Case Report

First Report of Two Cases of Acute Gastric Ischemia after Robot-Assisted Radical Cystectomy

Nikolaos Grivas,1 Alexander D. Horsch,2 Esther Wit,1 Annemarie Bruining,2 Johanna van Sandick,3 and Henk G. van der Poel1

1Department of Urology, The Netherlands Cancer Institute-Antoni van Leeuwenhoek Hospital, Amsterdam, Netherlands
2Department of Radiology, The Netherlands Cancer Institute-Antoni van Leeuwenhoek Hospital, Amsterdam, Netherlands
3Department of Surgery, The Netherlands Cancer Institute-Antoni van Leeuwenhoek Hospital, Amsterdam, Netherlands

Correspondence should be addressed to Nikolaos Grivas; nikolaosgrivas@hotmail.com

Received 3 December 2020; Revised 12 January 2021; Accepted 15 January 2021; Published 28 January 2021

Copyright © 2021 Nikolaos Grivas et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Gastrointestinal ischemia is rare after small pelvis surgery. Minimal invasive robotic surgery requires adaptation of the surgical approach for cystectomy and derivation construction such as the use of pneumoperitoneum and Trendelenburg positioning of the patient. Two cases with gastric ischemic complications after robot-assisted radical cystectomy are described. The first case was a 68-year-old female who had prolonged gastroparalysis and blood in a replaced gastric tube at day 10 after robotic cystectomy and Bricker urinary derivation. Gastroscopy revealed ischemia of gastric and proximal duodenal mucosa while computed tomography showed multiple calcifications and thrombi in the coeliac trunk branches and splenic infarcts. The stenosis of the origin of the mesenteric superior artery was stented via an endovascular procedure, and the patient recovered with normal gastroscopy 1 month postoperatively. The second case was a 73-year-old male who developed abdominal pain and fever 5 days after robotic cystectomy and Bricker. On abdominal computed tomography imaging, subcutaneous emphysema, intra-abdominal air, and calcification at the origin of the coeliac trunk were found. At laparotomy 5 days after the cystectomy, a 3 cm hole in the fundus of the stomach was found which was removed with the major stomach curvature. Gastroscopy 5 days after hemigastrectomy revealed no remnant ischemia. The prolonged pneumoperitoneum during robotic cystectomy, the deep Trendelenburg position, and the preoperatively impaired vascular system can be the reasons of our first two cases of gastric ischemia. This rare complication should be kept in mind in patients with symptoms of gastric ischemia since it can result in gastric perforation.

1. Introduction

Radical cystectomy is the gold standard for the treatment of muscle-invasive bladder cancer and high-risk nonmuscle invasive disease. Despite the widespread application and the increasing surgical experience with robot-assisted radical cystectomy (RARC), Clavien–Dindo ≥ 2 complications have been reported in 35-40% of the patients treated with RARC [1]. Ischemic complications can occur due to the increased intra-abdominal pressure associated with pneumoperitoneum applied during laparoscopic and robotic procedures, which can impair the splanchnic perfusion. Pneumoperitoneum itself and ischemia-reperfusion, after deflation of pneumoperitoneum, have been also found to decrease gastric pH and increase oxidative stress in patients undergoing robot-assisted radical prostatectomy with a prolonged duration of 4 hours [2]. Here, we present 2 cases with stomach ischemia after RARC both resulting in serious complications.

2. Case Presentation

2.1. Case 1. A 68-year-old female with a prior history of multiple sclerosis, peripheral vascular atherosclerosis with an arterial stent in the left external iliac artery developed a multifocal nonmuscle invasive high-grade bladder cancer. Due to
a low compliance bladder, multifocal disease, and suspected/-
potential muscle-invasive disease, it was decided to perform
an anterior exenteration with the removal of bladder, ure-
 thro, uterus, and adnexes using a robot-assisted surgical
approach. The procedure took 4 hours and included the
construction of an intracorporeal Bricker urinary derivation.
During the procedure, no bowel perfusion abnormalities
were noted by the surgeons, but a remarkable short small-
bowel mesentery was reported. Postoperative recovery was
characterized by prolonged gastroparalysis and blood in a
replaced gastric tube at day 10 postoperatively. Gastroscopy
revealed ischemia of gastric and proximal duodenal mucosa
(Figure 1). The Bricker stoma remained well perfused.
Angio-computed tomography (CT) scan showed multiple
calcifications and thrombi in the coeliac trunk branches
and splenic infarcts (Figure 2). Stenosis of the origin of the
mesenteric superior artery was stented (5 × 19 mm stent)
via an endovascular procedure. One month after stent place-
ment, there was a subsequent recovery with the improvement
of clinical and gastroscopy findings. In the cystectomy spec-
imen, a pTcisN0MxG3R0 urothelial carcinoma was found
and the patient is recurrence-free three years after surgery.

2.2. Case 2. A 73-year-old male was seen with BCG-resistant
carcinoma in situ of the bladder. The patient was known with
hypercholesterolaemia, hypertension, and pulmonary embo-
 lism but no significant vascular disease. Five years after the
primary diagnoses, RARC and pelvic node dissection with
urine derivation according to Bricker was performed. Five
days postoperatively, the patient developed abdominal pain,
fever, and elevated serum CRP. On abdominal CT imaging,
subcutaneous emphysema and intra-abdominal air were vis-
ible with perigastric and subphrenic fluid and renal ischemia
on the left side, as well as calcification at the origin of the coe-
liac trunk (Figures 3 and 3(b)). At laparotomy 5 days after the
RARC, a 3 cm hole in the fundus of the stomach was found
with apparent ischemia of the major curvature of the stom-
ach. The major curvature containing the hole in the stomach
was removed using a surgical stapler, and the abdominal cav-
ity was rinsed. Gastroscopy 5 days after hemigastrectomy
revealed no remnant ischemia. The patient suffered pneumo-
nia resulting in prolonged intensive care and showed a
delayed recovery. The pathology of the cystectomy specimen
revealed a pT1N0MxR3 urothelial carcinoma and a
pT2N0MxR0G3 prostate carcinoma. The gastrectomy
specimen showed a perforation due to ischemia. The patient
was discharged from the hospital 2 months after cystectomy
but suddenly died in a nursing home 3 months after surgery.
The autopsy revealed aorta sclerosis at the coeliac truncus but
no signs of acute stomach ischemia.

3. Discussion
To the best of our knowledge, these are the first reported
cases of gastric ischemia following RARC. In patients treated
with robot-assisted radical prostatectomy, Luo et al. have
shown that gastric pH is decreased by prolonged (4 hours)
pneumoperitoneum [2]. It has been also found that low pH
levels persist after termination of the pneumoperitoneum
indicating that impaired splanchnic circulation continues
even after deflation [2]. Moreover, the concentrations of mal-
donialdehyde, which are the most reliable and producible
markers of oxidative stress, were significantly elevated [2].
Ischemia-reperfusion can result in impaired myocardial and
cerebral function, breakdown of the gastrointestinal barrier,
and systemic and inflammatory response syndrome. Experi-
mental models have also shown the clinical relevance of
pneumoperitoneum-induced oxidative stress, with splanch-
nic ischemia while intestinal ischemia has been described
after laparoscopic procedures [3, 4]. Since the severity of
pneumoperitoneum-induced oxidative stress is time-depen-
dent, splanchnic perfusion can be seriously impaired in a
long operation as RARC (>4 h).

Patient-related risk factors can also impair splanchnic
perfusion. Specific risk factors include advanced age, diabe-
tes, hepatic and renal impairment, atherosclerosis, low car-
diac output, cardiac arrhythmias, and medications (such as
diuretics and beta-blockers) which can reduce intestinal per-
fusion [4]. In our study, both patients had cardiovascular dis-
ease symptoms and CT scans showed signs of vascular
atherosclerosis, which could have predisposed to gastric
ischemia. Calcified atherosclerotic plaques at the level of the coeliac trunk level in the aorta were present in both patients prior to surgery.

Prolonged Trendelenburg position can be also associated with gastric ischemia since it has been reported to be the cause also of acute intestinal distress syndrome [5]. This syndrome can especially occur in patients with preexisting cardiac and respiratory diseases who are in a prolonged, high-pressure Trendelenburg position [5]. This situation can result in high central venous and pulmonary arterial pressures while the cardiac output is decreased. The combination of Trendelenburg position with high CO2 pneumoperitoneum and a long surgical procedure can impair cardiac and vascular function, which could result in decreased gastric perfusion.

Measures to prevent this rare complication can be an increased intraoperative hydration, application of the lowest insufflation pressure possible, intermittent abdomen decompression, and use of novel smoke evacuation systems which combine stable intrabdominal pressure with constant suction via a mechanism of valve and insufflation. It has been associated with reduced need of CO2 insufflation, absorption, and elimination. Immediate gastroscopy in patients with symptoms of gastric ischemia (abdominal pain, nausea, vomiting, gastrointestinal bleeding) will allow an early diagnosis and improved survival. Treatment should include vascular support, antibiotic therapy, and vigorous use of proton-pump inhibitors. Patients with signs of ischemic stomach perforation require abdominal exploration, endovascular reconstruction, and/or partial gastrectomy.

4. Conclusion

The prolonged pneumoperitoneum during RARC, the deep Trendelenburg position, and the preoperatively impaired vascular system can be the reasons of our first two cases of gastric ischemia. This rare complication should be kept in mind in patients with symptoms of gastric ischemia since it can result in gastric perforation.
Abbreviations

RARC: Robot-assisted radical cystectomy
CT: Computed tomography.

Data Availability

No data were used to support this study.

Consent

Written informed consent was obtained from the patients for publication of this case report and accompanying images.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Authors’ Contributions

All authors have read and approved the final version of the manuscript.

References

[1] E. Mazzone, F. D’Hondt, S. Beato et al., “Robot-assisted radical cystectomy with intracorporeal urinary diversion decreases postoperative complications only in highly comorbid patients: findings that rely on a standardized methodology recommended by the European Association of Urology Guidelines,” World Journal of Urology, 2020.

[2] C. F. Luo, Y. F. Tsai, C. H. Chang, C. T. Wu, and H. P. Yu, “Increased oxidative stress and gut ischemia caused by prolonged pneumoperitoneum in patients undergoing robot-assisted laparoscopic radical prostatectomy,” Acta Anaesthesiologica Taiwanica, vol. 49, no. 2, pp. 46–49, 2011.

[3] W. Khoury, L. Schreiber, A. Szold, J. M. Klausner, and A. A. Wienbroum, “Renal oxidative stress following CO2 pneumoperitoneum-like conditions,” Surgical Endoscopy, vol. 23, no. 4, pp. 776–782, 2009.

[4] H. M. Hasson, C. Galanopoulos, and A. Langerman, “Ischemic necrosis of small bowel following laparoscopic surgery,” Journal of the Society of Laparoendoscopic Surgeons, vol. 8, no. 2, pp. 159–163, 2004.

[5] W. Al-Khyatt, J. D. Thomas, D. J. Humes, and D. N. Lobo, “Intestinal ischemia following laparoscopic surgery: a case series,” Journal of Medical Case Reports, vol. 7, no. 1, 2013.