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Colonoscopy Complications in an Iranian Teaching Hospital

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ABSTRACT

BACKGROUND:
Colonoscopy is generally a safe procedure with a limited number of adverse events. Few studies have addressed the rate of adverse events in teaching hospitals. This study aimed to investigate the rate of complications after colonoscopy performed by gastroenterology fellows in a teaching hospital in Tehran.

METHODS:
A historical cohort study was carried out to link the colonoscopy reports and the hospital information system to identify serious adverse events leading to unplanned hospitalization, unplanned procedures or interventions (e.g. surgery), prolongation of existing hospitalization, or death within 30 days after colonoscopy.

RESULTS:
We included 9928 colonoscopies (mean age of the patients 53.0 ± 15.9 years, 52.3% men) in this study. In-hospital patients comprised (34.8%) of the procedures. The indications of colonoscopy included 7137 diagnostic (71.9%), and 2519 screening (25.4%) reasons. Colorectal polyps were found in 2005 (20.2%) patients. Major complications were seen in 17 patients (0.2%), including serious bleeding in seven patients, cardiopulmonary complications in five patients, perforation in four patients, and sepsis in one patient.

CONCLUSION:
Serious adverse events after colonoscopy are relatively rare. The rate of complications does not appear to be higher in an academic teaching hospital when performed by fellows under supervision.

KEYWORDS:
Colonoscopy complications; Intestinal perforation; Gastrointestinal hemorrhage; Graduate medical education

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INTRODUCTION

Colonoscopy is a common procedure for screening and preventing colorectal cancer, as well as diagnosing and treating a wide range of gastrointestinal conditions. It is generally considered a safe procedure that has a limited number

of adverse events (AEs). Several studies have reported the rate of AEs after colonoscopy in different settings, indications, and patient populations. The most common serious AEs include bleeding and perforation.[1-2]

The American Society for Gastrointestinal Endoscopy review defines serious AEs after colonoscopy as follows: AEs that lead to an unplanned hospitalization, unplanned procedures or interventions, prolongation of existing hospitalization, or death.[3]

A systematic review and meta-analysis of population-based studies reported the following pooled prevalence of post-colonoscopy complications: perforation (0.5/1000), post-colonoscopy bleeding (2.6/1000), and mortality (2.9/100000). Colonoscopy with polypectomy was associated with a higher rate of perforation (0.8/1000) and bleeding (9.8/1,000).[4] However, most studies have reported the rate of complications for screening indications in outpatient settings performed by gastroenterologists. Few studies have reported complication rates of colonoscopy in teaching hospital environments.[5-6]

Data on the rate of complications in our country are also sparse. To our knowledge, there is only one study from Iran that has reported the complications rate of colonoscopy by an expert gastroenterologist.[7]

In this study, we aimed to investigate the rate of complications after colonoscopy performed by gastroenterology fellows in a teaching hospital in Tehran.

MATERIALS AND METHODS

We conducted a historical cohort study on individuals who underwent colonoscopy at Shariati Hospital in Tehran, which is a tertiary care center with an active subspecialty training program for fellowship in gastroenterology and hepatology. We included all consecutive adults over 20 years of age who underwent colonoscopy from March 2013 to March 2017. Canceled procedures for any reason (inadequate prep, sedation risk, etc.) were not included in the study.

We collected baseline demographic, clinical, and colonoscopic characteristics, including sex and age of patients; indication for colonoscopy; and findings at colonoscopy e.g. bowel preparation, number of polyps, size of the largest polyp, and type of polypectomy procedure technique. We found inconsistencies in the standards of reporting of the quality of bowel preparation; therefore, bowel preparation was categorized into two groups: the words good preparation and optimal bowel preparation were considered as proper preparation, and descriptions of bad preparation, suboptimal, poor, or moderate were considered as inappropriate preparation.

Indications for colonoscopy were retrieved using a decision algorithm described in the study by Fassil and colleagues.[8] The indications were finally categorized into three groups: diagnostic, screening, and unknown.

The primary outcome for this study was major post colonoscopy complications that were defined as those that lead to an unplanned hospitalization, unplanned procedures or interventions (e.g. surgery), prolongation of existing hospitalization, or death within 30 days after colonoscopy.[3] Major complications were initially identified through multiple queries in the electronic hospital information system. The paper-based medical records of patients' data were then retrieved and assessed to verify if there was any major complication.

At the time of discharge from the recovery unit, all ambulatory patients were advised to return to the hospital's emergency department if they experienced any major symptoms like abdominal pain or bleeding. However, to exclude the possible bias from patients' referring to other medical centers after a major colonoscopy complication, we interviewed all attending gastroenterologists and asked about the cases of major colonoscopy complications they had in the study period. We matched them to the findings from the electronic search. There was no case of major colonoscopy complication admitted to other centers.

Qualitative variables were expressed as a number and percentage, and quantitative variables were expressed as means and standard deviation. The independent samples t-test was used to compare the mean of quantitative variables, and the Chi-square test was used to compare qualitative variables. In this study, $P<0.05$ was considered significant, and SPSS software version 25 was used for statistical analysis.

RESULTS

We identified 10045 patients aged 20 years or older who had undergone colonoscopy. 117 records (1.1%) were excluded for missing and/or inconsistent data. Hence, 9928 colonoscopies were included in the analysis. The mean age of the patients was 53.0±15.9 years, 5196

patients (52.3%) were men, 3452 (34.8%) procedures were performed on hospitalized patients, and 6476 (65.2%) colonoscopies were done in ambulatory patients. The indications of colonoscopy included 7137 diagnostic (71.9%), 2519 screening (25.4%), and 272 unknown (2.7%) reasons (table 1). Total colonoscopy was done in 9093 patients, and cecal intubation was reported in 8298 cases (91.3%).

The quality of bowel preparation was not sufficiently described in 4049 patient records (40.8%). In the remaining cases, proper bowel preparation was found in 3301 (56.1%) patients and inappropriate bowel preparation in 2578 (43.9%) patients.

Colorectal polyps were found in 2005 (20.2%) patients, which included a rate of 18.2% in diagnostic procedures and 26.0% in screening procedures ($P<0.001$). The mean number of polyps (n=1902) was 1.6±1.1, and the highest number of polyps was 15. Polyp number was mentioned as «multiple» without providing an exact number in 103 (1.0%) patients. Polyp size was reported in 1976 (19.9%) colonoscopies, and the mean (SD) size was 7.6±6.7 mm.

Among the 2005 patients with polyps, 378 patients (18.8%) underwent hot snare polypectomy, and 214 patients (10.7%) underwent cold snare polypectomy. A cold biopsy forceps was used for polyp resection in 1218 patients (60.7%), and a biopsy without polypectomy was done in 130 patients (6.5%). No action was reported in the remaining 65 patients (3.2%).

Major complications happened in 17 patients (0.2%), including serious bleeding in seven patients, cardiopulmonary complications in five patients, perforation in four patients, and sepsis in one patient. Indications and risk factors for these complications are summarized in table 2.

The rate of serious bleeding was 3.6 in 1000 polypectomies, and all of them occurred after polypectomy. Bleeding was controlled with a hemostatic clip in all patients without any need for surgical intervention. However, they were admitted for close observation.

The cardiopulmonary complications that occurred during colonoscopy in five patients included respiratory distress, hypoxia, and tachyarrhythmias, which led to discontinuation of the colonoscopy and hospitalization for further evaluation and observation.

The overall incidence of post-colonoscopy perforation was low (0.4 in 1000), three of them occurred during diagnostic colonoscopy, and one occurred after polypectomy. Two of the four patients with perforation were identified at the time of colonoscopy and were referred to the surgery ward immediately. The two other patients developed abdominal pain and distension 4 and 14 hours after colonoscopy. They were also referred for surgical repair.

An immunodeficient patient with a history of rheumatoid

Table 1: Frequency of indications of colonoscopy in the Endoscopy Department of Shariati Hospital from 2013 to 2017, (n=9928)*

	Number	Percent
Diagnostic	7137	71.9
Acute bleeding (rectorrhagia, hematochezia, melena)	2004	20.2%
Abdominal pain	1548	15.6%
Anemia	1142	11.5%
suspected IBD	870	8.7%
Constipation	584	5.88%
Diarrhea	505	5.09%
Weight loss	292	2.9%
OB+	97	1.0%
Other	1510	15.2%
Screening	2519	25.4
Unknown	272	2.7

*Some cases were categorized into more than one group. Abbreviations: IBD, inflammatory bowel disease; OB+: positive occult blood test

Table 2: Indications and risk factors in patients with complications of colonoscopy

Complications	Number of patients	Indication of colonoscopy		Polypectomy	Biopsy
		Diagnostic	Screening		
Perforation	4	3	1	1	0
Cardiopulmonary	5	5	0	2	2
Bleeding	7	0	7	5*	2
Sepsis	1	1	0	0	0
Death	2	2	0	2	0

*Three polypectomies were performed using a hot snare.

arthritis developed fever and abdominal pain 48 hours after the procedure. Sepsis was attributed to colonoscopy as a complication.

Two deaths occurred following colonoscopy in this study, one following perforation and peritonitis and the other following cardiopulmonary complications. In both cases, a polypectomy was performed during the colonoscopy.

DISCUSSION

The rate of complications from colonoscopy in this study at a tertiary care teaching hospital was consistent with the rates reported in other studies worldwide.[5-11] These results represent the complication rates at public teaching hospitals where the procedure is performed by fellows in training supervised by experienced gastroenterologists, which can provide reassurance to patients.

Perforation of the colon is a serious complication that occurs in diagnostic and therapeutic procedures but more frequently with therapeutic procedures.[12] The rate of post colonoscopy bleeding and perforation were 1.64/1000 and 0.85/1000 in a large series from Canada.[13] Older age, male sex, polypectomy, and colonoscopy being performed by a low-volume endoscopist were associated with increased odds of complications.

Several studies, including a systematic review (table 3) have not found an increased incidence of colonic perforation performed by attending gastroenterologists compared with cases where fellows were involved.[4] Khalid and colleagues performed a retrospective analysis of a national database in the USA and found a higher rate of perforation in teaching hospitals compared with rural and non-teaching urban hospitals (OR=1.23, CI 1.07 - 1.42, P=0.004).[6] However, we believe that this statistical significance reflects the large sample size (n=257006) of their study and the odds ratio of 1.2 is not clinically important. Desai and others showed that the rate of post-colonoscopy perforation, bleeding, and infection was not higher during the early academic months.[14]

Post-colonoscopy bleeding is another complication that occurs more frequently with polypectomy. The overall rate of post-colonoscopy bleeding was 0.7 in 1000, and all events occurred after polypectomy (3.6 in 1000 polypectomies). The results of a meta-analysis of 21 studies showed that the pooled prevalence of post-colonoscopy bleeding was 2.6/1,000, and a time-trend analysis showed that post-colonoscopy bleeding declined from 6.4 to 1.0/1,000 colonoscopies from 2001 to 2015.[4] The rate of post-colonoscopy bleeding in gastrointestinal fellows was not more than attendings in a recent study.[11]

Cardiopulmonary complications of a colonoscopy include respiratory depression, hypoxia, cardiac ischemia, and cardiac dysrhythmias, which occurred in five patients in our study and led to death in one patient. In an analysis of data from 174,255 colonoscopies in the Clinical Outcomes Research Initiative (CORI) database, the overall risk of cardiopulmonary complications after colonoscopy was 1.1%.[15] The most common cardiopulmonary complications were transient hypoxia, bradycardia, hypotension, and vasovagal reactions. Such transient events did not fulfill our definition of serious adverse events and were not assessed in this study. We did not encounter any serious complications of sedation in our patients. A meta-analysis showed that the risk of

Table 3: Incidence of colonic perforation and bleeding after colonoscopy from studies in educational centers

Study	Year	Design	Country	Setting	Sample size	Perforation (in 1000 cases)	Bleeding (in 1000 cases)
Current study	2013-2017	Retrospective cohort study	Iran	Teaching hospital	9928	0.4	0.7
Malekzadeh	1994-2017	Retrospective cohort study	Iran	Single expert experience	9012	0.6	-
Viiala [5]	1989-1999	Retrospective cohort study	Australia	Teaching hospital	30463	0.8	1.6
Daniel E. Polter [9]	2011-2012	Retrospective cohort study	USA	Teaching hospital	10534	0.6	0.3
Beili cai et al. [10]	2000-2012	Retrospective study	China	Teaching hospital	110785	0.1	0.0

significant complications from moderate sedation for routine upper endoscopy and colonoscopy was low with all currently available agents.[16]

The retrospective design of this study carries a risk of underreporting complications. However, we aimed to assess «serious» adverse events only, which could be retrieved from the hospital information system, and we interviewed the attending who could recall any serious complications. Quality of bowel preparation was not reported with standard terminology in many reports, and we were not able to categorize this variable reliably.

Serious complications after colonoscopy are relatively rare. These may occur during diagnostic or therapeutic procedures and even when the procedure is performed by an expert gastroenterologist. The rate of complications does not appear to be higher in academic teaching hospitals when performed by fellows under supervision.

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ETHICAL APPROVAL

There is nothing to be declared.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this work.

REFERENCES

1. ASGE Standards of Practice Committee, Fisher DA, Maple JT, Ben-Menachem T, Cash BD, Decker GA, Early DS, et al. Complications of colonoscopy. Gastrointest Endosc 2011;74:745-52. doi:10.1016/j.gie.2011.07.025. Erratum in: Gastrointest Endosc. 2016 Nov;84(5):883.
2. Ko CW, Dominitz JA. Complications of colonoscopy: magnitude and management. Gastrointest Endosc Clin N Am 2010;20:659-71. doi:10.1016/j.giec.2010.07.005.
3. Kothari ST, Huang RJ, Shaukat A, Agrawal D, Buxbaum JL, Abbas Fehmi SM, et al; ASGE Standards of Practice Committee Chair. ASGE review of adverse events in colonoscopy. Gastrointest Endosc 2019;90:863-876.e33. doi:10.1016/j.gie.2019.07.033.
4. Reumkens A, Rondagh EJ, Bakker CM, Winkens B, Masclee AA, Sanduleanu S. Post-Colonoscopy Complications: A Systematic Review, Time Trends, and Meta-Analysis of Population-Based Studies. Am J Gastroenterol 2016;111:1092-101. doi:10.1038/ajg.2016.234.
5. Viiala CH, Zimmerman M, Cullen DJ, Hoffman NE. Complication rates of colonoscopy in an Australian teaching hospital environment. Intern Med J 2003;33:355-9. doi:10.1046/j.1445-5994.2003.00397.x.
6. Khalid M, Khalid M, Gayam V, Yeddi A, Adam O, Chakraborty S, et al. The Impact of Hospital Teaching Status on Colonoscopy Perforation Risk: A National Inpatient Sample Study. Gastroenterology Res 2020;13:19-24. doi:10.14740/gr1234.
7. Sadeghi A, Malekzadeh R. Complications of Colonoscopy and its Management: A Single Gastroenterologist Experience. Middle East J Dig Dis 2018;10:254-257. doi: 10.15171/mejdd.2018.119.
8. Fassil H, Adams KF, Weinmann S, Doria-Rose VP, Johnson E, Williams AE, et al. Approaches for classifying the indications for colonoscopy using detailed clinical data. BMC Cancer 2014;14:95. doi:10.1186/1471-2407-14-95.
9. Polter DE. Risk of colon perforation during colonoscopy at Baylor University Medical Center. Proc (Bayl Univ Med Cent) 2015;28:3-6. doi:10.1080/08998280.2015.11929170.
10. Shi X, Shan Y, Yu E, Fu C, Meng R, Zhang W, et al.

Lower rate of colonoscopic perforation: 110,785 patients of colonoscopy performed by colorectal surgeons in a large teaching hospital in China. Surg Endosc 2014;28:2309-16. doi:10.1007/s00464-014-3458-1.

11. Tziatzios G, Gkolfakis P, Triantafyllou K. Effect of fellow involvement on colonoscopy outcomes: A systematic review and meta-analysis. Dig Liver Dis 2019;5:1079-1085. doi: 10.1016/j.dld.2019.05.012.
12. Levin TR, Zhao W, Conell C, Seeff LC, Manninen DL, Shapiro JA, et al. Complications of colonoscopy in an integrated health care delivery system. Ann Intern Med 2006;145:880-6. doi: 10.7326/0003-4819-145-12-200612190-00004.
13. Rabeneck L, Paszat LF, Hilsden RJ, Saskin R, Leddin D, Grunfeld E, et al. Bleeding and perforation after outpatient colonoscopy and their risk factors in usual clinical practice. Gastroenterology 2008;135:1899-1906, 1906.e1. doi:10.1053/j.gastro.2008.08.058.
14. Desai R, Patel U, Goyal H. Does «July effect» exist in colonoscopies performed at teaching hospitals? Transl Gastroenterol Hepatol 2018;3:28. doi:10.21037/tgh.2018.05.04.
15. Sharma VK, Nguyen CC, Crowell MD, Lieberman DA, de Garmo P, Fleischer DE. A national study of cardiopulmonary unplanned events after GI endoscopy. Gastrointest Endosc 2007;66:27-34. doi:10.1016/j.gie.2006.12.040.
16. McQuaid KR, Laine L. A systematic review and meta-analysis of randomized, controlled trials of moderate sedation for routine endoscopic procedures. Gastrointest Endosc 2008;67:910-23. doi:10.1016/j.gie.2007.12.046.