

# Splenic injury after colonoscopy

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Splenic injury is a rare and serious complication of colonoscopy. The most likely mechanism is tension on the splenocolic ligament and adhesions. Eight cases were identified among claims for compensation submitted to the Danish Patient Insurance Association during the period 1992–2006, seven of which were reported after 2000. The total number of colonoscopies in Denmark in 2004 was 39 067. Seven of the eight patients were aged 65 years or over. Loops causing difficulties during the colonoscopy had been reported in four patients. All the patients had a symptom-free interval after the colonoscopy, ranging from 4 hours to 7 days, before presenting with signs of splenic injury. In all cases the spleen was torn, and the amount of blood in the perito-

neal cavity ranged from 1500 mL to 5000 mL. Two patients died postoperatively. The number of cases reported after 2000 indicates that this potentially lethal complication might be more common than was previously assumed, and it is possibly under-reported. Preventive measures include good colonoscopic technique to avoid loop formation and the use of excessive force; and it is possible that emerging endoscopic technologies will lead to a reduced risk of splenic injury. The information given to patients both before and after the procedure should include information on the signs of this complication, and patients should be also informed that these signs can develop after a symptom-free interval.

## Introduction

Colonoscopic splenic injury is a rare and serious complication of colonoscopy. The most likely mechanism is tension on the splenocolic ligament and/or on pre-existing adhesions due to manipulations of the sigmoid, descending colon, or transverse colon, or a more direct effect occurring during passage of the splenic flexure. Less than 60 cases have been reported worldwide since the 1970s [1,2]. The diagnosis can be problematic, partly because of the characteristic symptom-free interval and partly because referring physicians or even endoscopists might not be aware of this complication. The purpose of the present study was to identify similarities and probable risk factors in a national series of patients who had suffered this rare complication.

## Case series

### Methods

The Danish Patient Insurance Act ensures that patients receive compensation for the consequences of medical injury, even when the injury is not caused by negligent examination or treatment, and has been described in detail previously [3]. Claims can be filed by the patient, relatives, the hospital department, or by other advisors that the patient might have. The claim is registered in a database that includes the procedure and diagnoses. The Patient Insurance Association (PIA) collects all the information on the case, including case notes, radiographs, pathology reports, and other documentation related to the injury. All cases of injuries related to colonoscopy and sigmoidoscopy were identified, and these were analyzed in order to identify cases of splenic injury. Other injuries related to these procedures have been reported elsewhere [4,5].

Table 1 The eight claims filed by the Danish Patient Insurance Association during the period 1992–2007 regarding splenic injury after colonoscopy or sigmoidoscopy

Year	Sex	Age, years	ASA, NSAID, SSRI, or anticoagulant use; co-morbidity	Endoscopist	Indication	Difficulties	Completeness	Therapy	Time to symptoms	Diagnostic method	Splenic injury	Clinical course
1992	M	65	None	Consultant (surgeon)	Adenoma follow-up	None	Cecum	Polypectomy x 5	12 hours	Ultrasound	Laceration	Uneventful
2001	F	70	ASA 150 mg, Seroxat 10 mg; depression	Senior registrar (surgeon)	Adenoma follow-up	Two loops, long transverse colon	Cecum	None	12 hours	Ultrasound	Laceration	Three further operations; fatal outcome; lung cancer found at autopsy
2005	M	38	None	Senior registrar (surgeon)	Symptoms	None (and easy passage of left flexure)	Sigmoidoscopy to transverse colon	Polypectomy	6 days	Computed tomography	Hilar laceration	Pancreatic duct injury
2004	F	72	Spinal stenosis sequelae, low back pain	Consultant (gastroenterologist)	Symptoms	Sigmoid looping	To splenic flexure	None	7 days	Computed tomography	Laceration	Superficial wound infection
2005	F	66	None	Consultant (gastroenterologist)	Adenoma follow-up	None mentioned	Cecum	None	24 hours	Computed tomography	Capsule avulsion	Uneventful
2006	F	80	None	Senior registrar (gastroenterologist)	Symptoms	Loops in sigmoid and transverse colon	Cecum	Polypectomy	15 hours	Laparotomy	Capsule avulsion	Uneventful
2006	F	68	Warfarin; pulmonary silicosis	Senior registrar (surgeon)	Symptoms	None, but prior colonoscopy incomplete	Cecum	Polypectomy	24 hours	Computed tomography	Capsule avulsion and tear in lower pole	Died after 16 days; no autopsy
2007	F	67	Alcohol abuse	Senior registrar (surgeon)	Symptoms	Looping (segments not specified)	Cecum	None	4 hours	Ultrasound	Capsule avulsion and tear	Uneventful

ASA, acetylsalicylic acid; NSAID, nonsteroidal anti-inflammatory drug; SSRI, selective serotonin re-uptake inhibitor

## Patients

Eight claims filed during the period 1992–2006 regarding injury after colonoscopy ( $n=7$ ) or sigmoidoscopy ( $n=1$ ) were identified (● **Table 1**). All the procedures had been performed in a hospital setting, and all the patients subsequently underwent splenectomy. All but one of the patients were aged 65 years or over; four had a co-morbid condition; and only one patient had a history of abdominal surgery (hysterectomy). With regard to medications with possible effects on coagulation, one patient was on low-dose acetylsalicylic acid treatment, one was on anticoagulants, and another was being treated with a selective serotonin re-uptake inhibitor; none of the patients were taking nonsteroidal anti-inflammatory drugs.

## Procedures

The endoscopist was a fully trained specialist in three cases, and a senior registrar in the other five cases. All colonoscopies were intended to reach the cecum. The colonoscope reached the cecum in six cases, the splenic flexure in one patient, and the transverse colon in one patient (in this case the endoscopy report explicitly reported that the passage of the splenic flexure had been easy). In four cases the colonoscopist described having difficulties because of loop formation in the sigmoid and/or transverse colon. The endoscopy reports did not mention whether variable-stiffness endoscopes had been used.

## Clinical course

The patients were all discharged after the endoscopic procedure. Their symptoms began after an interval ranging from 4 hours to 7 days, followed by re-admission with abdominal pain and anemia; five of the patients were hemodynamically unstable. At emergency surgery, all the patients were found to have a torn spleen, with 1500–5000 mL of blood in the peritoneal cavity. The splenic injuries ranged from lacerations to a completely torn spleen. According to the surgeons' reports, none of the spleens were enlarged, and subsequent histological examination revealed that they were all normal.

Three patients had complicated clinical courses after splenectomy. In one patient the pancreatic tail and duct was injured, but the fistula sealed after endoscopic pancreatic stenting. One patient underwent three further operations: one to treat bleeding from the splenic vascular pedicle, a procedure 1 month later to relieve intestinal obstruction due to adhesions, and then a laparotomy for intestinal perforation, after which she died. One patient with pulmonary silicosis had postoperative respiratory insufficiency, and died 16 days after the operation. The patients whose postoperative course was uneventful were discharged after 4–10 days.

## Discussion

Colonoscopic injury requiring surgery occurs in 0.1%–0.2% of procedures [4,5]. Splenic injury comprises only a fraction of these, occurring in 3% of cases in a recent study of all colonoscopic injuries claims to the PIA [4,5]. It is possible that splenic injury after colonoscopy has been under-reported, six out of the eight cases identified in the present study occurring between 2004 and 2007. Furthermore, it is probable that patients with splenic injuries such as subcapsular hematomas and minor lacerations that did not lead to hemodynamic instability and which were treated conservatively did not submit claims. The number

of colonoscopies performed in Denmark (population 5.5 million) in 2004 was 36 845 in public-sector hospitals and 2222 in the private sector [5].

It might be difficult to identify patients at risk of developing colonoscopic complications prior to the procedure. Gatto et al. [6] analyzed a total of 39 286 colonoscopies in patients with colorectal symptoms, 77 of which were complicated by a perforation. They found increased rates among patients older than 70 years and among patients with one or several co-morbid conditions. Neither this study nor other studies on risk factors included cases of splenic injury, however. It is also difficult to extrapolate data from studies on colonoscopic perforation because a large proportion of these perforations are likely to be related to polypectomy, compared with splenic injury, where straining forces are more important as a causative factor.

Data regarding the experience of the endoscopists involved in colonoscopic injury are conflicting. Some series have found a higher rate of perforation when trainees were either on their own or assisted [7,8], while others have described equal perforation rates in fully trained specialists and trainees [4,5,9]. Outside the United States the presence of a supervising specialist in the endoscopy room is not generally mandatory, so a higher rate of complications occurring when trainees are assisted by specialists in other communities [9] could just be a reflection of the fact that these were more difficult procedures. In the present series the case notes or endoscopy reports did not mention whether a supervising specialist had been present in the five cases where a trainee (a senior registrar in all cases) had been involved, but this was probably not the case because it is established practice in Denmark to document the name of any senior colleague assisting or taking over a procedure from a trainee.

The characteristic symptom-free interval has also been reported in previous case reports, which have documented intervals ranging from 3 hours to 72 hours [2]. In the present series, two patients presented with clinical signs after 6 days and 7 days. This is similar to the timescale in some splenic injuries occurring after blunt abdominal trauma [10,11], but while it has been suggested that in cases of blunt abdominal trauma the time lapse is mostly due to misinterpretation of the initial clinical signs [10], all the patients in the present series were symptom-free when they were discharged from the endoscopy unit. This was verified by the case notes, the endoscopy reports, and the patients' or relatives' statements in the claim forms.

With regard to risk factors, it might be possible that coagulopathy and/or treatment with acetyl salicylic acid or nonsteroidal anti-inflammatory drugs could have an effect in some cases, but only one of the patients in this series was on acetylsalicylic acid, and one other patient was taking anticoagulants. Regarding other general risk factors for colonoscopic complications, the presence of co-morbid conditions has been shown to increase the risk of perforations [6], but four of the eight patients in the present series had no co-morbidity. Age over 70 years is also a risk factor [6] and all but one of the patients in the present series were aged 65 years or over.

Looking at the literature, the diagnosis of splenic rupture is made by computed tomography in a quarter of cases or at laparotomy in half the cases, while diagnosis by laparocentesis, ultrasonography, and angiography are more rarely reported [2]. The most important differential diagnoses are colonic perforation and intraluminal bleeding, which are much more common [4,5]. If computed tomography is used to investigate these pa-

tients, both the spleen and free gas in the abdominal cavity can be visualized.

While all the patients in this series underwent splenectomy, percutaneous transarterial embolization with coils is a nonsurgical alternative in hemodynamically stable patients with splenic injury [2,12].

The mechanism of injury is most probably traction on the splenicocolic ligament and/or on adhesions between the splenic flexure and the spleen. The peak force exerted when pushing the colonoscope in human subjects was measured in one study to be 4.4 kg, the peak pulling force is – 1.8 kg, and the torque during rotation is 0.8–1.0 Newton meters [13]. None of the procedures in that study resulted in injury. These quite considerable forces obviously play a role in colonoscopic injury. Even more forceful manipulations, leading to traction, should therefore be avoided by means of optimization of endoscopic technique, and this can be facilitated by monitoring progress with devices such as the electromagnetic positioner. A recently developed colonoscopy simulator includes measurements of the pushing/pulling and torque forces exerted during the procedure [14], which increases the endoscopist's awareness of these factors. The correct use of abdominal compression to control difficult loops is another factor that could reduce the risk of forceful traction. New and emerging technologies such as self-propelling and self-navigating instruments [15,16] might also mean that less or negligible force and straining can be applied to the splenic flexure. One study that investigated the forces exerted on the colon during computer-assisted, fully articulated colonoscopy showed significantly less looping and lateral forces compared with standard push-colonoscopy [17].

Direct trauma is a theoretical mechanism in this injury. This could occur if the colonoscope is advanced in the splenic flexure area despite the absence of a clear luminal view. Polypectomy and biopsy have also been suggested as factors that increase this risk [2], but this is probably rarely the cause.

In conclusion, colonoscopic splenic injury, though relatively rare, might occur more often than previously believed. Information on delayed symptoms must be included in the oral and written information that the patient receives before endoscopy and this should be repeated at discharge. Endoscopy staff and emergency room staff must be aware of this rare but potentially fatal complication and be able to recognize its clinical presentation. Endoscopists should take great care in their endoscopic manipulations in cases of loop formation, and use optimal technique and equipment in order to avoid this complication.

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