The Incidence of 30-Day Adverse Events After Colonoscopy Among Outpatients in the Netherlands

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OBJECTIVES: Colonoscopy is the gold standard for visualization of the colon. It is generally accepted as a safe procedure and major adverse events occur at a low rate. However, few data are available on structured assessment of (minor) post-procedural adverse events.

METHODS: Consecutive outpatients undergoing colonoscopy were asked for permission to be called 30 days after their procedure. A standard telephone interview was developed to assess the occurrence of (i) major adverse events (hospital visit required), (ii) minor adverse events, and (iii) days missed from work. Adverse events were further categorized in definite-, possible-, and unrelated adverse events. Patients were contacted between January 2010 and September 2010.

RESULTS: Out of a total of 1,528 patients who underwent colonoscopy and gave permission for a telephone call, 1,144 patients were contacted (response: 75%), 49% were male, the mean age was 59 years (s.d.: 14). Thirty-four patients (3%) reported major adverse events. These were definite-related in nine (1%) patients, possible-related in 6 (1%), and unrelated in 19 patients (2%). Minor adverse events were reported by 466 patients (41%). These were definite-related in 336 patients (29%), possible-related in 36 (3%), and unrelated in the remaining 94 patients (8%). Female gender (odds ratio (OR): 1.5), age < 50 years (OR: 1.5), colonoscopy for colorectal cancer screening/surveillance (OR: 1.6), and fellow-endoscopy (OR: 1.7) were risk factors for the occurrence of any definite-related adverse event. Patients who reported definite-related adverse events were significantly less often willing to return for colonoscopy (81 vs. 88%, \( P < 0.01 \)) and were less often positive about the entire colonoscopy experience (84 vs. 89%, \( P = 0.04 \)).

CONCLUSIONS: Structured assessment of post-colonoscopy adverse events shows that these are more common than generally reported. Close to one-third of patients report definite-related adverse events, which are major in close to 1 in 100 patients. The occurrence of adverse events does have an impact on the willingness to return for colonoscopy.

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INTRODUCTION

Colonoscopies are responsible for > 50% of all endoscopic procedures performed per year in the United States (1). In 2002, it was estimated that over 14 million colonoscopies were performed in the United States (2). The total volume of colonoscopies has consistently expanded since then and will further increase in the coming years (3,4).

In general, colonoscopy is a safe procedure, but a small number of major adverse events do occur. The most serious adverse event is procedure-related death. A Canadian population-based cohort study showed that colonoscopy-related mortality 30 days after the procedure was 0.007% (5). Other major adverse events include perforation (0.07%) and bleeding (0.16%) after colonoscopy (5,6). The most common adverse events are sedation.

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related, in particular cardiopulmonary events. These adverse events have been reported to occur in >1% of colonoscopies (7,8). Furthermore, case reports described sporadic complications such as splenic rupture and colonic explosion (9,10).

Most adverse events occur at the endoscopy unit. However, adverse events can also occur in the days after the procedure. The incidence of major adverse events in the days after a colonoscopy is insufficiently clear (11–13). Furthermore, few data are available on the occurrence of minor adverse events. It has been suggested that up to 30% of patients experience minor adverse events (11,14,15). The occurrence of these minor adverse events may have an impact on the willingness to return for colonoscopy. This loss of adherence and the potential negative advice to others to undergo colonoscopy impair the effectiveness of colorectal cancer screening and surveillance (16).

The aim of this study was to systematically assess the rate of both major and minor adverse events in the 30 days after colonoscopy.

METHODS

This study took place in the context of a quality evaluation of colonoscopy performance in the Netherlands in 12 hospitals. Ethical approval for the study was obtained from the Institutional Review Board in each individual hospital. Consecutive outpatients undergoing a colonoscopy in one of 12 participating centers were asked to complete a patient satisfaction survey about their experiences during the whole endoscopy journey. A total of 150 surveys were required per department to complete the study. The survey consisted of a pre- and post-procedure questionnaire. At the end of the pre-procedure part (completed in the waiting room before the colonoscopy), patients were asked for permission to be called 30 days after the procedure.

Patients were contacted for this adverse event registration study between January 2010 and September 2010. A standard telephone interview was developed based on the most common adverse events reported in the literature (Figure 1) (11). The standard interview first asked about general health problems in the 30 days after the procedure. Next, the occurrence of gastrointestinal symptoms was assessed, with specific interest in bleeding and abdominal discomfort. We further assessed the severity and duration of bleeding and abdominal discomfort on a 3-point scale. It was also assessed whether patients had visited their family physician, an emergency department, or hospital. At last, it was assessed how many days of work (if applicable) were lost as a consequence of the procedure, excluding the day of the procedure.

The target of the adverse event registration study was to include at least 1,000 patients. Three researchers called the individuals 30 days after their procedure. Individuals were called at the end of the day or beginning of the evening on working days. When a subject could not be reached, they were approached again several days later. After two attempts, the subject was noticed to be not reached by telephone.

At the end of the study, the related colonoscopy reports were identified in the hospital files and the following data were recorded: date of birth, gender, indication for endoscopy, use of sedation,
quality of bowel preparation, therapeutic interventions during the procedure, extent of the procedure, endoscopic findings, and definite adverse events. Additionally, the telephone interview was linked to the satisfaction survey. Six months after the study end, the hospital records of all patients were checked to see whether patients were deceased during the study period.

For data analyses, a distinction was made between major adverse events and minor adverse events. Major adverse events were defined as any health problem that made the patient visit an emergency department or hospital within the 30 days after their colonoscopy. Minor adverse events were defined as any health problem that the patient experienced in the 30 days after the procedure, not requiring a hospital visit. Individual patients could report both major and minor adverse events. When complaints had already existed before the procedure (based on the indication provided in the report, the patient satisfaction survey, or the telephone interview), similar complaints in the 30 days after the procedure were not regarded as an adverse event, unless it was specifically stated that the complaints had deteriorated after the colonoscopy. Both major and minor adverse events were further divided in definite-related, possible-related, and unrelated adverse events. The hospital record was searched to assess the relation between major adverse events and the colonoscopy, time between the colonoscopy and the adverse were also taken into account. For minor adverse events, two investigators discussed and reached consensus whether the event had been definite-, possible-, or unrelated.

Statistical analyses were performed using the SPSS statistical package, version 17.0 (IBM Corporation, Chicago, IL). Descriptive statistics were performed using χ² tests (categorical data) and Student’s t-test (continuous data). Multivariate binary logistic regression using robust standard errors was performed to find predictors of the occurrence of any (major or minor) definite-related adverse event. The following variables were included in the model: gender, age, screening/surveillance as indication, the use of sedation, polypectomy, and specialization of the endoscopist. A two-sided P value of < 0.05 was considered to be significant.

**RESULTS**

During the study period, 1,528 out of 1,800 patients (84.9%) gave permission in the pre-procedure questionnaire to be called 30 days after the procedure for the adverse event registration. A total of 1,144 persons (response rate: 74.9%) were successfully contacted after the procedure for the adverse event registration. A total of 1,144 persons (response rate: 74.9%) were successfully contacted and included in the study cohort. The number of patients included per endoscopy department ranged from 4.4 to 11.3% (mean: 9.0%). Patients were contacted after a mean of 32 days (s.d.: 4).

Patients who reported any major adverse event (n = 34) were between the responders and non-responders. Direct complications, extracted from the colonoscopy reports, were (minor) bleeding in nine patients (0.8%), hypoxia in two patients (0.2%), and bradycardia in two patients (0.2%).

**Major adverse events**

Table 2 shows the reported major adverse events in the 30 days after colonoscopy and the range between the participating departments.

No mortality was observed in this study cohort. Definite-related major adverse events were reported by nine patients (0.8%), while another six patients had possible-related adverse events (0.5%). All patients with major definite-related events had received conscious sedation and had undergone a complete colonoscopy.

Patients who reported any major adverse event (n = 34) were seen at the emergency department or admitted to the hospital for a median of 3.9 days (interquartile range: 1.0–5.5 days). Patients who reported definite-related major adverse events were admitted for a median of 4.0 days (interquartile range: 1.0–2.5).

**Minor adverse events**

Table 3 shows the reported minor adverse events in the 30 days after colonoscopy and the range between the participating departments.
departments. A total of 336 patients (29.4%) experienced definite-related minor adverse events, 36 patients (3.1%) had possible-related minor adverse events. Most common definite-related minor adverse events were abdominal discomfort (\(n = 195, 17.0\%\)), rectal blood loss (\(n = 64, 5.6\%\)), and change in bowel habits (\(n = 62, 5.4\%\)).

Of the patients who reported abdominal discomfort, 73 patients (37.4%) reported that abdominal discomfort had been absent before the procedure, 100 patients (51.3%) said that their complaints of discomfort was worse than before, and 12 patients (6.2%) said that they had less discomfort than before the colonoscopy. Forty-two patients (21.5%) scored their pain as severe, while the other 153 patients (78.5%) reported mild-to-moderate pain. Patients reported that the abdominal discomfort persisted for a median of 2.0 days (interquartile range: 1.0 – 4.0 days).

Of the patients who reported rectal blood loss at home, five patients (7.8%) reported much blood loss and 59 patients (92.2%) reported little blood loss. Blood loss was reported for a median of 1.0 day (interquartile range: 1.0 – 3.0).

Of all patients who were not retired (\(n = 749\)), 64.1% went to work the day after the procedure, 24.8% missed 1 extra day from work, 4.1% 2 days, and 6.9% \(\geq 3\) days (mean: 1.4 days). Among the patients who were not retired and who reported definite-related minor adverse event (\(n = 226\)), 59.1% went to work the day after the procedure (\(P = 0.15\)), 26.1% missed 1 day from work, 5.9% 2 days, and 8.8% \(\geq 3\) days.

Predictors of adverse events
Table 4 shows the predictors of the occurrence of any adverse event. Any definite-related adverse event was significantly more often reported by female patients (odds ratio (OR): 1.5, 95% confidence interval (CI): 1.1 – 2.0), patients who were \(\leq 50\) years of age (OR: 1.5, 95% CI: 1.1 – 2.1), when the colonoscopy was performed for colorectal cancer screening or surveillance (OR: 1.5, 95% CI: 1.2 – 2.2) and when the colonoscopy was performed by a fellow (OR: 1.7, 95% CI: 1.2 – 2.5).

Satisfaction
The colonoscopy was more often perceived as more discomforting than expected by patients who reported definite-related adverse events compared with patients who did not experience definite-related adverse events (59.4 vs. 70.5%, \(P < 0.01\)). Furthermore, patients with definite-related adverse events found the colonoscopy less often comfortable (40.0 vs. 51.1%, \(P < 0.01\)), and less often acceptable (60.9 vs. 76.7%, \(P < 0.001\)), compared with patients who were free of adverse events.

Patients who had experienced any definite-related adverse event were also less willing to return for colonoscopy (80.6 vs. 87.6%,
The results of this cross-sectional quality assessment represent the daily clinical practice. The perforation rate (0.1%) and bleeding rate (0.4%) in our study were similar to other series and below the suggested standards (perforation: 0.2%; bleeding: 1%) (5,13,17). Compared with a large prospective cohort study from the United States in which patients were called at 7 and 30 days post-procedure, numbers of definite- or possible-related major adverse events were higher in our study: 1.3 vs. 0.33% (19). This difference might be explained by the fact that in the study from the United States the cohort was restricted to patients who underwent colonoscopy for screening or surveillance and thus the included patients might be healthier and have less complicated procedures. Contradictory, we found that patients undergoing colonoscopy for screening or surveillance reported more often adverse events. This result might be explained by the fact that we included all reported adverse events, including minor adverse events. One may hypothesize that patients who do not undergo colonoscopy because of symptoms may sooner notice and report health problems in the period after the colonoscopy. At last, the expected and perceived symptoms after colonoscopy may be different between asymptomatic and symptomatic patients.

As the number of major adverse events was small, we were unable to identify significant risk factors for the occurrence of definite-related major adverse events. However, we did show that they were reported more often in older patients and female patients. Age has been proven to be a risk factor before (5,6,19). Results on gender as a risk factor are more inconsistent. A systematic review showed that female gender was a risk factor for colonic perforation (OR: 2.3) (6). On the other hand, a Canadian population-based cohort study found a negative association between female gender and the risk of perforation or bleeding (OR: 0.67) (5). However, for perforation alone, females did have an increased risk (OR: 1.21). In our study, the inclusion of abdominal discomfort might explain why female gender was found to be a risk factor for reporting major adverse events, as they generally experience more discomfort during and after colonoscopy (11,20).

Besides the well-known adverse events, in our study other major adverse events that made the patient visit the emergency department were observed as well. Some might be related to sedation or bowel preparation (angina and dizziness), others were probably related to the colonoscopic technique or interventions (discomfort). Furthermore, we observed more uncommon adverse events, such as transient ischemic attack, pulmonary embolism, and syncope. We could not prove a definite relation between the occurrence of these adverse events and the colonoscopy, therefore classified them as possible-related, as has been done before (19). However, the clinical impact of these adverse events will be the same, as patients will most probably link them to the colonoscopy. Our results thus show that the real incidence of adverse events will be underestimated both in number and in impact when only definitive adverse events are counted. It underlines that conservative quality assessment may underestimate this issue. The results further underline the importance of proper information provision, medication plans, and monitoring of patients after their colonoscopy.

Table 4. Predictors of the occurrence of major or minor adverse events in the 30 days after colonoscopy in an outpatient cohort (n=1,144) in the Netherlands

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Definite-related adverse event OR 95% CI</th>
<th>Definite- or possible-related adverse event OR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female gender</td>
<td>1.53 1.14–2.01</td>
<td>1.66 1.25–2.21</td>
</tr>
<tr>
<td>Age &lt;50 years</td>
<td>1.51 1.09–2.11</td>
<td>1.34 0.98–1.85</td>
</tr>
<tr>
<td>Indication CRC screening/surveillance</td>
<td>1.58 1.15–2.17</td>
<td>1.33 0.98–1.81</td>
</tr>
<tr>
<td>Sedation used</td>
<td>0.87 0.53–1.44</td>
<td>0.70 0.44–1.13</td>
</tr>
<tr>
<td>Polypectomy performed</td>
<td>0.97 0.71–1.32</td>
<td>0.95 0.70–1.28</td>
</tr>
<tr>
<td>Specialist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastroenterologist</td>
<td>Ref</td>
<td>Ref</td>
</tr>
<tr>
<td>Fellow</td>
<td>1.74 1.20–2.50</td>
<td>1.75 1.23–2.51</td>
</tr>
<tr>
<td>Internist</td>
<td>1.25 0.76–2.04</td>
<td>1.31 0.82–2.11</td>
</tr>
<tr>
<td>Surgeon</td>
<td>0.51 0.17–1.54</td>
<td>0.57 0.21–1.58</td>
</tr>
<tr>
<td>Nurse-endoscopist</td>
<td>0.84 0.36–1.93</td>
<td>0.74 0.32–1.81</td>
</tr>
</tbody>
</table>

CI, confidence interval; CRC, colorectal cancer; OR, odds ratio.

\( P<0.01 \) and were less often positive about the entire colonoscopy experience (83.9 vs. 88.9%, \( P=0.04 \)). These results were the same when only minor adverse events were taken into account.

DISCUSSION

Major adverse events during colonoscopy occur in a small proportion of patients. Few data are available on the incidence of adverse events in the period after the procedure. Especially little is known about the occurrence of minor adverse events, which might influence the perceived burden of a colonoscopy and thereby the willingness to return.

This study supports that only a small proportion of patients experience major adverse events in the 30 days after their procedure (0.8% definite-related adverse events). However, almost a third of the patients do experience definite-related minor adverse events. These complaints do not result in significant more days lost from work. However, they do affect the willingness to return for colonoscopy (81 vs. 88%).

The credo ‘primum non nocere’ (first, do no harm) underlies all medical practice. Therefore, adverse events have been a core issue in quality assurance for colonoscopy. Several guidelines have been published to set targets for the occurrence of major adverse events (17). Large database studies have shown that the occurrence of death (<1 in 14,000), perforation (<1 in 1,200), and bleeding (<1 in 600) are generally low (5,6,13). Limitations of these studies might be the use of administrative databases and failure to follow patients for a longer period (18). Furthermore, many studies were performed in colorectal cancer screening trials, single-center settings, academic settings, or focused on single complications. The results of this cross-sectional quality assessment represent the daily clinical practice. The perforation rate (0.1%) and bleeding rate (0.4%) in our study were similar to other series and below the suggested standards (perforation: 0.2%; bleeding: 1%) (5,13,17). Compared with a large prospective cohort study from the United States in which patients were called at 7 and 30 days post-procedure, numbers of definite- or possible-related major adverse events were higher in our study: 1.3 vs. 0.33% (19). This difference might be explained by the fact that in the study from the United States the cohort was restricted to patients who underwent colonoscopy for screening or surveillance and thus the included patients might be healthier and have less complicated procedures. Contradictory, we found that patients undergoing colonoscopy for screening or surveillance reported more often adverse events. This result might be explained by the fact that we included all reported adverse events, including minor adverse events. One may hypothesize that patients who do not undergo colonoscopy because of symptoms may sooner notice and report health problems in the period after the colonoscopy. At last, the expected and perceived symptoms after colonoscopy may be different between asymptomatic and symptomatic patients.

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Besides the major adverse events, patients may experience significant burden from minor adverse events. Previous research has found that these minor adverse events occur in 34% of patients undergoing a colonoscopy (11). Limitations of that study were the smaller sample size (n=470), the academic single-center setting of the study, no assessment of bowel complaints before the colonoscopy, and inclusion of screening and surveillance colonoscopies only (11). We addressed these items and our results are similar, with definitive-related adverse events occurring in 29% of the patients. With respect to the severity of minor adverse events, we provided detail on the duration and experienced severity of the most common minor events, abdominal discomfort, and rectal blood loss. Our results show that rectal blood loss mostly was a minor problem, but abdominal discomfort could hold on for several days, and was experienced as more burdensome than before the procedure for the majority of patients that experienced it. Additionally, our results show that patients often miss a day from work after the colonoscopy due to the procedure. However, there was only a small difference in absenteeism between all patients and patients who reported direct-related adverse events (36 vs. 41%), indicating that the adverse events in general may not keep patients from their normal work. The number of minor adverse events reported by our and the American study from 2007 are significantly higher compared to a study performed in 1997 in the United States, where 17% of the patients experienced any adverse event (12). This may be explained by their less comprehensive interview-technique, and the inclusion of colonoscopies performed by experienced colonoscopists only. In our study, patients reported significantly more often adverse events when the colonoscopy was performed by a fellow. A retrospective chart audit found that perforation did occur more often when the endoscopist had performed <200 lower gastrointestinal endoscopies (13). Moreover, it has been established that a longer procedure time increases the risk of minor adverse events (11,20). Taken these results together indicate that the risk for any (major and minor) adverse event is higher if procedures are performed by less-experienced endoscopists.

Our study does have some limitations. First, as approximately a quarter of the patients were not reached by telephone, we could have missed some patients with serious adverse events. However, all patient records were checked for 30-day mortality. We assured ourselves that these patients were not deceased. However, they might have been admitted for adverse events at the time of the telephone interview. Another limitation might be recall-bias. As we called 30 days after the procedure, patients might have forgotten the exact details of their complaints. However, this would not be the case for serious adverse events, and may lead to an underestimation of the occurrence of minor adverse events.

In conclusion, this study supports that a colonoscopy is a safe procedure in daily clinical practice. Serious adverse events do occur in a small proportion of patients, however. Moreover, should the burden of the procedure in terms of minor adverse events not be ignored as a significant part of the patients undergoing colonoscopy do experience complaints in the days following their procedure and this decreases their willingness to return for colonoscopy. Patients and physicians should be aware that a colonoscopy is a burdensome procedure. Regular monitoring of the occurrence of both minor and major adverse events can help endoscopy departments improve the patient-centered care.

**CONFLICT OF INTEREST**

**Guarantor of the article:** Vincent de Jonge, BSc.

**Specific author contributions:** Study concept and design, acquisition of data, analysis and interpretation of data, drafting of the manuscript, statistical analysis, and approval of the final submitted draft: Vincent de Jonge; study concept and design, acquisition of data, analysis and interpretation of data, critical revision of the manuscript for important intellectual content, statistical analysis, and approval of the final submitted draft: Jerome Sint Nicolaas; study concept and design, critical revision of the manuscript for important intellectual content, and approval of the final submitted draft: Onno van Baalen, Johannes T. Brouwer, Mark F.J. Stolk, Thjon J. Tang, and Antonie J.P. van Tilburg; study concept and design, interpretation of data, critical revision of the manuscript for important intellectual content, study supervision, and approval of the final submitted draft: Monique E. van Leerdam and Ernst J. Kuipers.

**Financial support:** None.

**Potential competing interests:** None.

**Study Highlights**

### WHAT IS CURRENT KNOWLEDGE

- Colonoscopy is a commonly performed procedure, generally considered to be safe.
- Patients can experience burden from a colonoscopy in the days after the procedure, the majority being minor adverse events within 7 days.

### WHAT IS NEW HERE

- Major adverse events occur in ~1 in 100 patients.
- A significant proportion of patients (up to one-third) experience minor adverse events in the days after their procedure.
- Minor adverse events do hamper the willingness to return for a colonoscopy.

**REFERENCES**


APPENDIX

List of participants in the SCoPE consortium: V. de Jonge, J. Sint Nicolaas, M.E. van Leerdam, E.J. Kuipers (Erasmus MC University Medical Center, Rotterdam); O. van Baalen (Beatrix Hospital, Gorinchem); F. ter Borg (Deventer Hospital, Deventer); J.T. Brouwer (Reinier de Graaf Hospital, Delft); D.L. Cahen (Amstelland Hospital, Amstelveen); F.J.G.M. Kubben (Maastad Hospital, Rotterdam); W. Lesterhuis (Albert Schweitzer Hospital, Dordrecht); W. Moolenaar (Medical Center Alkmaar, Alkmaar); R.J.Th. Ouwendijk (Ikazia Hospital, Rotterdam); M.F.J. Stolk (Sint Antonius Hospital, Nieuwegein); T.J. Tang (IJsseleland Hospital, Capelle aan den IJssel); A.J.P. van Tilburg (Sint Franciscus Gasthuis, Rotterdam).