



Colonic Ischemia after Laparoscopic Low Anterior Resection Due to Pneumoperitoneum: Case Report and Review of the Literature

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Abstract

Inflation of CO₂ during laparoscopic colorectal surgeries increases intra-abdominal pressure and pneumoperitoneum obviously effects intra-abdominal arteriovenous stream causing complications. Increased Intra Abdominal Pressure (IAP) causes decreased venous stream back and arteriol flow leading ischemic process on colon and anastomosis line. Ischemic segment could end with anastomosis leakage or colonic cast. We presented a case whom we performed laparoscopic low anterior resection due to rectum malignancy and improved colonic ischemia postoperatively due to pneumoperitoneum.

Introduction

Laparoscopic procedures commonly used for colorectal malignancies, because intraoperative manipulation and view is wider and easier than open procedures. Inflation of CO₂ increases intra-abdominal pressure and pneumoperitoneum obviously effects intra-abdominal arteriovenous stream causing complications after laparoscopic surgery. Increased Intra Abdominal Pressure (IAP) causes decreased venous stream back and arteriol flow leading ischemic process on colon and anastomosis line which could end with anastomosis leakage due to ischemic colonic segment.

Aim

To alert colorectal surgeons that after laparoscopic colorectal surgery colonic ischemia could occur due to pneumoperitoneum causing anastomotic leakage with a case and review of the literature.

Case Presentation

Male, 42 Year old patient was referred to our hospital with rectal bleeding complaint. Colonoscopy showed a mass at 10 cm of rectum. Laparoscopic LAR performed at reverse Trendelenburg position without diverting ileostomy. Operation time was 135 min and total blood loss was 200 ml. The mass excised totally with negative margins, Inferior Mesenteric Artery (IMA) ligated at origin of abdominal aorta and anastomosis performed by 34 mm circular stapler. Splenic flexura mobilized and there was not any tension or ischemic findings on anastomosis line. Postoperative first day patient had a fever 38.3°C, White Blood Cell (WBC): 17100, peritoneal signs with physical examination. After abdomen CT urgent laparotomy performed and explored 10 cm full-thickness colonic ischemic segment. Ischemic colon segment and anastomosis resected and end colostomy performed. The patient died at third postoperative day.

Bowel preparation, thromboprophylaxis with low-molecular weight heparin and clothing compression socks was performed preoperatively and the patient didn't have any hematologic diseases history. The procedure was performed with CO₂ inflation with 12 mmHg IAP.

Discussion

Laparoscopic assisted surgery for colorectal malignancies was first described in 1991 and has been widely used by colorectal surgeons [1]. Large series of studies showed the decrease of hospital stay time and morbidity after laparoscopic colon and rectum resections [2]. Smaller incisions, easier dissection and wider field of vision are the advantages of laparoscopy when compared with open colorectal surgeries. However technical instruments and experienced surgeons are the sine qua non part of laparoscopy [3]. Guillou et al. [4] reported that, conventional and laparoscopic

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colorectal surgeries had similar complication rates with a multicentre, randomized controlled trial and defined laparoscopic colorectal surgery as an effective procedure for colorectal cancers [4].

There are quite a few studies about cardiac, pulmonary and renal complications of IAP associated with frequent use of laparoscopic surgery; but there are a few studies about IAP's effects on visceral blood flow. Kotzampassi et al. [5] reported that severe hemodynamic changes in the blood flow to intra peritoneal viscera occur at IAP of 14 mmHg with an experimental study on dogs [5]. Kubato et al. [6] reported that in laparoscopic cholecystectomies with 10 mmHg IAP, there would not be significant blood flow change detected by Schwan-Ganz cateter [6].

Colonic ischemia is a rare but also deadly complication of laparoscopic colorectal surgeries. Colonic ischemia varies from colonic cast which contains mucosal necrosis to full thickness of colon necrosis bringing on anastomosis leakage. Here we presented a case of full thickness colon necrosis due to colonic ischemia after laparoscopic Low Anterior Resection (LAR).

Pneumoperitoneum with carbon dioxide increases intra peritoneal pressure causing systematic vascular system and local vascular flow by mechanical pressure in proportional with exposed time and mechanical pressure quantity. Several studies reported that pneumoperitoneum could cause Promocentric Venous Thrombosis (PVT) leading colonic ischemia [7]. Increased IAP decreases 35% to 84% mesenteric and portal venous flow which is dose and exposure time depended [8]. Our operation time, blood loss and IAP values were similar with the literature.

Carbon dioxide inflation has also biochemical effects on vascular venous system. CO₂ can mix in systematic circulation by transperitoneal diffusion bringing on hypercapnia causing decreased splanchnic blood flow leading mesenteric vasoconstriction ended with colonic ischemia which has direct proportion with ischemic process [9]. We use CO₂ inflation for our all laparoscopic procedures.

Laparoscopic colorectal surgeries generally performed in reverse Trendelenburg position which experimental studies showed prolonged position could cause portal venous stasis [9]. In our institution we performed laparoscopic colorectal surgeries in reverse Trendelenburg position.

Surgical manipulations to splanchnic whether laparoscopic or open surgery could cause splanchnic endothelium injury and portal venous system local thrombus development [10]. Congenital hematologic diseases such as; Antithrombin III deficiency, Protein S and C deficiency, Factor V Leiden mutation were reported under risk of Promocentric venous thrombosis [11]. The patient didn't have hematologic disease history.

Nonspecific symptoms like; abdominal pain, nausea, vomiting, bloody defecation or sub febrile fever could lead delayed diagnosis. When metabolic acidosis occurs, it will be too late for the patient for a typical finding. Diagnosis could be done by IV contrast abdominal CT with 90% sensitivity and invasive angiographic studies are the gold standard diagnosis methods [12]. The patient had non-specific abdominal pain, sub febrile fever and had metabolic acidosis. The specific findings were due to anatomic leakage. Case was diagnosed by IV contrast abdominal CT reporting anastomosis leakage.

Prophylaxis is the first step of thrombosis and ischemia. We began low-molecular weight heparin to the patient the day before surgery and clothed compression socks during surgery till the patient's mobilization. After thrombus formation; anticoagulant or thrombolytic therapy is recommended [7].

There are a few studies about pneumoperitoneum effects on mesenteric blood supply. Prospective randomized studies are needed to clarify the effects of IAP increase. We want to contribute the literature with our case.

Conclusion

In laparoscopic surgeries especially for colorectal surgeries; it is evident that increasing IAP by inflation of CO₂ leads to significant changes in intra-abdominal visceral blood flow by either mechanical or biochemical effects, so that laparoscopic colorectal surgeries should be done with minimal possible IAP for optimal vision and manipulation with shortest operation time.

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