



The University of  
**Nottingham**

UNITED KINGDOM • CHINA • MALAYSIA

Al-Khyatt, Waleed and Thomas, James D. and Humes, David J. and Lobo, Dileep N. (2013) Intestinal ischemia following laparoscopic surgery: a case series. *Journal of Medical Case Reports*, 7 (25). 25/1-25/4. ISSN 1752-1947

**Access from the University of Nottingham repository:**

[http://eprints.nottingham.ac.uk/2945/1/Al-Khyatt\\_Intestinal.pdf](http://eprints.nottingham.ac.uk/2945/1/Al-Khyatt_Intestinal.pdf)

**Copyright and reuse:**

The Nottingham ePrints service makes this work by researchers of the University of Nottingham available open access under the following conditions.

This article is made available under the Creative Commons Attribution licence and may be reused according to the conditions of the licence. For more details see:  
<http://creativecommons.org/licenses/by/2.5/>

**A note on versions:**

The version presented here may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the repository url above for details on accessing the published version and note that access may require a subscription.

For more information, please contact [eprints@nottingham.ac.uk](mailto:eprints@nottingham.ac.uk)

CASE REPORT

Open Access

# Intestinal ischemia following laparoscopic surgery: a case series

Waleed Al-Khyatt<sup>1\*</sup>, James D Thomas<sup>2</sup>, David J Humes<sup>3</sup> and Dileep N Lobo<sup>3</sup>

## Abstract

**Introduction:** Intestinal ischemia is a rare complication of laparoscopic surgery. Its prognosis depends on a high index of suspicion and effective early treatment.

**Case presentation:** In the present report, we describe three cases where intestinal ischemia developed following laparoscopic surgery. Case 1 concerns a 52-year-old Caucasian man who developed large bowel ischemia following laparoscopic adjustable gastric band surgery. Case 2 concerns an 82-year-old Caucasian woman who developed fatal intestinal ischemia following laparoscopic cholecystectomy. Case 3 concerns a 58-year old Caucasian woman who developed right-sided lower intestinal ischemia following open cholecystectomy.

**Conclusions:** Intestinal ischemia is a rare complication of laparoscopic surgery. The identification of high-risk patients is an essential primary preventive measure. A high index of suspicion is required to make an early diagnosis, which may help improve outcomes.

## Introduction

Intestinal ischemia is a rare complication of laparoscopic surgery. Its prognosis depends on a high index of suspicion and effective early treatment. However, the early signs and symptoms are entirely non-specific or even absent. Mesenteric ischemia has previously been reported after various laparoscopic procedures [1-14]. In this report, we describe two cases of large bowel ischemia following elective laparoscopic gastric banding (LAGB) and an elective laparoscopic cholecystectomy (LC), and a case of fatal small bowel ischemia following elective LC.

## Case presentation

### Case 1

A 52-year-old Caucasian man underwent LAGB for morbid obesity (body mass index (BMI) 49.7kg/m<sup>2</sup>). He had a medical history of diabetes mellitus, hypertension and obstructive sleep apnea. The procedure was performed according to the standard technique with maintenance of the intra-abdominal pressure at 15mmHg with a pneumoperitoneum time of 70 minutes. A calf

muscle pump was applied during the procedure and our patient received low molecular weight heparin (LMWH) post-operatively. He had an uneventful post-operative recovery and he was discharged home within 24 hours. On the seventh post-operative day, he was readmitted with a two-day history of increasing abdominal pain and distension with multi-organ failure. He had leukocytosis ( $13 \times 10^9$  cells/L) and a raised lactate level of 5.5mmol/dL. An abdominal computed tomography (CT) scan showed intra-mural gas in the cecum and ascending colon, in keeping with ischemic bowel. On laparotomy, an ischemic right colon was identified with normal superior mesenteric artery (SMA) pulsation; therefore a right hemicolectomy was performed with an end ileostomy and removal of the gastric band. Post-operatively our patient required intensive care unit support for three weeks and renal replacement therapy. Post-operative histological examination demonstrated ischemic changes with no identifiable cause. He was discharged five weeks later.

### Case 2

An 82-year-old Caucasian woman underwent LC for symptomatic gallstones. Her medical history included hypertension and a previous transient ischemic attack on aspirin. LC was performed according to the standard technique with maintenance of intra-abdominal pressure

\* Correspondence: mzxwa@nottingham.ac.uk

<sup>1</sup>Division of Surgery, School of Graduate Entry Medicine and Health, University of Nottingham, Royal Derby Hospital, Uttoxetter Road, Derby DE22 3DT, UK

Full list of author information is available at the end of the article

at 12mmHg with a pneumoperitoneum time of 45 minutes. A calf muscle pump was applied during the procedure and our patient received LMWH post-operatively. Our patient was discharged on the first post-operative day. On the fifth post-operative day, she was readmitted with a history of severe generalized pain associated with vomiting and diarrhea. She had generalized abdominal distension and tenderness. Blood test results showed a raised C-reactive protein level of 300mg/L, and a raised lactate level of 6mmol/dL. An abdominal CT scan showed markedly dilated small and large bowel loops with a heavily calcified aorta and SMA. No intravenous contrast could be seen within the SMA (arrow, Figure 1) suggesting total or subtotal occlusion. On laparotomy, there was extensive ischemia of the stomach, small bowel and right colon. The mesenteric pulsation was undetectable. The operative findings were beyond surgical correction and she died six hours later.

### Case 3

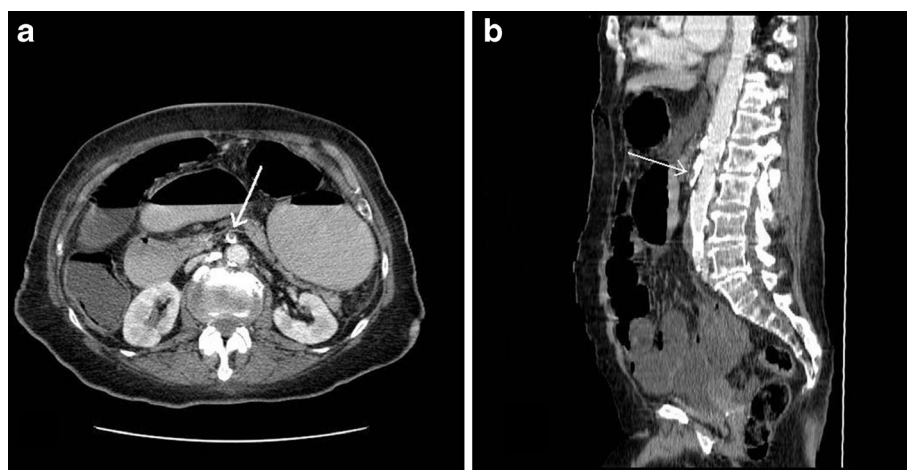
A 58-year-old Caucasian woman with hypertension, diabetes and symptomatic gallstones was admitted for an elective LC. The procedure was performed according to the standard technique with maintenance of the intra-abdominal pressure at 12mmHg with a pneumoperitoneum time of 50 minutes prior to conversion to open cholecystectomy due to dense adhesions around the gallbladder. A calf muscle pump was applied during the procedure and our patient received LMWH post-operatively. On the third post-operative day she became quite unwell, and was hypotensive with a peritonitic abdomen and a raised lactate of 6mmol/dL. She was resuscitated and taken to theatre for a laparotomy, where an ischemic right-sided colon and distal terminal ileum was

found. An extended right hemicolectomy was performed with an end ileostomy. She made a slow but uneventful recovery following her second procedure.

### Discussion

Acute intestinal ischemia is a rare complication following laparoscopic surgery. It has been described after LC (n=9) [1-3,5-9,13], inguinal hernia repair (n=1) [10], gynecological adhesiolysis and myolysis (n=1) [11], Nissen fundoplication (n=2) [4,12], and laparoscopic repair of incisional hernia (n=1) [14].

Normal intra-abdominal pressure (IAP) is 5 to 7mmHg and at an IAP of 12mmHg, renal functional impairment develops [15]. The profound effects of intra-abdominal hypertension (IAH) on intestinal circulation have been demonstrated in experimental studies [16,17]. The intra-abdominal perfusion pressure is the result of mean arterial blood pressure minus IAP [18]. Hence, a raised IAP due to pneumoperitoneum can predispose to splanchnic ischemia during laparoscopic surgery [19,20]. This initial 'first hit' causes diminished perfusion, mucosal acidosis and leads to the development of what is called acute intestinal distress syndrome [21,22]. In addition to this, IAH reduces cardiac output directly by compressing splanchnic venous return [23]. Moreover, the carbon dioxide (CO<sub>2</sub>) is absorbed into the circulation, resulting in hypercapnia, respiratory acidosis, and increasing the systemic vascular resistance secondary to the hemodynamic stress response (anti-diuretic hormone, renin activity, and catecholamines) [21,24-26]. Acute intestinal distress syndrome may be further triggered by either significant vascular narrowing or arterial thrombosis as in our second case [27]. Although these physiological changes create a theoretical risk of compromised intestinal blood flow, it is well tolerated by healthy adults



**Figure 1** (a) Axial and (b) parasagittal images from a computed tomography scan of the abdomen demonstrating a heavily calcified aorta and superior mesenteric artery. No intravenous contrast can be seen within the superior mesenteric artery (arrow), suggesting total or subtotal occlusion.

with adequate cardiopulmonary reserve, with no clinical consequences.

Risk factors such as atherosclerosis and hepatic or renal impairment can predispose to ischemia [11]. Nearly 17 percent of patients undergoing LC have an American Society of Anesthesiologists (ASA) status of III or IV [28]. In the present report, our second patient had significant cardiovascular disease and CT scans showed extensive atherosclerosis of the SMA, which could have predisposed to this complication (Figure 1). However, an alternative explanation is that symptomatic episodes of mesenteric angina have been misinterpreted clinically as symptomatic gallstones [9]. However, our first and third patients had normal SMA pulsations on laparotomy and no causes of ischemia were found on post-operative histopathology in either case. Although acute intestinal ischemia is regarded as a rare complication of laparoscopic surgery, it is associated with 71 percent (12 out of 17 cases) mortality in reported cases, including this case series [1-14].

Diagnosis of acute intestinal ischemia requires a high index of suspicion. Patients commonly present with early non-specific symptoms of abdominal pain, nausea, vomiting with either diarrhea or delayed bowel action [29]. Prevention is best achieved by a thorough pre-operative assessment and early involvement of experienced surgeons in the selection of any anticipated difficult laparoscopic cases [28]. Gasless laparoscopy using abdominal wall lifting devices has been considered in an attempt to avoid the adverse effects of CO<sub>2</sub> pneumoperitoneum that may occur in standard laparoscopy. This technique may be an alternative option in high-risk patients with cardiorespiratory diseases [30].

## Conclusions

Intestinal ischemia is a rare complication of laparoscopic surgery. It tends to occur mainly in high-risk patients with significant cardiopulmonary diseases or atherosclerosis. Proper pre-operative assessment to identify those patients at risk may help to prevent the development of this serious complication. A high index of suspicion is required to make an early diagnosis, which may help improve outcomes.

## Consent

Written informed consent was obtained from the patients (cases 1 and 3) or the patient's next-of-kin (case 2) for publication of this manuscript and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

## Competing interests

The authors declare that they have no competing interests.

## Authors' contributions

WAK, DJH, and JDT prepared the manuscript. DNL outlined the manuscript's layout and supervised the work. All authors read and approved the final manuscript.

## Author details

<sup>1</sup>Division of Surgery, School of Graduate Entry Medicine and Health, University of Nottingham, Royal Derby Hospital, Uttoxetter Road, Derby DE22 3DT, UK. <sup>2</sup>Department of Radiology, Nottingham University Hospitals, Queen's Medical Centre, Nottingham, UK. <sup>3</sup>Division of Gastrointestinal Surgery, Nottingham Digestive Diseases Centre NIHR Biomedical Research Unit, Nottingham University Hospitals, Queen's Medical Centre, Nottingham, UK.

Received: 24 June 2012 Accepted: 19 December 2012

Published: 21 January 2013

## References

1. Paul A, Troidl H, Peters S, Stuttmann R: **Fatal intestinal ischaemia following laparoscopic cholecystectomy.** *Br J Surg* 1994, **81**:1207.
2. Jaffe V, Russell RC: **Fatal intestinal ischaemia following laparoscopic cholecystectomy.** *Br J Surg* 1994, **81**:1827-1828.
3. Thiele H, Lang RD: **Complications after 1,000 laparoscopic cholecystectomies.** *Chirurg* 1994, **65**:795-800.
4. Mitchell PC, Jamieson GG: **Coeliac axis and mesenteric arterial thrombosis following laparoscopic Nissen fundoplication.** *Aust N Z J Surg* 1994, **64**:728-730.
5. Dwerryhouse SJ, Melsom DS, Burton PA, Thompson MH: **Acute intestinal ischaemia after laparoscopic cholecystectomy.** *Br J Surg* 1995, **82**:1413.
6. Schorr RT: **Laparoscopic upper abdominal operations and mesenteric infarction.** *J Laparoendosc Surg* 1995, **5**:389-392.
7. Klugewitz K, Reherrmann B, Seifert U, Böker KH, Stolte M, Meier PN, Wagner S, Manns MP: **A rare case of bloody diarrhea: thrombosis of the V. mesenterica inferior following laparoscopic cholecystectomy.** *Z Gastroenterol* 1998, **36**:35-39.
8. Sternberg A, Alfici R, Bronek S, Kimmel B: **Laparoscopic surgery and splanchnic vessel thrombosis.** *J Laparoendosc Adv Surg Tech A* 1998, **8**:65-68.
9. Andrei VE, Schein M, Wise L: **Small bowel ischemia following laparoscopic cholecystectomy.** *Dig Surg* 1999, **16**:522-524.
10. Bandyopadhyay D, Kapadia CR: **Large bowel ischemia following laparoscopic inguinal hernioplasty.** *Surg Endosc* 2003, **17**:520-521.
11. Hasson HM, Galanopoulos C, Langerman A: **Ischemic necrosis of small bowel following laparoscopic surgery.** *JLS* 2004, **8**:159-163.
12. García Díaz RA, Rodríguez-Sanjuán JC, Domínguez Díez RA, García-Barón Pórtoles A, Trageda Carrera MS, de la Torre CF, Gómez-Fleitas M: **Fatal portal thrombosis after laparoscopic Nissen fundoplication [in Spanish].** *Rev Esp Enferm Dig* 2005, **97**:666-669.
13. Leduc LJ, Mitchell A: **Intestinal ischemia after laparoscopic cholecystectomy.** *JLS* 2006, **10**:236-238.
14. Wassenaar EB, Raymakers JT, Rakic S: **Fatal intestinal ischemia after laparoscopic correction of incisional hernia.** *JLS* 2007, **11**:389-393.
15. Cheatham ML, De Waele J, Kirkpatrick A, Sugrue M, Malbrain ML, Ivatury RR, Balogh Z, D'Amours S: **Criteria for a diagnosis of abdominal compartment syndrome.** *Can J Surg* 2009, **52**:315-316.
16. Diebel LN, Wilson RF, Dulchavsky SA, Saxe J: **Effect of increased intra-abdominal pressure on hepatic arterial, portal venous, and hepatic microcirculatory blood flow.** *J Trauma* 1992, **33**:279-282.
17. Diebel LN, Dulchavsky SA, Wilson RF: **Effect of increased intra-abdominal pressure on mesenteric arterial and intestinal mucosal blood flow.** *J Trauma* 1992, **33**:45-48.
18. Malbrain M: **Abdominal compartment syndrome.** *F1000 Med Rep* 2009, **1**:86.
19. Sammour T, Mittal A, Loveday BP, Kahokehr A, Phillips AR, Windsor JA, Hill AG: **Systematic review of oxidative stress associated with pneumoperitoneum.** *Br J Surg* 2009, **96**:836-850.
20. Windberger UB, Auer R, Keplinger F, Längle F, Heinze G, Schindl M, Losert UM: **The role of intra-abdominal pressure on splanchnic and pulmonary hemodynamic and metabolic changes during carbon dioxide pneumoperitoneum.** *Gastrointest Endosc* 1999, **49**:84-91.
21. Malbrain ML, Vidts W, Ravys M, De Laet I, De Waele J: **Acute intestinal distress syndrome: the importance of intra-abdominal pressure.** *Minerva Anestesiol* 2008, **74**:657-673.
22. Malbrain ML, De laet I: **It's all in the gut: introducing the concept of acute bowel injury and acute intestinal distress syndrome.** *Crit Care Med* 2009, **37**:365-366.

23. Ho HS, Gunther RA, Wolfe BM: **Intraperitoneal carbon dioxide insufflation and cardiopulmonary functions. Laparoscopic cholecystectomy in pigs.** *Arch Surg* 1992, **127**:928–932.
24. Nunes QM, Gemmill EH, Eastwood JR, Lobo DN: **Carbon dioxide narcosis and grand mal seizure complicating laparoscopic herniorrhaphy.** *Surg Laparosc Endosc Percutan Tech* 2007, **17**:52–53.
25. Joris JL, Noirod DP, Legrand MJ, Jacquet NJ, Lamy ML: **Hemodynamic changes during laparoscopic cholecystectomy.** *Anesth Analg* 1993, **76**:1067–1071.
26. O'Leary E, Hubbard K, Tormey W, Cunningham AJ: **Laparoscopic cholecystectomy: haemodynamic and neuroendocrine responses after pneumoperitoneum and changes in position.** *Br J Anaesth* 1996, **76**:640–644.
27. Neri E, Sassi C, Massetti M, Roviello F, Giomarelli P, Bizzarri F, Scolletta S, Setacci C: **Nonocclusive intestinal ischemia in patients with acute aortic dissection.** *J Vasc Surg* 2002, **36**:738–745.
28. Giger UF, Michel JM, Opitz I, Th Inderbitzin D, Kocher T, Krähenbühl L, Swiss Association of Laparoscopic and Thoracoscopic Surgery (SALTS) Study Group: **Risk factors for perioperative complications in patients undergoing laparoscopic cholecystectomy: analysis of 22,953 consecutive cases from the Swiss Association of Laparoscopic and Thoracoscopic Surgery database.** *J Am Coll Surg* 2006, **203**:723–728.
29. Wyers MC: **Acute mesenteric ischemia: diagnostic approach and surgical treatment.** *Semin Vasc Surg* 2010, **23**:9–20.
30. Uen YH, Liang AI, Lee HH: **Randomized comparison of conventional carbon dioxide insufflation and abdominal wall lifting for laparoscopic cholecystectomy.** *J Laparoendosc Adv Surg Tech A* 2002, **12**:7–14.

doi:10.1186/1752-1947-7-25

**Cite this article as:** Al-Khyatt *et al.*: Intestinal ischemia following laparoscopic surgery: a case series. *Journal of Medical Case Reports* 2013 **7**:25.

**Submit your next manuscript to BioMed Central and take full advantage of:**

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at  
[www.biomedcentral.com/submit](http://www.biomedcentral.com/submit)

