Global Surgery

Review Article ISSN: 2056-7863

Cecal volvulus: what the radiologist needs to know

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Abstract

Cecal volvulus is a quite rare pathologic condition and therefore sometimes misdiagnosed, but is indeed more common than thought. It occurs with aspecific acute onset abdominal pain associated to nausea and vomiting, so that it often poses a diagnostic challenge for the clinician who needs radiological consultation for further evaluation. As cecal volvulus represents a cause of intestinal obstruction, radiologists have to recognize it at multimodality imaging in order to obtain a prompt diagnosis, suggest the adequate treatment and avoid severe complications. Thus, it is fundamental to be familiar with cecal volvulus appearance, especially at first level investigation: in fact abdominal plain film radiography is often sufficient to suspect the diagnosis and to require a confirmation with Computed Tomography (CT). This pictorial essay highlights cecal volvulus features, the importance of typical imaging findings pointing out X-ray/CTcorrelation, the management strategies and gives some warnings about its way of mimicking other diseases.

Introduction

Recognizing which part of the colon is involved in volvulus is critical especially with traditional radiology examination alone. The colonic segments involved in this pathology are most frequently sigma and cecum, the transverse colon is rarely involved. Differential diagnosis at traditional X-ray and at CT imaging is necessary in order to perform the correct therapy. In fact cecal volvulus needs open or laparoscopic surgery differently from sigmoid volvulus that could be eventually submitted to therapeutic endoscopy. Recognizing the type of volvulus is necessary to avoid the potentially fatal complications of cecal volvulus which are obviouslyischemia and perforation.

Cecal volvulus consists of a bowel twist involving the cecum, the ascending colon and sometimes the terminal ileum, often resulting in a closed-loop obstruction. It generally occurs in patients between 30 and 60 years of age and accounts for about 25-40% of all colonic volvulus, being responsible for 1-3% of cases of intestinal obstruction. The factors which predispose to develop this kind of pathological entity are a long congenital cecal mesentery (due to an insufficient mesenteric fusion with the retroperitoneal structures that causes right colon abnormal motility) and conditions that contribute to create a fulcrum of rotation like the presence of abdominal scars and adhesions due to previous abdominal surgery, neoplastic masses or calcified lymph nodes; other conditions like pregnancy, colonic atony, recent colonoscopy and rarely outer effort and violent coughing could also be implicated [1,2].

Types of cecal volvulus

Cecal volvulus is due to a rotation of the cecum on its axis, on its mesentery or to an anterior slipping. These features identifies the three type of volvulus (Figure 1).

I type. Axial torsion type: cecum makes a twist of 180-360 degrees along its axis rotating clockwise or counterclockwise, and remaining in the lower right quadrant of the abdomen (Figure 2).

II type. Loop Type: after rotating on its horizontal axis the cecum goes to occupy the left upper part of the abdomen twisting along with the terminal ileum. The visualization of a gas distended appendix confirms this diagnosis, as the pole of the cecum goes upward and is filled with air (Figure 3).

Due to the fact that twisting might induce vascular strangulation the axial type and the loop type forms have high mortality rate, with immediate vascular occlusion occurring along with the obstructive process.

III type. Cecal bascule type: cecum folds forward anteriorly without twisting coming to be in abnormal position, the cecal loop appear expanded in the middle of the abdomen, in this type of volvulus a flap-

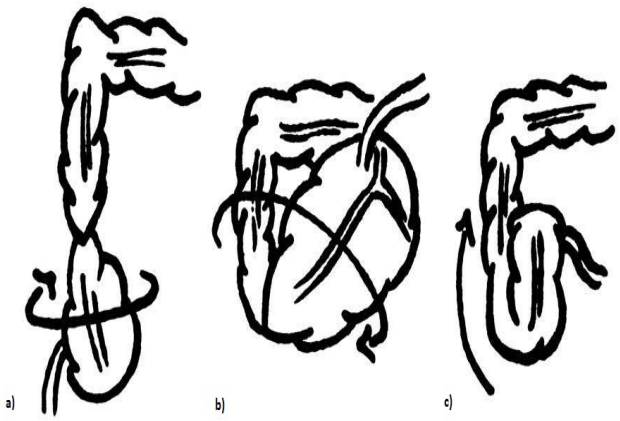

Figure 1. The schematic illustration shows the three types of cecal volvulus, pointing out the respective torsion mechanism (arrows). a) I type: axial torsion type. b) II type: loop type. c) III type: cecal bascule type.

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Key words: *intestinal volvulus, acute abdomen, intestinal obstruction, multidetector computed tomography, diagnostic X-Ray*

Received: June 18, 2015; **Accepted:** July 14, 2015; **Published:** July 18, 2015

Figure 2. Cecal volvulus: axial type, complicated by ischemia. a) Supine abdominal plain film radiography shows distended cecum (arrow), that occupies the right lower quadrant. Retroperitoneal free gas is visible on the right flank. b) CT oblique reconstruction shows distended cecum with parietal pneumatosis (arrow). c-d)Axial unenhanced CT scans show the whirl sign (arrow in c) and the retroperitoneal air effusion (arrows in d).

Figure 3. Cecal volvulus: loop type. a) Supine abdominal plain film radiography shows extremely distended ascending colon and cecum (asterisk), that occupies an ectopic site in the left upper quadrant. No colic frame is visible on the right flank. A thin tubular air-filled structure (arrow) arises from the dilated cecum and likely corresponds to the appendix. b) CT coronal reconstruction reflects abdominal X-rayfindings. Axial contrast enhanced CT scans evidence the whirl sign (c) and the abrupt transition point (d) between the distended and the collapsed bowel loop (beak sign).

valve mechanism determines occlusion (Figure 4 and Figure 5). It is necessary to consider that if a whirl sign is visible on CT scans, twist is present, so we can exclude the cecal bascule type, moreover if the dilated loop is located in the upper abdomen this will be a loop type instead if it's located in the lower right this will be an axial torsion type [3].

Clinical features

Clinical symptoms in patients with cecal volvulus might be acute or remittent and varies from mild symptoms such as abdominal distension, constipation, nausea and vomiting - to acute colicky cramping abdominal pain due to intestinal obstruction.

In elderly patients mild symptoms occurs more often according to the lower pain sensibility.

As laboratory findings after vomiting, dehydration with electrolyte disturbance might occur and also leukocytosis may be present [4].

Imaging findings

As cecal volvulus is not easily suspected just on the basis of symptoms and physical examination, the radiologist gets often involved playing a central role in the diagnostic procedure. Traditional abdominal radiography is obtained as initial imaging approach in patients presenting to the emergency department with acute abdomen and suspected intestinal obstruction. So the radiologist should be able to recognize X-ray imaging findings that suggest the first evidence of cecal volvulus, in order to further investigate with CT; this is necessary to confirm the diagnosis, identify the cecal volvulus type and evaluate

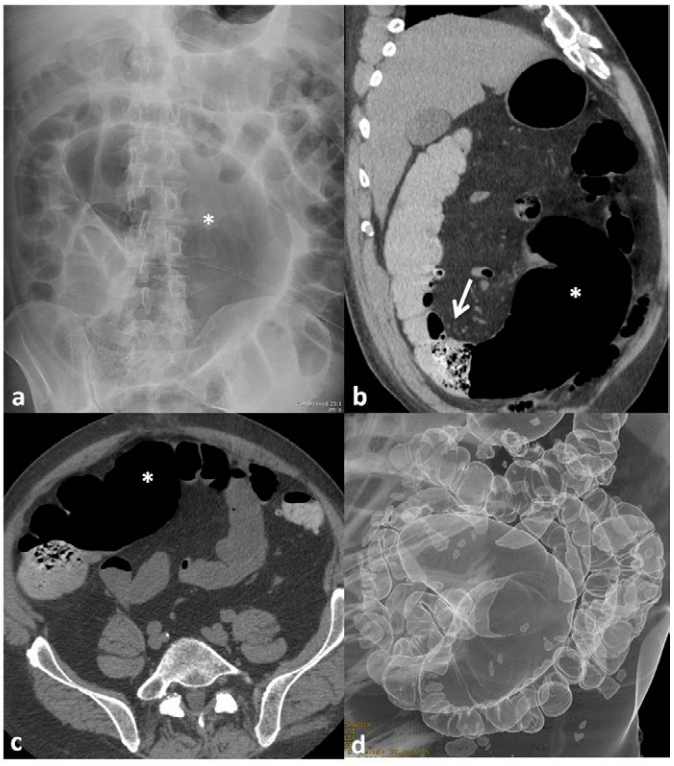

Figure 4. Cecal volvulus: cecal bascule type. a) Supine abdominal plain film radiography shows distended cecum (asterisk), that occupies the central region of the abdomen. b) CT oblique reconstruction shows the distended cecum (asterisk) and the point of anterior reflection (arrow). No whirl sign is present. c) Axial unenhanced CT scans shows distended cecum (asterisk) with air-fluid level. d) 3D reconstruction of the distended loops.

Figure 5. Cecal volvulus: cecal bascule type. a) Supine abdominal plain film radiography shows distended cecum that occupies the right and central lower quadrants. b) CT oblique reconstruction shows distended cecum folding anteriorly (asterisk). The patient was also affected by right Spigelian hernia.

the presence of any complications such as infarction and perforation that could change the therapeutic path.

The classical finding on abdominal plain film radiography is a dilated gas-filledcecum with air-fluid level that can be displaced anywhere in the abdomen depending on the volvulus type, so it sometimes represents a diagnostic dilemma and can be confused with gastric ectasia or sigmoid volvulus; besides, the axial torsion type is more easily overlooked because the cecum remains in the right lower quadrant of the abdomen. The associated presence of an air-distendedappendix is a helpful finding to evoke the diagnosis (Figure 3). Conventional radiography can also demonstrate a disproportionate distention of the right colon against a collapsed left colon, as a consequence of the twisting; small bowel dilatation and proximal obstruction signs may occur depending on the time of onset [1,3,5]. The focal rounded air-filled cecum may present as a loop with haustral markings resembling a coffee bean; which appears as a dilated bowel loop with an inverted "U" shape converging at the site of torsion, and a thickened central radiopaque line composed by the walls of the two part of the colon that are adjacent to each other. The "coffee bean sign" is anyway more typical of sigmoid volvulus, in which the twisted sigmoid tract usually has no haustral creases, arises from the lower left side of the abdomen and overlaps the left flank [6,7].

CT scans evidence the abnormal dilated cecum and confirm its ectopic location, simply identified looking for the terminal ileum loop, the ileocecal valve and the appendix. An important sign to look for is the "whirl sign" that consists of a whirlpool pattern of swirling structures including collapsed bowel loops, mesenteric fat and engorged ileocecal vessels. This finding, associated to a dislocated enlarged cecum, is acknowledged to be diagnostic of volvulus and is typical of the axial torsion type and the loop type; the bascule type (Figures 4 and 5) doesn't recognize twisting as pathophysiological mechanism, so no whirl sign is present in this case [3,8].

Another important diagnostic element is the detection of the fulcrum point, revealed by following the dilated bowel that progressively taper until theobstruction site ("beak sign"); the transition point is generally single, and this finding is in fact considered more sensitive for cecal volvulus. Multiplanar and three- dimensional reconstructions should complete exam review because they give a fundamental contribute to the diagnosis, allowing the identification of the torsion site and whirl sign, which sometimes is not visible on the axial scans depending on the twisting plane [9,10].

Image analysis, especially contrast enhanced CT scans, should also focus on the potential evolution towards severe complications: the axial torsion type and the loop type are particularly expected to aggravate because of the twist at the base of their development. In fact, the associated torsion and strangulation of the vascular pedicle compromise the blood supply determining ischemia of the bowel wall; this results in absent or reduced contrast enhancement of the bowel wall that appears thickened and surrounded by increased density mesenteric fat. Free intraperitoneal fluid represents an initial sign of mechanical ileum failure. In advanced clinical pictures and in cases of late diagnosis, imaging findings further show free intraperitoneal gas due to pneumatosisintestinalis (Figure 2) finally leading to perforation that should be avoided [11].

Therefore it's clear how the diagnosis should be as prompt as possible.

Differential diagnosis

The various volvulus types that develop in different colonic segments, first of all sigmoid volvulus, represent the principal differential diagnosis especially on abdominal plain film radiography. Some advice to quickly distinguish it on conventional imaging are mentioned above; moreover, sigmoid volvulus generally affects elderly patients, whereas cecal volvulus usually occurs in younger patients (typically 30-60 years of age). Other differential diagnosis include bowel obstruction from other causes and complicated inflammatory bowel disease as in case of toxic megacolon.

Even though congenital anomalies of the gastrointestinal tract are quite rare in adults because usually demonstrated in childhood, misdiagnosed malrotation can be responsible of chronic abdominal symptoms and could undergo acute exacerbations due to flogistic entities such as diverticulitis or appendicitis [12]. So the evidence at imaging of malrotated colonic tracts in ectopic sites, distended by the hypotonic ileus consequent to the overlap pathologic condition could mimic the findings of colonic volvulus.

Anyway, performing CT examination solves diagnostic doubts in almost all cases.

Treatment

Surgery represents the treatment of choice for cecal volvulus, on the contrary of sigmoid volvulus that might be treated initially by endoscopic detorsion. Whereas the low success rate and the high recurrence percentage constitute a risk for thepatient and a possible surgical delay, endoscopic approach is not recommended for the management of cecal volvulus. Surgery offers some options including manual detorsion, cecopexy, cecostomy and open or laparoscopic colectomy. Some authors prefer a radical surgical management mentioning no more recurrences at all; others are in favour of cecopexy, citing very low morbidity and mortality rates. Obviously, in case of life-

threatening complications surgical resection should definitely be performed [4,13].

Summary

Cecal volvulus is a severe surgical abdominal condition, predisposed by abnormal cecal mobility and incomplete intestinal rotation. It represents a cause of access to the emergency department, potentially occurring with acute abdomen and intestinal obstruction. Both conventional X-ray radiography and contrast enhanced CT are crucial in the diagnostic path, first to suspect and then to confirm and stage this pathological entity. Therefore radiologists should be confident with its appearance at multimodality imaging in order to readily make the proper diagnosis, help clinicians and surgeons in the management of the patient and avoid serious consequences.

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