



Short report

Medico-legal considerations in a case of splenic injury that occurred during colonoscopy

Chiara Zandonà MD, Forensic Physician, Stefania Turrina PhD, Forensic Scientist*, Nicole Pasin MD, Forensic Physician, Domenico De Leo MD, Professor, Director

Department of Public Health and Community Medicine, Institute of Legal Medicine, University of Verona, Policlinico G.B. Rossi, P.le L.A. Scuro 10, 37134 Verona, Italy

ARTICLE INFO

Article history:

Received 28 April 2011

Received in revised form

8 November 2011

Accepted 27 December 2011

Available online 13 January 2012

Keywords:

Colonoscopy

Splenic injury

Complication

Medical professional liability

ABSTRACT

Colonoscopy has become the gold standard diagnostic and therapeutic treatment for rectum and colon diseases. The splenic injury is a rare complication of colonoscopy and relatively few cases (less than 70) have been reported in the literature so far. Here we present a case of splenic rupture identified in an 80 year-old man few hours after an apparently uneventful colonoscopy. Acknowledging a causal relationship between the lesion and the diagnostic procedures, we discuss the possible medico-legal implications with regard to professional liability considering the exceptional nature of such an event and the stance recently taken by the Italian law.

© 2012 Elsevier Ltd and Faculty of Forensic and Legal Medicine. All rights reserved.

1. Introduction

Colonoscopy is a relatively straightforward procedure introduced in the 1960s, that has gradually gained an important role both as a diagnostic and therapeutic procedure, and in the follow-up of colorectal diseases. It is currently considered a routine practice and is generally well tolerated by patients.¹ It is an invasive test, nonetheless, even used for purely diagnostic purposes, and it is not without complications, the most common being perforation of the intestinal wall (0.34–2.14%) and bleeding (1.8–2.5%), while the less common include visceral lesions such as pneumothorax, pneumoperitoneum, acute appendicitis and retroperitoneal abscess.^{2,3}

Another, exceptionally rare but potentially lethal complication of the procedure is represented by splenic lesions, particularly when these occur in the absence of intestinal wall lesions. This complication was first described in 1974 by Werry and Zhener and only a few dozen such cases have been reported in the international literature so far (with 68 cases known to date, see Table 1).

In this report, we describe a case of splenic injury following colonoscopy and discuss the possible professional liability considering the stance recently taken by the Italian law.

2. Case report

The case concerns an 80-year-old male with a past medical history of hypertension, aortic valve replacement, surgery for abdominal aorta aneurysm, and resection of a colorectal neoplasm. Moreover, he had been treated with anticoagulants and antihypertensive drugs for many years. On July 2008, he underwent a colonoscopy follow-up for his colorectal neoplastic disease during which biopsies were performed. The colonoscopy was completed without encountering any intraoperative difficulties and the patient felt well with no complications upon routine discharge.

Few hours post-procedure, the patient developed the onset of widespread abdominal pain, profuse perspiration and syncopal episodes. He was taken to emergency room, he denied abnormality in his bowel movements and his observations were all within normal limits. His heart rate was 85 beats/min, his blood pressure was 110/65 mmHg and his hemoglobin was 12.3 mg/dl. Therefore, based on the patient's medical history a diagnosis of "cardiac insufficiency and acute renal insufficiency" was established and he was hospitalized in the department of geriatrics.

Because of his progressive worsening over the next two days, laboratory tests demonstrated anemia (hemoglobin level was dropped to 6.7 mg/dl), an abdominal computed tomographic (CT) scan was performed. It revealed: "... a conspicuous area of hemoperitoneum and an enlarged spleen with a morphology disrupted by the presence of hypodense infra-parenchymal conglomerates of

* Corresponding author. Tel.: +39 (0) 45 8124942; fax: +39 (0) 45 8027479.

E-mail address: stefania.turrina@univr.it (S. Turrina).

Table 1
Splenic rupture following colonoscopy: summary of cases found in literature.

| Year | Age | Sex | Procedure | Symptom onset | Time to diagnosis | Treatment | Outcome | Author ^a |
|------|-----|-----|------------------|---------------|-------------------|---------------|---------|---------------------------------|
| 1974 | | | data unavailable | | | | | Wherry et al ⁴ |
| 1977 | 53 | F | Colonos | <24 h | 3 days | Splenec | Uncompl | Telmos et al ⁸ |
| 1979 | 33 | F | Colonos | 4 h | 3 days | Splenec | Uncompl | Ellis et al ⁹ |
| 1986 | 71 | F | Colonos | 24 h | 1.5 days | Splenec | Uncompl | Castelli ⁶ |
| | 76 | M | Colonos | 14 h | <1 day | Splenec | Died | Reynolds et al ¹⁰ |
| 1987 | 70 | F | Polypec | – | <1 day | Splenec | Uncompl | Doctor et al ¹¹ |
| | 62 | F | Polypec | 6 h | 1 day | Splenec | Uncompl | Levine et al ¹² |
| | 45 | F | Colonos | <24 h | <1 day | Splenec | Uncompl | Tuso et al ¹³ |
| 1989 | 60 | F | Polypec | 6 h | <1 day | Splenec | Uncompl | Gores et al ¹⁴ |
| | 62 | F | Colonos | 5 h | 10 day | Conserv | Uncompl | Taylor et al ¹⁵ |
| 1990 | 66 | M | Colonos | 2.5 days | 5 day | Splenec | Uncompl | Merchant et al ¹⁶ |
| | 74 | M | Polypec | <1 day | 8 day | Conserv | Uncompl | Rockey et al ¹⁷ |
| | 90 | F | Colonos | 6 h | 1.5 days | Conserv | Uncompl | |
| 1991 | 82 | M | Polypec | 8 h | – | – | Died | Colarian et al ¹⁸ |
| | 59 | F | Polypec | <24 h | 6 days | Splenec | Uncompl | Ong et al ¹⁹ |
| 1992 | 68 | M | Colonos | – | – | Conserv | Uncompl | Adamek et al ²⁰ |
| 1994 | 66 | M | Polypec | 36 h | 6 days | Conserv | Uncompl | Heath et al ²¹ |
| 1997 | 57 | F | Polypec | 10 h | 1.5 days | Splenec | Uncompl | Espinal et al ²² |
| | 60 | F | Colonos | 8 h | <1 days | Splenec | Uncompl | |
| | 72 | F | Polypec | 2 days | 3 days | Splenec | Uncompl | Ahmed et al ²³ |
| | 70 | F | Colonos | 6 h | 6 h | Splenec | Uncompl | Bergamaschi et al ²⁴ |
| 1998 | 52 | F | Colonos | 2 h | – | Conserv | Uncompl | Reisman et al ²⁵ |
| 1999 | 70 | M | Polypec | 48 h | – | Splenec | Uncompl | Olshaker et al ⁵ |
| | 67 | F | Colonos | 4 h | – | Splenec | Uncompl | Tse et al ²⁶ |
| 2002 | 63 | M | colonos | 48 h | – | Conserv | Uncompl | Stein et al ²⁷ |
| 2003 | 75 | F | Colonos | 4 days | – | Conserv | Uncompl | Hamzi et al ²⁸ |
| 2004 | 39 | F | Colonos | 1 h | 2 h | Splenec | Uncompl | Goitein et al ²⁹ |
| | 65 | F | Polypec | 4 days | – | Conserv | Uncompl | Lekas ³⁰ |
| | 73 | F | Polypec | 12 h | – | Splenec | Uncompl | Al Alawi et al ³¹ |
| | 73 | F | Colonos | 3 h | – | Conserv | Uncompl | Boghossian et al ³² |
| | 57 | F | Polypec | 24 h | – | Splenec | Uncompl | Jaboury ³³ |
| | 80 | M | Polypec | <24 h | – | Splenec | Uncompl | |
| | 52 | F | Colonos | 24 h | – | Splenec | Uncompl | |
| | 29 | F | Colonos | <12 h | – | Conserv | Uncompl | |
| 2005 | 75 | F | Colonos | – | – | Splenec | Uncompl | Weisgerber et al ³⁴ |
| | 56 | F | Colonos | 12 h | – | Splenec | Uncompl | Shah et al ³⁵ |
| | 47 | F | Colonos | 24 h | <24 h | Splenec | Uncompl | Janes et al ⁷ |
| | 66 | M | Colonos | 6 h | – | Splenec | Uncompl | Naini et al ³⁶ |
| | 85 | F | Colonos | <24 h | 5 days | Conserv | Uncompl | Prowda et al ³⁷ |
| | 48 | F | Colonos | <24 h | 7 days | Conserv | Uncompl | |
| 2006 | 64 | M | Colonos | <12 h | – | Splenec | Uncompl | Zenooz et al ³⁸ |
| | 76 | F | Colonos | <1hr | 1 days | Splenec | Uncompl | Volchok et al ³⁹ |
| | 75 | F | Colonos | 4 days | 12 h | Splenec | Uncompl | Johnson et al ⁴⁰ |
| | 35 | F | Colonos | 1 days | <1 days | Conserv | Uncompl | |
| 2007 | 59 | F | Colonos | 5 h | – | Conserv | Uncompl | Tsoraides et al ⁴¹ |
| | 62 | M | Colonos | 24 h | 3 h | Splenec | Uncompl | Dugué et al ⁴² |
| | 81 | F | Colonos | 9 h | – | Splenec | Uncompl | Holubar et al ⁴³ |
| | 77 | F | Colonos | 5 days | – | Conserv | Uncompl | |
| | 62 | F | Colonos | <12 h | – | Splenec | Uncompl | Pfefferkorn et al ⁴⁴ |
| | 82 | F | Colonos | – | – | Splenec | Uncompl | Lalor et al ⁴⁵ |
| 2008 | 64 | M | Colonos | <24 h | – | Splenec | Uncompl | Di Lecce et al ⁴⁶ |
| | 61 | F | Polypec | – | – | Conserv | Uncompl | Saad et al ⁴⁷ |
| | 52 | F | Polypec | <24 h | – | Conserv | Uncompl | |
| | 68 | F | Colonos | <24 h | 3 days | Conserv | Uncompl | |
| | 50 | F | Polypec | 4 h | 13 days | Splenec | Uncompl | Cappellani et al ³ |
| | 73 | F | Polypec | – | – | Splenec | Uncompl | Pichon et al ⁴⁸ |
| | 57 | F | Colonos | 8 h | – | Conserv | Uncompl | Schilling et al ⁴⁹ |
| | 60 | M | Colonos | 36 h | – | Conserv | Uncompl | Parker et al ⁵⁰ |
| | 74 | M | Colonos | 4 h | – | Splenec | Uncompl | Famularo et al ⁵¹ |
| | 50 | F | Colonos | <24 h | 34 h | Conserv | Uncompl | Duarte ⁵² |
| 2009 | 60 | F | Polypec | 8 h | <1 days | Splenec | Uncompl | Guerra et al ² |
| | 63 | M | Polypec | 5.5 h | – | Splenec | Uncompl | Lewis et al ⁵³ |
| | 64 | F | Polypec | 6 h | – | Splenec | Uncompl | Patselas et al ⁵⁴ |
| | 71 | F | Polypec | 24 h | 6 days | Splenec | Uncompl | Skipworth et al ⁵⁵ |
| | 68 | F | Colonos | 4 h | – | Splenec | Uncompl | Younes et al ⁵⁶ |
| | 81 | M | Polypec | 36 h | – | Splenic-embol | Died | de Vries et al ⁵⁷ |
| | 66 | F | Colonos | 24 h | – | Splenec | Uncompl | |
| | 47 | F | Colonos | – | – | Splenec | – | Kiosoglous ⁵⁸ |
| | 80 | M | Colonos | 6 h | 48 h | Splenec | Uncomp | Present report |

Colonos = colonoscopy; Polypec = polypectomy; Splenec = splenectomy; Conserv = conservative; Uncomp = uncomplicated.

^a Details were not provided in some cases.

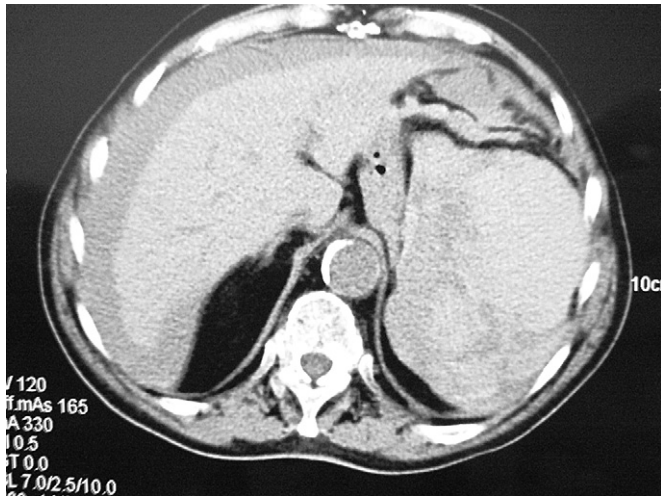


Fig. 1. CT scan showing hemoperitoneum with spleen enlarged and its morphology disrupted by intraparenchymal hemorrhage, 48 h after colonoscopy.

a likely hemorrhagic nature...” (Fig. 1). The patient underwent an emergency exploratory laparotomy, which identified “rupture of the splenic capsule” and prompted a splenectomy, while confirming that the colonic wall was intact (particularly on a level with the descending colon and splenic angle). The postoperative period was uneventful and the patient was discharged a few days later.

A few months later, the case came under the observation of our medico-legal department when the patient made a claim for € 100,000 in damages for the temporary and permanent consequences of the splenectomy.

3. Discussion

The use of colonoscopy in the follow-up of intestinal disease is well established and the procedure is very simple to perform and has a low complication rate, among these the most common are perforation and bleeding resulting from biopsies and polypectomies. The traumatic rupture of the spleen as a consequence of a colonoscopy is an unusual occurrence and only for a few cases (less than 70, as shown in Table 1) reported in the international scientific literature a causal relationship with colonoscopy has been recognized. In such situations, the problem of establishing any medical professional liability lies specifically in the paucity of available documentation, the difficulty of clearly identifying the pathogenic mechanisms behind such an event, and the shortage of data on potential risk factors that might contribute to injuring the splenic ligament and parenchyma.

To date, the mechanisms determining splenic injury have yet not to be fully elucidated. Pathological events that can occur mainly concern the rupture of the splenic capsule, with a consequent destruction of the portion of parenchyma adhering thereto and the development of subcapsular or intraparenchymal hematomas. As for the possible pathogenesis of the injury, some Authors have suggested that this might be facilitated by pre-existing anatomic anomalies of the splenic ligaments anchoring the spleen in the upper left abdominal quadrant. If ligaments are shorter than normal, their excessive traction could lead to rupture of the splenic capsule and the same could be said of maneuvers inducing torsional strain on the splenocolic ligament. As concerns the potential causal role of endoscopic investigations, the emphasis has been placed on a direct trauma induced by the endoscopic instrument transiting at splenic flexure level, and/or an excessive tensile stress on the splenocolic ligament during the endoscopic

procedure, both mechanisms possibly exacerbated by tissue adhesions between the spleen and the colon due to previous surgical procedures or inflammatory processes. An increase in the pressure exerted directly on the abdominal wall during the colonoscopy has also been indicated as a potential causes for this type of lesion.^{2–6}

Reviewing the published reports, it becomes clear that most cases of splenic lesions became manifest with pain in the upper left quadrant and radiating to the homolateral shoulder (Kehr’s sign). There is only one case of a patient reporting no painful symptoms at all in the interval between the invasive test’s performance and the radiological confirmation of a splenic lesion. Other common signs reported ranged from a painful reaction to palpation in the epigastric region and upper left abdominal quadrant, with a reduction or disappearance of epigastric tympanism, to diffuse peritoneal signs as well as hemodynamic changes such as pallor, hypotension, tachycardia, dyspnea, and even shock. The time of onset of the symptoms of the splenic trauma varied from two hours to as much as 10 days after the colonoscopy. There is also one report of a patient whose painful symptoms caused by the splenic lesion developed 13 days after the test was performed.³

The following were identified as possible splenic trauma risk factors during colonoscopy: coagulopathies, infections, splenomegaly of hematological origin, certain pharmacological treatments (e.g. erythropoietic growth factors), intestinal or pancreatic inflammatory processes, and a history of intra-abdominal surgery, but the literature fails to establish the concausal role for such risk factors in the occurrence of splenic lesions.

In the case described here, while the onset of symptoms of splenic injury (hypotension and progressive anemia) and the radiological findings of hemoperitoneum after the colonoscopy confirm the causal relationship between the invasive procedure and the rupture of the splenic capsule, it is impossible to accuse the colonoscopist of any evident negligence, which would have been readily recognizable, for instance, had there been an associated perforating injury to the intestinal wall during the surgical phase of the test.

In our case, there is nothing to indicate that the colonoscopist’s behavior was culpable, and that the operator could consequently be accused of manifest inexperience, negligence or imprudence. The fact (emerging from our review of the international literature) that there are no specific risk factors to predict splenic vulnerability before or during a colonoscopy suffices to make this type of lesion unpredictable and practically impossible to contrast. Analyzing the reported cases enables “generic” risk factors to be identified (particularly anticoagulant prophylaxis and adhesions from prior surgery, both of which applied to our case), but these factors do not demand a different patient management for colonoscopy.

Nor can we hypothesize a diagnostic delay because, as the literature shows, the rarity of this particular complication and the mild associated symptoms sometimes mean that the injury is diagnosed only after several days, as in the case presented here. Given the difficulty of presenting incontrovertible defensive arguments in court, the hospital’s insurance company opted to negotiate a settlement for a much lower figure than was originally requested to avoid the hazards of judgment – relating more to legal procedural issues than to any technical considerations. In the Italian civil lawsuit, there is a growing focus on the contractual nature of the professional relationship between patients and hospitals that puts the onus on the latter to demonstrate the “good” quality of the professional service they provide.

This is naturally all the more difficult to do when it comes to rare or exceptional complications, when the anatomical or pathological factor that triggered the injury cannot be clearly identified. In other words, the emphasis is on the principle of liability for a patient’s

baseline condition worsening after a surgical (or medical) procedure with a high binding force, which would normally be expected to have a positive outcome and no negative sequelae for the patient's state of health. This approach to the issue of medical professional liability brings the Italian civil law system close to that of common law, and this is clearly expressed in the following ruling of the Supreme Court (Cass. Civ.) sentence n. 6141/78, which is now dated but has nonetheless been recalled in recent sentences: "In the case of procedures that are easy to perform, there is no passage from obligation of means to obligation of results, which would be difficult to justify dogmatically without denying the same distinction between two types of obligation (as the majority of recent doctrine does), but the principle of *res ipsa loquitur* applies, as is amply applied on the matter in British and American law (where medical responsibility is always of an aquilian nature), in the sense of that circumstantial evidence that leads to a deduction of negligence".

Our case could justifiably fit this definition, and that is why it was advisable to go for a settlement. In medico-legal series relating to cases of iatrogenic lesions, the Italian system seems to be increasingly oriented towards finding solutions negotiated out of court wherever possible. A recent legislative reform identified the matter of medical professional responsibility as worthy of a formal attempt to arrive at a settlement before starting any legal proceedings, as in other areas of civil responsibility with a technical conflictual content (Legislative decree n. 28 of 4/3/2010, implementing the Law n. 69/2009).

This law was proposed to avoid the civil litigation in the field of medical liability particularly, favoring solutions of mediation when:

- a) a worsening of the health after the medical treatment is sure;
- b) the connection between medical action and worsening is uncertain;
- c) there is not unequivocal test of the inadequacy of the medical treatment.

Conflict of interest

None declared.

Funding

None declared.

Ethical approval

None declared.

References

1. Dafnis G, Ekblom A, Pahlman L, Blomqvist P. Complications of diagnostic and therapeutic colonoscopy within a defined population in Sweden. *Gastrointest Endosc* 2001;**54**:302–9.
2. Guerra JF, San Francisco I, Pimentel F, Ibanez L. Splenic rupture following colonoscopy. *World J Gastroenterol* 2008;**14**:6410–2.
3. Cappellani A, Di Vita M, Zanghi A, Cavallaro A, Alfano G, Piccolo G, et al. Splenic rupture after colonoscopy: report of a case and review of literature. *World J Emerg Surg* 2008;**3**:8.
4. Wherry DC, Zehner Jr H. Colonoscopy fiberoptic-endoscopic approach to the colon and polypectomy. *Med Ann Dist Columbia* 1974;**43**:189–92.
5. Olshaker JS, Deckleman C. Delayed presentation of splenic rupture after colonoscopy. *J Emerg Med* 1999;**17**:455–7.
6. Castelli M. Splenic rupture: an unusual late complication of colonoscopy. *Can Med Assoc J* 1986;**134**:916–7.
7. Janes SE, Cowan IA, Dijkstra B. A life threatening complication after colonoscopy. *BMJ* 2005;**330**:889–90.
8. Telmos AJ, Mittal VK. Splenic rupture following colonoscopy. *JAMA* 1977;**237**:2718.
9. Ellis WR, Harrison JM, Williams RS. Rupture of spleen at colonoscopy. *BMJ* 1979;**1**:307–8.
10. Reynolds FS, Moss LK, Majeski JA, Lamar Jr C. Splenic rupture following colonoscopy. *Gastrointest Endosc* 1986;**32**:307–8.
11. Doctor NM, Monteleone F, Zarmakoupis C, Khalife M. Splenic injury as a complication of colonoscopy and polypectomy. Report of a case and review of the literature. *Dis Colon Rectum* 1987;**30**:967–8.
12. Levine E, Wetzel LH. Splenic trauma during colonoscopy. *Am J Roentgenol* 1987;**149**:939–40.
13. Tuso P, McElligott J, Marignani P. Splenic rupture at colonoscopy. *J Clin Gastroenterol* 1987;**9**:559–62.
14. Gores PF, Simso LA. Splenic injury during colonoscopy. *Arch Surg* 1989;**124**(11):1342.
15. Taylor FC, Frankl HD, Riemer KD. Late presentation of splenic trauma after routine colonoscopy. *Am J Gastroenterol* 1989;**84**:442–3.
16. Merchant AA, Cheng EH. Delayed splenic rupture after colonoscopy. *Am J Gastroenterol* 1990;**85**:906–7.
17. Rockey DC, Weber JR, Wright TL, Wall SD. Splenic injury following colonoscopy. *Gastrointest Endosc* 1990;**36**:306–9.
18. Colarian J, Alousi M, Calzada R. Splenic trauma during colonoscopy. *Endoscopy* 1991;**23**:48–9.
19. Ong E, Böhmler U, Wurbs D. Splenic injury as a complication of endoscopy: two case reports and a literature review. *Endoscopy* 1991;**23**:302–4.
20. Adamek RJ, Wegener M, Schmidt-Heinevetter G, Ricken D, Jergas M. Milzruptur nach Koloskopie: eine ungewöhnlich Komplikation. *Z Gastroenterol* 1992;**30**:137–41.
21. Heath B, Rogers A, Taylor A, Lavergne J. Splenic rupture: an unusual complication of colonoscopy. *Am J Gastroenterol* 1994;**89**:449–50.
22. Espinal EA, Hoak T, Porter JA, Slezak FA. Splenic rupture from colonoscopy. A report of two cases and review of the literature. *Surg Endosc* 1997;**11**:71–3.
23. Ahmed A, Eller PM, Schiffman FJ. Splenic rupture: an unusual complication of colonoscopy. *Am J Gastroenterol* 1997;**92**:1201–4.
24. Bergamaschi R, Arnaud JP. Splenic rupture from colonoscopy. *Surg Endosc* 1997;**11**:1133.
25. Reissman P, Durst AL. Splenic hematoma: a rare complication of colonoscopy. *Surg Endosc* 1998;**12**:154–5.
26. Tse CCW, Chung KM, Hwang JST. Prevention of splenic injury during colonoscopy by positioning of the patient. *Endoscopy* 1998;**30**:74–5.
27. Stein DF, Myaing M, Guillaume C. Splenic rupture after colonoscopy treated by splenic artery embolization. *Gastrointest Endosc* 2002;**55**:946–8.
28. Hamzi L, Soyer P, Boudiaf M, Najmeh N, Abitbol M, Dahan H, et al. Rupture splénique après colonoscopie: à propos d'un cas inhabituel survenant sur une rate initialement saine. *J Radiol* 2003;**84**:320–2.
29. Goitein D, Goitein O, Pikarski A. Splenic rupture after colonoscopy. *Isr Med Assoc J* 2004;**6**:61–2.
30. Lekas BJ. Splenic hematoma as a complication of colonoscopy. *J Am Geriatr Soc* 2004;**52**:320–1.
31. Al Alawi I, Gourlay R. Rare complication of colonoscopy. *Aust N Z J Surg* 2004;**74**:605–6.
32. Boghossian T, Carter JW. Early presentation of splenic injury after colonoscopy. *Can J Surg* 2004;**47**:148.
33. Jaboury I. Splenic rupture after colonoscopy. *Intern Med J* 2004;**34**:652–3.
34. Weisgerber K, Lutz MP. Splenic rupture after colonoscopy. *Clin Gastroenterol Hepatol* 2005;**3**:A24.
35. Shah PR, Raman S, Haray PN. Splenic rupture following colonoscopy: rare in the UK? *Surgeon* 2005;**3**:293–5.
36. Naini MA, Masoompour SM. Splenic rupture as a complication of colonoscopy. *Indian Gastroenterol* 2005;**24**:264–5.
37. Prowda JC, Trevisan SG, Lev-Toaff AS. Splenic injury after colonoscopy: conservative management using CT. *AJR AM J Roentgenol* 2005;**185**:708–10.
38. Zenooz NA, Win T. Splenic rupture after diagnostic colonoscopy: a case report. *Emerg Radiol* 2006;**12**:272–3.
39. Volchok J, Cohn M. Rare complications following colonoscopy: case reports of splenic rupture and appendicitis. *JLS* 2006;**10**:114–6.
40. Johnson C, Mader M, Edwards DM, Vesly T. Splenic rupture following colonoscopy: two cases with CT findings. *Emerg Radiol* 2006;**13**:47–9.
41. Tsoraides SS, Gupta SK, Estes NC. Splenic rupture after colonoscopy: case report and literature review. *J Trauma* 2007;**47**:148.
42. Dugué L, Maftouh A, Condat B, Zanditenas D, Bonnet J, Balian C, et al. Rare complication of colonoscopy: hemoperitoneum secondary to splenic rupture. *Gastroenterol Clin Biol* 2007;**31**:1153–4.
43. Holubar S, Dwivedi A, Eisdorfer J, Levine R, Strauss R. Splenic rupture: an unusual complication of colonoscopy. *Am Surg* 2007;**73**:393–6.
44. Pfefferkorn U, Hamel CT, Viehl CT, Marti WR, Oertli D. Haemorrhagic shock caused by splenic rupture following routine colonoscopy. *Int J Colorectal Dis* 2007;**22**:559–60.
45. Lalor PF, Mann BD. Splenic rupture after colonoscopy. *JLS* 2007;**11**:151–6.
46. Di Lecce F, Viganò P, Pilati S, Mantovani N, Togliani T, Pulica C. Splenic rupture after colonoscopy. A case report and review of the literature. *Chir Ital* 2007;**59**:755–7.
47. Saad A, Rex DK. Colonoscopy-induced splenic injury: report of 3 cases and literature review. *Dig Dis Sci* 2008;**53**:892–8.
48. Pichon N, Mathonnet M, Verdrière F, Carrier P. Splenic trauma: an unusual complication of colonoscopy with polypectomy. *Gastroenterol Clin Biol* 2008;**32**:123–7.
49. Schilling D, Kirr H, Mairhofer C, Rumstadt B. Splenic rupture after colonoscopy. *Dtsch Med Wochenschr* 2008;**133**(16):833–5.
50. Parker WT, Edwards MA, Bittner 4th JG, Mellinger JD. Splenic hemorrhage: an unexpected complication after colonoscopy. *Am Surg* 2008;**74**:450–2.
51. Famularo G, Minisola G, De Simone C. Rupture of the spleen after colonoscopy: a life-threatening complication. *Am J Emerg Med* 2008;**26**:834.
52. Duarte CG. Splenic rupture after colonoscopy. *Am J Emerg Med* 2008;**26**:117.e1–3.

53. Lewis SR, Ohio D, Rowley G. Splenic injury as a rare complication of colonoscopy. *Emerg Med J* 2009;**26**:147.
54. Patselas TN, Gallagher EG. Splenic rupture: an uncommon complication after colonoscopy. *Am Surg* 2009;**75**:260–1.
55. Skipworth JR, Raptis DA, Rawal JS, Olde Damink S, Shankar A, Malago M, et al. Splenic injury following colonoscopy - an underdiagnosed, but soon to increase, phenomenon? *Ann R Coll Surg Engl* 2009;**91**:6–11.
56. Younes NA, Al-Ardah MI, Daradkeh SS. Rupture of spleen post colonoscopy. *Saudi Med J* 2009;**30**:1095–7.
57. De Vries J, Ronnen HR, Oomen AP, Linskens RK. Splenic rupture following colonoscopy, a rare complication. *Neth J Med* 2009;**67**:230–3.
58. Kiosoglous AJ, Varghese R, Memon MA. Splenic rupture after colonoscopy: a case report. *Surg Laparosc Endosc Percutan Tech* 2009;**19**:104–5.