

Diagnosis and treatment of caecal volvulus

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Caecal volvulus is an infrequently encountered clinical condition and an uncommon cause of intestinal obstruction. Patients with this condition may present with highly variable clinical presentations ranging from intermittent, self limiting abdominal pain to acute abdominal pain associated with intestinal strangulation and sepsis. Lack of familiarity with this condition is a factor contributing to diagnostic and treatment delays. The objective of this review is to promote clinicians' awareness of this disease through patient case illustration, discussion of disease pathogenesis, clinical features, and management strategies.

Caecal volvulus is characterised anatomically by the axial twisting that occurs involving the caecum, terminal ileum, and ascending colon.^{1,2} Caecal bascule is a variant of this condition associated with the upward and anterior folding of the ascending colon and accounts for about 10% of all caecal volvulus cases² (figs 1 and 2). Although anatomically distinct, caecal volvulus and caecal bascule share many similar clinical features, including the potential for intestinal obstruction and strangulation.^{1,2}

The incidence of caecal volvulus is reported to range from 2.8 to 7.1 per million people per year, and the process is responsible for 1%–1.5% of all the adult intestinal obstructions and 25%–40% of all volvulus involving the colon. Patients' ages at presentation are presumably affected by cultural and dietary influences and their effects on intestinal motility, resulting in highly variable peak ages of presentation from various geographical regions, where the average age of patients reported in India is 33 years as compared with 53 years in reports from Western countries.¹

ANATOMY AND PATHOGENESIS

Intestinal development during embryogenesis is a complex and sequential process, where during the final stages, the caecum rotates counter clockwise from the left side of the abdomen to its final position in the right lower abdomen. Simultaneous with the final rotational process is fixation of the right colon mesentery to retroperitoneal structures. People with incomplete intestinal rotation generally develop inadequate right colon fixation associated with the potential for caecal volvulus formation. Based on reports from necropsy reviews, sufficient caecal mobility for volvulus and bascule formation is found in 11% and 25% of adults, respectively.^{4,5}

The nearly 40-fold difference between the incidence of mobile caecum and occurrence of caecal volvulus suggests that factors other than anatomical susceptibility are involved in volvulus development. Clinical series have reported that 23%–53% of patients presenting with caecal volvulus have a history of prior abdominal surgery,^{1,6–8} and based on this association, previous abdominal surgery has been identified as an important contributor in caecal volvulus formation. It is postulated that postoperative adhesions contribute to the formation of fixation points and fulcrum of rotation for the mobile right colon, whereby promoting volvulus development.¹

Additional conditions such as those seen during late term pregnancy,^{9,10} high fibre intake,⁶ adynamic ileus, chronic constipation, and distant colon obstruction^{11,12} have also been implicated in caecal volvulus formation in anatomically susceptible people, presumably through caecal displacement, hyperperistalsis, and colonic distension.

CLINICAL FEATURES

The clinical findings and laboratory abnormalities associated with caecal volvulus are predominantly determined by the pattern, severity, and duration of the intestinal obstruction (box 1). The patterns of clinical presentation are broadly categorised as recurrent intermittent, acute obstruction, and acute fulminant patterns.¹³

Recurrent intermittent pattern

The recurrent intermittent pattern has also been referred to as the mobile caecum syndrome.^{14,15} This clinical presentation has been reported to occur in nearly 50% of patients before the onset of acute volvulus.^{5,14,15} Typically, the patients have recurrent symptoms consisting of generalised or localised right lower quadrant abdominal pain, abdominal distension, and pain resolution after the passage of flatus. The physical findings in patients during symptomatic episodes may include high pitched bowel sounds and right lower quadrant abdominal tenderness; however, these abnormal physical findings generally disappear as the patients' symptoms resolve.^{14,15}

Acute obstructive and acute fulminant patterns

Patients with acute volvulus and obstruction typically exhibit a clinical picture that is indistinguishable from acute, uncomplicated small bowel obstruction. Depending on the patients' body habitus, tender and dilated caecum may or may not be palpable and may help to differentiate caecal volvulus from other forms of small bowel obstruction. For patients without this

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Figure 1 Schematic diagram of caecal volvulus showing axial twisting of the ascending colon and terminal ileum resulting in closed loop obstruction of the caecum.

characteristic physical finding, differentiation between small bowel obstruction and caecal volvulus on clinical basis may be problematic; therefore, it is recommended that these patients undergo early radiological evaluation.

Patients with untreated acute volvulus may progress to develop intestinal strangulation and perforation leading to the acute fulminant presentation. With this clinical presentation, patients typically exhibit severe abdominal pain, peritoneal irritation, dehydration, and haemodynamic instability.

PRESENTATIONS IN PATIENTS WITH CONCURRENT ILLNESSES

There is an apparent increased propensity for acute caecal volvulus presentation during periods of concurrent acute medical illnesses, as 12%–28% of the reported patients with acute volvulus are already hospitalised for a variety of medical illnesses at the time of diagnosis.^{7 8 13} In these hospitalised patients, caecal volvulus development is believed to be associated with the increased occurrence of colon distension and intestinal dysmotility.

Recognition of acute caecal volvulus in the hospitalised patient population can be difficult because of alternative causes of abdominal distension in many of these patients. Moreover, symptoms and findings related to acute volvulus may be more easily overlooked in patients presenting with serious concurrent medical illnesses. Therefore, prompt diagnosis in this setting requires heightened clinical suspicion and timely acquisition of diagnostic imaging studies.

LABORATORY EVALUATIONS

Laboratory evaluations are neither sensitive nor specific for the diagnosis of caecal volvulus, as the laboratory values are often unremarkable in patients with intermittent symptoms and early acute obstruction. Whereas, in patients with advanced obstruction, the white blood cell count and serum



Figure 2 Schematic diagram of caecal bascule showing anterior folding of the caecum resulting in closed loop obstruction of the caecum.

chemistry abnormalities are not useful for diagnosis but reflect the fluid, electrolyte deficiencies, and inflammatory or infectious changes related to the obstructive process.

DIAGNOSTIC IMAGING

As most patients with acute caecal volvulus present with clinical pictures suggestive of intestinal obstruction, abdominal radiography is frequently obtained as the initial diagnostic imaging. It has been reported that radiological abnormalities are identifiable in nearly all patients with acute caecal volvulus, with caecal dilatation (98%–100%), single

Box 1 Clinical syndromes associated with abnormal caecal mobility and volvulus

Mobile caecum syndrome

Chronic intermittent abdominal pain with spontaneous resolution after the passage of flatus. Physical examination may show mild right sided abdominal tenderness or no abnormalities. This clinical presentation is generally not associated with bowel necrosis however may be an identifiable predecessor in 50% of patients presenting with acute volvulus

Acute obstruction

Cramping abdominal pain and vomiting that do not resolve spontaneously. The physical findings generally include tenderness of the abdomen, with or without a palpable abdominal mass, and high pitched bowel sounds. With recognition and timely treatment, this presentation is associated with comparatively low incidence of bowel necrosis

Acute fulminant

Patients generally have toxic appearance with abdominal tenderness associated with peritonitis. Patients with this presentation frequently have bowel necrosis

air-fluid level (72%–88%), small bowel dilatation (42%–55%), and absence of gas in distal colon (82%) reported as the most commonly visualised abnormalities.^{1–16} However, given the non-specific nature of these radiological findings and the unusual occurrence of caecal volvulus, many of the patients are erroneously given the diagnoses of small bowel obstruction.^{1–8} Several additional radiological findings have been reported to improve the diagnostic specificity of abdominal radiography, and these include the presence of dilated small bowel loops localised lateral to a dilated caecum¹⁶ (figure 3 is an abdominal radiograph illustrating this finding).

As the clinical, laboratory, and abdominal radiological findings are frequently non-specific definitive diagnosis in most patients is rarely established on the basis of the initial evaluation.^{1–3} In most patients, these initial findings help raise the suspicion of caecal volvulus, which lead to subsequent confirmation by barium enema, computed tomography (CT), colonoscopy, or exploratory caeliotomy.

Barium enema has been the imaging modality traditionally applied for caecal volvulus confirmation, with reported diagnostic accuracy of 88% for acute volvulus.¹ Furthermore, occasional successful volvulus reduction has been reported after barium enema administration.⁸ The “beak sign” or a smooth tapering cut off at the efferent limb of the obstruction is the most common confirmatory finding visualised during barium enema.¹⁷ An additional value of barium enema is in visualisation of the distal colon for the exclusion of coexisting abnormality that may have contributed to the caecal volvulus formation. Because of time requirement for the completion of this procedure and the potential for contrast extravasation, barium enema is generally not recommended for the evaluation of critically ill patients with advanced obstruction, suspected perforation, and gangrenous bowel.^{1–2, 13}

Unlike barium enema evaluations in the setting of acute obstruction, this diagnostic modality offers limited value in patients with intermittent symptoms related to caecal volvulus. In these patients without ongoing intestinal obstruction, radiological diagnosis relies on the visualisation of caecal axial rotation and/or excessive caecal mobility.¹⁴ In this setting, some investigators have proposed the application of abdominal compression during barium enema examinations to facilitate visualisation of caecal mobility.¹⁵

Abdominal CT is being increasingly used for the evaluation of acute abdominal pain, and for this reason, CT is replacing barium enema as the preferred imaging modality for the diagnosis of acute caecal volvulus in many practice environments.³ The “coffee bean”, “bird beak”, and “whirl” signs are three of the common CT findings associated with acute caecal volvulus.³ The “coffee bean” sign generally refers to an axial view of a dilated caecum filled with air and fluid that may be visualised anywhere within the abdominal cavity. The “bird beaks” are images correlating with the progressively tapering efferent and afferent bowel loops terminating at the site of torsion. The “whirl sign” is a description applied to the CT image of a soft tissue mass with internal architecture containing swirling strands of soft tissue and fat attenuation. In the setting of acute caecal volvulus, the whirl is composed of spiralled loop of collapsed caecum, with low attenuating fatty mesentery and engorged mesenteric vessels.^{3, 18} In addition to the above described pathoneumonic CT signs, visualisation of a gas filled appendix has been described as a finding associated with caecal dilatation from caecal volvulus.³

COLONOSCOPY

Flexible sigmoidoscopy is commonly performed for the confirmation and initial management of sigmoid volvulus, however the utility of endoscopic therapy in acute caecal

volvulus diagnosis and treatment is generally considered limited,² as the success rate of colonoscopic reduction of caecal volvulus has been about 30%.^{7, 19–21} Given the modest success rate, the potential for colonic perforation, and potential delays in operative treatment associated with unsuccessful reduction, colonoscopy is generally not recommended in the initial treatment of caecal volvulus.^{2, 13}

SURGICAL TREATMENT

It is generally agreed that patients with acute caecal volvulus benefit from surgical intervention for the correction of intestinal obstruction. Contemporary surgical options include manual detorsion, caecopexy, caecostomy, and colectomy by open or laparoscopic approaches. Given the unusual nature of the disease, there are no prospective treatment trials to guide management decisions in these patients. It is generally agreed that when intestinal gangrenous changes and perforations are encountered, the non-viable intestines should be resected; however, the appropriate extent of the operative therapy in patients without these complications has remained undetermined.² (box 2 contains descriptions of the therapeutic options and table 1 lists findings from representative case series).

Surgeons who are in favour of resecting the ascending colon in treatment of uncomplicated volvulus have generally cited recurrent volvulus and local complications associated with caecostomy and caecopexy as basis for performing bowel resections; whereas, the proponents of non-resectional approaches have generally cited reduced mortality, reduced physiological insult, and low recurrence rates as reasons for not proceeding with intestinal resection.

While resection of the ascending colon eliminates the possibility of volvulus recurrence, this procedure is frequently associated with prolonged operation times and increase in the magnitude of physiological insult to the patient. Historically, the operative mortality associated with colectomy has been higher than the mortalities associated with caecopexy and caecostomy; however, a confounding factor in outcomes reported by these retrospective series is that colon resection is necessitated in some patients as the result of bowel strangulation, therefore the increased morbidity and mortality reported may reflect patient differences rather than

Box 2 Treatment descriptions and results

Barium enema

Sporadic reports of reduction after barium enema. The success rate is unknown. This modality is not usually recommended as a therapeutic option

Colonoscopy

Reduction of volvulus by endoscopic approach; the reported success rate is about 30% and the recurrence rate is unknown

Operative detorsion

Manual reduction of volvulus by caeliotomy. Mortality 0%–25%; recurrence 0%–70%

Caecopexy

Fixation of right colon by suturing of caecum and/or ascending colon to lateral parietal peritoneum. Operative mortality 0%–30%; recurrence 0%–40%.

Caecostomy tube placement

Fixation of right colon by tube placement into caecum. Operative mortality 0%–40%; recurrence 0%–33%.

Colectomy

Resection of involved intestinal segment. Mortality 0%–39% with lower mortality in patients treated after 1990. No recurrence has been reported after resection.

Table 1 Representative reports of outcome after surgical treatment

Authors	Year	Number	Mortality (%)	Gangr/non-gang (%)	Resection (m/r) (%)	Caecopexy (m/r) (%)	Caecostomy (m/r) (%)	Detorsion (m/r) (%)
Ballantyne <i>et al</i>	1985	55	45	33/12	39/0	8/0	0/0	0/20
O'Mara <i>et al</i>	1979	50	12	33/7	7/0	0/0	25/0	17/0
Rabinovici <i>et al</i>	1990*	561	19	NA	22/0	10/13	32/14	22/12
Friedman <i>et al</i>	1989	26	15	NA	13/0	NA	NA	NA
Tejler, Jiborn	1988	25	16	NA	7/0	50/0	0/0	25/25
Tejler, Jiborn	1988*	350	30	NA	8/0	13/5	10/1	13/13
Theuer	1990	16	31	NA	22/0	0/0	100/0	NA
Wright, Max	1988 ²⁵	12	17	50/9	25/0	NA/0	NA/0	NA/0

Gangren/non-gang, gangrenous/non-gangrenous. (m/r), mortality/recurrence. NA, not available. *Collective reviews.

treatment related differences. With advances in intraoperative care and perioperative care, the morbidity and mortality associated with colectomies performed for caecal volvulus has improved over the past decade.²

With the recent advances in laparoscopic technology, laparoscopic colon resections are being increasingly applied. Similarly, there have been several reports of laparoscopic treatment of caecal volvulus published.²²⁻²⁴ Given the physiological advantages of laparoscopy over open surgery and the continued rapid expansion of laparoscopic gastrointestinal surgery, laparoscopic right colectomy and caecopexy will probably become the mainstay of treatment in the near future.

In our opinion, the most appropriate operative strategy for a given patient can be determined only by the operating surgeon after taking into consideration the surgical expertise, patient's physiological status, viability of the involved intestines, the potential perioperative morbidity and mortality, and the risk of volvulus recurrence.



Figure 3 Plain radiograph of the abdomen showing caecal dilatation and the presence of small bowel loops lateral to the dilated caecum.

SUMMARY

The occurrence of caecal volvulus is predisposed by excess caecal mobility that is often associated with incomplete intestinal rotation. Obstruction of the distal colon, caecal displacement, and non-obstructive caused of colonic distension are conditions that may produce acute volvulus in anatomically susceptible people. Bowel necrosis may occur as the sequelae of untreated and unresolved acute volvulus. Optimal patient management consists of metabolic support, early diagnosis, and operative therapy. The reported operative mortality has ranged from 0% to 40% with recurrence rates reported between 0% and 40% for those undergoing non-resectional treatment. Patient outcome is adversely affected by the presence of intestinal gangrenous changes and perforation, which are complications associated with delayed treatment of the condition. Based on the available evidence, which consists of retrospective case series, case reports, and collective reviews, the optimal surgical strategy has not been determined.

ILLUSTRATIVE CASE REPORT

A 65 year old woman presented to the hospital with persistent and diffuse abdominal pain of about 24 hour duration. The patient reported that several hours after the onset of cramping abdominal pain, she developed bilious vomiting. The patient also related a history of having chronic intermittent abdominal pain of lesser intensity along with intermittent constipation for several years, which has prompted an ongoing evaluation by a gastroenterologist in the outpatient setting. Her other medical problems included hypertension, gastro-oesophageal reflux disease, hypercholesterolaemia, and osteoarthritis. Her surgical



Figure 4 Abdominal CT scan showing "coffee bean sign" in the mid-anterior abdomen (depicted by bold arrow) and "whirl sign" in the right lower quadrant (depicted by the smaller arrow).

history consisted of previous open cholecystectomy and bilateral tubal ligation greater than 10 years ago. On physical examination, the vital signs and cardiopulmonary examinations were within normal limits. During the abdominal examination, a palpable, firm, and tympanitic mass was identified in the mid-portion of the upper abdomen, and diffuse tenderness without peritoneal irritation was noted. Her laboratory studies showed white blood cell count of 13 300 cell/mm³, haemoglobin of 133 g/l, packed cell volume of 36.8%, and normal electrolytes. The plain radiographs of the abdomen showed a prominent segment of dilated intestine suggestive of caecal volvulus (fig 3). A CT scan of the abdomen was obtained confirming the diagnosis of acute caecal volvulus (fig 4).

The patient underwent an urgent caeliotomy, with findings at the operation showing axial rotation of the caecum associated with pronounced congestion and oedema of the caecum and terminal ileum, and no evidence of transmural bowel infarction. The operative treatment consisted of resection of the terminal ileum and right colon followed by primary intestinal anastomosis. The patient recovered after the operation and reported no further recurrence of abdominal pain at one year after her operation.

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