

# Can Multiparity Predict a Difficult Colonoscopy? Prospective, Single-Centre Study in an Orthodox Jewish Hospital in Israel

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## Abstract

**Background and aim:** The effects of multiparity on performing colonoscopies have not been evaluated. This study compared the levels of difficulties encountered in performing colonoscopies among unipara and multipara orthodox Jewish women.

**Patients and methods:** This single-centre, prospective observational study included all consecutive women who underwent colonoscopies between November, 2017 and July, 2018 by four gastroenterologists trained in endoscopy. Patient characteristics included age, body mass index, and history of constipation, number and type of past deliveries, past abdominal or pelvic surgeries, and date and indications for colonoscopy.

Colonoscopy-associated data included abdominal compression, position changes, scope insertion time, type and dosage of sedation, cleansing status of the bowel, the presence of diverticulosis or other pathologies, and the reasons for an incomplete procedure. The patients were divided into those undergoing therapeutic colonoscopy (e.g., for polypectomy) and those undergoing diagnostic colonoscopy. The parameters that defined a difficult procedure were position changes, weight-related abdominal compression, and scope insertion time.

**Results:** A total of 227 women participated in the current study, of whom 181 underwent diagnostic colonoscopy and 46 underwent therapeutic colonoscopy. Multipara women had significantly more position changes (89.5% vs. 10.5% for unipara women,  $p=0.05$ ), and unipara women weighed more than multipara women ( $75.04 \pm 19.60$  vs.  $70.11 \pm 15.16$  kg, respectively,  $p=0.05$ ). Being multipara and a longer scope insertion time were associated with encountering difficulties (OR=2.29; %CI: 0.95-8.81 and OR=4.49; %CI: 2.11-9.97, respectively).

**Conclusion:** Practicing endoscopists should be alert to the likelihood of colonoscopy being more difficult to perform on multipara women compared to unipara women.

**Keywords:** Colonoscopies; Endoscopists; Gastroenterology; Post-hemicolectomy; Polypectomy

## Introduction

Since the introduction of colonoscopy in the 1960's [1], there has been rapid technological development as manifested by flexibility and maneuverability of the endoscopes, accompanied by improved optical resolution [2]. Endoscopist competence, defined by cecal intubation, has also improved, becoming a quality indicator in colonoscopy. The U.S. Multi-Society Task Force on Colorectal Cancer sets a target of successful intubation of the cecum in at least 90% of all colonoscopies and a success rate of at least 95% with photo documentation in screening colonoscopies [3].

Colonoscopists can, however, encounter difficulties during scope insertion which can lead to lower success levels of cecal intubation. Although there is no standard definition of what comprises a "difficult" colonoscopy, procedures in which more than 10 min are needed for insertion, when at least two attempts are needed to reach the cecum, or altogether failed intubation are generally considered as being "difficult" [4-6]. The reasons for incomplete colonoscopy include increased age,

female gender, prior pelvic or abdominal surgeries, low Body Mass Index (BMI), diverticulosis, type of colonoscope used, and the competence of the endoscopist [1,7].

Many authors consider colonoscopy in women more difficult compared to men [8-11], and it has been suggested that the reason was the comparatively greater number of pelvic surgeries undergone by women [12], although Waye et al. [13] found that the incidence of failed colonoscopies in women with previous hysterectomy did not impact the completion rate. The most common cause of difficulty in performing colonoscopy in women is recurrent looping of the colonoscope in a long or mobile colon [14].

Mayenei Hayeshua Hospital is an orthodox Jewish hospital. Most of the women in the current study group who underwent colonoscopy in its facilities were multipara, among them many grand multipara (>5 births) and including not a few with more than 10 children. The aim of this study was to determine whether there is an association between difficult colonoscopies and multiparity.

## Patients and Methods

This single-centre, prospective observational study included women who underwent elective colonoscopy at the Gastroenterology Unit at Mayanei Hayeshua Medical Center during a period of 8 months, from November 2017 to July 2018. Colonoscopies were performed by four experienced gastroenterologists trained in endoscopy, two of whom were <5 years after residency and two who were >5 years after residency. Colonoscopies were carried out by video colonoscope (EC-3890LK; EC38i10L; EC-3890Li, Pentax medical, Tokyo, Japan).

The study included women 18-85 years of age. Written informed consent was obtained from all the patients. The study protocol was approved by the institutional review board of the Mayanei Hayeshua Medical Center.

Exclusion criteria were pregnancy and lactation, post-hemicolectomy, poor bowel preparation, known colon stricture or obstructing tumour, hemodynamic instability, and inability to sign informed consent.

The prospectively collected data included age, BMI, history of constipation, time since last delivery, and total number of births. Women with fewer than two viable pregnancies were considered as unipara. Type of delivery (vaginal or cesarean), history of abdominal and pelvic surgeries, and current indications for colonoscopy were noted. The information recorded during colonoscopy was the number of abdominal compressions by the nurse, the number of position changes, and the time to successful probe insertion.

The type and dosage of the medication used for sedation were also noted (usually starting with a low dose of propofol titrating up to 2.5 mg/kg and midazolam up to 2.5 mg/kg), as were the levels of preparation (e.g. Good, medium and poor), the known pathology (e.g., polyps, diverticulosis) and the reasons for an incomplete procedure.

The study patients were divided between those who were referred for therapeutic colonoscopy and those for diagnostic colonoscopy. The difficulty or incompleteness of the procedure was analysed for each group separately. "Therapeutic" colonoscopy was defined as procedures carried out on patients who were undergoing polypectomy, colonic biopsies, or any other procedure with the potential of extending the time of the colonoscopy.

"Diagnostic" colonoscopy was defined as all the routine procedures carried out on patients with no established pathologies and not undergoing the colonoscopy for the purpose of administering endoscopic treatment.

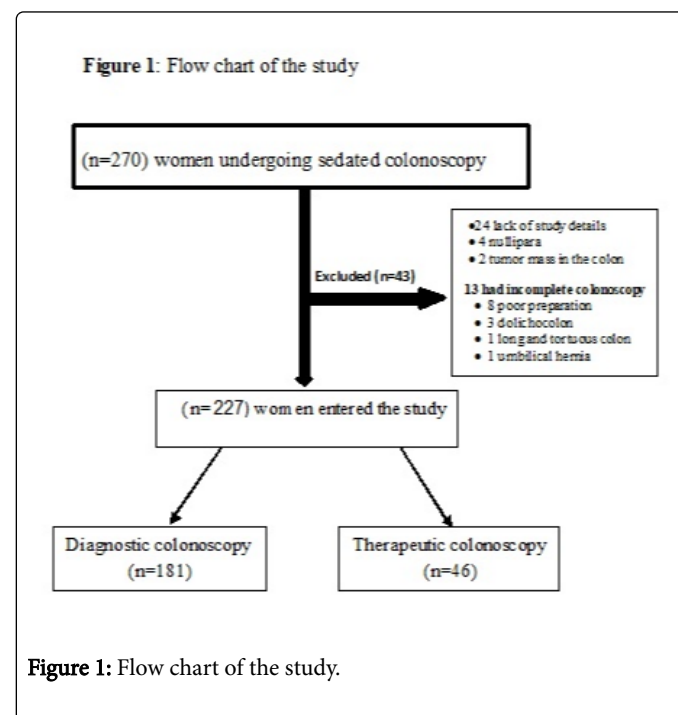
### Baseline patients' characteristics

A total of 270 women underwent colonoscopy during the study period. Forty-three women were excluded, among them 24 for missing data, four who were nullipara, and two in whom a tumour mass was found.

Also excluded were 13 women who had incomplete colonoscopy, eight because of poor preparation, three due to dolichocolon, one due to a long and tortuous colon, and one due to an umbilical hernia.

Those exclusions left 227 women who were eligible to participate in the current study. 181 women underwent diagnostic colonoscopy (79.7%), and 46 underwent therapeutic colonoscopy for known

pathologic findings (the latter being excluded from the analysis to determine difficult colonoscopies) (Figure 1).



**Figure 1:** Flow chart of the study.

### Data collection and outcome measurements

Demographic data and clinical characteristics of all 227 study patients were collected. Time to insertion of the scope to the cecum, the number of abdominal compressions, and the number of position changes were recorded. Those three parameters were used to define whether a procedure had been difficult.

The correlations between multipara (>2 births) and procedure time (cut off 10 min), abdominal compression (yes/no), position change (yes/no) were done using a logistic regression model. A mix scoring for colonoscopy difficulty was developed in line with the regression coefficients of those variables (the relative rate for each parameter: abdominal compression 10%, procedure time 10%, and position change 80%). The top 50% were considered high probability for difficult colonoscopy and the bottom 50% were considered low probability.

Continuous variables were expressed as means  $\pm$  standard deviation (SD) and analyzed with Student's t test and the Mann Whitney test when appropriate. Categorical variables were analyzed using the chi-square test or the Fisher exact test when appropriate.

Analyses were performed with SPSS V.25 for Windows (IBM). The group differences in BMI, diagnostic colonoscopy without clinical endoscopic findings, uniparity ( $\leq 2$  births), and multiparity ( $\geq 2$  births) were evaluated by univariate analysis (t-test).

## Results

The mean age of the 227 study women was  $58.5 \pm 11.9$  years, and their mean BMI  $27.6 \pm 6.47$ . Sixty-six (29%) women had a history of constipation, and 42 (18.5%) had a history of diverticulosis. An additional 112 (49.3%) women had undergone pelvic/abdominal surgery, among them 52 (23%) involving a caesarian section. The two

experienced endoscopists with >5 years post-residency were involved in 84 (37%) colonoscopies, and the two experienced endoscopists with <5 years post-residency were involved in 143 (63%) colonoscopies. One-hundred and seventy (92%) women were defined as multipara, and 57 (8%) as unipara Table 1. Of the 227 women who underwent diagnostic colonoscopy, 181 procedures were judged as being difficult.

Patient characteristics	Total (n=227)
Mean age(years)	58.5 ± 11.9
Height (cm)	158.0 ± 16.64
Weight (kg)	71.35 ± 16.48
Mean body mass index	27.6 ± 6.47
History of constipation (n)	66 (29%)
Diverticulosis (n)	42 (18.5%)
Abdominal pelvic surgery (n)	112 (49.3%)
Caesarian section (n)	52 (23%)
Endoscopists (n=4)	
2 with >5 years post-residency	84 patients (37%)
2 with <5 years post-residency	143 patients (63%)

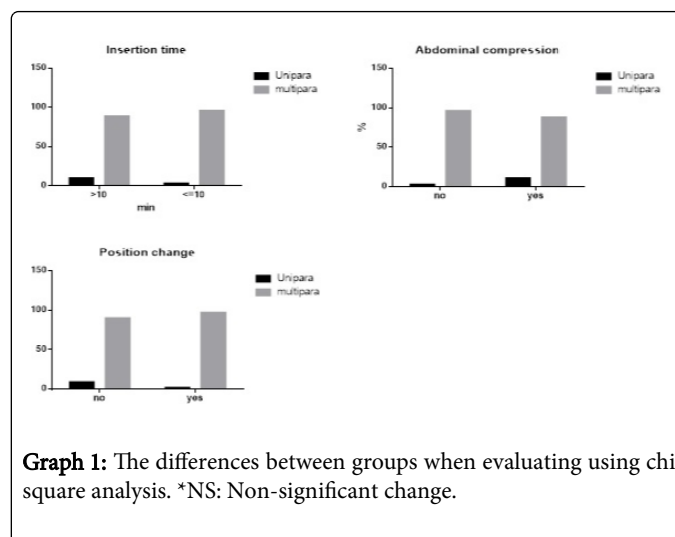
**Table 1:** Patient characteristics.

### Multiparity and difficulty parameters

The three selected difficulty parameters of position changes, time to probe insertion, and abdominal compressions were compared between the multiparity and the uniparity groups (Table 2) (Graph 1).

Parameter	Parameter	Parameter	Parameter	Parameter
Insertion (min) time to scope	>10	12	106	0.1
		10.20%	89.80%	
	<10	2	59	
		3.30%	96.70%	
Abdominal compression (%)	No	3	90	0.03
		3.20%	96.80%	
	Yes	8	59	
		11.90%	88.10%	
Position change (%)	No	13	128	0.17
		9.20%	90.80%	
	Yes	1	37	
		2.60%	97.40%	

**Table 2:** The correlation between unipara and multipara women and the difficult colonoscopy parameter.



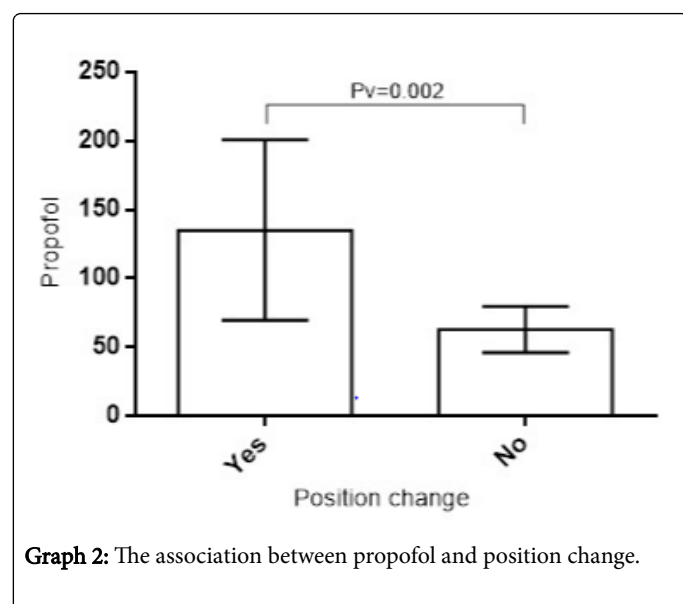
Significantly more abdominal compressions were carried out in the former compared to the latter group (n=59, 88.1% vs. n=8, 11.9%, respectively, p<0.05). More multipara women had position changes (n=37, 97.4% vs. n=1, 2.6%, p=0.17), but the difference did not reach a level of significance. The findings of the scope insertion time parameter (96.7% vs. 3.3% for <10 min, respectively, and 89.8% vs. 10.2% for >10 min, respectively, p=0.1) were similar for the multipara and unipara women. Two models of logistic regression were used to analyze the association between difficulty parameters and multiparity Table 3.

Parameter	OR	Upper CI	Lower CI	P Value
Adjusted for age height weight				
Abdominal compression (n)	4.19	0.95	18.59	0.06
Time to scope insertion (min)	0.27	0.03	1.96	0.19
Position change (n) OR=Odds Ratio; CI=Confidence Interval	0.46	0.05	4.37	0.5

**Table 3:** The association between difficulty parameters and number of births.

The first model evaluated this association without adjustment for the endoscopist's experience. The association between position change and multiparity was strong [Odds Ratio (OR)=10.33 confidence interval (CI):1.32-80.69], and it persisted after adjustment for the operator's experience [OR=10.03 (CI:1.28-78.4)].

The propofol dose was significantly associated with position change (135.2 ± 65.55 mg/kg vs 63.06 ± 16.73 mg/kg, p=0.002) Graph 2.



Since position change was the dominant parameter among the three difficulty parameters, we computed the risk for its occurrence by logistic regression, transferring the predictive values to binary parameter by a cut off at the median of the range. The high-risk score of  $0.74 \pm 0.31$ , which represents the multipara group's having a longer time to scope insertion compared to the low risk score of  $0.05 \pm 0.05$  for the unipara group.

There were no group differences in age, height, and BMI. The propofol dose was significant higher in the group at high risk for a difficult colonoscopy compared to the low-risk group ( $151 \pm 84.9$  mg/kg vs  $104 \pm 51.1$  mg/kg, respectively,  $p=0.001$ ). There was an association between multiparity and time to scope insertion to the high-risk scores [OR=2.29 (CI:0.95-8.81) and OR=4.49 CI:2.11-9.97], respectively.

#### Patients' characteristics according to number of births

The characteristics of the unipara and multipara women undergoing diagnostic colonoscopy were compared according to age, height, weight, and BMI (Table 1). It emerged that the only significant difference between them was that the former weighed more than the latter ( $75.04 \pm 19.60$  kg vs.  $70.11 \pm 15.16$  kg, respectively.  $p=0.05$ ).

The influence of cesarean section on the difficulty parameters during colonoscopy Fifty-two (23%) of the women in the diagnostic colonoscopy group had undergone a cesarean section which turned out not to make any significant difference in the difficulty parameters between them and the women who did not undergo a cesarean section (Table 4).

Abdominal compressions			P value
C-section	No	Yes	0.85
	12	9	
	57.10%	42.90%	
	60	49	
No C-section	55.00%	45.00%	

Position change		0.67
	23	5
C-section	82.10%	17.90%
	95	26
No C-section	78.50%	21.50%
Scope insertion time		0.57
	10<min	$\leq 10.00$ min
C-section	20 (71.4%)	8 (28.6%)
No C-section	79 (65.8%)	41 (34.2%)

**Table 4:** The influence of caesarian section on difficulty parameters during colonoscopy.

The difficulty parameters vis-à-vis the endoscopists with varying lengths of experience Four experienced endoscopists participated in the current study, two gastroenterologists with <5 years post-residency and two gastroenterologists with >5 years post-residency. Analysis of the difference between them according to the difficulty parameters revealed that more abdominal compressions were done by the latter compared to the former ( $n=54$ , 80.6% vs.  $n=13$ , 19.4%, respectively,  $p<0.01$ ). The former endoscopists recorded less time to scope insertion than the latter endoscopists (mean 48 min, 78.7% vs. mean 13 min, 21.3%,  $p \leq 0.001$ ). There was no significant difference in the number of position changes between the two pairs of endoscopists ( $n=14$ , 36.8% vs.  $n=24$ , 63.2%,  $p=0.74$ ) (Table 5).

	Endoscopist		P value
Parameter	>5 years	<5 years	
	post-residency	post-residency	
Abdominal compressions			
No	12	81	<0.01
	12.90%	87.10%	
Yes	54	13	
	80.60%	19.40%	
Scope insertion time (min)			
10<	57	61	<0.001
	48.30%	51.70%	
<10.00	13	48	
	21.30%	78.70%	
Position change			
No	56	85	0.74

	39.70%	60.30%	
Yes	14	24	
	36.80%	63.20%	

**Table 5:** Difficulty parameters between endoscopists.

### The impact of the endoscopist's experience

We added multiparity to the difficulty parameters in order to assess the impact of the endoscopists' length of experience in performing colonoscopies (Table 6).

Multipara yes/no				
Endoscopist	Abdominal compressions	No	Yes	P value
>5 years post-residency	No	2	10	
		16.70%	83%	
	Yes	12	42	
		22.20%	78%	
<5 years post-residency	No	15	66	
		18.50%	81%	0.19
	Yes	6	7	
		46.20%	54%	
Endoscopist	Insertion time (min)			
>5 years post-residency	10<	14	43	
		24.60%	75%	
	<10.00	1	12	
		7.70%	92%	
<5 years post-residency	10<	8	53	
		13.10%	87%	0.15
	<10.00	16	32	
		33.30%	67%	
Endoscopist	Position change			
>5 years post-residency	No	15	41	
		26.80%	73%	
	Yes	0	14	
		0.00%	100%	
<5 years post-residency	No	20	65	
		23.50%	76%	0.05
	Yes	4	20	

		16.70%	83%	
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**Table 6:** Difficulty parameters among multipara and unipara women according to endoscopists' experience.

There was a non-significant difference in favour of more abdominal compressions in part of the operator with more experience (n=42, 78% vs. n=7, 54%, p=0.19) and longer time to scope insertion (Range=22 min., 92% vs. Range=37 min., 67%, p=0.15) on the part of the operators with less experience. They also recorded significantly more position changes compared to the operators with less experience (n=14, 100% vs. n=20, 83%, p=0.05).

### Discussion

The greater difficulty in performing colonoscopy in women compared to men is well-documented [1,9,15]. One of the hypotheses for that finding is that women have a larger intrapelvic volume and more sigmoid mobility, especially thin, older women, which allow more looping during colonoscopy and subsequent greater difficulty in carrying out the procedure [1]. The women chosen for the current study underwent colonoscopies in the Mayenei Hayeshua Medical Center, an orthodox Jewish hospital in which most of the female population includes a relatively high proportion of multiparas (mean 5 ± 3.12 living births). Several studies had reported several factors that were related to the difficulty of colonoscope intubation and the completion rate of colonoscopy, including advanced age, lower BMI, technical skill of the endoscopist, female gender, history of constipation, history of abdominal or pelvic surgery, and inadequate bowel preparation [1,4,5,6-14]. To best of our knowledge, there has been no study to date that has explored the effect of multiparity on difficult colonoscopies.

We chose the difficulty parameters of position change, time to scope insertion, and abdominal compression during colonoscopy and compared them between uniparas and multiparas, hypothesizing that the latter would involve more difficult procedures. The results demonstrated a significantly greater number of abdominal compressions among the multipara women than among the unipara women (p<0.05). Concomitantly, the dose of propofol rose significantly in parallel with the need for more abdominal compressions (p=0.002). There was no significant difference in time to probe insertion (p=0.1) or position change (p=0.17).

We examined the association of the difficulty parameters with the endoscopist's experience and then added the parameter of multiparity to evaluate whether it had any additive influence. It emerged that there was a relation between multiparity and position change (p ≤ 0.05), and that this relation persisted when the endoscopist's experience was taken into account.

The possibility of a past cesarean section posing another factor that could influence the difficulty parameters was also considered. The results showed that it had no significant effect.

There are several weaknesses of the present study that bear mention. One is that it is a single-centre study, and another is that the cohort is relatively small. Its major strength is that it is the first to exploit the availability of a unique population of multipara and grand multipara women in order to investigate whether parity plays a role in difficult colonoscopy procedures.



## Conclusion

The current study findings are that multipara women will need more position changes during diagnostic colonoscopy than unipara women, thereby indicating a greater likelihood of a comparatively more difficult procedure. The length of experience of the endoscopist had no effect on procedural difficulty. The important implications of these results for practicing endoscopists is that different diameters or degrees of stiffness of the scopes, and even an alternative way of diagnostic screening, such as virtual colonoscopy, might be considered for this select group of women.

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