Quality assurance and gastrointestinal endoscopy: an audit of 500 colonoscopic procedures

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SUMMARY
The aim of this study was to assess the quality of colonoscopic procedures in our endoscopy unit with the goal of improving performance.

Methods — We prospectively audited 500 consecutive colonoscopic procedures and assessed sixty-two process or outcome indicators for each procedure.

Results — Most of the measured indicators were within standard limits: cecal intubation rate (92%), inadequate bowel preparations (24%), inappropriate procedures (9.7%), normal procedures (54%), yield for neoplasia (32%), morbidity (0.4%), and overall patient satisfaction (95.8%). Some indicators were outside standard limits suggesting our practices should be modified: endoscopy withdrawal time less than 6 minutes (78%), forceps removal of polyps (31%), resected polyps not recovered for pathological examination (12%), adenomas with villous elements (22%), patients unsatisfied because of time spent waiting for the procedure (19%), patients unsatisfied because of inadequate explanations (10%). There was no standard for a few indicators: patient discomfort (6.9%), diagnostic success (89%), therapeutic success (92%). Three new indicators were proposed: proportion of patients aged < 50 years, number of normal colonoscopic procedures to perform to detect one advanced adenoma or cancer, and proportion of colonoscopic procedures causing discomfort. The diagnostic yield of colonoscopy was dependent on age, gender, indication and appropriateness of indication but not on the prescriber.

Conclusion — This audit allowed us to evaluate our endoscopic practices and to detect certain shortcomings and deviations from standards. It enabled us to change some of our practices with the goal of improving the quality of our colonoscopic procedures.

Introduction
According to the World Health Organization, assessment of healthcare quality is a process designed to guarantee for each patient the range of diagnostic and therapeutic procedures assuring, considering the current state of the art of medical science, the best outcome in terms of health, with the lowest cost for the same result, the lowest iatrogenic risk, and the best patient satisfaction in terms of procedures, results and human contacts within the healthcare system [1]. A large body of literature has been cumulated concerning the quality of gastrointestinal endoscopy procedures [2-15], but very few studies have been conducted in France to assess the quality of colonoscopic procedures [16-21]. Quality assurance of colonoscopy, a frequently prescribed complex procedure involving risk and healthcare expenditure [5], could be expected to contribute significantly to improved patient care.

A wide range of quality assessment tools are available [22]. Healthcare auditing is a first-intention method providing essential information on the quality of care [22]. According to the definition of the French national agency for healthcare accreditation and evaluation (ANAES), a clinical audit is an evaluation method based on explicit and determined criteria enabling comparison of healthcare practices with accepted standards and designed to measure the quality of these practices and healthcare results with the goal of improving patient care [23]. An audit evaluates quality using an approach based on measurement and comparison [24]. It has the advantage of inciting awareness among the concerned professionals thus favoring implementation of guidelines.
Table I. – Process indicators.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Audit results</th>
<th>Standard values [reference]</th>
<th>Data in the literature [reference]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median waiting time for the colonoscopy appointment</td>
<td>28 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients aged &lt; 50 years</td>
<td>19.4%</td>
<td></td>
<td>30% [18, 32]</td>
</tr>
<tr>
<td>Information for examination adequate</td>
<td>98%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Complete files</td>
<td>97%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Informed consent</td>
<td>96%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>Inappropriate procedures (^a) (all indications)</td>
<td>9.7%</td>
<td>0%</td>
<td>6-32% [20, 32-34]</td>
</tr>
<tr>
<td>Inappropriate procedures (^b) (screening)</td>
<td>10%</td>
<td>0%</td>
<td>17-44% [32, 34, 35]</td>
</tr>
<tr>
<td>Inappropriate procedures (^b) (surveillance)</td>
<td>7%</td>
<td>0%</td>
<td>45-53% [32, 34-36]</td>
</tr>
<tr>
<td>Insufficient colon preparation</td>
<td>24%</td>
<td>0%</td>
<td>23-41% [12, 16, 37]</td>
</tr>
<tr>
<td>Withdrawal time (^c) 6 minutes</td>
<td>21.7%</td>
<td>100% [10]</td>
<td></td>
</tr>
<tr>
<td>Forceps polypectomy</td>
<td>31%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-recovered resected polyps</td>
<td>12%</td>
<td>&lt; 5% [10]</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) as recommended by the European Panel on the Appropriateness of Gastrointestinal Endoscopy [31];
\(^b\) as recommended by the 1998 consensus conference on colorectal cancer [30].

Patients and methods

The audit concerned colonoscopic procedures performed in the gastrointestinal endoscopy unit of the Colmar Civil Hospitals, Colmar, France, from June 1 to October 31, 2002. All endoscopic procedures were undertaken to explore the entire colon and/or the terminal ileum were included. Process criteria were evaluated as well as output and outcome criteria (Donabedian) (tables I et II). The evaluation criteria were selected among the guidelines promulgated by the American Society for Gastrointestinal Endoscopy (ASGE) and reviews recently published in the literature [5-11]. Standards were chosen from the recommendations of the French consensus conference on colonic cancer held in 1998 [30], the appropriateness criteria proposed by the European Panel on the Appropriateness of Gastrointestinal Endoscopy (EPAGE) [31] for colonoscopy indications, and the guidelines for colonoscopy presented by the US multisociety task force on colorectal cancer [10]. We compared our data with these standards which were expressed either as established reference values or as expected ideal values when an established reference value was not available. When no standard value was available, we compared our results with published data. A 62-item evaluation chart was prepared. Gender, age, and the ASA (American Society of Anesthesiologists) score were recorded for each patient. For each colonoscopic procedure, we recorded: prescription modality, preparation and execution conditions, technical quality, diagnostic yield, and clinical impact. The chart was initially tested with a sample of 20 patients. Colonoscopy was performed by five senior gastroenterologists. The endoscopist filled in the evaluation chart before and after each procedure. Operators were instructed to choose among a predefined list one indication which described the context and best reflected the reasons for performing the exploration.

A questionnaire completed by the operator before the procedure was reviewed by one of the authors (BD) to establish the EPAGE appropriateness score (http://www.epage.ch) [31]: 1-3 inappropriate, 4-6 uncertain, and 7-9 appropriate. The recommendations of the colonic cancer consensus conference held in 1998 [30] were used to assess appropriateness of screening procedures and procedures performed for surveillance of adenomas or colorectal cancer. The proportion of the mucosa visible within the explored colon was used to assess quality of the colon preparation. Uncomplicated diverticula were not considered as an anomalous finding. Histology results were recorded secondarily. Adenomas measuring more than 1 cm or with villous elements or high-grade dysplasia were defined as advanced adenomas [10]. Diagnostic yield was determined from the number of normal procedures (N), the number of procedures disclosing significant neoplastic lesions (SNL), cancer or advanced adenoma, and the N/SNL ratio reflecting the number of normal procedures performed for each procedure revealing a SNL. Complications were recorded in a ledger, a practice used in our endoscopy unit since 1999 [28]. A phone inquiry was performed 2 to 3 weeks after the procedure. The unit hostess asked patients about any complication expe-
rienced and their satisfaction with the exploration procedure. In order to
allow comparison with data in the literature, two categories of complica-
tions, morbidity (requiring care) and discomfort (not requiring care),
were retained. Symptoms not leading to consultation (abdominal pain,
nausea, bloating, headache, or vertigo) were classified in the discomfort
category. Patient satisfaction was evaluated with a French translation of
the GHAA-9 (Group Health Association of America) questionnaire,
recommended by the ASGE [6]. A question concerning the patient’s
satisfaction with colonic preparation was added.

Statistical analysis

Data were processed and analyzed with Modalisa® software. The
chi-square test was used for comparison of indications, appropriateness,
and diagnostic yield between groups. The significance threshold was set
at 0.05.

Results

Process and outcome indicators are presented in tables I
and II.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Audit results</th>
<th>Standard values [reference]</th>
<th>Data in the literature [reference]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output indicators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cecal intubation rate</td>
<td>92%</td>
<td>2 90% [10]</td>
<td>91-98% [38]</td>
</tr>
<tr>
<td>Polypectomy failures</td>
<td>2.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyps ≥ 2 cm resected endoscopically</td>
<td>83%</td>
<td></td>
<td>84% [39]</td>
</tr>
<tr>
<td>Cancers</td>
<td>5.4%</td>
<td>2 1.4-5% [12, 17, 18, 32, 38]</td>
<td></td>
</tr>
<tr>
<td>Polyps</td>
<td>37%</td>
<td></td>
<td>24-34% [12, 17, 18, 38]</td>
</tr>
<tr>
<td>Proportion of adenomatous polyps</td>
<td>71%</td>
<td></td>
<td>70-75% [40, 41]</td>
</tr>
<tr>
<td>Adenomas</td>
<td>28%</td>
<td>2 25% (men &gt; 50 yr) [10]</td>
<td>2 15% (women &gt; 50 yr) [10]</td>
</tr>
<tr>
<td>Proportion of adenomas with villous elements</td>
<td>22%</td>
<td>&lt; 10% [10]</td>
<td></td>
</tr>
<tr>
<td>Advanced adenomas</td>
<td>10%</td>
<td></td>
<td>3-10% [10, 32]</td>
</tr>
<tr>
<td>Significant neoplastic lesions (SNL)</td>
<td>14.6%</td>
<td></td>
<td>6-11% [17, 18, 42]</td>
</tr>
<tr>
<td>Normal procedures: N</td>
<td>54.2%</td>
<td></td>
<td>34-68% [4, 12, 16-18, 38]</td>
</tr>
<tr>
<td>N/NSNL a</td>
<td>3.7</td>
<td></td>
<td>4.5-8.3 [17, 18]</td>
</tr>
<tr>
<td><strong>Outcome indicators</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>0%</td>
<td>0%</td>
<td>0.01-0.05% [43]</td>
</tr>
<tr>
<td>Handicap</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Morbidity b</td>
<td>0.4%</td>
<td>0%</td>
<td>0.2-1% [43]</td>
</tr>
<tr>
<td>Discomfort c</td>
<td>6.9%</td>
<td>0%</td>
<td>13.7-15% [44, 45]</td>
</tr>
<tr>
<td>Overall dissatisfaction</td>
<td>4.2%</td>
<td>0%</td>
<td>6% [45]</td>
</tr>
<tr>
<td>Diagnostic success</td>
<td>89%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Therapeutic success</td>
<td>92%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Contributive procedure</td>
<td>94%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

a NSNL: the number of normal procedures performed for each procedure detecting a significant neoplastic lesion;
b Morbidity: Complications requiring care;
c Discomfort: Complications not requiring care.

Patients

Five hundred colonoscopic procedures were performed during
the 5-month audit in 254 women and 246 men, median age
63 years (range: 15-92). Patient characteristics are given in
table III. The ASA score was 1 in 34%, 2 in 48% and 3 in 16%.

Most frequent indications for colonoscopy are listed in
table IV. The colonoscopy was performed for therapeutic pur-
poses in 3% of patients, mainly for polypectomy. The predomi-
nant diagnostic indications were exploration for symptoms
(41%), screening for adenoma and colorectal cancer (21%) and
surveillance after polypectomy or colorectal cancer surgery
(20%). Exploration of symptoms accounted for 70% of the proce-
dures performed in patients aged over 80 years.

Appropriateness

Appropriateness results are presented in table V for 485 diag-
nostic colonoscopic procedures. The EPAGE score could not be
established for 7% of patients because the indication did not cor-
respond to the defined scenarios. Most frequent inappropriate
procedures were performed for hematochezia (28%), abdominal pain (17%), screening (11%), and surveillance after polypectomy (11%). The inappropriate procedures performed for hematochezia were performed without prior anorectal exploration. The proportions of inappropriate procedures are presented by indication in table IV. The proportion of inappropriate procedures varied with age but was not different between men and women, gastroenterologist prescribers or not, or outpatients and inpatients (table III). According to the consensus conference recommendations, the 73 colonoscopic procedures performed for screening purposes were appropriate in 32% of patients, of uncertain appropriateness in 58%, and inappropriate in 10%. The appropriateness was uncertain for procedures performed in patients with a family history of adenoma or colorectal cancer over 60 years of age. According to the consensus conference recommendations, the 98 colonoscopic procedures performed for surveillance purposes were appropriate in 89% of patients, of uncertain appropriateness in 4% and inappropriate in 7% (table IV).

Colonoscopy modalities

The large majority (98%) of the colonoscopic procedures were performed under general anesthesia and 59% were performed in an outpatient setting. Ninety percent or more of the colonic mucosa was visualized in 76% of patients, between 80% and 90% in 11% of patients and less than 80% in 12%. The quality of the colonic preparation was not different in patients aged over 80 years. Cecal intubation was unsuccessful because of an obstructing stenosis in 2% of patients, poor colonic preparation in 2% and technical difficulty in 4%. Ileoscopy was achieved in 15% of patients. Median exploration time, determined as the withdrawal time from the cecum to the anus was assessed in 300 diagnostic colonoscopies and was 4 min 40 sec (figure 1). The withdrawal times were 6 minutes in 21.7% of patients undergoing a diagnostic procedure. This proportion did not vary with age. It was however significantly lower for screening procedures (9.1%) than for procedures performed to explore symptoms (26%) (P = 0.02). Biopsies were taken in 16% of patients and polyp(s) were removed in 38%. Forty-two percent of the polypectomies were performed by electrocautery snare excision, 27% by endoscopic mucosal resection, and 31% with a biopsy forceps. Endoscopic polypectomy was unsuccessful in 5 patients (1% of the polyps and 2.6% of the patients). Fifteen (83%) of the 18 polyps measuring more than 2 cm were resected endoscopically.

Diagnostic yield

During the 485 colonoscopic procedures performed for diagnostic purposes, 422 polyps were diagnosed in 179 patients (37%), 14% of them measuring more than 1 cm. Seventy one percent of polyps were adenomas and 24% advanced adenomas. A neoplastic lesion (cancer or adenoma) was diagnosed in 32% of patients. Two hundred sixty adenomas were identified in 137 patients (28%) and 78 advanced adenomas in 50 (10%).
The histological type was tubular in 78%, tubulovillous in 18% and villous in 4%. High-grade dysplasia was present in 22% of adenomas.

The proportion of normal procedures and the number of procedures revealing significant neoplastic lesions (SNL) varied with age, gender, indication and appropriateness, but not with type of prescriber (gastroenterologist or not), nor with inpatient or outpatient status (tables III, IV and V; figure 2). There were significantly more procedures which were abnormal or disclosed SNL in patients explored for anemia (48.4% and 17.7%, respectively) or for hematochezia (52.5% and 10%) than in patients explored for abdominal pain or change in bowel habits (29.1% and 3.5%) (P < 0.05). The proportions of procedures disclosing neoplasia or SNL were not significantly different between procedures performed for hematochezia (35% and 10% respectively) or for screening purposes (30% and 9.6%). In patients with hematochezia, 64% of the neoplastic lesions were within the reach of flexible sigmoidoscopy and none of the

Table IV. – Main indications of colonoscopic procedures, their appropriateness and their diagnostic yield.
Principales indications des coloscopies, leur pertinence et leur rendement diagnostique.

<table>
<thead>
<tr>
<th>Indications</th>
<th>Number of patients N (%)</th>
<th>Proportion of appropriate procedures EPAGE score a %</th>
<th>Proportion of appropriate procedures 1998 Consensus b %</th>
<th>Proportion of normal procedures: N %</th>
<th>Proportion of procedures detecting SNL c %</th>
<th>N/SNL d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anemia</td>
<td>62 (12.4)</td>
<td>97</td>
<td>52</td>
<td>17.7</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>42 (8.4)</td>
<td>52</td>
<td>74</td>
<td>2.4</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Hematochezia</td>
<td>40 (8)</td>
<td>33</td>
<td>48</td>
<td>10</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Constipation</td>
<td>22 (4.4)</td>
<td>41</td>
<td>73</td>
<td>4.5</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Diarrhea</td>
<td>22 (4.4)</td>
<td>41</td>
<td>64</td>
<td>4.5</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Weight loss</td>
<td>16 (3.2)</td>
<td>6</td>
<td>50</td>
<td>6.3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Total symptoms</td>
<td>204 (40.8)</td>
<td>56</td>
<td>59</td>
<td>9.3</td>
<td>6.3</td>
<td></td>
</tr>
<tr>
<td>Screening</td>
<td>73 (14.6)</td>
<td>21</td>
<td>32</td>
<td>58</td>
<td>9.6</td>
<td>8.4</td>
</tr>
<tr>
<td>FOBT * positive</td>
<td>33 (6.6)</td>
<td>100</td>
<td>42</td>
<td>30.3</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>Total screening</td>
<td>106 (21.2)</td>
<td>45</td>
<td>53</td>
<td>53</td>
<td>14.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Postpolypectomy surveillance</td>
<td>67 (13.4)</td>
<td>79</td>
<td>90</td>
<td>46</td>
<td>17.9</td>
<td>2.6</td>
</tr>
<tr>
<td>CRC surveillance f</td>
<td>31 (6.2)</td>
<td>52</td>
<td>87</td>
<td>58</td>
<td>9.7</td>
<td>6</td>
</tr>
<tr>
<td>Total surveillance</td>
<td>98 (19.6)</td>
<td>70</td>
<td>89</td>
<td>50</td>
<td>15.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Total diagnostic procedures</td>
<td>485 (97)</td>
<td>55</td>
<td>54</td>
<td>14.6</td>
<td>3.7</td>
<td></td>
</tr>
</tbody>
</table>

* EPAGE: European Panel on the Appropriateness of Gastrointestinal Endoscopy [31];
* SNL: significant neoplastic lesion;
* N/SNL: the number of normal procedures performed for each procedure detecting a significant neoplastic lesion;
* FOBT: fecal occult blood test;
* CRC: colorectal cancer.

Table V. – Diagnostic yield of 485 diagnostic colonoscopic procedures in relation to their appropriateness.
Rendement diagnostique des 485 coloscopies diagnostiques en fonction de leur pertinence.

<table>
<thead>
<tr>
<th>Appropriateness EPAGE a</th>
<th>Number of patients N (%)</th>
<th>Proportion of normal procedures: N%</th>
<th>Proportion of procedures detecting SNL b %</th>
<th>N/SNL c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appropriate</td>
<td>265 (54.6)</td>
<td>50</td>
<td>20.3</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NS</td>
<td>P &lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>Uncertain</td>
<td>139 (28.7)</td>
<td>57</td>
<td>6.5</td>
<td>8.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NS</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Inappropriate</td>
<td>47 (9.7)</td>
<td>66</td>
<td>6.4</td>
<td>10.3</td>
</tr>
<tr>
<td>Not cited in standard</td>
<td>34 (7)</td>
<td>64</td>
<td>15.2</td>
<td>4.2</td>
</tr>
</tbody>
</table>

* EPAGE: European Panel on the Appropriateness of Gastrointestinal Endoscopy [31];
* SNL: significant neoplastic lesion;
* N/SNL: the number of normal procedures performed for each procedure detecting a significant neoplastic lesion.
lesions out of the reach of flexible sigmoidoscopy were SNL. Among the 26 cancers diagnosed, 23 (88%) were discovered with appropriate procedures. Cancer was discovered during one procedure of uncertain appropriateness (screening in a patient with acromegaly and whose father developed colorectal cancer at 81 years), in one inappropriate procedure (hematochezia explored directly by colonoscopy without prior anorectal exploration), and in one other procedure performed for an indication (venous thrombosis) which was not mentioned by EPAGE appropriateness scale. Among the procedures leading to the diagnosis of SNL, 76% were appropriate, 13% were of uncertain appropriateness, and 4% were inappropriate.

After having completed the procedure, the endoscopist felt that the explorations had fully (89% of procedures) or largely (5% of procedures) answered the diagnostic questions raised. For 3% of the procedures, the operator felt the diagnostic questions were only partially answered and for another 3% not at all. After having completed procedures with a therapeutic stage (N = 189), the operator considered the endoscopic treatment had been totally successful (92% of procedures), nearly totally (5%), partially (2%), or not at all (1%). For the endoscopists, 94% of the procedures were contributive.

**Morbidity**

The telephone survey was conducted for 369 patients (74%). The other patients could not be contacted by telephone (17%), could not answer the questions asked (6%) or did not want to answer the questions (3%). Complications were reported by 28 patients (7.6%). Most were minor complications (93%), predominantly abdominal pain (43%). Ten complications had been recorded in the unit’s complication ledger, giving a 2% complications rate which was significantly lower than the complications rate established by the telephone survey (7.6%) (P < 0.01).

**Patient satisfaction**

The patients’ self-evaluated satisfaction scores are presented in table VI. There were significantly fewer patients who were unsatisfied with information received when the prescriber was a gastroenterologist (5.6%) than when the prescriber was not a gastroenterologist (12.7%) (P = 0.01). Dissatisfaction with information received was not different between inpatients (9.4%) and outpatients (6.1%).

**Discussion**

Our results showed that most of the values for the quality of care criteria studied in the audit complied with established standards. Compliance with standards does not however signify optimal quality of care with no need for improvement. Demonstrating compliance is simply a means of assuring that our practices are comparable with accepted practices. The quality of care criteria were chosen for their pertinence, simplicity, and acceptability.
[6, 24, 46]. The metrological performance (validity, reliability) of these criteria is known for only a small number (cecal intubation rate, complication rate, proportion of cancer diagnoses). We did not measure any quality of care criterion based on structural data since no standard or reference value has been established. We chose to audit our practices in comparison with three sets of well-described standard practices established on solid scientific evidence. We preferred to evaluate the appropriateness of our colonoscopic procedures with the EPAGE score rather than the ASGE guidelines because they are more explicit, more detailed, and cover a larger scope of indications [31, 34, 36, 47, 48]. We did not use the official guidelines of the French agency for health accreditation and evaluation (approachable medical references, medical recommendations and reference values concerning lower gastrointestinal endoscopy) [49] because the terms used in these guidelines are too vague [21]. Cleaning and disinfection were excluded from this audit due to the lack of applicable recommendations. The current French legislation is rather ambiguous in this area and can lead to variable interpretation [50].

There is no standardized system for describing bowel preparation [10]. Our scale has not been validated. Colonic preparation was insufficient in 24% of our procedures, a rate comparable to the 23% observed in a series of 93,004 colonoscopies performed in the United States [37]. Our patient-satisfaction survey showed that one out of five patients were dissatisfied with the bowel cleansing solution. Ideal effective and well-tolerated colonic preparation remains to be found. Detection of small lesions depends on the quality of the bowel preparation; patient satisfaction, and thus compliance, depends on tolerance. Even after attentive exploration, colonoscopy misses 15-25% of small adenomas and 0-6% of adenomas measuring more than 1 cm [51-53]. The rate of adenoma detection is operator-dependent, higher rates being obtained when the endoscopist explores carefully the proximal side of the folds, the flexures, the ileocecal valve, and the rectum using retroversion [10]. Exploration time is moreover correlated with the rate of adenoma detection [54-56]. The US multisociety task force on colorectal cancer recommended that withdrawal times, exclusive of time for biopsies and polypectomies, should average at least 6 to 10 minutes [10]. This is the mean withdrawal time of an operator with a low rate of missed adenomas [52, 54]. Withdrawal times were sufficient in only 21.7% of our diagnostic colonoscopic procedures.

Nearly one out of three polypectomies were performed with a biopsy forceps. This is an excessive rate because forceps resection is less effective than snare resection polypectomy [10, 41]. Our rate of neoplastic lesions was comparable to that generally reported, but the 22% rate of adenomas with villous elements was well above the recommended rate of less than 10% [10]. This tendency of pathologists to overread villous elements of adenomas has been reported before [57]. It should be corrected because presence of villous elements has an impact on post-polypectomy surveillance intervals [10, 30].

Our 9.7% rate of inappropriate diagnostic colonoscopic procedures is one of the best reported in the literature. It is much lower than the 72.5% of procedures not fully complying with standards presented in a retrospective study reported by the Provence-Alpes-Côte d’Azur health insurance fund [21]. Similar to reports in the literature, our rate of appropriate procedures increased with patient age [20, 32, 33]. But unlike most of the reported series, we found that the rate of appropriate colonoscopic procedures was not less when prescribed by non-gastroenterologists than when prescribed by gastroenterologists [34, 36, 58]. We found no appropriateness difference between inpatients and outpatients, as did Minoli et al. [36] but not Bosset et al. [32].

Compliance with the recommendations of the 1998 consensus conference on colorectal cancer has not been evaluated prospectively. Two retrospective studies have been conducted, one

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Table VI. – Results of the satisfaction phone survey.

<table>
<thead>
<tr>
<th>Question</th>
<th>Excellent %</th>
<th>Very good %</th>
<th>Good %</th>
<th>Fair %</th>
<th>Poor %</th>
</tr>
</thead>
<tbody>
<tr>
<td>How long you waited to get an appointment</td>
<td>13.4</td>
<td>21.5</td>
<td>51.4</td>
<td>11.5</td>
<td>2.2</td>
</tr>
<tr>
<td>Your satisfaction with bowel preparation before colonoscopy was</td>
<td>7.6</td>
<td>7.3</td>
<td>45.6</td>
<td>20</td>
<td>19.5</td>
</tr>
<tr>
<td>Length of time spent waiting at the office for the procedure</td>
<td>16.4</td>
<td>24.5</td>
<td>39.8</td>
<td>14.8</td>
<td>4.5</td>
</tr>
<tr>
<td>The personal manner (courtesy, respect, sensitivity, friendliness) of the physician who performed your procedure</td>
<td>41.6</td>
<td>37.2</td>
<td>16.5</td>
<td>3.8</td>
<td>0.9</td>
</tr>
<tr>
<td>The technical skills (thoroughness, carefulness, competence) of the physician who performed your procedure</td>
<td>36.1</td>
<td>39.2</td>
<td>22.8</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>The personal manner (courtesy, respect, sensitivity, friendliness) of the nurses and other support staff</td>
<td>40.1</td>
<td>41.4</td>
<td>17.4</td>
<td>1.1</td>
<td>0</td>
</tr>
<tr>
<td>Adequacy of explanation of what was done for you, all your questions answered</td>
<td>19.4</td>
<td>38.2</td>
<td>32.4</td>
<td>8.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Your overall satisfaction with the procedure was</td>
<td>16.5</td>
<td>39</td>
<td>40.3</td>
<td>3.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Would you have the procedure done again by this physician?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Would you consider having this procedure done again at this facility?</td>
<td>99.4</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
published in abstract form [19, 21]. Our 10% rate of inappropriate screening procedures is good, equivalent to the overall rate for all indications. The high rate of uncertain appropriateness indications (58%) reflects the large number of screening colonoscopies performed at the request of average-risk persons. This rate should decrease with the advent of an organized mass screening program for colorectal cancer based on fecal occult blood testing. The rate of appropriate surveillance procedures was 89% in our audit. This is an excellent rate, much higher than the 13% reported in the Provence-Alpes-Côte d’Azur region and the 52% from the Rennes University Hospital [19, 21]. This difference might be related to an observation bias or to a center effect. Differences in geographical patterns or modes of public hospital practice could also be involved. Other studies are needed to clarify this point. Moreover, the internal audit performed may have altered practices and improved our results. Compliance with recommended surveillance schedules is an important factor for limiting the growing number of surveillance procedures and should be emphasized as organized mass colorectal cancer screening programs are being undertaken [10]. Since conducting this audit, we have posted the recommendations of the consensus conference in our endoscopy rooms to facilitate consultation.

The diagnostic yield of colonoscopy can be assessed on the basis of the proportion of normal procedures, the proportion of abnormal procedures including all pathologies, and the specific rates for certain pathologies, for example cancers, polyps, or adenomas. To assess the efficacy of colonoscopy as a screening and prevention tool for colorectal cancer, we retained the rate of SNL rather than the rate of polyps as is recommended by the ASGE or the rate of adenomas and colorectal cancers as is advocated by Rex because advanced adenomas constitute the primary target of screening [6, 59]. To facilitate comparisons between published series, it would be useful to establish a single input/output ratio to assess procedure efficiency. We thus propose the N/SNL ratio, which expresses the number of normal procedures (N) performed for each procedure detecting a significant neoplastic lesion (SNL) (figure 2).

In our audit, the rates of abnormal procedures and procedures demonstrating SNL increased in patients aged over 50 years and in men. These are common observations [18, 32, 42, 59, 60]. Colorectal cancer seldom occurs before 50 years, so the diagnostic yield is low and appropriate indications for colonoscopy are rare [18, 31, 32, 43, 59-61]. We propose adopting the rate of patients < 50 years as an indirect evaluation criterion for the appropriateness of indications. This is a simple criterion much easier to assess than the EPAGE appropriateness score. This criterion could be a good indicator if its metrological qualities are demonstrated [24]. Periodic evaluations could be made but at the present time a standard value has not been established. The rate of patients < 50 years should probably not exceed 25%. In line with earlier publications, the indication with the best diagnostic yield was the positive FOBT (fecal occult blood test) [59]. As reported by Lieberman et al. [42], we found that the proportions of abnormal colonoscopies and procedures demonstrating a SNL were the same for procedures performed to explore symptoms and for procedures performed for screening purposes. These rates were significantly higher when procedures were performed for hematochezia or anemia in comparison with procedures performed for pain or change in bowel habits, a finding also reported by others [18, 59]. The rate of SNL detection was not higher for hematochezia than for screening. For patients presenting hematochezia, performing a flexible sigmoidoscopy then a colonoscopy if a polyp was detected would not have missed any of the SNL detected. In light of this observation and the results of the controlled trial presented by Eckardt et al., we now apply the EPAGE recommendations to not perform first-intention colonoscopy for patients with bright red blood loss, preferring flexible sigmoidoscopy for these patients [31, 62]. The rate of SNL detection was 17.9% among the post-polypectomy surveillance procedures. This is an unusually high level. The diagnostic yield for this indication is generally among the lowest [10, 41]. This rate might be technique-related, reflecting a high level of missed polyps due to an overly rapid exploration, or on the contrary, disease-related since the incidence of colorectal cancer in our area is one of the highest in France and Europe [61, 63]. Our appropriate procedures yielded a significantly higher rate of SNL- positive explorations than our uncertain appropriateness or inappropriate procedures. This pattern has been reported by others [32, 34, 48]. The diagnostic yield of uncertain appropriateness or inappropriate procedures is not however negligible since these explorations detected cancer in 2 patients and SNL in 17%. An appropriateness score is probably not useful to establish indications for colonoscopy in the routine clinical setting [64].

Measuring the final outcome of a colonoscopic procedure is a difficult task. Technical success is only part of the story: reaching the cecum is not sufficient! The final objective is to confirm or eliminate a diagnosis and/or treat an anomaly in order to improve the patient’s health status. There is no established method that measures procedure success nor standard outcome value [8]. We chose to rely on the endoscopist’s opinion at the end of the exploration. Diagnostic or therapeutic success was considered total for 90% of the procedures, 94% of which were considered to be contributive. These are reassuring but subjective levels. Moreover, since for many of our patients, the endoscopists had prescribed the procedure themselves, we examined self-evaluation scores. A more objective assessment could probably be provided by an outside observer.

Systematic search for complications occurring late after the exploration enabled us to record a 7.6% complication rate which is significantly higher than the 2% rate recorded in our unit’s operative ledger and discussed in our monthly mortality and morbidity conferences [28]. Other teams have made the same observation [44, 45]. Most of the complications reported by the patients were nevertheless minor events which did not require care. We propose classifying these events in the category of discomfort rather than morbidity. To date, there is no standardized system enabling measurement and classification of gastrointestinal endoscopy complications [65]. Several systems have been proposed [66-69]. Minor complications not requiring care are never mentioned in these systems. They are not even mentioned in literature reviews on colonoscopy complications [43, 70]. These events are nevertheless undeniable adverse effects with an incidence that reached 13.7% in the study by Bini et al. [45]. Discomfort, reported by 6.9% of our patients, is not negligible and should be mentioned to candidates when delivering information before the examination. Such events should be taken into consideration when evaluating complications of gastrointestinal endoscopic procedures because they have an impact on patient satisfaction, which in turn has an impact on compliance [45, 71]. Our system of recording complications in a ledger enabled us to identify significant complications and can be a useful tool for evaluating morbidity in daily practice [28]. A punctual inquiry was sufficient to evaluate the rate of minor complications. No standard lapse of time has been established for evaluating late complications. Thirty days, as is used for surgical complications, is proposed by some authors [44, 45]. We opted for 2-3 weeks since most of the complications occur within 48 hours [44] and late evaluation might lead to underestimation of minor complications forgotten by the patients [45].

A valid reliable tool is needed to achieve adequate self-evaluation of patient satisfaction. No such tool has been developed for gastrointestinal endoscopy. We used the questionnaire rec--
ommended by the ASGE and which has been validated for medical consultations. This is not an ideal tool since it does not take into account the pain dimension [72]. The vast majority of our patients were satisfied with their colonoscopy. The information received and the waiting time were however two weak points, considered as fair or poor by a number of patients. The information delivery process should be improved, mainly for patients undergoing colonoscopy without prior consultation with a gastroenterologist. Our audit enabled us to quantify our performances and thus to tailor information to our specific recruitment with our own data instead of relying on general data in the literature [14, 73].

The ANAES distinguishes six phases in a clinical audit: 1) choice of a theme and institution of the study, 2) constitution of standards and choice of evaluation criteria, 3) choice of the study design and measurement methods, 4) data collection and measurements, 5) data analysis, 6) plan for improvement measures and re-evaluation [23]. Our audit was not strictly speaking a clinical audit as defined by the ANAES since the sixth phase was only partially performed. The results of the audit were presented to the medical and nursing teams for information, analysis of the strong and weak points, search for the causes of observed deviations, and elaboration of corrective measures to implement. Improvement measures should focus on the elements for which the audit demonstrated deviation from standard values, for example the duration of the colonic exploration, the rate of forceps polypectomy, the rate of non-recovered resected polyps, the proportion of adenomas with villous elements, patient information, and waiting time the day of the procedure. These criteria should be adopted as indicators to be periodically evaluated to determine the efficacy of improvement measures [24]. This audit constituted the first phase of an overall program designed to improve the quality of our colonoscopic procedures. Methodological improvements would be useful for the next audit: use of the method recommended by the ANAES for clinical audits, reinforcement of the plural discipline of the working group, adjunction of an external evaluation in addition to self-evaluation, adjunction of further evaluation criteria concerning structures, cleaning and disinfection, medical records, and anesthesia. Sample evaluation is sufficient for certain criteria such as the appropriateness of the indications, the cecal intubation rate or patient satisfaction. Other criteria such as demographic data, indications, or complications require continuous systematic evaluation [6]. The ASGE recommended that about ten quality indicators be routinely tracked on all patients undergoing endoscopy [6]. Such continuous evaluation constitutes a significant work load and could be considerably facilitated by a dedicated information tool [6, 14].

In conclusion this audit enabled us to evaluate our practices, detect certain insufficiencies and dysfunctions, and to modify certain practices to improve the quality of our colonoscopic procedures. But will the final outcome of this audit improve quality of care? A future audit will be required to answer this question. Evaluation is a prerequisite to quality but cannot itself create quality [24]. Currently, evaluation is optional in the French healthcare system, but with the increasing burden of health care expenditures, it will undoubtedly sooner or later become mandatory. Quality improvement is inconceivable without evaluation, the guarantee that the necessary regulation of health care will be based on medical and not financial criteria [1]. In order to improve quality of care, gastroenterologists should take an active role in evaluation, which should become an integral part of everyday practice [6]. Gastroenterologists should take the lead, otherwise others — health authorities, financial supporters, judicial authorities, journalists — will assuredly fill the gap, limiting the clinician’s credibility and independence [6, 9, 74]. The study conducted by the Provence-Alpes-Côte d’Azur health insurance fund, which reported results that were not very flattering for endoscopists, is adequate proof [21]. The efficiency of quality assurance can only be strengthened by direct implication of healthcare professionals. This approach implies a significant workload and cost which must be considered as an integral part of the overall cost of colonoscopy [14].

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