Assessing colon polypectomy competency and its association with established quality metrics

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Background and Aims: Inadequate polypectomy leads to incomplete resection, interval colorectal cancer, and adverse events. However, polypectomy competency is rarely reported, and quality metrics are lacking. The primary aims of this study were to assess polypectomy competency among a cohort of gastroenterologists and to measure the correlation between polypectomy competency and established colonoscopy quality metrics (adenoma detection rate and withdrawal time).

Methods: We conducted a prospective observational study to assess polypectomy competency among 13 high-volume screening colonoscopists at an academic medical center. Over 6 weeks, we made video recordings of ≥28 colonoscopies per colonoscopist and randomly selected 10 polypectomies per colonoscopist for evaluation. Two raters graded the polypectomies by using the Direct Observation of Polypectomy Skills, a polypectomy competency assessment tool, which assesses individual polypectomy skills and overall competency.

Results: We evaluated 130 polypectomies. A total of 83 polypectomies (64%) were rated as competent, which was more likely for diminutive (70%) than small and/or large polyps (50%, $P = .03$). Overall Direct Observation of Polypectomy Skills competency scores varied significantly among colonoscopists ($P = .001$), with overall polypectomy competency rates ranging between 30% and 90%. Individual skills scores, such as accurately directing the snare over the lesion ($P = .02$) and trapping an appropriate amount of tissue within the snare ($P = .001$) varied significantly between colonoscopists. Polypectomy competency rates did not significantly correlate with the adenoma detection rate ($r = 0.4$; $P = .2$) or withdrawal time ($r = 0.2$; $P = .5$).

Conclusions: Polypectomy competency varies significantly among colonoscopists and does not sufficiently correlate with established quality metrics. Given the clinical implications of suboptimal polypectomy, efforts to educate colonoscopists in polypectomy techniques and develop a metric of polypectomy quality are needed. (Gastrointest Endosc 2018;87:635-44.)

Colonoscopy reduces colorectal cancer (CRC) incidence and mortality through the detection and removal of precancerous polyps in the colon.[1] The majority of colonoscopy quality improvement efforts have focused on improving polyp detection.[2] In contrast, little work has focused on ensuring effective colon polyp resection. Unfortunately, incomplete polypectomy may occur in a significant proportion of patients undergoing colonoscopy. In a prospective study of 1427 patients undergoing colonoscopy, approximately 10% of polyps were incompletely resected.[3] An ineffective polypectomy technique may lead to costly referral to surgery[4] or even interval CRC. It is estimated that up to 30% of interval CRCs may be due to incomplete polyp resection.[5] Thus, it is imperative that we ensure that all colonoscopists can remove polyps effectively.

Abbreviations: ADR, adenoma detection rate; CRC, colorectal cancer; DOPyS, Direct Observation of Polypectomy Skills.

DISCLOSURE: *T. Kaltenbach is a consultant for Olympus America. R. Keswani is a consultant for Boston Scientific, Cook Medical, and Medtronics. All other authors disclosed no financial relationships relevant to this publication.*

0016-5107/$36.00
https://doi.org/10.1016/j.gie.2017.08.032

Received May 18, 2017. Accepted August 20, 2017.

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Although polypectomy is essential to CRC prevention, competency is rarely reported, and quality metrics for this skill are lacking. The Direct Observation of Polypectomy Skills (DOPyS) was developed as a tool to assess polypectomy competency in a wide range of polypectomy techniques. The tool's validity and feasibility were established by using video recordings of polypectomies performed by experienced endoscopists in Europe,[6] and it has been shown to reliably differentiate between polypectomies performed by endoscopists of varying levels of experience.[7] Despite the development of this tool and the importance of polypectomy, there are little data on the variation in polypectomy competency among endoscopists, and it is unknown whether these variations are associated with established colonoscopy quality metrics.

The primary aims of this study were to assess polypectomy competency among a diverse cohort of colonoscopists by using the DOPyS scale and to measure the correlation between polypectomy competency and established colonoscopy quality metrics, specifically the adenoma detection rate (ADR) and withdrawal time. We hypothesized that colonoscopy competency would vary among colonoscopists and would not sufficiently correlate with current quality measures.

METHODS

Setting

We conducted a prospective observational study to assess polypectomy competency among high-volume attending screening colonoscopists at a single urban academic medical center from October 3, 2016 to November 11, 2016. The Northwestern University Institutional Review Board approved the study (IRB No. STU00203769, approval date September 8, 2016). Colonoscopists included in the study provided written informed consent.

Study design

We recruited colonoscopists who had performed 150 or more screening colonoscopies in the year preceding study onset. Over a 6-week period (October 3, 2016 to November 11, 2016), study investigators prospectively recorded at least 28 consecutive screening or surveillance colonoscopies performed by each colonoscopist. We excluded colonoscopies performed for diagnostic indications, inflammatory bowel disease, or a personal history of a polyposis syndrome or cancer. We also excluded colonoscopies with a Boston Bowel Preparation score of <6 and/or trainee involvement.

A single study investigator who was not involved in the polypectomy grading process set up all video recorders, edited videos, and then randomly selected polyps for grading. Video recordings were obtained by using a portable high-definition digital video recorder (Sony HVO-500MD, Sony, Tokyo, Japan) attached to the endoscope processor. Patient and endoscopist identifiers were removed from the television monitor before the start of the recordings. The colonoscopists were aware of the recorders but were not told specifically when they were being recorded and were not aware that the primary aim of the study was to assess polypectomy technique. All physicians were assisted by nurses and technicians who were dedicated to the endoscopy laboratory and assisted daily in colonoscopy and upper endoscopy.

The entire colonoscopy was recorded, and the videos were then edited by using Sony Movie Studio Platinum V13 software to include only the polypectomy, defined as the time from polyp identification to polyp retrieval. All polypectomies during the study period were edited and then cataloged. Each polypectomy was assigned a number in consecutive order. Polypectomy videos per endoscopist were stratified into diminutive (<6 mm) and small-to-large (≥6 mm) based on the size estimate of the polyps documented in the colonoscopy procedure report. By using a random number generator, we randomly selected 10 polypectomies per endoscopist (5 diminutive and 5 small-large) for grading. We chose 10 polyps per endoscopist because the DOPyS was found to be reliable and representative of competence when a minimum of 2 reviewers assessed at least 5 polypectomies performed by the same endoscopist.[6]

The polypectomy videos were arranged in random order and independently graded by 2 blinded US gastroenterologists with experience in polypectomy and colonoscopy quality (raters). Both raters underwent an hour-long DOPyS training session, in which they reviewed descriptor guidelines (Table 1[6-8]) and scored 5 polypectomy videos to ensure consistent grading. Both raters were familiar with the DOPyS before their training but had not used the tool previously to grade polypectomies.

DOPyS assessment

The DOPyS is the only established polypectomy competency assessment tool, and its use has been advocated for the assessment of trainees and practicing endoscopists.[7-10] The DOPyS includes 33 individual parameters and a global assessment scale (overall competency). Six of the 33 components are applicable only to "live" polypectomies and thus were not used in this study. The remaining parameters are broken down into (1) pre-procedural or general skills that are applicable to all polyps, (2) specific skills required depending on the morphology of the polyp (pedunculated versus sessile), and (3) post-polypectomy skills applicable to all polyps. Each of the individual parameters and the global scale were scored from 1 to 4, with scores of 1 (standards not met) or 2 (some standards not met, uncorrected errors) indicating a lack of competence and scores of 3 (competent and safe, no uncorrected errors) or 4 (highly skilled) denoting competence. The scoring criteria for all parameters are detailed in Table 1.[6-8] If an individual parameter was not applicable to a polyp, it was marked *not applicable*. We averaged the grades given by both raters

TABLE 1. Direct observation of polypectomy skills descriptors

Skill	Score 1: standards not met	Score 2: some standards not met, uncorrected errors	Score 3: competent and safe, no uncorrected errors	Score 4: highly skilled
All polyps				
Achieves optimal polyp position	Does not maintain polyp in the optimal position at any time during the procedure	Does not maintain polyp at 5-6 o'clock position. Few attempts made at position correction	Maintains polyp at 5-6 o'clock position with attempts at position correction	Ensures good polyp position (5-6 o'clock) with no errors. Attempts made at position correction throughout the procedure
Optimizes view	Poor polyp views throughout the procedure with no attempts at correction	Clear polyp views not maintained	Attempts to obtain clear polyp views through aspiration, insufflation, and lens wash	Maintains clear polyp views throughout the procedure
Determines full extent of lesion	No attempts made at determining or visualizing full extent of the polyp. Attempts polypectomy on lesions that are unlikely to be endoscopically resectable	Does not determine or visualize full extent of the polyp or fails to recognize features suggestive of malignancy	Determines the full extent of the lesion; may not use adjunctive measures	Determines the full extent of the lesion by using adjunctive measures where appropriate
Uses appropriate polypectomy technique	Inappropriate polypectomy technique. Uses diathermy or hot biopsy technique unsafely or inappropriately	Chooses inappropriate polypectomy technique	Uses appropriate polypectomy technique safely based on size, site, and morphology	Uses most appropriate polypectomy technique safely with no errors
Adjusts/stabilizes colonoscope position	Unstable colonoscope position throughout procedure with no attempts made at correction	Colonoscope not stabilized adequately. Little or no attempts made at use of adjunctive techniques	Adjusts and stabilizes colonoscope position before polypectomy	Maintains stable colonoscope position throughout polypectomy
Examines remnant stalk/base	Makes no attempt to examine remnant stalk/polyp base	Makes inadequate attempt to examine remnant stalk/polyp base	Examines remnant stalk/polyp base to check for bleeding and any residual polyp tissue	Always examines remnant stalk/polyp base thoroughly to check for bleeding and any residual polyp tissue
Identifies and treats residual polyp	Leaves residual polyp tissue behind	Does not adequately identify or treat visible residual polyp tissue	Identifies and resects any residual tissue	Identifies and resects any residual tissue accurately
Identifies bleeding and performs adequate hemostasis	Does not identify or treat bleeding	Inadequately identifies or treats bleeding	Identifies bleeding and performs adequate endoscopic hemostasis with satisfactory immediate results	Identifies bleeding and performs adequate endoscopic hemostasis promptly
Retrieves or attempts retrieval of polyp	No attempts made at polyp retrieval	Inadequate attempt at retrieval of polyp	Retrieves or attempts retrieval of polyp. May not use method appropriate to polyp/size	Retrieves polyp by using method appropriate to polyp/size
Places tattoo, where appropriate	Does not use tattooing in the appropriate setting. Places tattoos at inappropriate site. Inappropriate depth of ink, risking peritoneal staining	May not use tattooing in the appropriate setting. May not place tattoos at appropriate sites. Inappropriate depth of ink, risking peritoneal staining	Uses tattooing in the appropriate setting (eg, high-risk polyp size/morphology/method of resection). May not place appropriate number of tattoos	Uses tattooing in the appropriate setting. Places appropriate number of tattoos
Stalked polyps				
Applies prophylactic hemostasis if appropriate	Makes no attempt to use prophylactic measures where required	Attempts to use prophylactic measures where appropriate but with poor technique and uncorrected errors	Applies prophylactic hemostatic measures (eg, endo-loop, clips, if deemed appropriate) with good technique	Applies prophylactic hemostatic measures (eg, endo-loop, clips) where appropriate with excellent technique

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TABLE 1. Continued

Skill	Score 1: standards not met	Score 2: some standards not met, uncorrected errors	Score 3: competent and safe, no uncorrected errors	Score 4: highly skilled
Selects appropriate snare size	Inappropriately small or large snare size used	Snare size may be inappropriate for polyp size	Selects appropriate snare size	Always selects snare size appropriate to the polyp
Directs snare accurately over polyp head	Multiple unsuccessful attempts at snare positioning over polyp head	Multiple attempts at snare positioning over polyp head	Steers the snare over the polyp head with reasonable accuracy	Always steers the snare over the polyp head accurately
Correctly selects en bloc or piecemeal removal depending on size	Incorrectly selects en bloc or piecemeal removal	Incorrectly selects en bloc or piecemeal removal	Correctly selects en bloc or piecemeal removal	Correctly selects en bloc or piecemeal removal
Advances snare sheath toward the stalk as snare is closed	Closes snare too rapidly, cutting/shearing through the polyp stalk	Closes snare too rapidly or in an uncontrolled fashion	Advances snare sheath in a controlled fashion toward stalk as snare is closed	Advances snare sheath slowly toward stalk as snare is closed gradually
Places snare at the appropriate position on the stalk	Poor snare position on polyp stalk, either too close to the polyp head or too close to the base	Poor snare position on polyp stalk	Appropriate position on stalk with snare	Excellent position on stalk with snare, midway between polyp head and stalk base
Mobilizes polyp to ensure appropriate amount of tissue is trapped within the snare	Makes no attempt to mobilize the polyp before diathermy where necessary. Does not check for additional trapped tissue	Does not attempt to mobilize the polyp before diathermy where deemed necessary. Does not check for additional trapped tissue	Mobilizes the polyp (eg, to tent stalk away from mucosa and contralateral wall if necessary)	Always mobilizes the polyp to tent stalk away from mucosa and contralateral wall
Applies appropriate degree of diathermy	Uses inappropriate diathermy technique causing either bleeding or burns	Inappropriate diathermy technique risking either bleeding or burns	Applies appropriate degree of diathermy. Does not cause contralateral burns or cut through too quickly, causing bleeding	Applies appropriate degree of diathermy, with no evidence of contralateral burns or cutting through too quickly, causing bleeding
Sessile polyps				
Adequate submucosal injection	Does not attempt submucosal injection. Optimal views of the lesion not obtained	Attempts submucosal injection but inadequate views of the lesion obtained	Injects the submucosa, maintaining adequate views of the lesion	Accurately injects the submucosa, maintaining excellent views of the lesion
Proceeds only if the lesion lifts adequately	Does not check for lifting before attempting polypectomy	May proceed despite parts of the lesion not lifting and inadequate attempts at further lifting	Proceeds only if the lesion lifts adequately	Always checks for lifting and proceeds only if the lesion lifts adequately
Selects appropriate snare size and directs snare accurately over lesion head	Inappropriately small or large snare size used. Clumsy steering of snare causing mucosal injury	Snare size may be inappropriate for polyp size. Clumsy steering of snare over the lesion head	Selects appropriate snare size. Steers appropriately sized snare accurately over the lesion head with minimal difficulty	Always selects snare size appropriate to the polyp. Steers appropriately sized snare accurately over the lesion head with no errors
Correctly selects en bloc or piecemeal removal, depending on size	Incorrectly selects en bloc or piecemeal removal	Incorrectly selects en bloc or piecemeal removal or piecemeal removal in excessive pieces	Correctly selects en bloc or piecemeal removal, depending on size of lesion	Correctly selects en bloc or piecemeal removal, depending on size of lesion. Removes piecemeal in as few pieces as possible

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TABLE 1. Continued

Skill	Score 1: standards not met	Score 2: some standards not met, uncorrected errors	Score 3: competent and safe, no uncorrected errors	Score 4: highly skilled
Appropriate positioning of snare over lesion as snare closed	Closes snare too rapidly, cutting/shearing through the polyp tissue	Closes snare too rapidly or in an uncontrolled fashion	Advances snare sheath in a controlled fashion toward stalk as snare is closed	Accurately positions snare over lesion as snare closed gradually
Ensures appropriate amount of tissue is trapped within snare and tents lesion gently away from the mucosa	Does not check for additional tissue trapped within snare before applying diathermy. No attempt to tent the lesion away from the mucosa	Does not ensure that additional tissue is not trapped within snare. Inadequate attempt to tent the lesion away from the mucosa	Ensures no additional tissue is trapped within snare by gently tenting the lesion away from the mucosa	Always ensures no additional tissue is trapped within snare by gently tenting the lesion away from the mucosa and mobilizing the snare
Uses cold or hot snare, as appropriate	Inappropriately chooses cold or hot snare. Applies inappropriate diathermy with bleeding or burns	Inappropriately chooses cold or hot snare. Inappropriate diathermy technique, risking either bleeding or burns	Chooses cold or hot snare appropriately. Applies appropriate diathermy, with no adverse events	Chooses cold or hot snare appropriately. Applies appropriate diathermy with no adverse events
Ensures adequate hemostasis before further resection	Does not ensure adequate hemostasis before further resection	Does not necessarily ensure adequate hemostasis before further resection	Ensures adequate hemostasis before further resection	Always ensures adequate hemostasis before further resection

(per individual polyp) for all applicable parameters and for overall competency. We defined individual skill and overall polypectomy competency (per individual polyp) as a mean score by 2 raters of $\geq$3.

Raters reviewed only the edited polypectomy for each polyp. They documented polypectomy size, morphology (using the Paris classification), and polypectomy technique (cold forceps, cold snare, hot snare, or hot snare plus submucosal lift). To mitigate the limitation of variability among endoscopists in polyp size estimation,[11] we used the mean size estimate of the 2 raters, who both had expertise in endoscopic resection, to categorize the polyps into diminutive (<6 mm) and small-to-large ($\geq$6 mm) for our data analyses.

For polyps removed by cold forceps, raters were asked to subjectively consider the adequacy of resection, including whether piecemeal resection was required and whether residual polyp was suspected. Specifically, raters were asked 3 additional questions not included in the DOPyS assessment: (1) Were multiple bites required? (2) Would an alternate polypectomy technique have been more appropriate? and (3) If so, what alternate technique would have been more appropriate?

Study outcomes

The primary study outcomes were (1) overall competency at polypectomy as assessed by the DOPyS and (2) colonoscopist historical ADR. The secondary outcomes were individual polypectomy skill parameters as assessed by the DOPyS and colonoscopist historical withdrawal time.

Historical ADR and withdrawal time

We calculated the ADR and withdrawal times by using 12-month historical data (October 1, 2015 to July 31, 2016) from screening colonoscopies (no documented history of colon neoplasia) performed by each gastroenterologist. Data were obtained from our institution's Enterprise Data Warehouse, an integrated database of clinical and research information from all patients receiving treatment at Northwestern University healthcare affiliates. We defined ADR as the proportion of screening colonoscopies in patients aged 50 to 75 years with $\geq$1 adenoma and withdrawal time as the time spent withdrawing the colonoscope (inspecting for polyps) in screening colonoscopies in which no pathology was obtained (ie, no polyps found and no biopsy specimens taken).

Statistical analysis

Descriptive statistics were determined for all evaluations and were reported as means or medians for continuous variables and proportions for categorical variables. Comparative statistics were performed by using the *t* test for normally distributed variables and χ^2 analysis to compare the association between categorical variables and outcomes. We used 1-way analysis of variance to assess variations of DOPyS scores between colonoscopists. *P* values < .05 were considered statistically significant. All statistical analyses were performed by using SPSS Version 22 (IBM, Armonk, NY).

RESULTS

Thirteen gastroenterologists met inclusion criteria and provided informed consent to participate in the study. Colonoscopists had been in practice for a median of 13 years (range 3-31 years) after fellowship.

TABLE 2. Polyp morphology and polypectomy technique for all polyps

Polyp size	Morphology	Polypectomy technique
Diminutive (n = 90)	Paris 0-Ip (n = 0)	Cold forceps (n = 0)
		Cold snare (n = 0)
		Hot snare (n = 0)
		Hot snare + lift (n = 0)
	Paris 0-Is (n = 82)	Cold forceps (n = 26)
		Cold snare (n = 55)
		Hot snare (n = 1)
		Hot snare + lift (n = 0)
	Paris 0-IIa (n = 6)	Cold forceps (n = 0)
		Cold snare (n = 6)
		Hot snare (n = 0)
		Hot snare + lift (n = 0)
	Paris 0-IIb (n = 2)	Cold forceps (n = 0)
		Cold snare (n = 1)
		Hot snare (n = 1)
		Hot snare + lift (n = 0)
Small-to-large (n = 40)	Paris 0-Ip (n = 7)	Cold forceps (n = 0)
		Cold snare (n = 1)
		Hot snare (n = 6)
		Hot snare + lift (n = 0)
	Paris 0-Is (n = 15)	Cold forceps (n = 0)
		Cold snare (n = 7)
		Hot snare (n = 8)
		Hot snare + lift (n = 0)
	Paris 0-IIa (n = 11)	Cold forceps (n = 1)
		Cold snare (n = 4)
		Hot snare (n = 6)
		Hot snare + lift (n = 0)
	Paris 0-IIb (n = 7)	Cold forceps (n = 0)
		Cold snare (n = 3)
		Hot snare (n = 2)
		Hot snare + lift (n = 2)

Historical ADR and withdrawal time

The 13 colonoscopists performed a median of 877 screening colonoscopies (interquartile range [IQR] 762-981) in the 12 months preceding study onset. Median historical ADR for the included colonoscopists was 40% (IQR 31%-47%), and median withdrawal time was 11.1 minutes (IQR 7.7-14.9 minutes).

Polyp and polypectomy characteristics

We assessed 130 polypectomies (10 polypectomies per colonoscopist). Based on the mean (± standard deviation [SD]) size estimates by the 2 raters, 90 polyps were classified as diminutive (mean size 3.9 mm ± 1.0), and 40 were classified as small-to-large (mean size 8.2 mm ± 2.3 mm). Small-to-large polyps ranged in size from 6 mm to 15 mm. Only 8 polyps were measured by the raters as ≥10 mm. Most polyps (75%) were Paris classification 0-Is (protruded, sessile) in morphology. Size estimates differed minimally between the 2 expert raters (mean size difference 0.7 mm, range 0-3 mm). Similarly, polyp size estimates differed minimally between the expert raters and those in the endoscopy reports (mean size difference 0.5 mm, range 0-2.5 mm).

Snare polypectomy was performed in 103 of 130 polypectomies (79%) (Table 2). A submucosal lift was performed in 2 snare polypectomies. Specifically, a submucosal lift was used in 2 of 18 (11%) small-to-large, nonpolypoid lesions (Paris 0-IIa and Paris 0-IIb) and was not used for any of the small-to-large sessile polyps (Paris 0-Is). Cold biopsy forceps were used in the remaining 27 polypectomies, 26 of which were diminutive polyps and 1 of which was small-to-large. Multiple bites to remove the entire polyp were required in 23 (85%) of the cold forceps polypectomies.

The majority of diminutive polyps were removed with cold snare (69%) followed by cold forceps (29%) and hot snare (2%). In contrast, most of the small-to-large polyps were removed with hot snare (55%) followed by cold snare (38%), hot snare plus submucosal lift (5%), and cold forceps (3%).

Polypectomy competency

The mean overall DOPyS competency score was 2.8 (SD 0.9) for all 130 polypectomies. Eighty-three polypectomies (64%) were graded as competent (mean overall DOPyS score ≥3). The raters agreed on competency (ie, both scores ≥3 or <3) in 95% of polypectomies. The interrater agreement of overall competency demonstrated very good agreement among the raters (weighted Cohen's kappa = 0.80). Polyps that were removed competently were significantly smaller than those not removed competently (mean size 4.8 mm ± 1.9 vs 5.9 mm ± 3.2; P = .01). Similarly, competent polypectomy was more common for diminutive polyps (70%) than for small-to-large polyps (50%; P = .03). Of the 18 small-to-large nonpolypoid lesions (Paris 0-IIa or Paris 0-IIb), the overall rate of competent polypectomy was 39%.

Overall, 72 of 103 snare polypectomies (70%) were graded as competent. In contrast, 11 of 27 cold forceps polypectomies (41%) were graded as competent (P = .01). The raters felt that a cold snare would be a more appropriate polypectomy technique in 19 of 27 cold forceps polypectomies (70%).

Individual polypectomy skills

With regard to specific polypectomy skills, the optimal polypectomy position and a stable endoscope position were competently achieved in 61% and 58% of polypectomies, respectively (Table 3). The colonoscopists sufficiently

TABLE 3. Overall and individual skill polypectomy competency stratified by polyp size for all polyps

Skill	Total polyps (n = 130)	Diminutive polyps (n = 90)	Small-to-large polyps (n = 40)	*P* value*
Overall competency, mean score, % competent	2.8, 64%	2.9, 70%	2.5, 50%	.03
Achieves optimal polyp position	2.9, 61%	3.0, 64%	2.8, 53%	NS
Determines full extent of lesion	2.7, 72%	2.9, 84%	2.3, 45%	< .0001
Uses appropriate polypectomy technique	3.2, 70%	3.4, 73%	2.9, 63%	NS
Adjusts/stabilizes colonoscope position	2.8, 58%	2.9, 60%	2.7, 55%	NS
Examines remnant stalk/base	2.8, 57%	2.8, 56%	2.8, 60%	NS
Identifies and treats residual polyp	2.7, 58%	2.8, 59%	2.6, 58%	NS

NS, Not significant.
*Significance between diminutive and small-to-large polyps calculated by using percent competent.

evaluated the polypectomy site for remnant tissue in 57% of polypectomies. Among nonpedunculated (sessile and nonpolypoid) lesions removed by snare, colonoscopists chose the correct snare size and competently positioned the snare over the polyp in 73% of polyps, but an appropriate amount of tissue was competently resected in only 50% of polyps (Table 4). Colonoscopists were less likely to resect an appropriate amount of tissue (too little tissue in all cases) for small-to-large polyps (34%) compared with diminutive polyps (58%; $P = .03$).

Variation in polypectomy competency and correlation with established colonoscopy quality metrics

DOPyS scores varied significantly among endoscopists, with a median overall competency score of 2.8 (IQR 2.5-3.1; $P = .001$). The rate of competent polyp removal ranged between 30% and 90% among colonoscopists. Performance on the individual skills, including achieving the optimal polypectomy position ($P = .001$) and polyp view ($P = .002$), determining the full extent of the lesion ($P = .04$), obtaining a stable endoscope position ($P = .001$), examining the after-polypectomy site for remnant polyp ($P < .0001$), and treating residual polyp ($P < .0001$) varied significantly among endoscopists. For sessile polyps excised with a snare, competency related to directing the snare accurately over the lesion ($P = .02$), obtaining an appropriate amount of tissue trapped within the snare ($P = .001$), and tenting the lesion ($P = .003$) varied significantly among endoscopists.

The rate of competent polyp removal did not correlate significantly with colonoscopist historical ADRs (r = 0.4; $P = .2$) (Fig. 1). The rate of competent polyp removal also did not correlate significantly with colonoscopist historical withdrawal times (r = 0.2; $P = .5$).

DISCUSSION

This prospective observational study of 13 high-volume screening colonoscopists demonstrates that polypectomy competency varies significantly among endoscopists, ranging between 30% and 90%. Almost half (46%) of polypectomies were graded as incompetent (mean overall DOPyS score <3), and incompetent polypectomy was significantly more common for small-to-large polyps compared with diminutive polyps. Moreover, we found that the rate of polypectomy competency did not sufficiently correlate with established colonoscopy quality measures, including ADR and withdrawal time.

Previous studies have shown that incomplete polypectomy is common, and it contributes to up to 30% of interval CRCs after colonoscopy.[3,5,12-14] Less is known about the variability in polypectomy techniques among endoscopists. Pohl et al[3] performed a prospective analysis of 1427 patients who underwent colonoscopies performed by 11 gastroenterologists. Three hundred forty-six polypectomies were performed, and the post-polypectomy site was systematically biopsied. Based on these biopsies, roughly 10% of polyps were incompletely resected. The rate of incomplete resection increased with polyp size and was highly variable among endoscopists, ranging from 7% to 23%. Consistent with this, we found that polypectomy competency varies among endoscopists, with only 64% of polypectomies rated as competent. Similarly, polypectomy competency was significantly less common for larger polyps (50% vs 70%; $P = .03$).

Measuring clinical performance facilitates feedback and meaningful improvements in several areas of medicine, including endoscopy quality.[15-19] In the majority of studies, providing endoscopists with report cards has resulted in performance improvement.[15-20] In previous work, our group demonstrated that physician ADR report cards significantly improved colonoscopy quality among a large group of endoscopists with diverse baseline ADRs.[15] In this study, we found that competency in polypectomy does not correlate sufficiently with ADRs or withdrawal times. In other words, endoscopists who are highly skilled in detecting adenomas are not necessarily highly skilled at removing adenomas. Therefore, we cannot rely on these quality measures as surrogates for polypectomy technique. Given the importance of polypectomy in CRC

TABLE 4. Overall and individual skill competency stratified by polyp size for nonpedunculated polyps removed by hot or cold snare polypectomy

Skill	Total polyps (n = 96)	Diminutive polyps (n = 64)	Small-to-large polyps (n = 32)	*P* value*
Overall competency, mean score, % competent	2.9, 70%	3.1, 81%	2.4, 47%	< .001
Selects appropriate snare size and directs snare accurately over lesion	3.1, 73%	3.8, 83%	2.7, 53%	.002
Correctly selects en bloc or piecemeal removal, depending on polyp size	3.5, 81%	3.7, 92%	2.9, 59%	< .001
Appropriate amount of tissue trapped within snare	2.8, 50%	3.0, 58%	2.4, 34%	.03
Uses cold versus hot snare, as appropriate	3.7, 91%	3.9, 95%	3.2, 81%	.03

*Significance between diminutive and small-to-large polyps calculated by using percent competent.

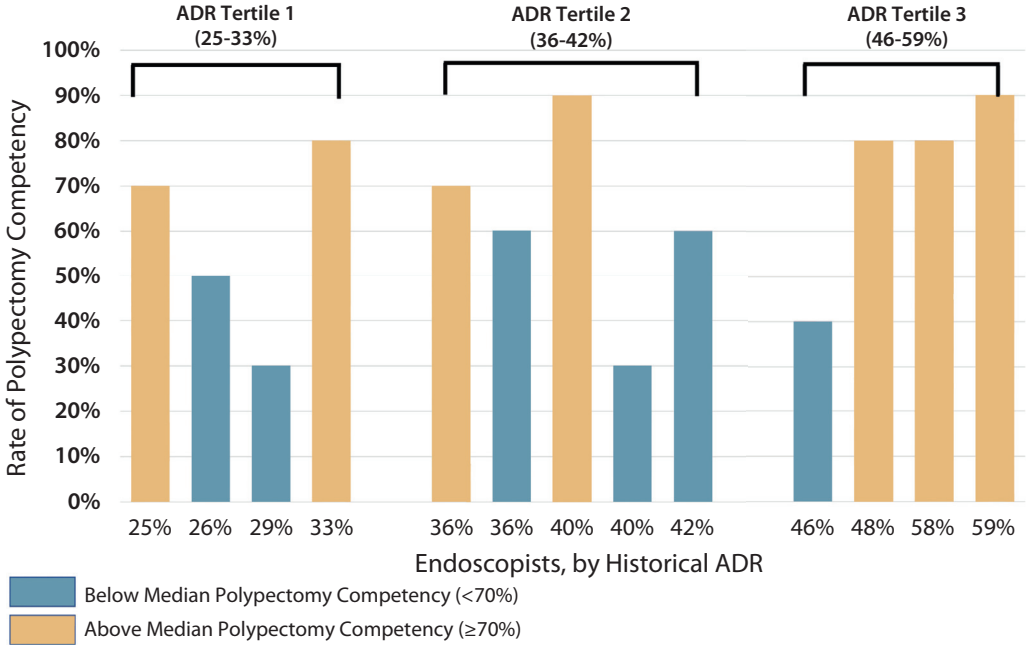

Figure 1. Polypectomy competency does not correlate sufficiently with adenoma detection rate (r = 0.4; *P* = .2). *ADR*, adenoma detection rate.

prevention and the variability in performance among endoscopists, we propose that endoscopists should receive individualized feedback (ie, polypectomy report cards) on polypectomy competency (Table 5).

There is growing clinical interest in determining the optimal method for removing diminutive polyps. Several studies have shown significantly lower rates of incomplete polypectomy with the use of cold snare versus cold forceps polypectomy.[21-26] In a prospective study evaluating the efficacy of cold forceps for polypectomy,[23] only 39% of diminutive polyps were completely resected. Similar studies have shown variable polypectomy completion rates (51%-79%) when cold forceps are used.[21,22] A meta-analysis of 5 randomized controlled trials, including 668 patients and 721 polyps, found that the incomplete polyp removal rate (based on histologic criteria) was significantly lower with cold snare and/or jumbo forceps than with the cold biopsy technique for diminutive and small polyps (≤7 mm).[26] In our diverse cohort of endoscopists, we found that cold forceps were used to remove nearly one-third of diminutive polyps, and for the majority of cases (85%), the use of cold forceps required piecemeal polypectomy. Less than half of cold forceps polypectomies were graded as competent, primarily because of the frequent need for piecemeal polypectomy, with inability to visually confirm complete polyp eradication. In contrast, the majority of snare polypectomies were graded as competent. Our data confirm the need for ongoing education and standardization of optimal polypectomy techniques to ensure safe, efficient, and complete resection of diminutive lesions.

Although we found that performance varied significantly among endoscopists, we identified several common skills in which many endoscopists performed poorly. We found low rates of submucosal-lift polypectomy in the removal of small-to-large polyps. Submucosal injection was not used in any sessile polyps ≥10 mm and in only 2 of 18 non-polypoid lesions. As a result, several of these lesions

TABLE 5. Sample polypectomy skills report card for physician X

Polypectomy					
Total no. of polyps evaluated: 10					
Diminutive polyps (<6 mm): 5					
Small-to-large polyps (≥6 mm): 5					
Polypectomy technique					
Cold forceps: 1					
Cold snare: 3					
Hot snare: 6					
Hot snare + lift: 0					
Skill	**Mean DOPyS score**	**Competent, %**	**50th percentile score**	**75th percentile score**	**90th percentile score**
Overall competency for all polyps (n = 10)	2.65	0.5	2.75	3	3.32
Achieves optimal polyp position (n = 10)	2.85	0.6	2.85	3.2	3.33
Optimizes polyp view (n = 10)	2.85	0.6	2.95	3.25	3.35
Determines full extent of lesion (n = 10)	2.20	0.4	2.80	2.90	2.94
Uses appropriate polypectomy technique (n = 10)	2.90	0.6	3.25	3.45	3.55
Adjusts/stabilizes colonoscope position (n = 10)	2.75	0.7	2.80	3	3.27
Examines remnant stalk/base (n = 10)	3.15	0.7	2.85	2.95	3.39
Identifies and treats residual polyp (n = 10)	3.10	0.7	2.75	3.10	3.10
Selects appropriate snare size and directs snare over lesion head (n = 6)	2.80	0.8	3.17	3.31	3.58
Correctly selects en bloc or piecemeal removal, depending on size (n = 6)	3.10	1	3.58	3.75	3.82
Ensures appropriate amount of tissue is trapped within snare (n = 6)	2.6	0.8	2.75	3.07	3.4

DOPyS, Direct Observation of Polypectomy Skills.

(all ≤15 mm) were removed piecemeal and/or residual polyp was seen at polypectomy completion. Thus, many of these patients will require unnecessary early surveillance colonoscopy. As noted earlier, we found an overreliance on cold forceps for diminutive polyps, resulting in very high rates of piecemeal polypectomy. The optimal colonoscope position was achieved in less than two-thirds of polypectomies, suggesting that endoscopists do not prioritize this initial polypectomy skill. Similarly, the post-polypectomy site was examined sufficiently in only 57% of polypectomies, highlighting another skill in need of further education.

There are several limitations to our study. First, all colonoscopists were aware of their participation in the study and therefore might have altered their behavior (the Hawthorne effect). The colonoscopists, however, did not know that the specific purpose of the study was to evaluate polypectomy technique, and marked variation persisted despite colonoscopist awareness of recordings. Second, colonoscopists were not evaluated on 10 identical polyps. Therefore, it is possible that some endoscopists had a greater proportion of technically challenging polyps, resulting in fewer competent polypectomies. However, all polyps were ≤ 15 mm and were selected from routine screening and surveillance colonoscopies, as are encountered typically in daily practice. Thus, it is reasonable to assume that all polyps could be removed competently by a screening colonoscopist. Third, we did not evaluate the pathology of any of the polyps removed, and therefore no comment can be made regarding competency as it relates to polyp histology. Notably, however, we found very low rates of competency for nonpolypoid lesions. Fourth, we did not use a standardized method to assess polyp size. Unfortunately, any a priori effort to avoid this limitation likely would have negatively influenced our results. Our primary goal was to ensure that endoscopists were not specifically told when they were being recorded, and asking them to use a measuring device could have added bias to their behaviors. Finally, and of critical importance, although the DOPyS is a validated tool, there are no data to our knowledge that polypectomy competency as defined by the DOPyS correlates with residual or recurrent neoplasia after polypectomy. It is reasonable to assume, however, that incompetent polypectomy technique is associated with higher incomplete resection rates. Future work should be performed to validate the scale as it relates to

both residual neoplasia and adverse events, such as perforation and bleeding.

There are also several strengths to our study. To our knowledge, this is the largest study evaluating polypectomy competency among a diverse cohort of attending endoscopists. Additionally, it is the only study to evaluate the relationship between polypectomy competency and traditional quality measures. Finally, polyps used in our assessment were selected randomly to minimize bias based on morphology, size, and degree of technical difficulty.

In conclusion, we have shown that polypectomy competency varies significantly among endoscopists and does not sufficiently correlate with established quality metrics. Given the significant clinical implications of incomplete polypectomy, efforts to educate practitioners in polypectomy techniques and to develop a metric of polypectomy quality are urgently needed.

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