Risk Factors for Early Colonoscopic Perforation Include Non-Gastroenterologist Endoscopists: A Multivariable Analysis

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BACKGROUND & AIMS: **Bowel perforation is a rare but serious complication of colonoscopy. Its prevalence is increasing with the rapidly growing volume of procedures performed. Although colonoscopies have been performed for decades, the risk factors for perforation are not completely understood. We investigated risk factors for perforation during colonoscopy by assessing variables that included sedation type and endoscopist specialty and level of training.**

METHODS: **We performed a retrospective multivariate analysis of risk factors for early perforation (occurring at any point during the colonoscopy but recognized during or immediately after the procedure) in adult patients by using the Clinical Outcomes Research Initiative National Endoscopic Database. Risk factors were determined from published articles. Additional variables assessed included endoscopist specialty and years of experience, trainee involvement, and sedation with propofol.**

RESULTS: **We identified 192 perforation events during 1,144,900 colonoscopies from 85 centers entered into the database from January 2000–March 2011. On multivariate analysis, increasing age, American Society of Anesthesia class, female sex, hospital setting, any therapy, and polyps >10 mm were significantly associated with increased risk of early perforation. Colonoscopies performed by surgeons and endoscopists of unknown specialty had higher rates of perforation than those performed by gastroenterologists (odds ratio, 2.00; 95% confidence interval, 1.30–3.08). Propofol sedation did not significantly affect risk for perforation.**

CONCLUSIONS: **In addition to previously established risk factors, non-gastroenterologist specialty was found to affect risk for perforations detected during or immediately after colonoscopy. This finding could result from differences in volume and style of endoscopy training. Further investigation into these observed associations is warranted.**

Keywords: ASA Classification; GI; Intestine; Quality Control; Endoscopy Training.

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Colonoscopy is a common and safe procedure with a variety of diagnostic and therapeutic applications. Although it remains rare, the most serious and feared complication is bowel perforation. Data series of procedures performed since 1990 place the current worldwide incidence of perforation at 0.07% (1 in 1428) for all colonoscopies and 0.1% for therapeutic colonoscopies.[1] Despite improvements in technology and perceived advances in techniques, the incidence of perforation has not changed significantly over time.[2,3] Therefore, although the overall perforation rate remains low, the prevalence of colonoscopy-related perforations is rising as growing demand fuels a rapidly increasing volume of procedures. With the intensification of colorectal cancer screening programs, in which colonoscopy plays a central role, this translates to an increasing number of healthy, asymptomatic individuals being exposed to a procedure with risk of serious harm.

Various risk factors for colonoscopic perforation have been identified. Patient-related factors include advanced age, female sex, multiple comorbidities, and need for therapeutic intervention.[1] Once perforation occurs, the management is usually surgical.[4] Outcomes

Abbreviations used in this paper: **ASA, American Society of Anesthesia; CI, confidence interval; CORI, Clinical Outcomes Research Initiative; HMO, health maintenance organization; IBD, inflammatory bowel disease; OR, odds ratio; VA, Veterans Affairs.**

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after colonoscopic perforation vary, but serious sequelae, including perioperative complications and death, are not infrequent.[3,5] Colonoscopy-related perforation thus has the potential to become an increasingly common cause of preventable morbidity and mortality.

In this era of quality control, much attention has been paid to factors that improve polyp detection and cancer prevention in colonoscopy.[6] However, little is known about modifiable factors for colonoscopic perforation risk, namely endoscopist and procedural aspects. Although it has been suggested that low-volume endoscopists have more complications such as perforation and bleeding, this has received little attention.[7,8] A difference in complications between endoscopists from different specialties has never been conclusively demonstrated, but it has recently been shown that non-gastroenterologist endoscopists have higher rates of missed interval cancers, which suggests a quality gap.[9–11] Because of growing pressure to recruit more non-gastroenterologist endoscopists to meet the demand needs for colonoscopy, this question warrants some attention.

An additional question relates to the effect of sedation on performance of colonoscopy. Although colonoscopy has traditionally been performed under conscious sedation, typically using a combination of narcotic and benzodiazepine,[12] there has recently been a trend toward propofol use.[13] Propofol is usually intended to achieve conscious sedation but frequently results in deep sedation instead.[14] The benefit of propofol is faster initiation of sedation and quicker recovery, which is hoped to facilitate a higher rate of turnover in the endoscopy unit and thus improve efficiency.[13,15] However, many authors have speculated that propofol sedation has the potential to increase perforation risk[12,16–18] because deeply sedated patients cannot report discomfort and are difficult to reposition, which may encourage forceful and suboptimal colonoscopy technique. A handful of small studies have shown a nonsignificant trend toward more perforations with propofol use.[18,19] Although a recent study of anesthesia assistance in colonoscopy found increased complications in the deep sedation cohort, this was largely driven by higher rates of aspiration.[20]

The purpose of this study was to investigate risk factors for early bowel perforation in colonoscopy, with a special focus on the impact of endoscopist specialty and training as well as the effect of propofol compared with traditional sedation regimens.

Study Design, Methodology, and Analysis

Database

This study analyzed prospectively collected data from the Clinical Outcomes Research Initiative (CORI) National Endoscopic Database, a large North American database consisting of diverse practice types. Participating physicians are provided with an electronic health record that is completed at the time of endoscopy and generates procedure reports used for recordkeeping as part of the official medical record. Users are required to document at least 95% of procedures in CORI. Once signed off, these reports cannot be altered. A limited data set from every report is electronically sent to CORI where it is quality tested and then pooled in a central database. Data are collected and stored according to stringent security and health information privacy standards. During the course of this study, 125 sites from 85 participating practice locations in the United States contributed procedure reports to the database, including 104 community or health maintenance organization (HMO) sites, 11 academic centers, and 10 Veterans Affairs (VA)/military centers. Not all endoscopy providers at each site use CORI. These locations were distributed among the 6 regions of the United States: Northeast (14.6%), Southeast (16.4%), North Central (9.8%), South Central (11.5%), Northwest (12.6%), and Southwest (35.1%).

Study Cohort and Design

By using the CORI database, we performed a retrospective analysis of risk factors for early bowel perforation in colonoscopy. We included all complete and incomplete colonoscopies. Flexible sigmoidoscopies were excluded. Only colonoscopies involving patients older than 18 years of age entered into the database from the year 2000 up to the study period were included. We excluded procedures performed by pediatric gastroenterologists. Because the CORI database contains information generated at the time of endoscopy with no data on delayed complications, we examined only early perforations, which are those recognized during or immediately after the procedure. In this study, the term *early perforation* refers to a perforation discovered before the procedure report is signed off at the end of the colonoscopy. Early perforations are known to make up approximately one-fourth of all perforation events.[1] Information on perforation type and outcomes after perforation was not available.

Data collected included patient age, sex, American Society of Anesthesia (ASA) class, indication for procedure (screening and surveillance vs symptomatic), presence of diverticulosis, established or suspected inflammatory bowel disease (IBD), any therapy (argon plasma coagulation, bipolar electrocoagulation, banding, Botox, clips, dilation, heater probe, injection, laser, stent, other), right-sided polyp, polyp size and number, quality of bowel preparation, use of propofol, endoscopist years of experience, endoscopist specialty (gastroenterology, surgery, primary care, subspecialist), site type, and trainee involvement. IBD was divided into 2 variables, established IBD and all IBD, which included both established and suspected IBD cases. With regard to endoscopist specialty, the category of subspecialist included pulmonologists, radiologists, preventive medicine