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ORIGINAL ARTICLE

Impact of sedation type on adenoma detection rate by colonoscopy

Hawraa Tarhini[a], Ayman Alrazim[a], Wissam Ghusn[b], Mohammad Hosni[a], Anthony Kerbage[a], Assaad Soweid[a], Ala-I Sharara[a], Fadi Mourad[a], Fadi Francis[a], Yasser Shaib[a], Kassem Barada[a], Fady Daniel[a,*]

[a] *Department of Internal Medicine, American University of Beirut Medical Center, Beirut, Lebanon*
[b] *Division of Gastroenterology and Hepatology, Department of Medicine, Mayo Clinic, Rochester, MN, United States*

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Adenoma detection rate;
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Abstract
Background & Aims: Endoscopic detection of polyps and adenomas decreases the incidence and mortality of colorectal cancer. The available data concerning the relationship between the sedation type and adenoma detection rate (ADR) or polyp detection rate (PDR) is inconclusive. The aim of our study was to evaluate the impact of conscious vs. deep (propofol) sedation on the ADR/PDR in diagnostic and screening colonoscopies.
Methods: This was a retrospective cohort study. Patients aged 50—75 years old presenting for a first screening or diagnostic colonoscopy were included. Baseline demographic characteristics were collected, as well as PDR and ADR. Endoscopic withdrawal time and quality of bowel preparation rated in a binary fashion were also collected. Two multivariate logistic regression models were used to evaluate the independent predictors of endoscopic detection of polyps and adenomas.
Results: 574 patients met our inclusion criteria. Mean age was 59.26 ± 7.21 with 52.4% females and an average BMI of 28.08 ± 4.89. 374 patients (65.2%) underwent screening colonoscopies, and deep sedation was performed in 200 patients (34.8%). Only 4.7% had bad bowel preparation. PDR was 70% and ADR was 52%. On bivariate analysis, no significant difference was shown in PDR and ADR between conscious and deep sedation groups (0.70, 0.71; p = 0.712 and 0.50, 0.54; p = 0.394, respectively). On multivariate analysis for PDR, age and withdrawal time were independent predictors. For ADR, age, female sex, and withdrawal time were independent predictors. Sedation type and the indication did not reach statistical significance in both models.
Conclusion: The use of deep sedation didn't influence the ADR/PDR quality metrics in our mixed cohort of screening and diagnostic colonoscopies.

Abbreviations: ADR, Adenoma Detection Rate; PDR, Polyp Detection Rate; CS, Conscious Sedation; DS, Deep Sedation; BMI, Body Mass Index; CCI, Charlson Comorbidity Index.

* Corresponding author.
E-mail address: fd21@aub.edu.lb (F. Daniel).

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Introduction

Colonoscopy is considered the best screening modality for colorectal cancer, as well as a diagnostic tool in gastroenterology every day practice. Detecting polyps and adenomas decreases the incidence and mortality of colorectal cancer [1]. Therefore, adenoma detection rate (ADR) has been considered as the most important quality indicator for this procedure and is influenced by multiple factors [2,3]. Some of these factors have already been established including procedure related (e.g., bowel preparation) and operator related (technique, inspection time, expertise). However, other contributable influences (e.g., type of sedation) are still not well established as we are lacking randomized clinical trials to determine their effect on ADR. Conscious sedation based on the use of opioids and benzodiazepines is the most widely used sedation method. Deeper level of sedation provided by propofol and monitored anesthesia care is gaining momentum. It increases patient satisfaction level and willingness to undergo the procedure, although at the expense of a higher financial cost and possibly an increased risk of cardio-vascular adverse events. The type of sedation might also influence the quality of colonoscopy and its corresponding ADR, since a deeper level of patient sedation might be associated with higher quality of mucosal surface examination. Multiple studies evaluating the impact of sedation type have generated controversial results, the majority showing equivalence in terms of ADR [4–8]. Other studies claim that deep sedation might be associated with higher likelihood of finding polyps [9,10]. The aim of this study was to evaluate the impact of conscious sedation (CS) (midazolam+ fentanyl) versus deep sedation (DS) (propofol) use on the ADR and polyp detection rate (PDR) in both diagnostic and screening colonoscopies.

Methods

This is a retrospective cohort study using the American University of Beirut Medical Center's electronic health records system. It was conducted after securing Institutional Review Board approval. Patients included were aged between 50 and 75 years who presented to endoscopy unit for a first average risk screening or a diagnostic colonoscopy between March 2019 and August 2019. Patients who had family or personal history of gastrointestinal malignancy, personal history of inflammatory bowel diseases, previous colorectal surgery, and previous colonoscopy were excluded. Patients who underwent incomplete colonoscopies were also excluded.

The demographic variables as well as the usual quality indicators of colonoscopy (withdrawal time, quality of bowel preparation rated in a binary fashion as good or poor) were collected from the patients' charts. Charlson Comorbidity Index (CCI) was also calculated for each patient. The type of sedation administered to the patients was either fentanyl and midazolam (CS group) delivered by the endoscopy nurse under physician guidance, or propofol (DS group) delivered by the Anesthesia team. In our center, the choice of either modality is left to the discretion of the physician and his patient preferences. All colonoscopies were performed by five skilled full time endoscopists, each with more than 15 years of practice. The involvement of fellows either fully or partially within each procedure was recorded.

Statistical analysis

For descriptive and inferential statistics, SPSS for windows version 25 was used. (IBM, SPSS Inc. Chicago, IL, USA). BMI was calculated from the weight and height obtained from each patient's chart. The ADR and PDR were calculated. *Re*-categorization of the bowel preparation variable, which is based on the Aronchick Scale, was done in a binary fashion. Excellent and good on Aronchick Scale were coded as good, while fair or poor were coded as bad. For the bivariate analysis, a chi square analysis was done for categorical variables, while an independent sample T-test was used for continuous variables.

Two multivariate logistic regression models were employed to evaluate the predictors of finding an adenoma or polyp. Variables included in each model were: age, sex, BMI, CCI, withdrawal time, indication, sedation type, and bowel preparation

Results

1069 patients had colonoscopies done for screening and diagnostic purposes during study period. 574 patients met our inclusion criteria and their charts were reviewed, of which 301 (52.4%) patients were females. Mean age was 59.26 $\pm$ 7.21 years, mean BMI was 28.08 $\pm$ 4.89 kg/m^2, mean CCI was 0.85 $\pm$ 1.37, and 260 (45.3%) patients were active or former smokers. Patients undergoing colonoscopy for diagnostic purposes were 245 (42.7%) patients, the bowel preparation was classified as good in 547 (95.3%) patients, and the mean withdrawal time was 21.10 $\pm$ 10.6 min. Our PDR was 0.70 and ADR was 0.52.

In the bivariate analysis, patients with higher BMI tend to be subjected to moderate sedation more than deep sedation (t (559) = $-$3.31, p = 0.001) (Table 1).

When polyp detection and adenoma detection were cross tabulated with other variables, sex, age and withdrawal time were significant predictors for both whereas BMI and CCI were significant only for adenoma detection. Males were more likely to have more polyps (χ2 (1) =5.458, p = 0.019) and adenomas (χ2 (1) =7.358, p = 0.007) detected compared with females. In addition older patients and those with longer withdrawal times were more likely to have more polyps (t (572) = $-$3.047, p = 0.002, and t (470.5) = $-$11.340, $p < 0.001$, respectively) and more adenomas (t (572) = $-$3.063, p = 0.002, and t (558.5) = $-$8.045, $p < 0.001$). Whereas patients who had higher BMI or higher CCI were more likely to have more adenomas detected only (t (557.3) = $-$2.101, p = 0.036, t (572) = $-$1.982, p = 0.048, respectively).

Potential predictor explanatory variables were included in a binary logistic regression to elucidate which variables are predictors of polyps and adenomas detection. It was shown that age and withdrawal time were significant independent predictors of polyp detection (OR = 1.035, 95%

Table 1 Demographics and variables: Conscious vs. deep sedation (N = 574).

Variable		Deep sedation	Conscious sedation	Total	*P*- Value
Sex	Males	85 (42.5)	188 (50.3)	273 (47.6)	0.076
	Females	115 (57.5)	186 (49.7)	301 (52.4)	
Age (years)		58.56 ± 7.13	59.64 ± 7.24	59.26 ± 7.21	0.087
BMI (Kg/M^2)		27.14 ± 4.62	28.57 ± 4.96	28.08 ± 4.89	**0.001**
Smoking Status	Yes	88 (44.2)	172 (46.6)	260 (45.8)	0.585
	No	111 (55.8)	197 (53.4)	308 (54.2)	
Charlson Comorbidity Index		0.72 ± 1.25	0.93 ± 1.42	0.85 ± 1.37	0.075
Indication	Screening	124 (62.0)	205 (54.8)	329 (57.3)	0.097
	Diagnostic	76 (38.0)	169 (45.2)	245 (42.7)	
Presence of fellow during the colonoscopy	Yes	158 (79.0)	324 (86.6)	482 (84.0)	**0.018**
	No	42 (21.0)	50 (13.4)	92 (16.0)	
Bowel preparation	Good	189 (94.5)	358 (95.7)	547 (95.3)	0.510
	Bad	11 (5.5)	16 (4.3)	27 (4.7)	
Withdrawal time (min)		21.86 ± 12.01	20.69 ± 9.78	21.1 ± 10.62	0.241
Polyp detection rate	Yes	142 (71.0)	260 (69.5)	402 (70.0)	0.712
	No	58 (29.0)	114 (30.5)	172 (30.0)	
Polyp number perprocedure Rprocedure		2.54 ± 3.13	2.47 ± 3.13	2.49±3.13	0.793
Adenoma detection rate	Adenoma	108 (54.0)	188 (50.3)	296 (51.6)	0.394
	Not adenoma	92 (46.0)	186 (49.7)	278 (48.4)	

CI = 1.004, 1.066 and OR = 1.124, 95% CI = 1.092, 1.157, respectively) (Table 2). On the other hand, age (OR = 1.030, 95% CI = 1.003, 1.056), male sex (OR = 1.568, 95% CI = 1.091, 2.253), and withdrawal time (OR = 1.069, 95% CI = 1.048, 1.090) were significant independent predictors of adenoma detection (Table 3).

Discussion

In this single-center study, we found that the type of sedation used during screening or diagnostic colonoscopy had no influence on ADR or PDR either on bivariate analysis or after adjusting for their classic influencing factors on multivariate analysis. We chose to pool the colonoscopy indications to replicate every day practice where screening addresses asymptomatic patients by definition, whereas a first diagnostic colonoscopy will still serve the screening purpose. Ahmed et al. [11] compared colonoscopy quality indicators between screening and non-screening groups. No difference in neoplasia detection was found. In our study cohort, the indication type was not significantly different between the CS and DS modalities, the former being the most frequently used in our center. Two systematic reviews (Aziz et al.) [12,13] pooled 3 and 11 retrospective studies similar to ours respectively and showed that both had similar influence on adenoma or polyp detection. However, in a recently published large-scale retrospective study Huang et al. [14] included 10,788 patients, and examined factors influencing adenoma detection. Use of propofol sedation anesthesia was found to be an independent predictor. Jawitz et al. [15] performed a retrospective study of 7799 patients undergoing screening colonoscopy and used a two-level generalized linear mixed regression model to identify factors associated with polyp detection. Adenomas were more likely to be found during procedures performed with anesthesia care as

Table 2 Polyp detection predictors.

Variables		Adj. OR (95% CI)		*P*-value
Age		1.035	(1.004, 1.066)	**0.024**
Sex	Female	1		
	Male	1.485	(0.984, 2.241)	0.060
BMI		1.003	(0.960, 1.047)	0.907
Charlson comorbidity		1.006	(0.857, 1.180)	0.944
Withdrawal time		1.124	(1.092, 1.157)	<**0.000**
Indication	Screening	1		
	Diagnostic	0.816	(0.534, 1.246)	0.346
Sedation type	Deep sedation	1		
	Moderate sedation	0.866	(0.561, 1.337)	0.517
Bowel preparation	Good	1		
	Bad	0.486	(0.184, 1.286)	0.146

Table 3 Adenoma detection predictors.

Variables		Adj. OR (95% CI)		*P*-value
Age		1.030	(1.003, 1.056)	**0.026**
Sex	Female	1		
	Male	1.568	(1.091, 2.253)	**0.015**
BMI		1.019	(0.982, 1.058)	0.314
Charlson comorbidity		1.061	(0.922, 1.221)	0.407
Withdrawal time		1.069	(1.048, 1.09)	<**0.000**
Indication	Screening	1		
	Diagnostic	1.086	(0.749, 1.576)	0.663
Sedation type	Moderate sedation	1		
	Deep sedation	0.789	(0.538, 1.156)	0.224
Bowel preparation	Good	1		
	Bad	0.707	(0.283, 1.766)	0.458

compared to those with moderate sedation. These findings leave the debate open, and highlight the need for a randomized prospective study to be done in order to close it definitely. Krigel et al. [16] studied the effect of anesthesia use on trainee ADR, and found no significant association. Although a significantly higher number of our colonoscopies performed with fellow involvement were done using conscious sedation, fellow involvement was not predictive of ADR or PDR in both of our logistic regression models. Age and presence of comorbidities are likely to be associated with both the prevalence of colorectal adenomas and anesthesia use in real life practice. The majority of patients included were in the early sixties, and our ADR and PDR are well above those recommended by international endoscopic societies' guidelines, possibly reflecting our division members' expertise. CCI was not significantly higher in patients submitted to propofol sedation in comparison to the CS group. Furthermore, the CCI was not found to be an independent predictor of ADR on multivariate analysis. Marella et al. [17] performed the same study design as ours on a veteran's population. The overall ADR and PDR were, respectively 50% and 60%, no impact of sedation type being demonstrated. Another 2018 retrospective study done at MD Anderson by Thirumurthi et al. [9] showed higher ADR in deep sedation as compared to moderate sedation (46.3% vs. 41.2%, $p = 0.01$). In this study, the authors excluded patients with significant comorbidities from the moderate sedation group, which possibly could have led to biased results.

This study has several potential limitations. First, it has a retrospective single center design, with a relatively small sample size. However, all previous studies done about this topic have employed retrospective analysis. Second, it included a mix of screening and non-screening colonoscopies. As mentioned earlier, some authors have shown that this fact does not influence neoplasia detection rate. Finally, the use of binary score (good or poor) in bowel preparation assessment rather than a standardized scale (such as Boston bowel preparation scale) is considered a limitation. This might very well explain the fact that this variable was not found to be significantly predictive of ADR or PDR despite being established as a robust quality indicator metric for colonoscopy. Although a bad preparation is linked with missed polyps and interval cancer, luckily the extreme majority of our patients had a good to excellent preparation quality on the Aronchik scale used in our endoscopy unit. On the other hand, withdrawal time, the other well recognized quality indicator, was not significantly different between CS and DS groups. It still turned out to be an independent predictor of PDR/ADR.

In conclusion, use of deep sedation doesn't influence the ADR/PDR quality metrics in our mixed cohort of screening and diagnostic colonoscopies. A randomized controlled trial comparing both colonoscopy sedation modalities is warranted to validate these results. However, such a trial would need to involve multiple centers in order to ensure sufficient statistical power to detect a small difference in case it existed. Our results do not favor use of a particular sedation method and the choice of sedation should be individualized based on patient preference, risk factors and resource availability.

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none.

Ethics approval

The study protocol was approved by the Institutional Review Board/Ethics Committee of the American University of Beirut Medical Center.

Declaration of Competing Interest

None to declare.

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Author's contribution: The authors declare they have participated in the preparation of the manuscript and have seen and approved the final version.

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