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Sigmoid Volvulus in Patient with Fusion Anomaly of Peritoneal Embryological Layers and Trasverse-Megacolon Suffering from A Previous Interstitial Pneumonia SARS-COV Related: Radiological Aspects and Surgical Findings

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1. Abstract

Sigmoid Volvulus (SV) is the third leading cause of colon obstruction in adults, not only in Western Countries but also in Sud-African countries. It occurs in the setting of redundant sigmoid loop, which rotates around its narrow and elongated mesentery. SV is a rare disease process and requires high suspicion and timely diagnosis given the increased incidence of intestinal necrosis and potential mortality.

In adults, the etiology of this disorder is not completely understood and it can be associated to an history of constipation, a congenitally elongated colon, and other predisposing factors as anatomic variations, chronic constipation in neurologic disease, and megacolon.

Management of sigmoid volvulus involves relief of obstruction and the prevention of recurrent attacks; the outcomes depend on the selection of patients and his comorbidities and his clinical resilience, timeliness of radiological diagnosis, timing of therapeutic choices, accuracy of surgical treatment and effective post-operative cares. The symptoms at the presentation can be acute or indolent. The mortality data from SV vary with an overall range of 14% to 45 %(per cent) and is due to the complications as hemorrhagic infarction, perforation, septic shock.

The management of intestinal volvulus has changed because of constant advancements in technology and patient care. The goal standard treatment is surgery as emergent surgery with sigmoid resection and primary anastomosis if possible or stomy if elevated fecal stagnation with high risk of dehiscence. The non-resective alternatives are limited to particular clinical cases. Laparoscopic surgery in SV management is unwarranted and costly.

We present the case of a 75-years-old man with intestinal obstruction, who arrived at our Surgical Department with abdominal pain in all quadrants associated and associated vomiting with abdominal distension, after a first urological procedure. This patient had been hospitalized for a prostate cancer, but the urological pro-

cedure had not been carried out because the occurred contraindication. After clinical and laboratory evaluations, an Abdomen Computed Tomography (CT) scan without intravenous contrast medium administration was urgently requested. CT had shown the presence of a convoluted sigma, with a convoluted aspect also of the vascular structures contained in the vicinity of the sigma. This pathological condition is known as Sigmoid Volvulus and needs an emergency treatment.

CT had a crucial role for the diagnosis of sigmoid volvulus, for its high sensitivity and specificity, because it is able to provide the causes and the level of the obstruction, its extension and complications, thus orienting toward the best clinical management and the surgical tacticts and indirectly also future outcomes and long-term results.

2. Case Report

A 75-years-old man arrived at our surgical department with abdominal pain located in all, associated with vomiting, with a distended and globose abdomen after a laparoscopic urological-surgery. This patient has been hospitalized for a prostate cancer. The urological team had put him on the surgical table for prostate, but they could not perform the surgery because of finding distended colon. His general conditions were deteriorated after urological step, with clouded sensorium and alvus closed. His medical history was significant for arterial hypertension, atrial fibrillation, prostate cancer and recently bilateral Covid-19 interstitial pneumonia (Figure 1), also treated in our hospital.

The man was originally from Marocco and emigrated to Italy years ago. Blood examinations have shown: leukocytosis; increased inflammation indices (VES and PCR); elevated levels of azotemia, LDH and CPK; haemoglobin, hematocrit and electrolytes (sodium, potassium) were decreased, with consequently anemia and for the fluid seizure in the intestinal loops.

Firstly, an abdomen radiograph (Figure 2), after the clinical evaluation, was made, showing the intestinal distension and also a typical radiological finding, a “coffee bean sign”.

In consideration of patient's clinical conditions and in the suspicion of intestinal obstruction, an Abdomen Computed Tomography scan without intravenous contrast medium was urgently requested.

CT was made with a 64MS scanner, and the images obtained were analyzed with slice-thickness of 1.2 mms and MPR reconstructions (axial, sagittal, and coronal). CT had shown (Figure 3) a convoluted aspect of the proximal sigma, at the passage with the descending colon, which is associated upstream with marked distension of the colon since it appears particularly long and tortuous, reaching a maximum caliber of about 11 cms and showing a gross fluid-air level in the context; in the adipose tissue adjacent to the convoluted sigma there were multiple hyperdense shoots and the convoluted aspect of the vascular structures contained there. There was also the presence of a minimum amount of free air in the abdomen, placed in the peri-subhepatic area (max thickness of about 4 mms), with some very small air bubbles that could also be seen close to the anterior abdominal wall.

The surgical consultation required a further radiological examination, so an intestinal transit radiographies (Figure 4) with Gastrografin per os was performed before surgical decision.

Prompt diagnosis was essential for adequate treatment. The patient had urgently an emergent surgical treatment after the multisciplinary consultation. A long remnant sigmoid colon and a chronic constipation might have contribute to the development of sigmoid volvulus but an anatomical anomaly was discovered as intraoperative finding.

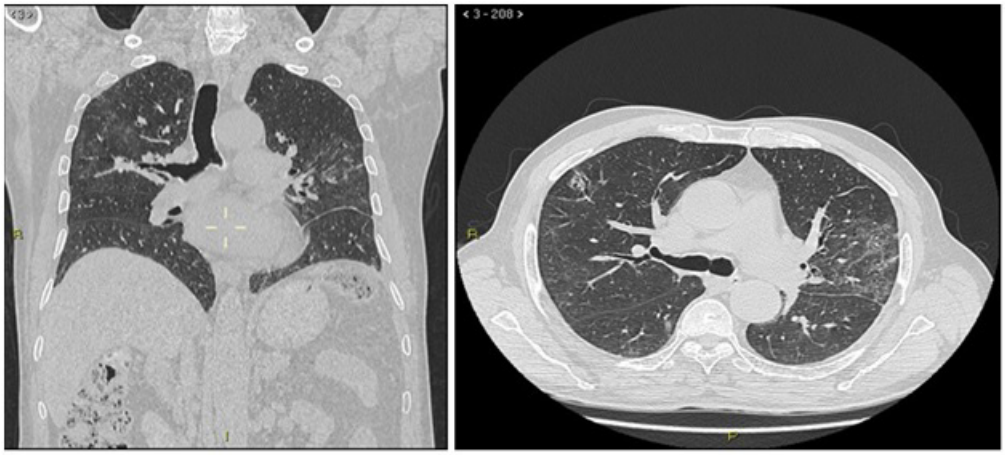

Figure 1: Chest Computed Tomography (coronal, on the left, and axial, on the right, reconstructions). There is an initial, bilateral, Covid19 pneumonia, with interstitial thickenings and bilateral ground-glass areas (more on the left side).

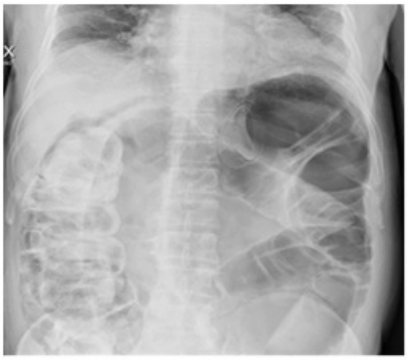

Figure 2: Abdomen radiograph had shown intestinal distension and the "coffee bean sign"

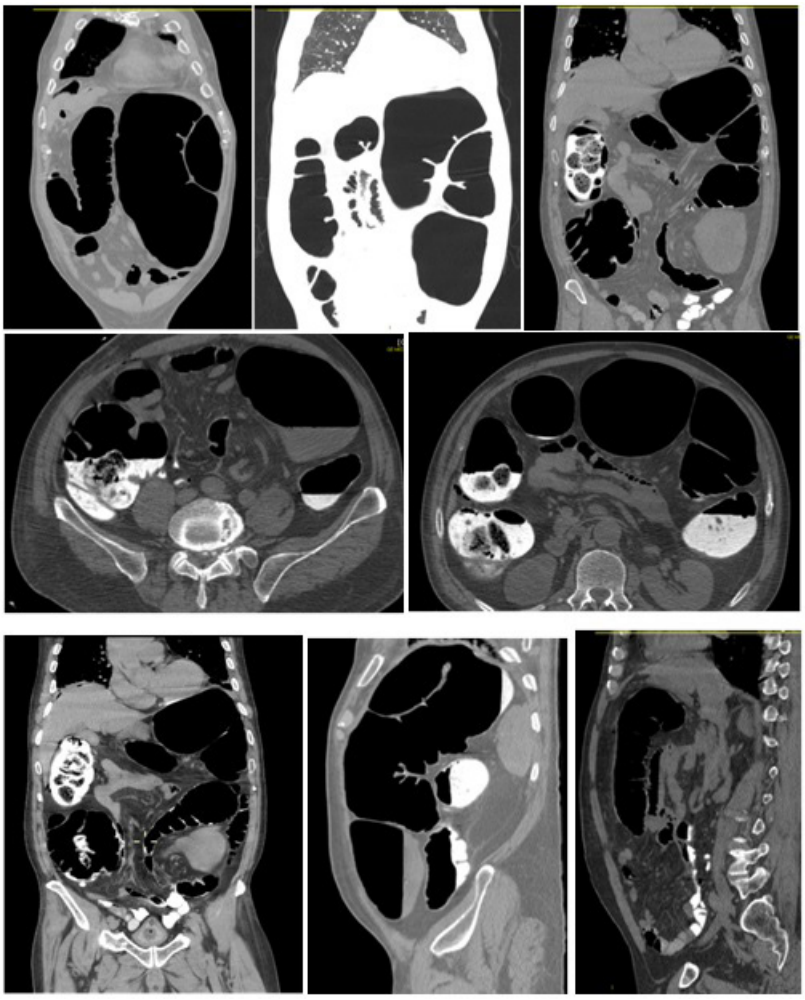

Figure 3: Images of coronal CT reconstructions (upper line), axial CT reconstructions (medium line), and sagittal CT reconstructions (inferior line). CT had shown a convoluted aspect of the proximal sigma, at the passage with the descending colon, which is associated with marked bowel dilatation of the colon, and fluid levels, since it appears particularly long and tortuous, with a maximum caliber of about 11 cms and showing a big fluid-air level in the context. In the adjacent adipose tissue to the convoluted sigma there were multiple hyperdense shoots and the convoluted aspect of the vascular structures contained there. Some small air bubbles (minimum amount of free air in the abdomen) were identified in the peri-subhepatic area. The residue of contrast visible in the intestinal loops refers to a previous exam (made in another structure).

Figure 4: Image of Gastrographin radiography transit, that had shown the presence of Gastrographin in the context of appreciable tenuous loops in the pelvic area. There was also a marked and widespread gaseous overdistension of the colon, with an evident convoluted course of the left sections.

The two layers of sigma's mesocolon were fused and folded in the shape of an U; this anomaly of peritoneal embryological layers had favored the development of volvulus (Figure 5).

Due to the clinical examinations and the contribute of radiological imaging, the patient was submitted to a surgery treatment of sigmoid resection and left colectomy, by laparotomy. The sigma was very dilated, with a diameter of about 11 cms, and a length of about 30 cms. A protective ileostomy was performed because of the coprostasis and the excessive dilation of intestinal loops especially for the thickening of the trasverse colon walls.

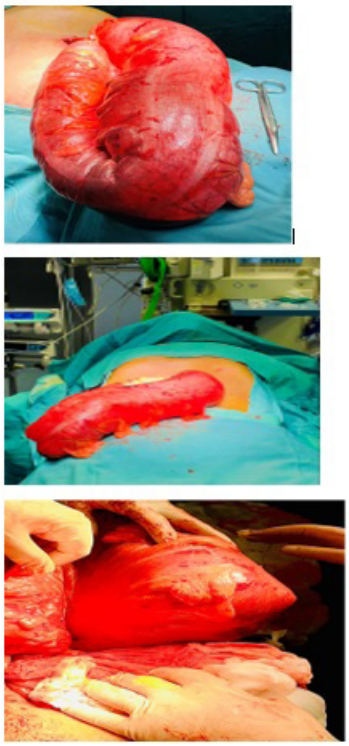

Figure 5: Surgical findings. Images of surgical specimen of sigmoid volvulus showing the big distention of the bowel, the megacolon extension respect to the size of the abdomen-pelvis'patient and the characteristic aspect of the anomaly of adhesion mesocolon.

In the operating table, surgeons saw that this sigmoid volvulus was due to a long and wide mesosigmoid that rotates on a constant mesosigmoid root width and also a trasverse colon had a particular aspect. The walls of trasverse colon were stretched out and suffering and also thickened.

By examining the anatomy of this sigmoid volvulus, surgeons have provided a strong evidence that refines prior hypotheses regarding the anatomic basis of sigmoid volvulus in literature.

It's known that the origin of the sigmoid colon is considered constant as is the V-shaped attachment of the sigmoid mesocolon attachment, but some study were undertaken to establish anatomical variations in the level of origin of the sigmoid colon, as in this case an inverted U-shaped or inverted V-shaped, more common in Africans.

On exploratory laparotomy, a band was discovered where the mesenteries of the sigmoid and left colon bowel adhered and created a narrow fixation point around which the sigmoid twisted.

A sigmoidectomy with primary anastomosis was performed, but a ileostoma as proximal diversion was performed as bowel's protection.

Risk factors for mortality usually include age, delayed admission, cardiovascular and respiratory diseases, fluid-electrolyte imbalance, presence of necrosis, and major contamination, but in this patient only few risk factors were simultaneously present, and the most credited risk factors was the anatomical anomaly, that is frequent in the African population.

The post-operative period was uneventful; in the fourth-day of post operative period, the patient started to drink water and in the seventh-day the light diet; while the patient was discharged on the 10th day. No wound infection or intraabdominal abscess or others complications discovered in this patient. Only a late recurrence was because of the excessive dehydration of ileostoma.

The histological report was examined by pathological anatomy's

specialist; a resection surgery of discendent and sigmoid colon was submitted to the laboratory of anatomical pathology and subjected to macroscopic exam. It was about 38 cm long and had a considerably dilated lumen with smoothed mucosa. The omental tissue was grossly normal.

Longitudinally orientated blocks of the full thickness of the bowel wall were fixed in 10% formol saline and embedded in paraffin wax. (Figure 6) Sections were cut at 3-4 µm and stained with haematoxylin and eosin.

The material under examination consisted of bowel wall with hypertrophy of the muscularis externa, a mild chronic inflammatory cell infiltrate in the lamina propria and edema of the submucosa.

The post-surgical urological treatment was hormone therapy with double-block with Leuprorelina, a non-steroidal antiabdrogen and a gonadotropin-releasing hormone agonist, one administration every three months in combination with Bicalutamide every day, an antiandrogen drug, monitoring by laboratory tests PSA and Testesterone levels during follow-up.

After this first step, a Gastrographin radiography enema was performed and a regular retrograde opacification of the colon was displayed without radiological sign of extraluminal spread. **(**Figure 7) During the long post-surgical period, the patient had few medical and few cardiological complications, so the second-look treatment for intestinal recanalization was considered contraindicated.

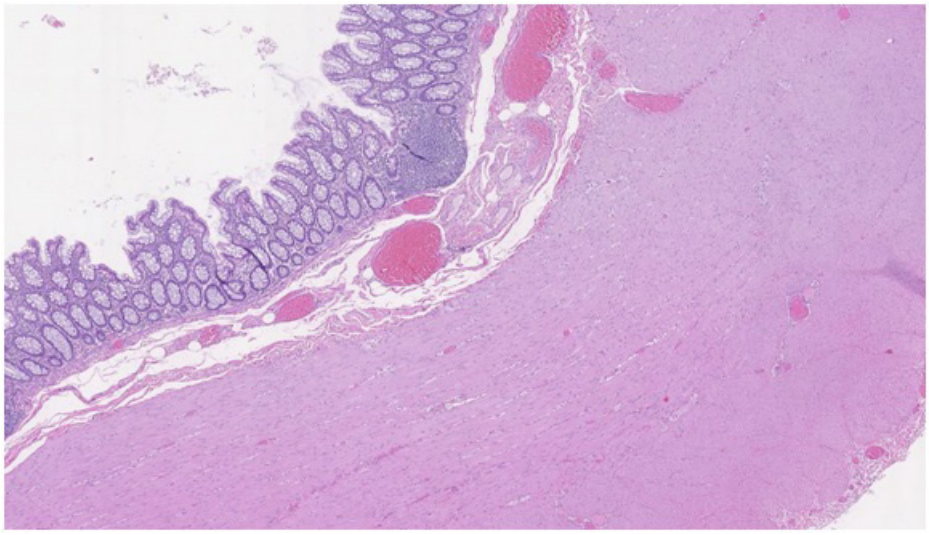

Figure 6: The microscopic exam of the histological aspect of the dilated colon: Bowel wall with hypertrophy of the muscular is externa, a mild chronic inflammatory cell infiltrate in the lamina propria and edema of the submucosa.

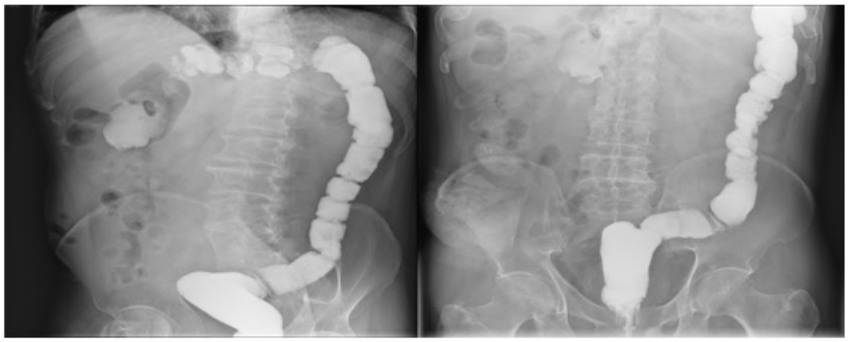

Figure 7: Images of Gastrographin radiography transit, that had shown a regular retrograde opacification of the colon without radiological signs of extraluminal spread.

3. Discussion

Sigmoid volvulus is the most common cause of strangulation of the colon and is also the cause for 3% to 7% of all intestinal obstructions in Western countries, but especially in Sud-African Countries [1,2,3].

Many patients with sigmoid volvulus have clinical findings indicating a disorder of bowel movement, such as constipation and abdominal distention long before the development of a sigmoid volvulus. Some researchers have claimed that sigmoid volvulus might be one of the disorders allied with Hirschsprung's disease [4]. It is also a fact that patients undergoing sigmoidectomy for sigmoid volvulus frequently suffer from elongation and dilatation of the remaining colon and some even require surgery for revolvulus [5].

This disease is rare and uncommon in children [6] and, if the chil-

dren have persistent and recurrent abdominal distention, abdominal pain, and vomiting, physicians should consider SV as a "do not miss diagnosis" in the differential diagnosis.

The main etiological link remains the intestinal transit alteration and the evacuation slowdown in association to risk predisposing factors that are: chronic constipation; a course with high fiber diet; pregnancy; pelvic tumors or cysts; previous abdominal surgery [7]. All these conditions may produce a large, redundant sigmoid colon, in association with mesocolon, long and narrow at its parietal attachment, resulting in the two ends of the loop being close together, under which condition, the bowel is capable of becoming torted around its central mesenteric axis.

The first level radiological imaging of sigmoid volvulus might observe the radiographic “coffee bean sign”, at the abdomen radiograph. If the clinical and radiological picture is not clear, a second level radiological exam is necessary. Abdominal Compute Tomography (CT) is the gold standard in the study of sigmoid volvulus; this exam can identify the typical “whirl sign” and the “bird’s beak sign”, so a Sigmoid Volvulus can be diagnosed rapidly with these characteristic radiological signs, revealing a possible marked distension and a twisted loop of sigmoid colon.

In the diagnostic process for the patient, CT can be both the first instance examination and the supplementary investigation of non-resolving imaging studies [8].

In our experience, CT and the adequate clinical exam were essential for the diagnosis and for a surgical treatment in emergency. A late diagnosis is associated with increased morbidity and mortality because of the high rate incidence of complications.

In sigmoid volvulus, the most important determinant of patient outcome is bowel viability. The initial treatment of sigmoid colon volvulus is sigmoidoscopy with rectal tube placement. Colonic resection for non-gangrenous sigmoid volvulus has an acceptably low rate of complications, particularly when it is done as a semi-elective procedure, i.e., subsequent to endoscopic detorsion and deflation [9].

The SV ‘s preferable treatment today is surgery with the resection and primary anastomosis if possible. In the majority of cases, resection of the involved sigmoid-colon is carried out; in which case primary anastomosis is the goal, either after “on table” lavage, or applying a diverting stroma [10-11].

Various non-operative procedures can be adopted for sigmoid volvulus in adult patients, such as barium enema, rigid or flexible sigmoidoscopy, or operative procedures as detorsion, mesosigmoidoplasty, sigmoidopexy, tube sigmoid colostomy or mesocoloplasty, tube cecostomy and colonic cleansing with or without resection, simple exteriorization, or finally resection with Hartmann’s procedure. In patients with sigmoid resection, a recurrence is possible approximately in incidence rate ranging from 25% to 35% cases [12], especially if the patient has a redundant colon or a fusion anomaly of peritoneal embryological layers.

The management of our patient was optimal because of sequential development of a full multidisciplinary interaction between Radiologists, Surgeons and other Specialists, to define the best surgical arrangements for this patient and the timing of surgery that was agreed in consultation. So, the better diagnosis and therapeutic approaches were individualized.

4. Conclusions

In this case report, the clinical framework of SV was optimal because the diagnostic program was chosen in sequential order to first to second level imaging exams, analyzing step-by-step the suspicious radiological signs detected. The radiological evidence of the “Coffee-bean signal” was helpful in X-ray exam for diagnostic confirmation.

A sequential full multidisciplinary interaction between Radiologists and Surgeons was necessary to guide subsequent choices and to define the best surgical arrangements for the patient.

In emergency, Abdominal Computed Tomography for suspected SV cases is the preferred diagnostic modality because of its rapid diagnosis and his crucial role orienting towards the best clinical management and outcomes for the patient.

Depending on the degree of severity of SV disease, operative therapy is performed as an emergency, urgent or elective resection. A challenge is posed not only by the decision on whether to opt for conservative therapy or speedy resection, but also, when resection is indicated, by choosing the most suitable procedure (primary anastomosis or discontinuity resection).

The most important goal of clinicians is to determine whether the patient has volvulus with intestinal ischemia, in which case an emergency laparotomy should be done. In cases without the complications of perforation or colon-gangrene, sigmoid resection with immediate anastomosis and a stomy-protection can be feasible; these surgical program doesn’t increase morbidity or mortality rates, also if a two-stage operations (first look and second-look surgery) is necessary for subsequent ileostomy closure.

In this patient there were anatomical variations in the level of origin of the sigmoid colon from the descending colon as well as in the shape of the attachment of its mesocolon and a fusion anomaly of peritoneal embryological layers ; these variations are often population-based and also the food habits might help to create the predisposing conditions to exasperate the anatomical variation , by chronic constipation and low water intake, causing an elongation of mesentery, the abnormal rotation around his vascular narrow and the lack of the peristaltic movement with consequent mechanical intestinal obstruction’s development.

The prompt diagnosis and the right management are essential to avoid a bowel gangrene and coagulopathy strongly predictors of mortality. In surgical treatment, resection and primary anastomosis

is the first choice, and it can be performed with acceptable mortality and morbidity rates if the patient is stable and a tension-free anastomosis is possible. Non-definitive procedures have high recurrence rates; thus, definitive surgical techniques must be preferred.

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