

SEROTONIN-MEDIATED COLONIC HYPERMOTILITY AS A POSSIBLE CAUSE OF SIGMOID VOLVULUS IN CARCINOID SYNDROME: A CASE REPORT AND PATHOPHYSIOLOGICAL HYPOTHESIS

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ABSTRACT:

Neuroendocrine tumors are uncommon malignancies that arise from hormone-producing cells of the diffuse neuroendocrine system. Some of these tumors secrete vasoactive substances such as serotonin, producing the constellation of symptoms known as carcinoid syndrome. The syndrome is classically characterized by episodic flushing, secretory diarrhoea, bronchospasm, and cardiac valvular abnormalities. Although gastrointestinal manifestations are frequent in carcinoid syndrome, acute mechanical obstruction of the bowel is rarely encountered. Neuroendocrine tumors and its management are riveting in teams of research, considering its etiopathology and prognosis. Among those pancreatic neuroendocrine tumors are of significance in terms of oncology and surgical gastroenterology. Tumours such as insulinoma, gastrinoma, non-functional tumours are more frequently encountered, but carcinoid tumour of head of pancreas is having less incidence and a higher malignant potential. This is a case report of a 73-year-old male with a previously diagnosed carcinoid tumor of the pancreatic head with hepatic metastases, who presented with symptoms of acute intestinal obstruction. Imaging revealed characteristic findings of sigmoid volvulus. Emergency exploratory laparotomy confirmed torsion of the sigmoid colon, which was managed by detorsion and sigmoidopexy. This case explores a possible relationship between carcinoid syndrome and sigmoid volvulus. Although such an association is uncommon, this report highlights the need to consider atypical surgical emergencies in patients with neuroendocrine tumors presenting with acute abdominal symptoms.

KEYWORDS: Carcinoid syndrome, Neuroendocrine tumor, Sigmoid volvulus, Serotonin, Colonic motility, Large bowel obstruction

INTRODUCTION

Sigmoid volvulus is a surgical emergency which requires immediate derogation of the sigmoid loop. Sigmoid volvulus is a well-recognized cause of large bowel obstruction and occurs when the sigmoid colon twists around its mesenteric axis. This rotation leads to obstruction of the intestinal lumen and may compromise blood supply to the affected bowel segment. The condition is frequently encountered in elderly individuals and is associated with several predisposing factors including chronic constipation, elongated sigmoid colon, and disturbances in colonic motility [1]. Neuroendocrine tumors (NETs), previously referred to as carcinoid tumors, originate from enterochromaffin cells that are distributed throughout the gastrointestinal tract and pancreas. These cells possess the ability to synthesize and release biologically active peptides and amines. When such secretory products enter the systemic circulation in significant quantities, they produce the clinical entity known as carcinoid syndrome [2]. Serotonin is the principal mediator involved in carcinoid syndrome and has a major role in regulating gastrointestinal motility and secretion. Elevated levels of serotonin may increase intestinal peristalsis and enhance secretory activity in the gastrointestinal tract. Patients therefore commonly experience persistent diarrhea and rapid intestinal transit [3,4]. Although intestinal obstruction in patients with neuroendocrine tumors has been described, it is usually attributed to tumor infiltration, mesenteric fibrosis, or external compression. Volvulus related to abnormal intestinal motility remains extremely uncommon. The present report describes a patient with carcinoid syndrome who developed sigmoid volvulus and proposes a potential pathophysiological explanation linking excessive serotonin activity to abnormal colonic motility and torsion.

Case Presentation

A 73-year-old male with a known diagnosis of carcinoid tumor of the head of pancreas and documented hepatic metastases presented to the emergency department with acute onset abdominal pain, progressive abdominal distension, and obstipation. The patient also experienced multiple episodes of vomiting and intermittent hiccups. The patient had a history of recurrent episodes of watery diarrhea over the previous months, which had been attributed to carcinoid syndrome. On examination, the patient appeared dehydrated and mildly tachycardic. Abdominal examination revealed marked distension with generalized tympany on percussion. Bowel sounds were absent. There were no signs of generalized peritonitis. Contrast-enhanced computed tomography (CECT) of the abdomen demonstrated a markedly dilated sigmoid colon with an inverted U-shaped configuration. The two limbs of the bowel loop converged toward the left iliac fossa, and twisting of the mesenteric vessels produced the characteristic swirl sign, consistent with sigmoid volvulus.

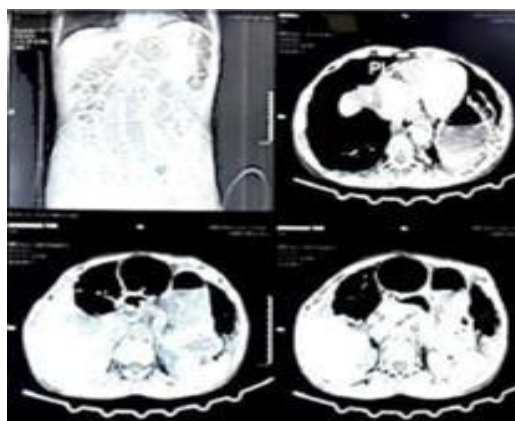


Figure 1 CECT image showing features consistent with sigmoid volvulus

Emergency exploratory laparotomy was performed. Intraoperatively, a massively distended sigmoid colon with torsion of the mesentery was identified. The volvulus was carefully detorsed and the dilated bowel loop was decompressed. The bowel appeared viable without evidence of ischemia. A sigmoidopexy procedure was performed to reduce the risk of recurrence.

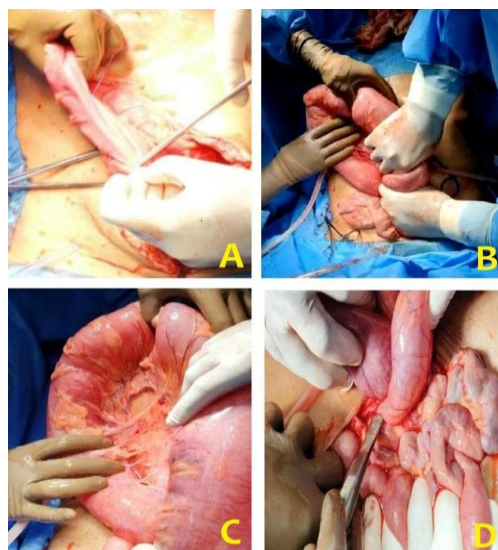


Figure 2 Intraoperative findings showing A-D showing intraoperative findings

The patient recovered well in the postoperative period. Bowel function gradually returned and the patient was discharged in stable condition with advice for follow-up regarding management of the neuroendocrine tumor.

DISCUSSION

Neuroendocrine tumors of the gastrointestinal tract constitute a heterogeneous group of neoplasms derived from hormone-producing cells of the diffuse neuroendocrine system [3]. These tumors may be functional or non-functional depending on their ability to produce bioactive substances. Functional neuroendocrine tumors may secrete several vasoactive mediators including serotonin, histamine, prostaglandins, and tachykinins. Among these, serotonin plays the most significant role in the pathogenesis of carcinoid syndrome [3,5]. Increased serotonin activity affects the gastrointestinal tract by stimulating intestinal smooth muscle contraction and enhancing secretory processes within the intestinal mucosa. The enteric nervous system regulates intestinal motility through complex interactions between neural networks and specialized pacemaker cells known as interstitial cells of Cajal. These cells coordinate rhythmic

contractions of intestinal smooth muscle and maintain normal peristaltic activity [6]. With advancing age, structural and functional changes

occur within the enteric nervous system. Studies have shown a gradual reduction in neuronal density and alterations in neurotransmitter signalling in elderly individuals. These changes may predispose older adults to gastrointestinal motility disorders [7]. In the presence of carcinoid syndrome, excessive serotonin release may exaggerate these physiological alterations. Continuous stimulation of enteric neurons can lead to persistent intestinal hypermotility. In such circumstances, abnormal contractile forces may develop within the colon [8]. The sigmoid colon possesses a relatively long mesentery and greater mobility compared to other segments of the large intestine. This anatomical characteristic makes it particularly susceptible to torsion when exposed to abnormal motility patterns.

The 24-hour urinary 5-hydroxyindoleacetic acid (5-HIAA) is a gold standard non-invasive biochemical investigation with a sensitivity of 73% and specificity of 100%. Plasma -5HIAA level has a sensitivity of 89% and specificity of 97% [2,8]. Chromogranin A (CgA) is not an ideal biomarker for screening as its specificity is affected by various factors such as use of proton pump inhibitors, chronic atrophic gastritis, renal, hepatic, cardiac failure and several other non-neuroendocrine malignancies. Though, it is sensitive and specific for tumour progression and basal level of serum CgA can predict overall survival (OS) [9]. CECT-scan has sensitivity of 70-80% in detection of primary tumor. MRI is usually used in case of evaluation of neuroendocrine liver metastasis and when other images are giving equivocal imaging findings. Endoscopic ultrasound is an operator dependent test which has a sensitive of 79-100%. ⁶⁸Ga-DOTANOC and ¹⁸F FDG dual tracer uptake is of great advantage [5,10,11] [Figure 3].

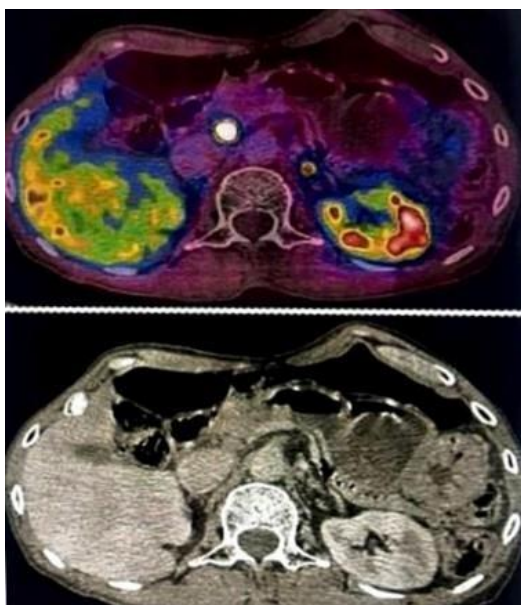


Figure 3 Somatostatin Receptor - Positron emission tomography computed tomography (SSTR PET-CT)

In the present case, chronic serotonin-mediated stimulation of intestinal motility may have contributed to increased peristaltic activity in the colon. Persistent hyperperistalsis and secretory diarrhea may generate abnormal contractile forces within the colon. In elderly patients with age-related alterations in intestinal neuromuscular coordination, these motility changes may predispose the sigmoid colon to torsion around its mesentery [4]. In an elderly patient with age-related changes in intestinal neuromuscular function, this hypermotility could potentially precipitate twisting of the sigmoid colon around its mesentery, resulting in volvulus. Although intestinal obstruction in carcinoid tumors is typically associated with desmoplastic reactions or tumor infiltration, the possibility of volvulus secondary to altered motility should also be considered in appropriate clinical settings [12,13] [Figure 4].

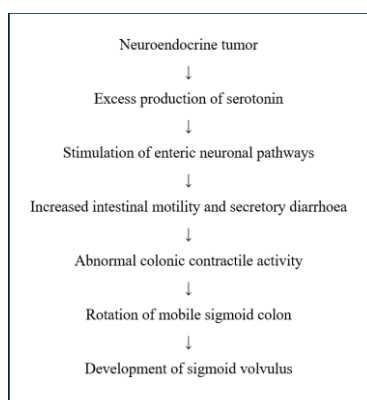


Figure 4 Proposed Pathophysiological Mechanism of Geriatric Bowel Conclusion

Sigmoid volvulus is an important cause of large bowel obstruction, particularly in elderly patients. However, its occurrence in association with carcinoid syndrome is rarely reported. Excess serotonin produced by neuroendocrine tumors may significantly influence intestinal motility and could theoretically predispose susceptible individuals to volvulus. This case highlights a potential relationship between carcinoid syndrome and sigmoid volvulus through serotonin-mediated alterations in gastrointestinal motility. Awareness of such atypical presentations may help clinicians recognize rare surgical complications in patients with neuroendocrine tumors. Further clinical reports and research are required to better understand the relationship between neuroendocrine tumors and intestinal motility disorders.

Ethical Consideration

Informed consent was obtained from the patient for academic publication. Patient confidentiality has been maintained.

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