction. <i>Am J Surg</i> 2002; 183(6):614-617.	Observational-Dx	27 patients	To compare the ability of radiographs, CT and MRI in the preoperative diagnosis of SBO.	Site and cause of obstruction was accurately diagnosed in 22 (81.5%) of 27 patients by abdominal radiographs, in 24 (92.3%) of 26 patients by CT, and in 25 (92.6%) of 27 by MRI. Sites of obstruction were consistent with surgical findings in 25 (92.6%) of 27 patients by MRI, and in 15 (57.7%) of 26 patients by CT. Causes of bowel obstruction were accurately diagnosed by MRI in 25 (92.6%) of 27 patients, and in 23 (88.5%) of 26 patients by CT scan. MRI could identify the presence and the site and cause of bowel obstruction in most of the cases. MRI is assumed to be superior to CT scan in the preoperative diagnosis of bowel obstruction.	3
66. Regan F, Beall DP, Bohlman ME, Khazan R, Sufi A, Schaefer DC. Fast MR imaging and the detection of small-bowel obstruction. <i>AJR</i> 1998; 170(6):1465-1469.	Observational-Dx	43 patients	Retrospective study to determine whether fast MRI using the HASTE MRI sequence is accurate for diagnosis of SBO.	Of the 43 patients imaged, 29 patients had SBO revealed by unenhanced or contrast-enhanced radiography or by CT. Surgical confirmation was available in 21 patients. SBO was shown by HASTE MRI in 26 (90%) of these 29 patients. HASTE MRIs showed the correct level of obstruction in 19 (73%) of the 26 patients and showed the cause of obstruction in 13 (50%) of the 26 patients.	3

**Suspected Small Bowel Obstruction
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
67. Takahara T, Kwee TC, Haradome H, et al. Peristalsis gap sign at cine magnetic resonance imaging for diagnosing strangulated small bowel obstruction: feasibility study. <i>Jpn J Radiol</i> 2011; 29(1):11-18.	Observational-Dx	38 patients	To determine the feasibility of cine MRI for diagnosing strangulated SBO.	Sensitivity, specificity, PPV, and NPV of cine MRI were 100%, 92.9%, 83.3%, and 100%, respectively; and those of CT (of which 26.5% was performed without contrast enhancement) were 66.7%, 92.0%, 75.0%, and 88.5%, respectively. There was no significant difference in diagnostic accuracy between the two methods (P=0.375).	3
68. Cronin CG, Lohan DG, Browne AM, Alhajeri AN, Roche C, Murphy JM. MR enterography in the evaluation of small bowel dilation. <i>Clin Radiol</i> 2009; 64(10):1026-1034.	Review/Other-Dx	N/A	To illustrate the utility of MR enterography in the evaluation of small bowel dilation, whether it be mechanical, functional, or related to infiltrative mural disease.	MR enterography enables high contrast resolution depiction of the location and cause of bowel obstruction through a combination of predictable luminal distension and multiplanar imaging capabilities.	4
69. Fidler J. MR imaging of the small bowel. <i>Radiol Clin North Am</i> 2007; 45(2):317-331.	Review/Other-Dx	N/A	Review MRI of the small bowel with enterography and enteroclysis techniques. Article reviews the advantages, limitations, technique, and indications and the results that have been obtained in evaluating different disease processes.	Cross-sectional imaging techniques such as CT and MRI have advantages over traditional barium fluoroscopic techniques in their ability to visualize superimposed bowel loops better and to improve visualization of extraluminal findings and complications.	4
70. McKenna DA, Meehan CP, Alhajeri AN, Regan MC, O'Keeffe DP. The use of MRI to demonstrate small bowel obstruction during pregnancy. <i>Br J Radiol</i> 2007; 80(949):e11-14.	Review/Other-Dx	1 patient	Authors present the MRI findings of an unusual case of SBO occurring secondary to compression from a 32-week gravid uterus, in a patient with an end ileostomy. The case highlights the value of MRI in pregnancy as a confirmatory test.	The case demonstrates the usefulness of rapid MRI techniques in pregnant patients with abdominal symptoms, both for delineating anatomy and excluding a variety of candidate pathological processes giving rise to SBO. Continuing innovation in the development of rapid MR pulse sequences offers further improvements in image quality and patient outcomes.	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

CI = Confidence interval

CT = Computed tomography

FE = Fluoroscopic enteroclysis

GI = Gastrointestinal

HASTE = Half-Fourier acquisition single-shot turbo spin-echo

HGSBO = High-grade small bowel obstruction

IV = Intravenous

MDCT = Multidetector computed tomography

MPR = Multiplanar reformations

MRI = Magnetic resonance imaging

NPV = Negative predictive value

OR = Odds ratio

PPV = Positive predictive value

SBO = Small bowel obstruction

SD = Standard deviation

US = Ultrasound

ROC = Receiver operating characteristic

RTZ = Radiographic transition zones