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SYSTEMATIC REVIEWS

Giant colonic diverticulum, clinical presentation, diagnosis and treatment: Systematic review of 166 cases

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Abstract

AIM: To investigate the clinical presentation, diagnosis, and treatment of giant colonic diverticulum (GCD, by means of a complete and updated literature review). GCD is a rare manifestation of diverticular disease of the colon. Less than 200 studies on GCD were published in the literature, predominantly case reports or small patient series.

METHODS: A systematic review of the literature was performed using the Embase and PubMed databases to identify all the GCD studies. The following MESH search headings were used: "giant colonic diverticulum"; "giant sigmoid diverticulum". The "related articles" function was used to broaden the search, and all of the abstracts, studies, and citations were reviewed by two authors. The following outcomes were of interest: the disease and patient characteristics, study design, indications for surgery, type of operation, and post-operative outcomes. Additionally, a subgroup analysis of cases treated in the last 5 years was performed to show the current trends in the treatment of GCD. A GCD case in an elderly patient treated in our department by a sigmoidectomy with primary anastomosis and a diverting ileostomy is presented as a typical example of the disease.

RESULTS: In total, 166 GCD cases in 138 studies were identified in the literature. The most common clinical presentation was abdominal pain, which occurred in 69% of the cases. Among the physical signs, an abdominal mass was detected in 48% of the cases, whereas 20% of the patients presented with fever and 14% with abdominal tenderness. Diagnosis is based predominantly on abdominal computed tomography. The most frequent treatment was colic resection with en-bloc resection of the diverticulum, performed in 57.2% of cases, whereas Hartmann's procedure was followed in 11.4% of the cases and a diverticulectomy in 10.2%. An analysis of sixteen cases reported in the last 5 years showed that the majority of patients were treated with sigmoidectomy and en-bloc resection of the diverticulum; the postoperative mortality was null, morbidity was very low (1 patient was hospitalized in the intensive care unit for postoperative hypotension), and the patients were discharged 4-14 d after surgery.

CONCLUSION: Giant colonic diverticulum is a rare manifestation of diverticular diseases. Surgical treatment, consisting predominantly of colonic resection with *en bloc* resection of the diverticulum, is the

preferred option for GCD and guarantees excellent results.

Key words: Colonic; Diverticulum; Sigmoid; Surgery; Giant

Core tip: This article presents a systematic and comprehensive review of all the studies concerning giant colonic diverticulum. The majority of the published studies are case reports on single cases. The authors performed an extensive literature search and a systematic review, with the aim of collecting and providing complete and updated information regarding the clinical presentation, diagnosis, and treatment of this rare disease. The results of the review indicate that surgical treatment, consisting predominantly of colonic resection with *en bloc* resection of the diverticulum, is the preferred option for giant colonic diverticulum and guarantees excellent results.

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INTRODUCTION

Giant colonic diverticulum (GCD) is a rare manifestation of diverticular disease of the colon[1]. Fewer than 200 studies, predominantly case reports or small patient series, have been published[2]. In this study, we present a comprehensive and updated review of the literature and a GCD case in an elderly patient. We identified 166 GCD cases published in the literature, to extract and discuss the complete and updated information on the diagnosis and treatment of GCD.

We hypothesize that an updated and complete review is needed to clarify and summarize current knowledge on this subject. The information is fragmented and available only from case reports or small series, and the published systematic reviews are not recent. Changes in the diagnosis and treatment of GCD have occurred in recent years such as the widespread use of computed tomography for the diagnosis of GCD and the diminution of the use of barium enemas as well as the emerging role of laparoscopic surgery with the first cases treated by laparoscopic sigmoidectomy; these changes should be emphasized. We hypothesize that a comprehensive review might provide useful, relevant and updated information to help clinicians in the diagnosis and treatment of this rare disease. In this review, a subgroup analysis of the previous five years was conducted to analyze the current trends and emerging possibilities in the treatment of this disease.

MATERIALS AND METHODS

Internal Review Board authorized this study

Systematic review of the literature: A systematic literature search of the literature was performed using the Embase and PubMed databases to identify all the published studies on GCD. The following MESH search headings were used: "giant colonic diverticulum"; "giant sigmoid diverticulum". The "related articles" function was used to broaden the search, and all the abstracts, studies, and citations were reviewed. The studies on pediatric patients were excluded.

Two reviewers independently extracted the following information from each study using standardized extraction tables developed a priori: the first author, year of publication, characteristics of the disease and patients, study design, indications for surgery, type of operation, and post-operative outcomes.

Additionally, a subgroup analysis of the cases treated in the previous 5 years was performed to show the current trends in the treatment of GCD.

Case presentation

A case of GCD in an elderly patient treated in our department by a sigmoidectomy with primary anastomosis and a diverting ileostomy is presented as a typical example of the disease.

RESULTS

One hundred and thirty-eight studies were identified[1-138], including 166 patients. The results of the systematic review are reported in Tables 1, 2, 3 and 4.

Clinical presentation

Regarding the clinical presentation, abdominal pain was the most common symptom (69% of the cases), followed by constipation (17%), sensation of an abdominal mass (17%), vomiting (12%), and diarrhea (11%). Rectal bleeding was present in 9% of the patients. Among the physical signs, an abdominal mass was detected in 48% of the cases, whereas 20% of the patients presented with fever and 14% with abdominal tenderness. Perforation was diagnosed at presentation or at the time of surgery in 44/166 patients (26.5%).

Diagnosis

A computed tomography (CT) scan is the most accurate and recommended examination and permits a correct diagnosis in nearly all the cases. In the first cases, a barium enema was used. A colonoscopy is generally avoided because of the risk of perforation.

Treatment of GCD

A colic resection with an en-bloc resection of the diverticulum was the most frequent treatment, performed in

Table 1 Symptoms of giant colonic diverticulum in 166 patients (review of the literature) *n* (%)

Symptoms	Patients (*n* = 166)
Abdominal pain	115 (69)
Constipation	29 (17)
Diarrehea	19 (11)
Vomiting	20 (12)
Nausea	16 (10)
Abdominal mass	29 (17)
Rectal bleeding/melena	15 (9)
Urinary problems	11 (7)
Weight loss	8 (5)
Asymptomatic	7 (4)
Anorexia	7 (4)
Vaginal bleeding	2 (1)
Meteorism	3 (2)
Dyspepsia	1 (0.6)
Symptoms of bowel obstruction	2 (1)
Difficulty in breathing	1 (0.6)
Tenesmus	1 (0.6)

Each patient may present with one or more symptoms.

Table 2 Signs of giant colonic diverticulum in 166 patients (review of the literature) *n* (%)

Physicalsigns	Patients (*n* = 166)
Abdominal mass, non-tender	47 (28)
Abdominal mass, tender	34 (20)
Fever	33 (20)
Abdominal tenderness	24 (14)
Normal	15 (9)
Acute abdomen	10 (6)
Abdominal distension	15 (9)

One or more signs may be present in each patient.

57.2% of the cases. Hartmann's procedure was used in 11.4% of the cases, and a diverticulectomy was performed in 10.2% of the cases. In emergency settings, Hartmann's resection might be performed; its disadvantage is the need of a second complex surgical procedure to restore the intestinal continuity. The treatments used in the remnant cases are reported in Table 3.

A sub-group analysis of 16 patients treated in the previous five years (Table 4) showed that only one patient was treated with a simple diverticulum resection. In this case, the GCD did not communicate with the bowel lumen[15]; no information is reported regarding the postoperative course in this case. A laparoscopic colectomy has been reported to be safe[7], however, it was performed only in 4 patients and only in the previous 5 years. In the previous five years, no postoperative mortality was reported, and complications occurred only in 1 patient (postoperative hypotension requiring 24-h hospitalization in the intensive care unit), and the duration of hospital stay ranged from 4 to 14 d[4-17]. Only one case of recurrent GCD is reported in the literature, which occurred after a diverticulectomy[45]. No recurrences are reported after a colectomy and *en bloc* diverticulectomy.

Non-surgical treatments have been rarely used and are considered in patients refusing surgery and in high-risk patients to resolve acute inflammation and are typically followed by a delayed elective segmental colectomy.

Table 3 Treatment of giant colonic diverticulum in 166 patients (review of the literature) *n* (%)

Operation	Patients (*n* = 166)
Resection, primary anastomosis	95 (57.2)
Resection, primary anastomosis and drainage	1 (0.6)
Diverticulectomy	17 (10.2)
Resection, colostomy	19 (11.4)
Conservative treatment	13 (7.8)
Diverticulectomy,colostomy	3 (1.8)
Drainage	4 (2.4)
Not mentioned	4 (2.4)
Laparoscopic colectomy	5 (3)
Excision of the cyst	3 (1.8)
Colectomy, ileostomy	1 (0.6)
computed tomography-guided percutaneous intervention	1 (0.6)

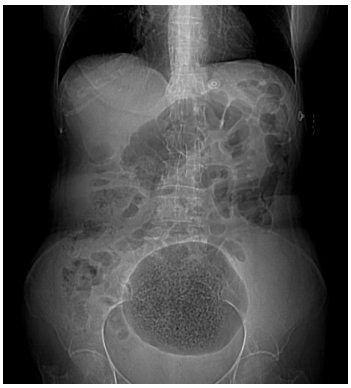

Figure 1 Abdominal X-ray shows a large gas-filled cavity in the lower abdomen.

Case presentation: An 80-year-old woman was admitted to the surgery department with a 2-d history of rectal bleeding, associated with left lower quadrant abdominal pain, abdominal swelling and nausea. The patient had reported episodic abdominal pain for 10-12 mo prior to admission. She did not report any changes in bowel habits. Her prior medical history included hypertension treated with beta-blockers. Previous surgeries included a hysterectomy 30 years before and an appendectomy in her childhood. The patient's weight was 60 kg, and her height was 160 cm, with a BMI of 23.44.

On clinical examination the abdomen was distended, soft, and mildly tender on the lower abdominal quadrants, where a large mass was palpable. The blood tests revealed a hemoglobin level of 7.7 g/dL, a white blood cell count of 11.42 × 10^3/uL and neutrophil level of 79.9%. The C-reactive protein level was 9.94 mg/dL. An abdominal X-ray showed a large gas-filled cavity in the lower abdomen (Figure 1). An axial non-contrast CT scan showed a 15.5 cm × 10.5 cm cystic lesion containing air and fluid, with a thick wall (Figure 2). A large cyst, adherent to the antimesenteric border

Table 4 Case reports of giant colonic diverticulum in adults, published in the last 5 years

Ref.	Treatment	Type	Complications	Hospital stay
Kam *et al*[4]	Left colectomy with primary anastomosis and abscess drainage	1,2	No	NR
Kim *et al*[5]	Laparoscopic right colectomy	3	No	7 d
Filippucci *et al*[6]	Sigmoid resection with primary anastomosis	NR	No	NR
Mahamid *et al*[7]	Laparoscopic sigmoidectomy	NR	Nr	NR
Khaikin *et al*[8]	Hartmann's resection	2	No	NR
Anderton *et al*[9]	IV antibiotics (high-risk for laparotomy)	NR	No	3 d
Olakowski *et al*[10]	Right colectomy	3	No	7 d
Sasi *et al*[11]	Hartmann's resection	NR	No	NR
Beddy *et al*[12]	Hartmann's resection	2	Hypotension	14 d
Collin *et al*[13]	Laparoscopic sigmoidectomy	2	No	4 d
Hogan *et al*[14]	No treatment (asymptomatic patient)	NR	Nr	NR
Chatora *et al*[15]	Excision of the cyst	1	No	NR
	laparoscopic sigmoidectomy	1	No	NR
Abdelrazeq *et al*[16]	Sigmoidectomy	NR	No	NR
Guarnieri *et al*[17]	Left colectomy	NR	No	9 d
Present study	Sigmoid resection with primary anastomosis and ileostomy	2	No	7 d

NR: Not reported.

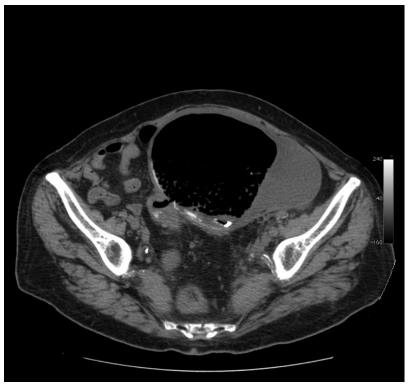

Figure 2 Axial non-contrast computed tomography scan shows a 15.5 cm x 10.5 cm cystic lesion containing air and fluid, with a thick wall.

of the sigmoid colon, was found during a laparotomy. Resection of the cyst en-bloc with the sigmoid colon, primary colonic anastomosis and loop ileostomy were performed. The postoperative course was uneventful and the patient was discharged on post-operative day 7. The pathology examination showed a giant colonic diverticulum containing blood and feces, with acute and chronic inflammation and foreign-body giant-cells, with no evidence of malignancy. The GCD was classified as type 2 according to McNutt *et al*[3].

DISCUSSION

Definition and prevalence

Giant colonic diverticula are colic diverticula greater than 4 cm in size, by definition; approximately 90% of the cases involve the sigmoid colon[2]. They might be isolated, but in 85% of the cases, GCDs are associated with concomitant diverticular disease[19].

Pathogenesis

Different hypotheses might explain the development of GCD. One theory asserts that it is caused by a unidirectional ball-valve mechanism through a tiny communicating diverticular neck, which causes air entrapment and gradual enlargement of the diverticulum[20]. Another hypothesis is that GCD is secondary to the action of gas forming organisms[21].

Classification

McNutt *et al*[3] classified GCD in three types. Type 1 diverticula (22% of the cases, according to Steenvoorde *et al*[2]) are pulsion diverticula, which enlarge gradually (pseudo-diverticula such as small colonic diverticula), with remnants of muscularis mucosa and true muscularis, which ends at the colonic border of the diverticulum. Chronic inflammatory cells and granulation and fibrous tissue are present in its wall. Type 2 diverticula (inflammatory diverticula, 66% of the cases[2]) are secondary to a subserosal perforation, leading to a walled off abscess cavity communicating with the bowel lumen and gradually enlarging. Their wall is composed of fibrous scar tissue, without a normal intestinal layer.

Type 3 (true diverticula, 12% of the cases[2]) contains all the bowel layers with a well-developed smooth muscle wall and is in continuity with the gut lumen. Type 3 diverticula most likely have a congenital origin. The etiology of the true giant diverticulum is possibly related to anomalous embryologic development and is sometimes referred to as a congenital diverticulum.

Clinical presentation

The clinical presentation is variable, ranging from an acute presentation with severe complications to no symptoms. An acute presentation (30%-35% of the patients) is characterized by an acute onset of abdominal pain, eventually associated with fever, nausea, vomiting, and rectal bleeding[1,22,23]. In two thirds of the patients, a palpable mass is noticed at the physical examination[22]. Complications occur in 15%-35% of the cases[24]. The

most common complication is peritonitis, caused by the perforation of the GCD, followed by abscess formation, intestinal obstruction, volvulus, and infarction[22]. Rarely, a carcinoma might develop from the diverticular mucosa[25]. Chronic presentation (30%-35% of the patients) is characterized by intermittent abdominal discomfort, bloating, and constipation, which might be associated with a palpable and soft abdominal mass, with variations in size[22]. Approximately 10% of the patients are asymptomatic; the mass is typically detected on examination or from radiological or endoscopic exams.

As shown in Tables 1 and 2, our review of 166 patients[1-138] showed that abdominal pain was the most common symptom (69% of cases), followed by constipation (17%), and a sensation of an abdominal mass (17%). Among the physical signs, an abdominal mass was detected in 48% of the cases, whereas 20% of the patients presented with fever.

Diagnosis

An abdominal X-ray typically shows a large gas-filled cyst (Ballon sign), with an air-fluid level and regular and smooth walls[26]. A CT scan is the most accurate exam, and it permits a correct diagnosis in nearly all the cases, demonstrating a smooth-walled gas-containing structure[27]. Barium enemas might show communication between the bowel lumen and the GCD in 60%-70% of the cases; a rare complication of an enema is a GCD perforation requiring emergency surgical treatment. A colonoscopy is rarely performed because it might cause GCD perforation[28].

Treatment

The preferred treatment of uncomplicated GCD is resection of the diverticulum and adjacent colon with primary colonic anastomosis[4], with or without a temporary diverting ileostomy. A simple diverticulectomy has been rarely reported[29] and should be avoided in case of concomitant diverticular disease. When a diverticulectomy and colonic suture are performed, there is a consistent risk of dehiscence because the diverticular neck is frequently wide and the surrounding tissue is inflammatory. The analysis of the literature showed that colic resection with an e-bloc resection of the diverticulum was the most frequent treatment and was performed in 57.2% of the cases. Hartmann's procedure was used in 11.4% of the cases, and a diverticulectomy was performed in 10.2% of the cases. In emergency settings, Hartmann's resection might be performed; its disadvantage is the need of a second complex surgical procedure to restore the intestinal continuity. The treatment of the remaining cases is reported in Table 3.

A sub-group analysis of the previous 5 years (Table 4) showed that in that time period only one patient was treated with a simple diverticulum resection. In this case, the GCD did not communicate with the bowel lumen[15]; no information is reported regarding the postoperative course. A laparoscopic colectomy has been reported to be safe[7], but it was performed only in 4 patients and only in the previous 5 years, most likely because most authors felt that open surgery is safer in this setting, in consideration of the large size of the GCD and the risk of diverticular perforation and fecal peritoneal contamination. Surgical treatment guarantees excellent results. In the previous five years, no postoperative mortality was reported, complications occurred only in 1 patient (postoperative hypotension requiring a 24-h hospitalization in the intensive care unit), and the hospital stay ranged from 4 to 14 d[4-17]. No recurrences are reported after colectomy and *en bloc* diverticulectomy.

Non-surgical treatments have been rarely used, and include percutaneous drainage[1], stent placement in the diverticular neck with drainage in the colic lumen[19], and antibiotics[9]. These options are considered in patients refusing surgery, and in high-risk patients, to resolve GCS acute inflammation, and are typically followed by delayed elective segmental colectomy.

GCD is a rare but potentially dangerous pathological entity. A correct diagnosis is predominantly based on an abdominal CT scan. A segmental colectomy with en-bloc diverticular resection and primary anastomosis with or without a diverting ileostomy is the preferred and most frequent treatment, and it is indicated in asymptomatic patients as well, to prevent potential dangerous complications (primarily, peritonitis from diverticular perforation). In emergency settings or in high-risk patients, Hartmann's procedure might be performed. Laparoscopic surgery has been reported to be safe; however, it has been performed only in 4 patients in the previous five years. Surgical treatment guarantees excellent results. In the previous 5 years, the mortality was null, morbidity very low (1 patient was hospitalized in the intensive care unit for postoperative hypotension), and the patients were discharged 4-14 d after surgery.

COMMENTS

Background

Giant colonic diverticulum (GCD) is a rare manifestation of diverticular disease of the colon. In the literature, fewer than 200 studies were published, predominantly case reports or small patient series. In this study, we present a comprehensive and updated systematic review of the literature and a case of GCD in an elderly patient.

Research frontiers

The pathogenesis and best treatment options of GCD are important areas of research on the subject.

Innovations and breakthroughs

This article provides a complete systematic review of the literature on GCD, summarizing the current evidence on the clinical presentation, diagnosis, and treatment options of this rare disease. Additionally, an example case is presented.

Applications

To guide the clinical management of patients presenting with GCD.

Terminology

Giant colonic diverticula are colic diverticula greater than 4 cm in size, by definition; approximately 90% of the cases involve the sigmoid colon. They might be isolated, however, in 85% of the cases, GCDs are associated with concomitant diverticular disease.

Peer review

This manuscript describes a case of an 80-year-old lady presenting with rectal bleeding in whom a giant diverticulum of the sigmoid colon was diagnosed and surgically treated. Also a review of this rare variant of colonic diverticular disease is reported. It is a useful overview of this pathological condition, its clinical manifestations and treatment options.

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