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Structured versus narrative reporting of pelvic MRI in perianal fistulizing disease: impact on clarity, completeness, and surgical planning

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Abstract

Objective To evaluate clarity, completeness, and impact on surgical planning of MRI reporting of perianal fistulizing disease using a structured disease-specific template versus narrative reporting for planning of disease treatment by colorectal surgeons.

Materials and methods In this HIPAA-compliant, IRB-approved study with waiver of informed consent, a structured reporting template for perianal fistulizing disease MRIs was developed based on collaboration between colorectal surgeons and abdominal radiologists. The study population included 45 consecutive patients who underwent pelvic MRI for perianal fistulizing disease prior to implementation of structured reporting, and 60 consecutive patients who underwent pelvic MRI for perianal fistulizing disease after implementation of structured reporting. Objective evaluation of the reports for the presence of 12 key features was performed, as also subjective evaluation regarding the clarity and completeness of reports, and impact on surgical planning.

Results Significantly more key features were absent in narrative reports [mean: 6.3 ± 1.8 (range 3–11)] than in structured reports [mean: 0.3 ± 0.9 (range 1–5)] ($p \leq 0.001$). The use of structured reporting also increased the percentage of completeness (72.5–88.3% for surgeon 1, and 61.2–81.3% for surgeon 2; $p = 0.05$ and 0.03, respectively), helpfulness in surgical planning (7.1 ± 1.5–7.6 ± 1.5 for surgeon 1, and 5.8 ± 1.4–7.1 ± 1.1 for surgeon 2; $p = 0.05$ and $p < 0.001$, respectively), and clarity (7.6 ± 1.3–8.3 ± 1.1 for surgeon 1, and 5.2 ± 1.4–7.1 ± 1.3 for surgeon 2; $p = 0.006$ and $p < 0.001$, respectively) of the reports.

Conclusion Structured MRI reports in patients with perianal fistulizing disease miss fewer key features than narrative reports. Moreover, structured reports were described as more complete and clear, and more helpful for treatment planning.

Keywords Structured reporting · Conventional reporting · Perianal fistulizing disease · Magnetic resonance imaging · Fistula treatment

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Introduction

Radiology reports are the key source of information in medical imaging and are the main mode of contact between radiologists and referring physicians [1]. Adequate reporting delivers one of the cornerstones of integrative and personalized medicine. Narrative reporting (NR) commonly lacks a proper structure, clarity, and universally established lexicon; therefore, the quality and completeness is heavily dependent on the radiologists training and experience [1, 2]. Recently, the use of structured reporting (SR) has been shown to improve diagnostic precision, reduce errors, and allow for a consistent use of terminology [2]. To the best of our knowledge, however, no prior studies have assessed the value of disease-specific SR in the evaluation of patients with perianal fistulizing disease with MRI.

Fistulas are defined as abnormal connections between two epithelial-lined surfaces. Perianal fistulas are typically identified between the anal canal and the perineal cutaneous tissue. They occur predominately in the male population (2:1 ratio) and their estimated annual incidence is one in 68.000–96.000 people in the United States [3, 4]. Perianal fistulas arise predominantly (90%) from impaired drainage of anal crypts, and are possibly related to increased sphincter tone [5]. Infection of anal glands may result in abscess formation in the intersphincteric space and then possibly spreads along adjacent spaces. Other less common causes (10%) of perianal fistulas include Crohn disease, tuberculosis, sexually transmitted disease, and trauma [6–9].

Historically, surgical or imaging-based classifications of perianal fistulas are proven helpful in planning for surgical intervention. Because of its superior soft tissue resolution, the use of MR imaging is widely accepted as the imaging modality of choice for diagnosis and classification [4, 10–14]. Moreover, certain key MRI features are important when planning for surgical management; these include: the number and location of the fistulas, the location of the internal anal opening, the fistula type, the presence of abscess, and the presence and location of secondary branches, etc.

For this study, in collaboration with our institutional colorectal surgery group, we therefore developed a disease-specific structured reporting template to be used in patients who underwent MRI for the assessment of their perianal fistulas. The primary endpoint of this study was to evaluate objectively the clarity and completeness of NR versus SR of pelvic MRI in the assessment of perianal fistulas. Secondarily, we also sought to evaluate the impact of SR on the clarity, completeness, and impact on surgical planning.

Materials and methods

Institutional review

This Health Insurance Portability and Accountability Act (HIPAA)-compliant retrospective study was conducted with the approval of our institutional review board (IRB). The requirement for informed consent was waived due to the retrospective nature of this study.

Subjects

We conducted a search of our picturing archiving communication system (PACS) from December 2016 to September 2017 and identified 597 consecutive contrast-enhanced pelvic MRI studies. All reports were reviewed by one observer for the word "perianal fistula" in the indication for imaging tab. A total of 122 reports were identified; of these, 17 reports were excluded because they belonged to same patients at different time points of evaluation. The final sample population was 105 reports in 105 individual patients. Implementation of a structured report (SR) took place in our institution on April 9, 2017 to be used in patients undergoing MRI for evaluation of perianal fistulizing disease. Due to personal preference of some radiologists, some of the reports after implementation (AI) of the SR were narrative reports (NR). Subsequent classification was performed by type of report in 3 groups, (1) narrative report before implementation (NRBI), (2) narrative report after implementation (NRAI), and (3) structured report after implementation (SRAI). The first group [NRBI] yielded 45 reports, the second group [NRAI] yielded 17, and the third group [SRAI] yielded 43 reports (Fig. 1). For each of the 105 patients, we recorded their age, gender, and prior history of inflammatory bowel disease.

Pelvic MRI protocol

Multiplanar, multisequence MRI data were acquired through the pelvis using 1.5 and 3.0 Tesla scanners (Signa LX Excite and 750 W, GE Healthcare, Milwaukee, WI, USA; Aera and Espree, Siemens Healthcare GmbH, Erlangen, Germany). The MRI protocol included, after placement of gauze within the anal cleft, single shot fast spin echo (SSFSE) T2-weighted sagittal imaging (TE = 100 ms, TR = 4000 ms, slice thickness = 4.5 mm, pixel spacing = 0.875/0.875 mm), single shot fast spin echo (SSFSE) T2-weighted fat suppressed coronal oblique and axial oblique imaging (TE = 59 ms, TR = 4840 ms, slice thickness = 4.5 mm, pixel spacing = 0.875/0.875 mm), and axial two dimensional in phase and out of phase T1-
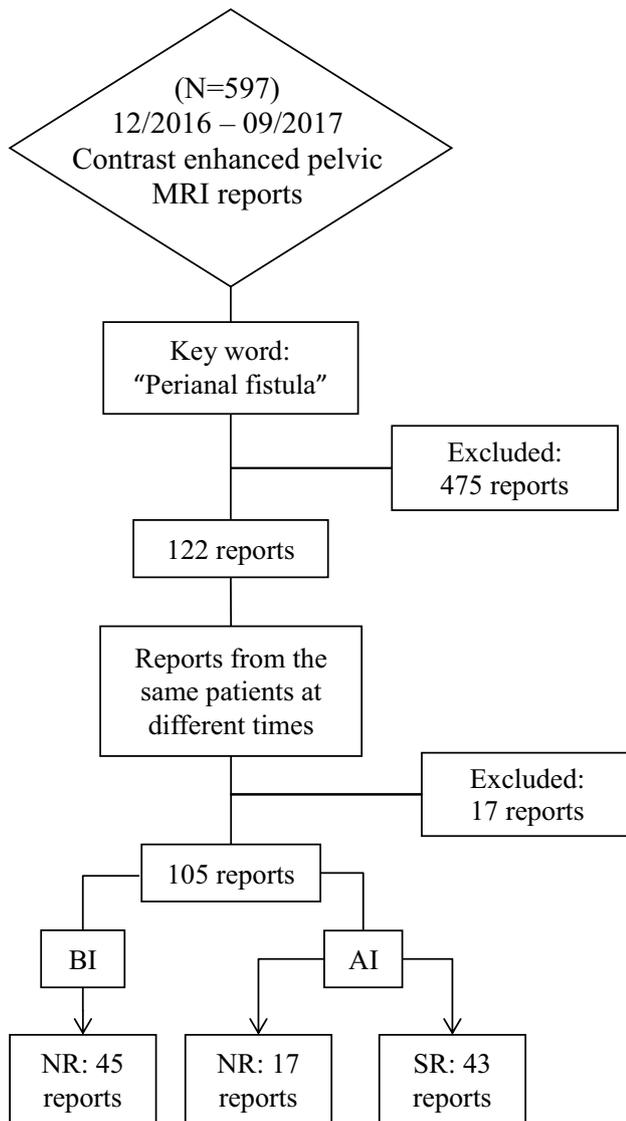
Fig. 1 Flow chart of inclusion criteria for study. *SR* structured report, *NR* narrative report, *BI* before implementation, *AI* after implementation

weighted spoiled gradient echo (TE = 2.38 ms, TR = 180 ms, slice thickness = 5 mm, pixel spacing = 0.546875/0.546875 mm) sequences. Gradient-echo, dynamic, high-resolution 3D T1-weighted fat suppressed axial oblique VIBE/SPGR sequence (TE = 2.19 ms, TR = 4.7 ms, slice thickness = 3 mm, pixel spacing = 1.25/1.25 mm) were acquired before and after the administration of Gadobutrol contrast medium (0.1 mL/kg body weight at a 2 ml/s rate) followed by a saline flush. Postcontrast imaging (2 phases) was obtained 45 s and 150 s following the contrast injection.
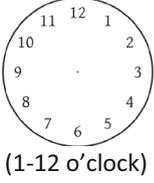
MRI structured reporting template

On April 9th 2017, an MRI structured reporting template for perianal fistula evaluation was implemented at our institution. This template was designed using the existing literature [15–17] by an abdominal radiologist (KJM, with 19 years of post-fellowship experience in reading pelvic MRI) and two colorectal surgeons (VYP and TEC, with 8 and 22 years of post-fellowship experience in treating patients with perianal fistulas, respectively). The ultimate goal was to increase report simplicity and usability as a surgical planning decision tool for perianal fistulas. The template, shown in Fig. 2, was reviewed and approved by all other radiologists of the body MRI section. Twelve features were deemed "key" by colorectal surgeons in the planning of management of these patients (Fig. 3). Although the use of the template was not mandated, it was recommended for routine use during clinical readout.

Evaluation of structured reports [SR] versus narrative reports [NR]

Objective evaluation for the existence of all 12 key features in the NRBI group (*n* = 45), NRAI group (*n* = 17) SRAI group (*n* = 43) was performed by two radiologists (OT and EED, with 17 and 14 years of abdominal radiology experience, respectively). In addition, the reports were assessed for the number of fistulas present in each patient by the same 2 radiologists.

Subjective assessments of both the SR and the NR for our entire sample (*n* = 105) were performed blinded and independently by two colorectal surgeons (VYP and TEC with 8 and 22 years of colorectal surgery experience, respectively) for clarity, completeness, and clinical usefulness for surgical planning (Fig. 4). All MRI reports were assigned in an anonymous random order. Randomization was performed sequentially with the aid of random number generator provided by *random.org*. A list of four specific questions that were to be completed by both colorectal surgeons was attached to each report. The first question assessed the clarity of the report using a Likert scale ranging from 1 (not at all clear) to 10 (completely clear). The second question (dichotomous) asked if, following reading the report, the surgeon had enough information to then decide on the management approach (e.g., medical treatment, fistulotomy, seton placement, abscess drainage, etc.). The third question asked, using a Likert scale ranging from 1 (not at all helpful) to 10 (completely helpful), whether the report was helpful for surgical planning. The final question (dichotomous) asked if, following reading the report, the surgeon still wanted to review the images.

CHECK	INTERNAL ANAL OPENING	
	Number of fistula openings If multiple fistulas are found, please describe each one individually following the same template	No: ___
	Fistula internal anal opening location Please note position accordingly to quadrant and clock face location (supine) ☐ Anterior (midline) ☐ Posterior (midline) ☐ Left anterolateral ☐ Right anterolateral ☐ Left posterolateral ☐ Right posterolateral	(clock face diagram 11 12 1 / 10 . 2 / 9 · 3 / 8 . 4 / 7 6 5) **(1-12 o'clock)**
	Distance between internal anal opening and the anal verge Please note in millimeters	_____ mm

CHECK	FISTULA TRACT
	Maximum tract diameter Please note in millimeters _____ mm
	Fistula type Please note according to *Park's* classification for perianal fistulas ☐Intersphincteric ☐Transphincteric ☐Extrasphincteric ☐Suprasphincteric ☐Superficial
	Presence of secondary branches Please note accordingly, If present, please describe where branch extends ☐ None ☐ One ☐ Multiple ☐ Extension:_____
	Exit site location Please note accordingly. Please circle the laterality as: left (L) or right (R). ☐Gluteal ☐Scrotal ☐Vaginal ☐Labial ☐Urethral ☐Blind ending (sinus tract) L - R L - R L - R L - R L - R L - R
	Hyperintensity of the tract on T2 weighted sequence (Van Assche Classification) Please note accordingly ☐ Absent ☐ Mild ☐ Marked
	Enhancement of the fistula tract Please note accordingly ☐ No central enhancement (tract is fluid-filled) ☐ Central enhancement with high signal intensity on T2 (granulation tissue) ☐ Minimal progressive enhancement with low signal intensity on T2 (fibrosis)

CHECK	OTHER FINDINGS	
	Presence of abscess	☐YES ☐NO
	If "YES", please describe if the abscess is separated from the fistula tract, location and size ☐Separated ☐ Connected Location: _____ Size: _____ mm	
	Please note if there is any of these specific additional findings: ☐ Anovaginal Fistula ☐ Rectal or sigmoid wall inflammation ☐ Seton/drains/prior surgeries	

Fig. 2 Structured reporting template for pelvic MRI to assess perianal fistulas

Statistical analysis

Student t test was used to compare the mean age and the mean presence of key features in both cohorts (BI and AI). Analysis of presence of key features among the groups was performed with Wilcoxon signed-rank test. Kruskal–Wallis and Dunn's post hoc test were used to compare the three reporting groups (NRBI, NRAI, and SRAI).

Differences in responses of colorectal surgeons for NR and SR groups were tested using Chi square for dichotomous answers and t test for Likert scale answers. Interobserver agreement was assessed using McNemar's test for

Fig. 3 Key features of MRI structured report and the rationale of including them in perianal fistula evaluation

Figure 3.	MRI structured report key features and the rationale of including them in perianal fistula evaluation
Key feature	**Justification**
Number of fistulas	An increased number of fistulas relate to a higher rate of operative and postoperative complications
Internal anal opening	Location (quadrant or clock face) describes the point of origin and direction of the fistula
Distance between internal anal opening and the anal verge	As it facilitates surgical planning
Relation between internal anal opening and internal anal sphincter	Guides surgical planning
Fistula type based on pathogenesis and anatomy from the Park's classification	Helps with surgical planning to minimize recurrence, postoperative incontinence and identify clinically unapparent disease
Presence of secondary branches	Secondary tracks may be complicated by abscess formation and require specific surgery for adequate drainage
Presence of abscess	Same as above
Exit site location	Same as above
T2 hyperintensity	According to the Van Assche classification, determines activity
Contrast enhancement of the tract	Crucial for assessment of fistula activity
Associated rectal and sigmoid colon inflammation	To assess unresponsiveness to medical treatment for inflammatory bowel disease (IBD)
Presence of setons, drainage catheters and features of prior surgeries	To assess rate of success of prior management

yes/no answers and paired samples t test for Likert scale answers, and kappa values were calculated. A p value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 25 (IBM Corporation, US).

Results

Subjects

The final study population consisted of 105 patients (Table 1). The BI group consisted of 45 patients: 31 males (68.8%) and 14 females (31.1%) with a median age of 43 years (IQ range 36–58.5 years). The AI group consisted of 60 patients: 29 males (48.3%) and 31 females (51.6%) with a median age of 42.5 years (IQ range 30.2–54.8 years) (p value > 0.05). A prior history of inflammatory bowel disease was found in 42.2% ($n = 19$) for the BI group, and 46.6% ($n = 28$) in the AI group (p value = 0.7).

Evaluation of structured reports [SR] versus narrative reports [NR]

Assessment of the number of fistulas/patient revealed that a single fistula was identified in 80% ($n = 36$) of the BI group patients, and 75% ($n = 45$) in the AI group ($p = 0.6$). In the BI group patients, multiple fistulas (2, 3, and 4) were identified in 5 (11.1%), 3 (6.6%), and 1 (2.2%) of patients, respectively. In the AI group, 2, 3, 4, and 5 fistulas were noted in 5 (8.3%), 5 (8.3%), 4 (6.6%), and 1 (1.6%) of cases, respectively ($p > 0.05$) (Table 1).

Regarding the presence or absence of the 12 key features in both BI and AI groups, the following findings were encountered (Table 2): (1) mentioning of the number of fistulas was only present in 13 (28.8%) of the NRBI reports, 0 (0%) of the NRAI reports and, 42 (98%) of SRAI reports; (2) the internal opening location (quadrant and clock face) was present in 41 (91.1%) of the NRBI reports, in 17 (100%) of the NRAI reports, and 42 (98%) of the SRAI reports; (3) reporting of the distance from the anal verge to the fistula opening was present in 25 (55.5%) of the NRBI reports, in 9 (53%) of the NRAI reports and, 42 (98%) of the SRAI reports; (4) the relation of the fistula to the internal sphincter was not mentioned in the NRBI

Fig. 4 Evaluation chart of radiology reports by colorectal surgeons

Evaluation of MRI Reports by Colorectal Surgeons

Please mark the correct numeric or Yes/No response to each question.

1. How easy to understand is this MRI report?
Please mark one

Not at all clear ← → Completely clear

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

2. Do you have enough information to decide on the management approach?
(Seton placement, abscess drainage, fistulotomy, conservative approach).
Please mark one.

YES   NO

3. How helpful is this MRI report for proper surgical planning?
Please mark one

Not at all helpful ← → Completely helpful

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

4. Based on this report do you still want to review the images?
Please mark one

YES   NO

reports while in 1 (6%) NRAI report and 42 (98%) of the SRAI reports, the opening was addressed; (5) the type of the fistula (intersphincteric, transphincteric, extrasphincteric, suprasphincteric, and superficial) was specified in 28 (62.2%) of the NRBI reports, while 13 (76.4%) of NRAI reports and 43 (100%) of the SRAI reports was specified; (6) presence of secondary branches were mentioned in 16 (35.5%) of the NRBI reports versus 3 (17.6%) of the NRAI reports and, 43 (100%) of the SRAI reports; (7) the fistula exit site (gluteal, scrotal, vaginal, labial, urethral or blind ending) was reported in 36 (80%) of the NRBI reports, in 6 (35.2%) of the NRAI reports and, in 43 (100%) of the SRAI; (8) hyperintensity of the tract on T2-weighted images was reported in 9 (20%) of the NRBI reports while in 2 (12%) of the NRAI reports and, 43 (100) of the SRAI was mentioned; (9) assessment of contrast enhancement of the tract was done in 19 (42.2%) of NRBI reports, 6 (35.2%), and, in 43 (100%) of the SRAI reports; (10) the presence/absence of an abscess was mentioned in 35 (77.7%) of the NRBI reports versus 16 (94%) of NRAI and 41 (95%) of SRAI reports; (11) absent/associated rectal or sigmoid wall inflammation was commented upon in 15 (33.3%) of NRBI reports versus 3 (18%) of NRAI reports and, 37 (86%) of the SRAI; and finally, (12) absence/presence of a seton, stitch, drain or sequela from prior surgery was mentioned in 13 (28.8%) of NRBI reports, 6 (35.2%) of NRAI and, 42 (98%) of SRAI reports.

An average of 6.3 ± 1.8 (range 3–11) key features were absent in NRBI reports ($n = 45$) and only 0.3 ± 0.9 (range 1–5) in the SRAI group reports ($n = 43$) ($p \leq 0.001$). For completeness, an average of 7.1 ± 1.0 (range 5–9) key features were absent in the NRAI group reports ($n = 17$) ($p \leq 0.001$). Statistical comparison analysis of the three groups by the MRI template as well as the subjective assessment (colorectal surgeons) is depicted in Table 3.

Table 1 Demographics, clinical presentation, imaging features and fistula number distribution among patients with perianal fistula

Variable	All patients ($N = 105$)	Before implementation ($n = 45$)	After implementation ($n = 60$)	p value
Sex, no. (%)				
Age, median (IQR), year	43 (32–56)	43 (36–58.5)	42.5 (30.2–54.7)	0.10
Female	45 (43)	14 (31.1)	31 (51.6)	0.01
Male	60 (57)	31 (68.8)	29 (48.3)	
Clinical presentation, no. (%)				
IBD history	47 (44.7)	19 (42.2)	28 (46.6)	0.69
Fistula number distribution, no. (%)				
Total number of fistulas				
1	81 (77.1)	36 (80)	45 (75)	0.641
2	10 (9.5)	5 (11.1)	5 (8.3)	0.741
3	8 (7.6)	3 (6.6)	5 (8.3)	0.99
4	5 (4.7)	1 (2.2)	4 (6.6)	0.389
5	1 (0.9)	0 (0)	1 (1.6)	0.99

IQR interquartile range, *IBD* inflammatory bowel disease

Table 2 Number of key features presence in all reports

Key features no. (%)	NRBI ($n = 45$)	NRAI ($n = 17$)	SRAI ($n = 43$)
Number	13 (28.8)	0 (0)	42 (98)
Internal opening	41 (91.1)	17 (100)	42 (98)
Distance from verge	25 (55.5)	9 (53)	42 (98)
Opening relation	0 (0)	1 (5.9)	42 (98)
Type	28 (62.2)	13 (76.4)	43 (100)
Branches	16 (35.5)	3 (17.6)	43 (100)
Exit site	36 (80)	6 (35.2)	43 (100)
T2 signal	9 (20)	2 (11.8)	43 (100)
Enhancement	19 (42.2)	6 (35.2)	43 (100)
Abscess	35 (77.7)	16 (94)	41 (95)
Wall inflammation	15 (33.3)	3 (18)	37 (86)
Past Sx history*	13 (28.8)	6 (35.2)	42 (98)

NRBI narrative report before implementation, *NRAI* narrative report after implementation, *SRAI* structured report after implementation

*Seton, drainage catheter, prior surgery

Subjectively, 105 reports were evaluated by two surgeons who were asked to rate them using a Likert scale and yes/no questions for completeness, helpfulness, and clarity (Table 3). Overall, the AI group reports increased the percentage of completeness (73.3–83.3% for surgeon 1, and 57.8–78.3% for surgeon 2; $p = 0.2$ and 0.02, respectively), helpfulness in surgical planning (7.2 ± 1.5–7.3 ± 1.5 for surgeon 1, and 5.8 ± 1.3–6.8 ± 1.4 for surgeon 2; $p = 0.84$ and $p < 0.001$, respectively), and clarity (7.7 ± 1.3–8.0 ± 1.3 for surgeon 1, and 5.1 ± 1.2–6.7 ± 1.5 for surgeon 2; $p = 0.33$ and $p < 0.001$, respectively) of the reports.

More importantly, however, when comparing the NR group ($n = 62$) with the SR group ($n = 43$), the SR group reports significantly increased the percentage of completeness (72.5–88.3% for surgeon 1, and 61.2–81.3% for surgeon 2; $p = 0.05$ and 0.03, respectively), helpfulness in surgical planning (7.1 ± 1.5–7.6 ± 1.5 for surgeon 1, and 5.8 ± 1.4–7.1 ± 1.1 for surgeon 2; $p = 0.05$ and $p < 0.001$, respectively), and clarity (7.6 ± 1.3–8.3 ± 1.1 for surgeon 1, and 5.2 ± 1.4–7.1 ± 1.3 for surgeon 2; $p = 0.006$ and $p < 0.001$, respectively) of the reports. The interobserver agreement (kappa) between two surgeons NR and SR groups are presented in Table 4.

Table 3 Statistical results of pairwise comparison of the groups according to type of report, time of implementation, and surgeon's evaluation of the reports

Key features	p value NRBI versus NRAI	p value NRBI versus SRAI	p value NRAI versus SRAI
Number	0.129	< 0.001	< 0.001
Internal opening	0.215	0.99	0.99
Distance from verge	0.99	< 0.001	0.002
Opening relation	0.99	< 0.001	< 0.001
Type	0.639	< 0.001	0.123
Branches	0.609	< 0.001	< 0.001
Exit site	< 0.001	0.052	< 0.001
T2 signal	0.99	< 0.001	< 0.001
Enhancement	0.99	< 0.001	< 0.001
Abscess	0.249	0.038	0.99
Wall inflammation	0.817	< 0.001	< 0.001
Past Sx History*	0.99	< 0.001	< 0.001

Subjective assessment of all reports by colorectal surgeons

Evaluation of report	p value NRBI versus NRAI	p value NRBI versus SRAI	p value NRAI versus SRAI
SURGEON # 1			
Completeness	0.146	–	–
Need for re-review images	0.432	–	–
Helpfulness	0.316	0.716	0.039
Clarity	0.295	0.175	0.007
SURGEON # 2			
Completeness	0.057	–	–
Need for re-review images	0.294	–	–
Helpfulness	0.99	< 0.001	0.005
Clarity	0.747	< 0.001	0.004

NRBI narrative report before implementation, *NRAI* narrative report after implementation, *NRBI* narrative report before implementation, *SRAI* structured report after implementation, *Sx* surgical

*Seton placement, drainage placement or prior surgery

Discussion

In this study, we evaluated the clarity, completeness, and impact on surgical planning of MRI reporting of perianal fistulizing disease using a structured disease-specific template (SR) versus narrative reporting (NR) for planning of disease treatment by colorectal surgeons. SR type reporting system has many advantages. SR serves as a guide for radiologists as it prescribes a standard methodology and systematic approach [18]. This checklist type reporting style prevents significant omissions, errors due to spelling and grammar, and improves standardization [2]. Numerous prior studies have concluded that in a vast array of abdominal diseases, SR type of reports have been extremely helpful to referring physicians [18–20]. For example, Brook et al. reported that SR-type reports were more guiding to referring doctors with regards to tumor resectability in pancreatic cancers [18]. Similarly,

Nörenberg et al. determined that referring physicians were more satisfied with SR type of reports in staging of rectal cancer with MRI [19]. A similar conclusion was reached by Franconeri et al. who stated that MRI-SR for uterine fibroid disease helped determine the course of treatment better than NR [20]. Gassenmaier et al. also recently claimed that SR type reports used to report shoulder MRI were more readable and understandable [21]. Lastly, the Annotation and Image Markup (AIM) project of the National Institutes of Health Cancer Biomedical Informatics Grid has shown that reports of both oncologic and nononcologic imaging studies using SR type reporting are more easily integrated into the AIM system [2, 22].

One of the most critical findings in our study was that objective evaluation showed that the AI group reports contained significantly more key features than BI group reports. The lack of description of the key features in BI group reports possibly relates to cognitive bias on the part

Table 4 Subjective assessment of all reports by colorectal surgeons

Reviewers	Narrative reports (n = 62)		Structured reports (n = 43)		p value		K value
	S1	S2	S1	S2	S1	S2	
Question, no. (%)							
Completeness[a]	45 (72.5)	38 (61.2)	38 (88.3)	35 (81.3)	0.05	0.03	0.063
Need for re-review images[b]	59 (95.1)	48 (77.4)	39 (90.6)	28 (65.1)	0.37	0.17	0.190
	Narrative reports (n = 62)		Structured reports (n = 43)		p value		K value
	S1	S2	S1	S2	S1	S2	
Question, mean ± SD, (range)							
Helpfulness[c]	7.1 ± 1.5 (4–10)	5.8 ± 1.4 (2–9)	7.6 ± 1.5 (5–10)	7.1 ± 1.1 (5–9)	0.05	< 0.001	< 0.001
Clarity[d]	7.6 ± 1.3 (4–10)	5.2 ± 1.4 (3–9)	8.3 ± 1.1 (5–10)	7.1 ± 1.3 (4–9)	0.006	< 0.001	< 0.001

S1 surgeon 1, *S2* surgeon 2

[a]Graded on a 0–1 scale (0 = no, 1 = yes)

[b]Graded on a 0–1 scale (0 = no, 1 = yes)

[c]Graded on a scale of 0–10 (0 = not helpful, 10 = very helpful)

[d]Graded on a scale of 0–10 (0 = unclear, 10 = very clear)

of the radiologist. In this type of bias, at some point of the report, the radiologist concludes that all relevant information has been communicated and fails to mention additional abnormal findings [23]. In our study, there was a statistically different discrepancy between the two groups for the inclusion of 10 out of 12 key features defining perianal fistulizing disease. Only for 2/12 key features, the location of the internal fistula opening and the location of the exit site, the two groups performed equally, most likely as both features are among the most imperative in the description of a perianal fistula.

In addition, colorectal surgeons, when assessing the reports subjectively, found that SR reports to be more complete, more helpful, and clearer than NR reports. In our study, both surgeon 1 (highly experienced) and surgeon 2 (moderately experienced) found SR more clear, more helpful, and more complete than narrative reports in determining the treatment plan. This finding differs from the results of Franconeri et al. [20] who found that, when assessing fibroids mapping before surgery, the highly experienced surgeons did not significantly benefit from SR. In contrast, when assessing pancreatic cancer staging CT reports, less-experienced surgeons did not find SR beneficial [18]. Of note, no significant change was seen in both surgeons' opinions regarding the need to review the images after reading the report, for both groups.

Our study has several limitations. First, although the reports were presented anonymously, the retrospective design may have included inherent recall bias for the surgeons. Secondly, only two expert surgeons in a tertiary care center were included in the study, and therefore the results may not be transferable to the surgical community at large. However, one would assume that less experience would even benefit more from structured reporting. Thirdly, since we did not mandate the use of the SR after implementation, the adherence to it was only 70%. It is possible that radiologists were "educated" on relevant points but still chose not to use the SR and were mentioning "more relevant" key features in the AI group. This highlights the need for education on top of the report standardization. One could hypothesize that a higher adherence rate would even improve the results further. Finally, no comparison was made between the findings in the original MRI reports and the accuracy of the reported findings. However, the point of the study was solely to assess the report content and clarity, as well as the colorectal surgeons' satisfaction with the report, and its impact on clinical decision making—not the ability of radiologists to predict correct perianal fistulizing disease diagnosis.

In conclusion, structured MRI reports in patients with perianal fistulizing disease miss fewer key features than narrative reports. Moreover, structured reports were described as more complete and clear, and more helpful for treatment planning. This potentially contributes to better surgical planning and patient outcomes.

References

1. Bink A, Benner J, Reinhardt J, et al. Structured reporting in neuroradiology: Intracranial tumors. Front Neurol 2018; 32:1–10

2. Ganeshan D, Duong PAT, Probyn L, et al. Structured reporting in radiology. Acad Radiol 2018; 25:66–73

3. de Miguel Criado J, del Salto LG, Rivas PF, et al. MR imaging evaluation of perianal fistulas: spectrum of imaging features. Radiographics 2012; 32:175–194

4. Abcarian H, Anal fistula principles and management, 1st ed. New York, NY: Springer, 2014:1–3

5. Hamadani A, Haigh PI, Liu IA, Abbas MA. Who is at risk for developing chronic anal fistula or recurrent anal sepsis after initial perianal abscess? Dis Colon Rectum 2009; 52:217–221

6. O'Malley RB, Al-Hawary MM, Kaza RK, Wasnik AP, Liu PS, Hussain HK. Rectal imaging: part 2, perianal fistula evaluation on pelvic MRI - what the radiologist needs to know. AJR 2012; 199:43–53

7. Gecse K, Khanna R, Stoker J, et al. Fistulizing crohn's disease: diagnosis and management. United Eur Gastroenterol J 2013; 1:206–213

8. Beaugerie L, Carrat F, Nahon S, et al. High risk of anal and rectal cancer in patients with anal and/or perianal Crohn's disease. Clin Gastroenterol Hepatol 2018; 16:892–899

9. Protyniak B, Shutt T, Farmer R. Squamous cell carcinoma originating from a Crohn's enterocutaneous fistula. Case Rep Surg 2017; 2017:1–4

10. Ong EM, Ghazi LJ, Schwartz DA, Mortelé KJ. Guidelines for imaging of Crohn's perianal fistulizing disease. Inflamm Bowel Dis 2015; 21:731–736

11. Sahni VA, Ahmad R, Burling D. Which method is best for imaging of perianal fistula? Abdom Imaging 2008; 33:26–30

12. Kim MJ. Transrectal ultrasonography of anorectal diseases: advantages and disadvantages. Ultrasonography 2015; 34:19-31

13. Burdan F, Sudol-Szopinska I, Staroslawska E, et al. Magnetic resonance imaging and endorectal ultrasound for diagnosis of rectal lesions. Eur J Med Res 2015; 20:1–14

14. Sharma G, Khandige G, Mohan M. Magnetic resonance imaging in perianal fistulas-a pictorial atlas. Indian J Gastroenterol 2016; 35:337–342

15. Parks AG, Gordon PH, Hardcastle JD. A classification of fistula-in-ano. Br J Surg 1976; 63:1–12

16. Van Assche G, Vanbeckevoort D, Bielen D, et al. Magnetic resonance imaging of the effects of infliximab on perianal fistulizing Crohn's disease. Am J Gastroenterol 2003: 98:332–339

17. Tutein Nolthenius CJ, Bipat S, Mearadji B, et al. MRI characteristics of proctitis in Crohn's disease on perianal MRI. Abdom Radiol 2016; 41:1918–1930

18. Brook OR, Brook A, Vollmer CM, Kent TS, Sanchez N, Pedrosa I. Structured reporting of multiphasic CT for pancreatic cancer: potential effect on staging and surgical planning. Radiology 2015; 274:464–472

19. Nörenberg D, Sommer WH, Thasler W, et al. Structured reporting of rectal magnetic resonance imaging in suspected primary rectal cancer: potential benefits for surgical planning and interdisciplinary communication. Invest Radiol 2017; 52:232–239

20. Franconeri A, Fang J, Carney B, et al. Structured vs narrative reporting of pelvic MRI for fibroids: clarity and impact on treatment planning. Eur Radiol 2017; 28:3009–3017

21. Gassenmaier S, Armbruster M, Haasters F, et al. Structured reporting of MRI of the shoulder – improvement of report quality? Eur Radiol 2017; 27:4110–4119

22. Zimmerman SL, Kim W, Boonn WW. Informatics in radiology: automated structured reporting o imaging findings using at AIM standard and XML. Radiographics 2011; 31:881–887

23. Brady AP. Error and discrepancy in radiology: inevitable or avoidable? Insights Imaging 2017; 8:171–182