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Stoma Formation in Rectal Cancer Surgery: Findings from an International Case-Based Survey

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Abstract

Background

The use of stomas related to rectal cancer resections varies considerably. This study aimed to assess interrater agreement among rectal cancer surgeons regarding the use of stomas in different clinical scenarios.

Methods

Twelve case-based scenarios of rectal cancer were developed and distributed digitally to colorectal surgeons in Europe, Asia, and the United States. For each case, respondents selected one of three management options: (1) anastomosis without diverting stoma, (2) anastomosis with diverting stoma, or (3) resection with permanent colostomy. Participants were additionally asked to report the degree of confidence associated with their response for each case. Interrater agreement was evaluated using Fleiss' kappa.

Results

Of 106 invited surgeons, 53 completed the survey. Agreement on recommended management was fair ($\kappa = 0.359$). Higher agreement correlated strongly with higher confidence levels ($r = 0.759$, $p = 0.004$). Patient age > 70 years and tumor height > 12 cm from the anal verge were associated with greater consistency in decision-making.

Conclusion

Interrater agreement regarding stoma use in rectal cancer surgery was only fair across this international cohort. Despite a modest response rate, these findings highlight substantial variability in clinical decision-making and may inform future efforts to standardize practice

Introduction

Colorectal cancer is the third most common cancer worldwide with rectal cancer constituting about 25% of this volume[1]. The standardization of surgical and oncologic treatment over the last decades has resulted in greatly improved survival and decreased rates of local recurrence[2, 3]. However significant variability remains in the utilization of stomas in the surgical management of rectal cancer.

Controversy persists regarding the necessity of a temporary diverting stoma following the creation of an anastomosis. Proponents argue that such stomas decrease the risk of anastomotic leakage and reoperations, supported by multiple studies[4–7]. Conversely, opponents contend that diverting stomas merely postpone the detection of a leak, and entail a spectrum of stoma-specific complications, also supported by literature[8–11]. Consequently, clinicians face challenges in integrating evidence into practice with recent findings indicating that emotions and personal experiences influence surgical decision making in 22% and 49% of cases respectively[12].

While technically feasible, the formation of an anastomosis may not always be the best solution. Anastomotic leakage, a feared and relatively common complication with long term follow-up studies reporting rates around 20%[8, 10], significantly contributes to post operative morbidity and has also been associated with cancer-specific mortality[13]. Additionally, concerns regarding long-term bowel function, evidenced by a high prevalence of major

low anterior resection syndrome (LARS) among anastomosed patients[14, 15], further complicate decision making. In addition, studies have not demonstrated superior health-related quality of life (HRQoL) outcomes in anastomosed patients compared to those with a permanent stoma[16, 17], adding to the complexity of selecting the most appropriate surgical strategy for the individual patient.

In the present study, rectal cancer surgeons were asked to determine the strategy for the use of stoma, based on available preoperative information, in 12 different clinical cases. To the best of our knowledge, this represents the first multi-center, multi-national case-based investigation into potential variability in stoma utilization in the surgical management of rectal cancer patients.

Material and Method

Cases

Twelve cases of rectal cancer patients with different tumor locations and patient factors likely to impact the decision, like diabetes, obesity, neoadjuvant radiation, fecal incontinence and age, were constructed. The treatment options for each case included: 1) resection with anastomosis without the construction of a diverting stoma; 2) resection with anastomosis and formation of a diverting stoma; or 3) resection without anastomosis, resulting in a permanent colostomy. The risk factors increased, and tumor height decreased from cases one to twelve, making cases one and two likely candidates for direct anastomosis without diversion, while cases eleven and twelve were more likely to result in a permanent colostomy. The order of cases was randomized prior to distribution to obscure this pattern. Respondents were asked to provide a preoperative recommendation for each case based on the clinical information provided, specifying the strength of their recommendation as very strong, strong, or medium. The surgeons were asked for their opinion, before going into discussion with the patient.

Distribution

Before the study commenced, the research team conducted a pilot study involving ten selected surgeons. The primary objectives were to assess the logistics of email distribution and the survey instrument itself, as well as to ensure that the clinical cases were clear and realistically aligned with everyday practice. The ten responses obtained during the pilot phase were excluded and not incorporated into the main study.

The questionnaire was distributed digitally using a well-established, globally recognized platform (SurveyMonkey, San Mateo, CA, USA). Invitations were sent out in two batches between September and October 2024. Each participant received a reminder 14 days after the original invitation.

The time (in minutes and seconds) used to complete the form was recorded for each participant. This was done to allow for the exclusion of participants whose response time was so short that they realistically could not have read and adequately evaluated the cases. None of the participants were excluded on this basis.

Participants

All participants were colorectal surgeons involved in the treatment of rectal cancer and included after written informed consent. While the study adhered to privacy handling according to EU-GDPR regarding the participating surgeons, no patients were involved, thus no ethical approval was obtained. The data was analyzed and reported anonymously. The e-mail address of the participant was only used for the distribution of the survey and not included

in the final dataset for analysis. The respondents were based in Northern Europe, Southern Europe, central Europe, US and Asia. All participating surgeons were either consultants or had consultant-level experience, hence we chose not to categorize participants based on their level of experience. The surgeons were asked to indicate the size of the center they represent in terms of the number of rectal cancer procedures performed per year; <25 cases, 25–50 cases, 51–75 cases, 76–100 cases, and > 100 cases.

Analysis

Fleiss' kappa (κ) was used to determine interrater agreement between the participants. The interpretation of kappa values was based on the guidelines by Landis and Koch, where $\kappa < 0$ indicates poor agreement, 0.00–0.20 slight, 0.21–0.40 fair, 0.41–0.60 moderate, 0.61–0.80 substantial, and 0.81–1.00 almost perfect agreement.

Cases were categorized based on the following variables to allow comparison of subgroups within patient factors: gender, age, BMI, height of tumor, neoadjuvant radiation, neoadjuvant chemotherapy, preoperative incontinence, diabetes, smoking, and ASA classification. Given the limited number of cases, when comparing patient factors in subgroup analysis, chance-corrected agreement statistics such as Fleiss' kappa or Gwet's AC1 were not calculated at the subgroup level. Instead, inter-rater agreement was summarized at the case level and compared descriptively across case-level patient characteristics by reporting mean and range of the proportion of raters selecting the modal response. This approach was chosen to facilitate clinically interpretable comparisons of agreement across cases with different patient characteristics.

Cases were categorized based on the following variables to allow comparison of subgroups within surgeon factors: time to complete survey, number of annual procedures (center), region, and the strength of the recommendation. The kappa value for region EU South and ASIA/US should be interpreted with caution because the sample size of objects was small, which may affect the reliability of the estimates.

Strength of recommendation was ordinally encoded from very strong, strong, medium to 3, 2 and 1 respectively. Spearman rank correlation coefficient (r) was used to determine correlation between the rater strength of recommendation and the level of agreement. A p-value of < 0.05 was considered significant. IBM SPSS Statistics v26 (IBM Corp., Armonk, NY, USA) was used to analyze the data. The manuscript was prepared according to SURGE guidelines.

Results

The survey was distributed to a total of 106 surgeons, of whom 53 (50%) completed the twelve cases. The average time spent completing the survey was 6 minutes and 59 seconds. A total of 6, 16, 7, 12 and 12 surgeons represented centers performing <25, 25-50, 51-75, 76-100 and >100 rectal cancer operations annually, respectively. The surgeons represented various regions; EU central, EU north, EU south and ASIA/USA in 15, 30, 4 and 4 cases respectively.

All case answers (a) and answers regarding the strength of recommendation (b) are presented in table 1 and depicted as a heat map in figure 1. The overall interrater agreement regarding the twelve cases was fair with $\kappa = 0.359$. There was a high level of agreement regarding cases one and six which were both high rectal cancers without a high burden of risk factors (modal response 87.8%, range 83.0-92.5). Excluding these two cases designed for maximum level of agreement, the overall agreement for the remaining cases fell ($\kappa = 0.264$), reflecting a high level of variability among surgeons in the suggested treatment options. Interestingly, in case four and eight, both with very low tumors only 3 cm above the anal verge, around 30% of surgeons suggested an anastomosis.

Table 2 presents an overview sorted with respect to proportion of agreement (%) on the recommended procedure. A high level of agreement on the recommended procedure correlated strongly with the strength of recommendation. (r=0.759, p = 0.004), figure 2.

With respect to patient factors, age > 70 years and height of tumor > 12 cm from the anal verge were associated with higher levels of agreement. Regarding other factors there were smaller differences in modal response, table 3.

Interestingly, surgeons completing the survey in less than 6 minutes or more than 12 minutes seemed to agree more than surgeons completing in 6-12 minutes. There was no clear pattern as to whether the size of the center (low vs. high volume) affected the level of agreement between the surgeons. Surgeons from EU central or EU north appeared to agree more than surgeons from EU south, but the latter was only represented by four surgeons (table 4).

Discussion

This survey reveals substantial variance in the recommended treatment strategies for rectal cancer among surgeons, particularly for mid- and low rectal cancers. The treatment options presented in this survey—direct anastomosis without diversion, anastomosis with a diverting stoma, and permanent colostomy—can be classified as follows: the first option represents a “high risk – high reward” scenario, the second entails intermediate risk while accepting the inconveniences and complications associated with a diverting stoma, and the third is the safest option, albeit at the cost of a permanent stoma. For mid-rectal cancers, all three options are technically feasible, and arguments can be made for each approach.

Literature on this topic is inconsistent. Although risk factors for anastomotic leakage—such as the level of anastomosis, neoadjuvant radiotherapy, and male gender—are well established [8, 18], there remains no consensus on the criteria for diverting stomas [9, 19]. Several studies advocate routine diversion [4, 5, 7], demonstrating reduced leak rates and reoperation rates, while others emphasize the extensive complications associated with diverting stomas and recommend a more selective approach [9, 11, 20]. Given the high rates of anastomotic leak [4, 8] and LARS [14, 15, 21] associated with low anastomosis, a permanent stoma may be a viable option for many patients, as studies have not shown inferior HRQoL in this group [16, 17].

It is emphasized in this study that we are looking for the recommendation given by the surgeon before going into the discussion with the patient. In many cases the choice on whether to put a stoma or not may have become clearer after taking the patient’s preferences into account. Nonetheless, many patients tend to place their trust in the surgeon's expertise to guide this decision. Of course, this study also does not account for intraoperative events or evaluation that may change the plan to divert or not. However, as this is similar for all participants, this will not affect the end point of the study, the interrater agreement.

The study has the following limitations: Most notably, the participation rate was unexpectedly low (50%). All participants were personally notified and invited to participate prior to inclusion. The questionnaire was distributed, followed by a reminder sent 14 days later. We chose not to send additional reminders or personal follow-ups for two main reasons. First, we aimed to ensure that participants felt a certain level of engagement in the study, responding truthfully and to the best of their ability, as if they were in a clinical setting. We cannot exclude the possibility that participants who respond after multiple reminders may feel obligated to do so rather than being genuinely willing to participate, which was not desirable. Second, participants had provided informed consent to take part in the study, and additional reminders could have compromised the integrity of that consent. With that in mind, a higher participation rate would not have altered the responses received from the 53 participants or the observed low inter-rater agreement them in-between. We also cannot rule out that the low participation is reflected in the disagreement

demonstrated in this study, and that surgeons may therefore hesitate to respond and make decisions in areas where they know, or may assume, that a large proportion of others would disagree with their choices.

To conclude, the interrater agreement between 53 rectal cancer surgeons from multiple centers was fair. In clinical decision-making, this is considered insufficient and indicates variability in interpretation or application of criteria. How this impacts patient outcomes is neither the aim nor the purpose of this paper; however, it serves as important background information for all professionals involved in rectal cancer surgery and who face these clinical decisions in everyday practice.

Declarations

Conflicts of interest: None

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Author Contribution

L.A.B.G. and K.W.B. wrote the manuscript. K.W.B prepared all tables and figures and together with C.B and C-Y. H. did the statistics.Y.N.Y., L.T.S, F.P, S.N., O.S. and H.M.F all contributed to the design and original idea of the study.All authors reviewed the manuscript and made contributions to the submitted version.

Data Availability

The datasets generated during the current study were collected using SurveyMonkey. Due to privacy and confidentiality considerations, the raw survey data are not publicly available but are available from the corresponding author upon reasonable request.

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Tables

Table 1 Treatment options and strength of recommendation for each case. Rates of suggested treatment options for each case given in absolute numbers and percentages as distributed among the 53 participants. Anastomosis = anastomosis without diverting stoma; Permanent = permanent colostomy; Diverting = anastomosis with diverting stoma

	Case recommendation						Strength of confidence					
	Anastomosis		Permanent		Diverting		Medium		Strong		Very strong	
Case	n	%	n	%	n	%	n	%	n	%	n	%
1	49	92 %	1	2 %	3	6 %	1	2 %	21	40 %	31	58 %
2	6	11 %	21	40 %	26	49 %	22	42 %	22	42 %	9	17 %
3	3	6 %	43	81 %	7	13 %	7	13 %	26	49 %	20	38 %
4	0	0 %	35	66 %	18	34 %	11	21 %	21	40 %	21	40 %
5	4	8 %	12	23 %	37	70 %	18	34 %	20	38 %	15	28 %
6	44	83 %	0	0 %	9	17 %	6	11 %	27	51 %	20	38 %
7	32	60 %	0	0 %	21	40 %	10	19 %	24	45 %	19	36 %
8	1	2 %	37	70 %	15	28 %	10	19 %	18	34 %	25	47 %
9	14	26 %	3	6 %	36	68 %	16	30 %	29	55 %	8	15 %
10	21	40 %	0	0 %	32	60 %	10	19 %	32	60 %	11	21 %
11	20	38 %	4	8 %	29	55 %	19	37 %	27	52 %	6	12 %
12	1	2 %	41	77 %	11	21 %	11	21 %	27	51 %	15	28 %

Table 2 Cases arranged according to proportion of agreement (modal response in n and in percentages) from top to bottom. Strength of confidence was ordinally encoded from very strong, strong, medium to 3, 2 and 1, respectively. Rec = recommendation; Ana = anastomosis; Div = diverting stoma; Per = permanent stoma; Strength = mean strength of confidence (by case); Height = distance from the anal verge to the lower edge (or lower margin) of the tumor – rigid scope in cm; NRT = neoadjuvant radio therapy; NACT = neoadjuvant chemotherapy; Incont = preoperative incontinence; Dia = diabetes; Smo = smoking; ASA = American Society of Anesthesiologist Physical Status Classification System.

Case	Rec	n (%)	Strength	Sex	Age	BMI	Height	NRT	NACT	Incont	Dia	Smo	ASA
1	Ana	49 (92)	2.57	F	75	26	14	no	no	no	No	no	2
6	Ana	44 (83)	2.26	M	67	23	15	no	no	no	no	yes	2
3	Per	43 (81)	2.25	M	86	23	5	no	no	yes	no	no	3
12	Per	41 (77)	2.08	F	83	32	8	yes	yes	some	yes	no	3
8	Per	37 (70)	2.28	M	55	37	3	yes	no	no	no	yes	2
5	Div	37 (70)	1.94	F	73	36	7	yes	yes	no	yes	yes	3
9	Div	36 (68)	1.85	M	76	22	9	no	no	no	no	no	3
4	Per	35 (66)	2.19	F	69	24	3	yes	no	some	no	no	3
10	Div	32 (60)	2.02	M	68	28	8	no	no	no	no	no	2
7	Ana	32 (60)	2.17	F	55	23	8	no	no	no	no	no	2
11	Div	29 (55)	1.75	M	55	27	9	no	no	some	no	no	2
2	Div	26 (49)	1.75	F	62	30	10	yes	no	some	yes	no	2

Table 3 Patient factors and correlated levels of interrater agreement (mean modal response and range). Strength = mean strength of confidence (by subgroup). Height = distance from the anal verge to the lower edge (or lower margin) of the tumor – rigid scope in cm; NRT = neoadjuvant radio therapy; NACT = neoadjuvant chemotherapy.

Patient factors			Range (%)		
	n (cases)	Modal response (%)	Lower	Upper	Strength
Sex					
Female	6	69.2	49.1	92.5	2.12
Male	6	69.5	54.7	83.0	2.06
Age					
≤70 years	7	63.3	49.1	83.0	2.14
>70 years	5	77.7	67.9	92.5	2.06
BMI					
<30	8	70.8	54.7	92.5	2.13
≥30	4	66.5	49.1	77.4	2.01
Height					
≤5	3	72.3	66.0	81.1	2.24
6-12	7	62.8	49.1	77.4	1.93
>12	2	87.8	83.0	92.5	2.42
NRT					
Yes	5	66.4	49.1	77.4	2.05
No	7	71.4	54.7	92.5	2.19
NACT					
Yes	2	73.6	69.8	77.4	2.01
No	10	68.5	49.1	92.5	2.11
Preoperative incontinence					
Some/yes	5	65.7	49.1	81.1	2.00
No	7	72.0	60.4	92.5	2.16
Diabetes					
Yes	3	65.4	49.1	77.4	1.92
No	9	70.6	54.7	92.5	2.14
Smoking					
Yes	3	74.2	69.8	83.0	2.16
No	9	67.7	49.1	92.5	2.06
ASA					
Class 2	7	72.5	66.0	81.1	2.11

Class 3	5	67.1	49.1	92.5	2.06

Table 4 Surgeon factors and correlated levels of interrater agreement (Kappa). *Kappa should be interpreted with caution because the sample size of objects was small, which may affect the reliability of the estimates. Mean strength of confidence (by surgeon).

Surgeon factors				95% CI	
		n (surgeons)	Kappa	Lower	Upper
Time to complete survey					
	< 6 min	20	.390	.389	.391
	6 - 12 min	21	.273	.272	.274
	> 12 min	12	.460	.458	.462
No. of annual procedures (center)					
	< 25	6	.372	.368	.375
	25 - 50	16	.449	.448	.451
	51 - 75	7	.350	.348	.353
	76 - 100	12	.254	.252	.256
	> 100	12	.283	.281	.285
Region					
	EU Central	15	.303	.301	.304
	EU North	30	.383	.383	.384
	EU South	4*	.138	.133	.143
	ASIA / USA	4*	.288	.283	.293
Strength of confidence					
	≤ 2.00	25	.414	.414	.415
	> 2.00	28	.311	.310	.312

Figures

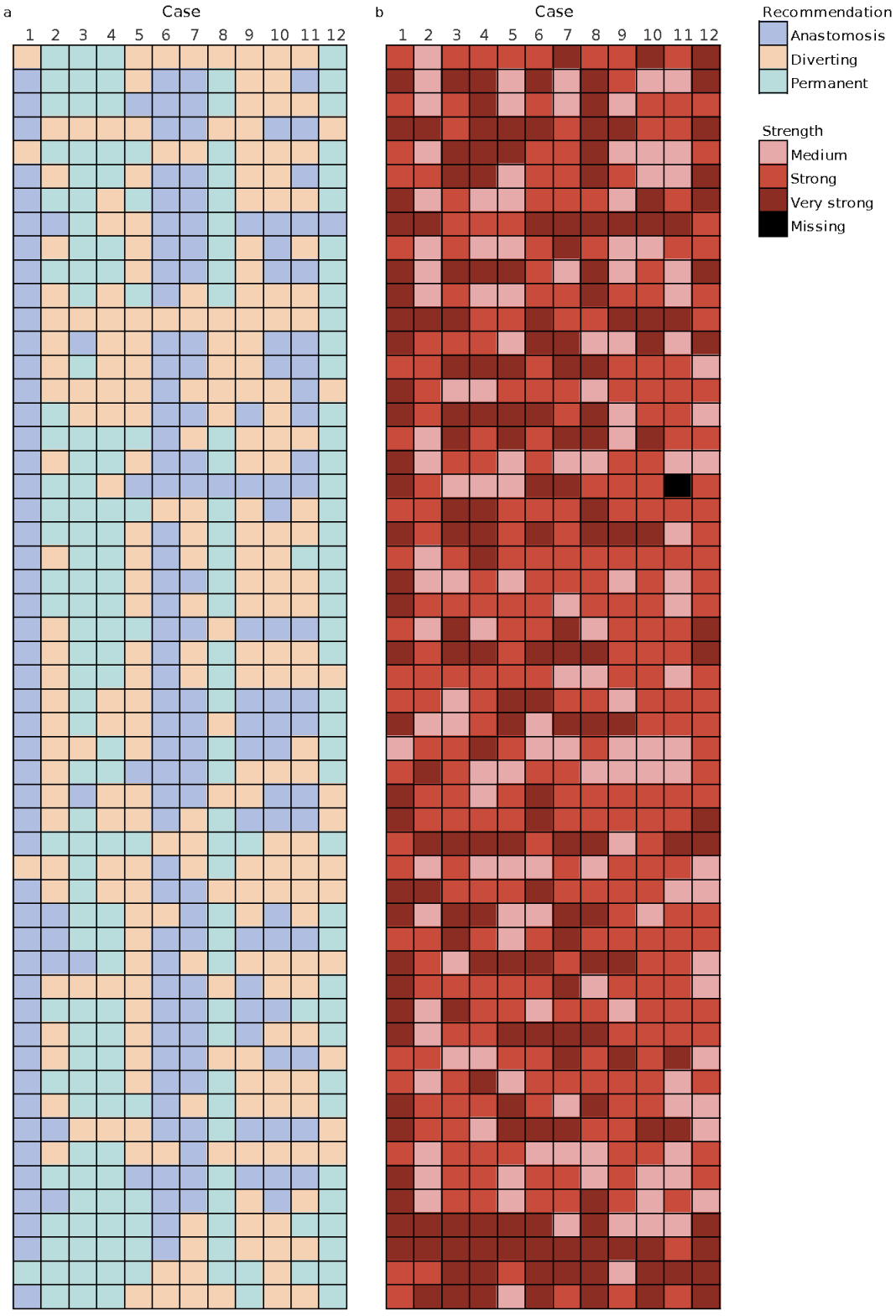


Figure 1

Heat map depicting suggested treatment options for each of the twelve cases (a) and the strength of confidence (b). Interrater agreement was determined using Fleiss kappa. The overall agreement was fair with κ = 0.359. When excluding cases 1 and 6 the agreement dropped, κ = 0.264.

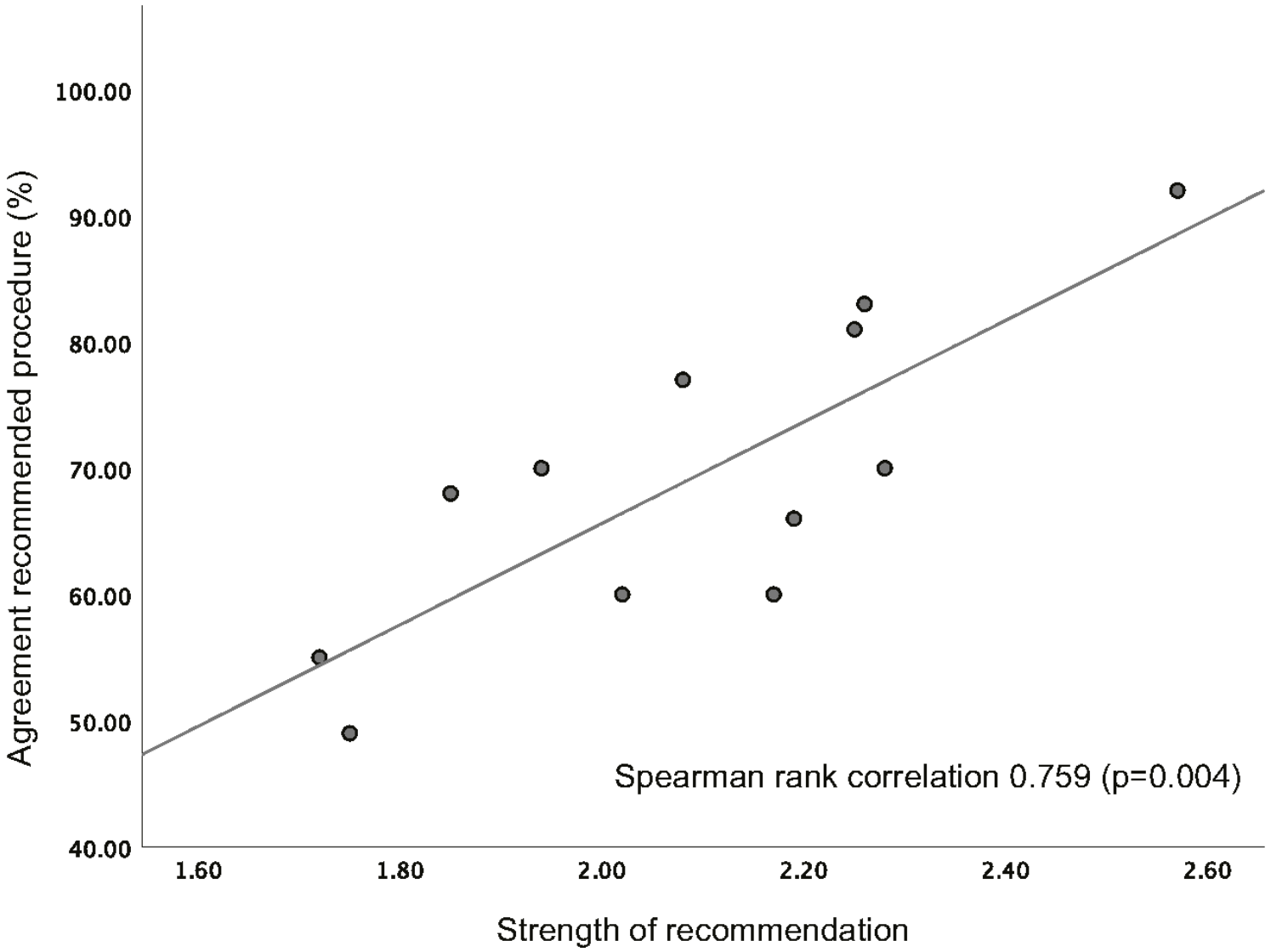


Figure 2

Scatterplot depicting correlation between agreement on the recommended procedure and the strength of the recommendation, Spearman rank correlation.