



Absence of a rectocele may be correlated with reduced internal anal sphincter function in patients with rectal intussusception and fecal incontinence

Akira Tsunoda¹ · Tomoko Takahashi¹ · Hiroshi Kusanagi¹

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Abstract

Purpose Fecal incontinence (FI) is common in patients with rectal intussusception (RI), although the mechanism behind its formation is unclear. Recent data indicate that a reduction in internal sphincter tone may cause FI, which becomes notable with increasing RI levels. However, the roles of other anatomical abnormalities in anal function remain unclear. This study assessed the relationships between various pelvic floor abnormalities and anal sphincter function in patients with RI and FI.

Methods Data for patients with RI, collected in a prospective pelvic floor database, were assessed retrospectively. All women with FI, without anal sphincter defect, were included. Data on anorectal physiology and evacuation proctography were analyzed.

Results Of 397 patients with RI, 85, who had predominantly passive FI, met the inclusion criteria. Maximum resting pressure (MRP) was significantly lower in patients with rectoanal intussusception (RAI) than in those with rectorectal intussusception (RRI) [51.1 (17.9–145.8) vs. 70.7 (34.7–240.6) cmH₂O, $P=0.007$]. Moreover, MRP was significantly lower in RI patients without rectocele than in RI patients with rectocele [50.1 (17.9–111.0) vs. 69.9 (34.7–240.6) cmH₂O, $P<0.0001$]. Regression analysis showed that RAI rather than RRI and RI without rectocele rather than RI with rectocele were predictive of decreased MRP. However, no variable was significantly associated with decreased maximum squeeze pressure on multivariate analysis.

Conclusion In addition to an advanced level of intussusception, the absence of a rectocele may be correlated with reduced internal anal sphincter function in patients with RI and FI.

Keywords Fecal incontinence · Rectal intussusception · Rectocele · Anal function

Introduction

Rectal intussusception is an infolding of the rectal wall that may occur during defecation. In patients with anorectal dysfunction, rectal intussusception is a common finding on evacuation proctography [1]. Rectal intussusception may cause symptoms of obstructed defecation [1, 2] and can be classified into rectorectal and rectoanal intussusception.

There is new evidence that rectal intussusception may be an important cause of fecal incontinence [3–5]. The role of rectal intussusception in the etiology of fecal incontinence remains

under debate [6] but a reduction in internal anal sphincter (IAS) tone may cause fecal incontinence. Previous studies have shown that there is a significant reduction in resting pressure with increasing levels of rectal intussusception [4, 5, 7, 8]. However, the role of other anatomical abnormalities such as rectocele, enterocele, and pelvic floor descent, which are frequently associated with rectal intussusception, on anal sphincter function, remains unclear.

Therefore, the aim of the study was to explore the effect of these anatomical abnormalities on anal sphincter function in female patients with rectal intussusception and fecal incontinence who did not have a sphincter defect.

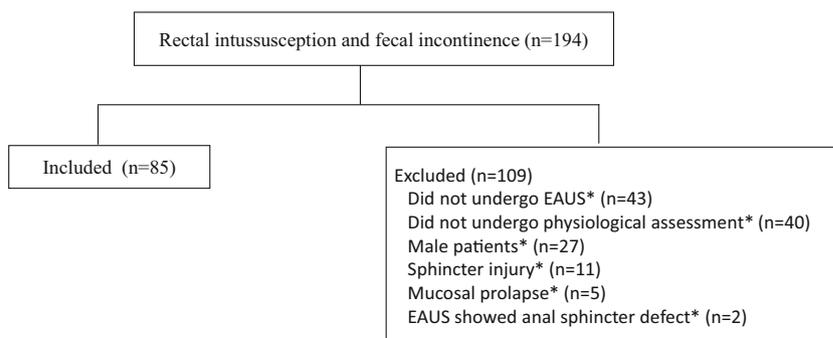
Methods

Patients seen in the proctology clinic with symptoms of obstructed defecation and/or fecal incontinence underwent

✉ Akira Tsunoda
tsunoda.akira@kameda.jp

¹ Department of Gastroenterological Surgery, Kameda Medical Center, 929 Higashi-cho, Kamogawa City, Chiba 296-8602, Japan

Fig. 1 EAUS, endoanal ultrasonography. *Conditions were overlapped



evacuation proctography as a part of the investigation protocol. Data for the patients with rectal intussusception were prospectively entered into a pelvic floor database. Symptoms of fecal incontinence were divided into passive and urge incontinence. A functional inventory of fecal incontinence symptoms was documented using the Fecal Incontinence Severity Index (FISI) score [9].

From the patients with rectal intussusception who had fecal incontinence, we selected those who underwent both manometric study and endo-anal ultrasound (EAUS). EAUS was performed using a B-K Medical ultrasound system with 6–16 MHz, 360 rotating endoprobe (Type 2052) covered with a water-filled hard sonolucent plastic cap (B-K Medical, Herlev, Denmark). Male patients, patients with history of sphincter injury (obstetric injury or anal fistula surgery), rectal mucosal prolapse, or anal sphincter defect shown by EAUS, were excluded from the analysis. We excluded such patients from the study to keep the study cohort as unbiased as possible.

This study was approved by the Ethical Committee of Kameda Medical Center (approved number, 18-214). Information of the study protocol was made public, and patients were ensured that they could withdraw consent. However, no patients or their relatives subsequently refused to participate in the study.

Evacuation proctography

A standardized proctography technique was used. The small bowel was opacified with a mixture containing 100 mL barium sulfate (100% w/w) and 10 mL Urografin (60% w/w), ingested 2 h prior to the procedure. Proctograms were evaluated using the criteria proposed by Shorvon et al. [10]. Briefly, rectoanal intussusception was diagnosed when the apex of the rectal intussusception impinged on the internal anal orifice or was intra-anal, based on the images taken during maximal straining defecation. Rectorectal intussusception was differentiated from rectoanal intussusception if the apex remained intrarectal and did not impinge on the internal anal orifice. A rectocele greater than 2 cm in diameter was regarded as abnormal. The size was calculated in standard fashion in the anterior-posterior dimension by measuring the distance between the actual most ventral part of the anterior rectal wall and an extrapolated line indicating the expected position of the rectal wall [11]. Pelvic floor descent during defecation was estimated by the degree of the anorectal junction in relation to the inferior margin of the ischial tuberosity. Enterocele was diagnosed when the extension of the loop of the bowel was located between the vagina and rectum. Images from proctography were analyzed by one of the authors (T. T.), who is experienced in the evaluation and was blinded at that time to the symptomatology of the individual patients.

Table 1 Characteristics of patients

	Total	Rectorectal intussusception	Rectoanal intussusceptions	P value
No. of patients	85	17	68	–
Age	74 (49–93)	74 (57–87)	74 (49–93)	0.469
Parity	2 (0–4)	2 (0–3)	2 (0–4)	0.397
Prior pelvic surgery	14	1	13	0.283
Prolapsed hemorrhoids	8	2	6	0.658
Type of fecal incontinence (passive/urgent/mixed)	66/9/10	14/3/0	52/6/10	0.169
FISI	24 (8–59)	34 (10–59)	24 (8–47)	0.601
Obstructed defecation	33	5	28	0.419

FISI fecal incontinence severity index

Values are presented as median (range)

Table 2 Evacuation proctography

	Total (<i>n</i> = 85)	Rectorectal intussusception (<i>n</i> = 17)	Rectoanal intussusception (<i>n</i> = 68)	<i>P</i> value
Rectocele	25	7	18	0.234
Size (mm)	31.2 (20.6–51.5)	31.6 (20.6–51.5)	29.7 (21.0–47.4)	0.495
Enterocele	16	2	14	0.509
Pelvic floor descent (mm)	24.1 (–4.4–60.4)	24.1 (5.3–60.4)	23.9 (–4.4–50.9)	0.813

Values are presented as median (range)

Physiological assessment

Each patient underwent laboratory studies of anal sphincter function. Examinations were performed with the patient in the left lateral position and no bowel preparation was used. Anal pressure was measured with a catheter-tip pressure transducer. The capacity of the rectum was measured by placing a balloon with its lower extremity 5 cm from the anal verge. Rectal perception of distention was examined by continuously slow air insufflation into the balloon, and defecation desire volume and maximum tolerated volume were measured.

Statistical analysis

Statistical analysis was performed using SPSS version 11.0 (SPSS Inc., Chicago, IL, USA). Continuous variables are

expressed as median (range). Univariate associations were analyzed using the Mann-Whitney *U* test or Pearson's correlation analysis for continuous variables and the Chi-square or Fisher's exact test for categorical variables. Stepwise multivariate regression analysis was used to establish which morphological parameters shown by proctography best predicted anal pressure. In the regression analysis, anal pressure was selected as the dependent variable. Independent variables included level of rectal intussusception, the presence of rectocele or enterocele, and pelvic floor descent. Age, sex, and history of pelvic surgery were analyzed as additional covariates. A value of $P < 0.05$ was taken as significant for all tests except for the stepwise multiple regression, where variables were entered at a P -value of ≤ 0.01 to reduce the risk of type I errors. Because this was a preliminary study, the sample size of 85 can be appropriate.

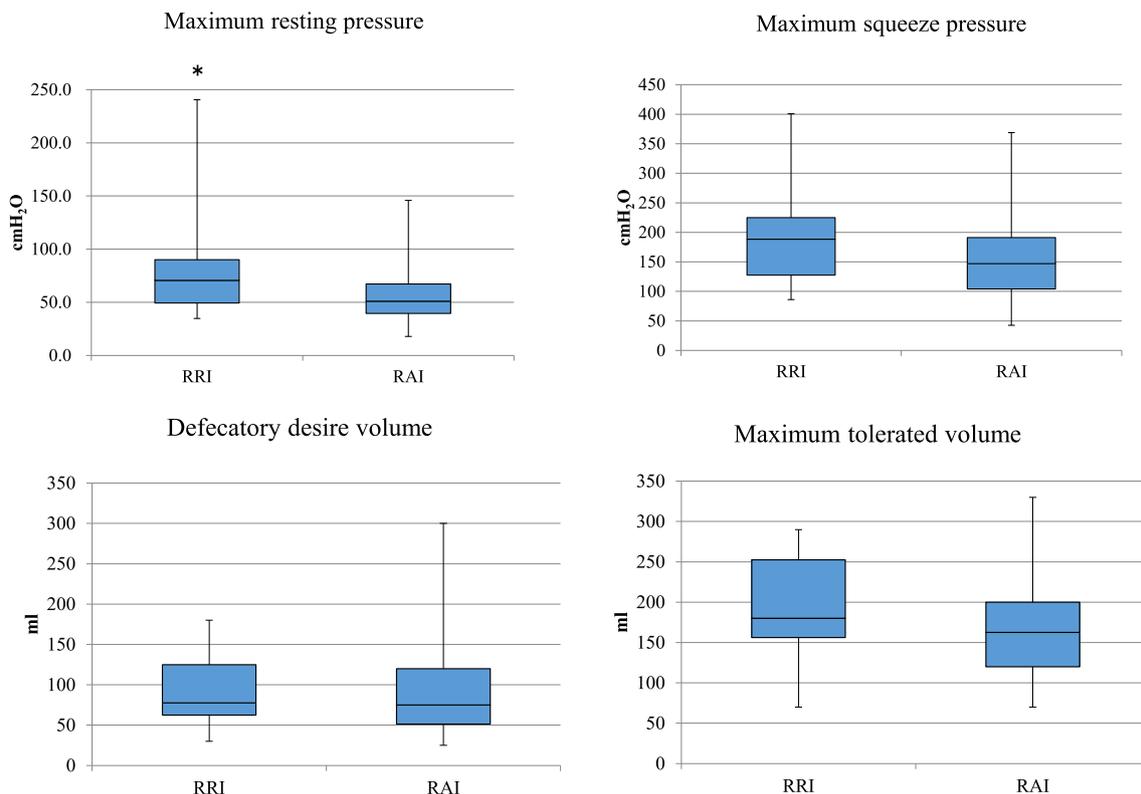


Fig. 2 Anorectal physiology in patients with rectorectal intussusception (RRI) and in those with rectoanal intussusception (RAI). Boxes show median values with upper and lower quartiles. The vertical line extends

from the minimum to the maximum values. * $P = 0.007$ versus RAI (Mann-Whitney *U* test)

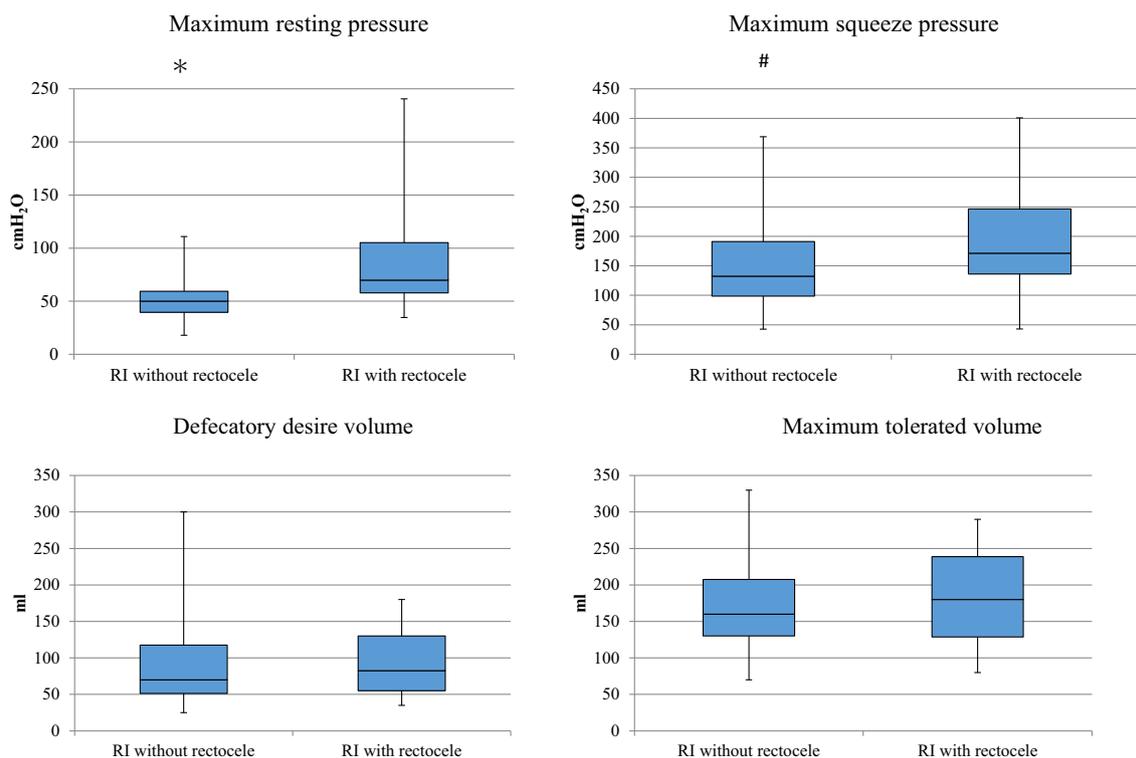


Fig. 3 Anorectal physiology in patients with rectal intussusception (RI) without rectocele and in those with RI with rectocele. Boxes show median values with upper and lower quartiles. The vertical line extends from the

minimum to the maximum values. * $P=0.0001$, # $P=0.019$ versus RAI with rectocele (Mann-Whitney U test)

Results

Demographic and clinical findings

Between June 2011 and January 2019, 802 patients underwent evacuation proctography, and 397 (49.5%) were found to have rectal intussusception. Of these, 194 had fecal incontinence and a final cohort of 85 patients was included (Fig. 1). Their median age was 74 (49–93) years. Seventeen patients had rectorectal intussusception and 68

had rectoanal intussusception. The median FISI score was 24 (8–59). There was no significant difference in FISI scores between those with rectorectal and rectoanal intussusception. The type of fecal incontinence was passive 66 (78%), urgent 9 (11%), and both 10 (12%) (Table 1). The median number of vaginal deliveries was 2 (0–4). Overall, 14 (16%) patients had undergone pelvic surgery, including hysterectomy ($n=7$), transvaginal surgery for pelvic organ prolapse ($n=4$), myomectomy of the uterus ($n=2$), and oophoro-salpingectomy ($n=1$).

Table 3 Pearson's correlation coefficients between maximum resting pressure and variables

	Coefficients	P value
Age	−0.388	<0.0001
Parity	−0.115	0.300
Prior pelvic surgery	−0.069	0.528
Rectal intussusception (RRI, RAI)	−0.331	0.002
Rectocele (no, yes)	0.462	<0.0001
Enterocoele (no, yes)	0.026	0.815
Pelvic floor descent	0.163	0.135
FISI	−0.089	0.419

FISI fecal incontinence severity index, RRI rectorectal intussusception, RAI rectoanal intussusception

Table 4 Pearson's correlation coefficients between maximum squeeze pressure and variables

	Coefficients	P value
Age	−0.245	0.024
Parity	−0.107	0.331
Prior pelvic surgery	0.013	0.906
Rectal intussusception (RRI, RAI)	−0.213	0.050
Rectocele (no, yes)	0.260	0.016
Enterocoele (no, yes)	0.068	0.535
Pelvic floor descent	0.226	0.037
FISI	−0.008	0.941

FISI fecal incontinence severity index, RRI rectorectal intussusception, RAI rectoanal intussusception

Table 5 Multiple regression

Variables included in equation	Unstandardized regression weight	<i>t</i> value	<i>P</i> value	Variance explained
Maximum resting pressure				
Rectocele (no, yes)	30.172	4.545	< 0.0001	
Rectal intussusception (RRI, RAI)	− 22.235	− 2.940	0.004	29%
Maximum squeeze pressure				
None				

RRI rectorectal intussusception, RAI rectoanal intussusception

Evacuation proctography

There was no significant difference in the incidence of rectocele or enterocele between patients with rectorectal and rectoanal intussusception. The size of the rectocele and pelvic floor descent was not significantly different between the groups (Table 2). No patient had pelvic floor dyssynergia.

Physiological assessment

The maximum resting pressure (MRP) was significantly lower in patients with rectoanal intussusception than in those with rectorectal intussusception [51.1 (17.9–145.8) vs. 70.7 (34.7–240.6) cmH₂O, *P* = 0.007]. The maximum squeeze pressure (MSP) tended to be significantly lower in patients with rectoanal intussusception than in those with rectorectal intussusception [146.9 (42.7–368.9) vs. 188.3 (86.1–400.8) cmH₂O, *P* = 0.052] (Fig. 2). There was no significant difference in defecatory desire volume and maximum tolerated volume between the groups, respectively. However, both MRP and MSP were significantly lower in patients with rectal intussusception without rectocele than in those with rectal intussusception and rectocele [MRP, 50.1 (17.9–111.0) vs. 69.9 (34.7–240.6) cmH₂O, *P* < 0.0001; MSP, 132.4 (42.7–368.8) vs. 171.5 (42.9–400.8) cmH₂O, *P* = 0.019] (Fig. 3). There was no significant difference in defecatory desire volume and maximum tolerated volume between the groups, respectively.

Pearson's correlation coefficients

The correlations between MRP and variable morphological and demographic parameters are shown in Table 3. Age, the presence of rectocele, and the level of rectal intussusception were significantly associated with MRP, i.e., the older the patient, the lower the MRP, and patients without rectocele or those with rectoanal intussusception had lower MRP. FISI was not correlated with lower MRP. The correlations between MSP and variables are shown in Table 4. Age, the presence of rectocele, and pelvic floor descent were significantly associated with MSP.

Regression analysis

The results of the stepwise multivariate regression analysis that included morphological and demographic variables are shown in Table 5. Rectoanal intussusception rather than rectorectal intussusception and the absence of a rectocele were significantly associated with decreased MRP. No variable was significantly associated with decreased MSP on multivariate analysis.

Discussion

This study demonstrated that in addition to an advanced level of intussusception, the absence of a rectocele may be

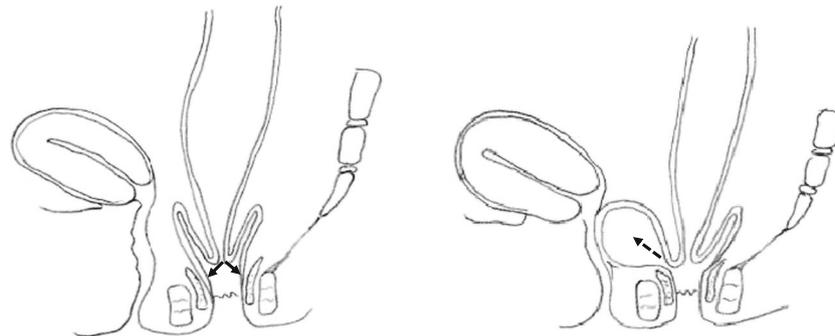


Fig. 4 Rectal intussusception without rectocele (left) and with rectocele (right). Luminal pressure may be applied predominantly onto or into the anal canal in patients with rectal intussusception without rectocele (solid

arrow), whereas the pressure may diffuse into the rectocele in patients with rectal intussusception with rectocele (broken arrow)

Table 6 Reported resting anal pressure in patients with rectocele

Authors	Year	No. patients	Resting anal pressure	Unit
Ho et al. [22]	1998	21	106.9 (9.5)	mean (s.e.)
Heriot et al. [23]	2004	17	80 (23)	mean (s.d.)
Nieminen et al. [24]	2004	30	74.4 (40.8–122.4)~75.2 (49.0–110.2)	mean (range)
Thornton et al. [25]	2005	80	87 (26–185)~91 (154–132)	median (range)
Roman et al. [26]	2005	71	124.8 (36.9)	mean (s.d.)
Yamana et al. [27]	2006	30	85.7 (70.7–117.0)	median (interquartile range)
Chung et al. [28]	2012	50	76.5 (19.6)~83.6 (29.9)	mean (s.e.)
Ours	unpublished	30	98 (36–185)	median (range)

Values are shown in terms of cmH₂O

s.d. standard deviation, *s.e.* standard error of the mean

correlated with reduced IAS function in patients with rectal intussusception and fecal incontinence.

Resting pressure was lower in patients with rectoanal intussusception than in those with rectorectal intussusception. This is consistent with the results of previous studies, and there was a significant reduction in resting pressure with increasing level of rectal intussusception [4, 5, 7, 8]. However, the reduction in resting pressure in patients with rectal intussusception remains unclear in relation to other anatomical abnormalities. We found that resting pressure was lower in patients without rectocele than in those with rectocele.

The role of associated rectocele in the mechanisms of preserved resting pressure in patients with rectal intussusception is unclear. The predominant effect of rectal intussusception is on reducing IAS tone without an effort on the external anal sphincter, since resting pressure is affected without a significant change in squeeze pressure in patients with rectal intussusception [4, 8]. In contrast, external rectal prolapse was associated with a significant reduction in both resting pressure and squeeze pressure [4, 12]. The reduction of IAS tone may be caused by sphincter dilatation [13] or applied pressure onto or into the anal canal repeatedly by the intussusception descent, when intraabdominal pressure is higher during daily life. The pressure in the upper anal canal may not increase in patients with rectocele than in those without rectocele, because the pressure may diffuse into the rectocele lumen (Fig. 4). Considering another viewpoint from a review of manometric studies in patients with rectocele, IAS function may not be impaired. In fact, the resting pressure of 75–125 cmH₂O was reported whether those with rectocele had associated rectal intussusception or not. This value does not seem to be lower, although the normal range of manometric study determined in each institution was not fully recorded. The MRP examined preoperatively in 30 patients with rectocele in our institution was 98 (36–185) cmH₂O (Table 6).

Fecal incontinence is a common symptom at presentation in patients with rectal intussusception [1, 2, 14]. Nearly 80% of patients in this study complained of passive incontinence. Passive incontinence suggests the dysfunction of the IAS, especially in patients with rectal intussusception without rectocele, as discussed previously. However, rectal intussusception may cause passive fecal incontinence more commonly by the inappropriate activation of the rectoanal inhibitory reflex (RAIR) [15]. The significance of RAIR in the pathogenesis of fecal incontinence has been supported by previous studies, where continence was improved, and postoperative increase in anal pressure was not found after abdominal surgical techniques for correcting rectal intussusception [16–18]. Rectocele is also regarded as a cause of fecal incontinence and improvement of continence was observed after perineal rectocele repair [19]. The mechanisms of fecal incontinence in rectocele are uncertain, but fecal trapping, leading to leakage after defecation to occur, can be considered a cause.

Symptoms of fecal incontinence were more common in the elderly than in younger patients [20], and we found that the older age was associated with a lower resting pressure in the univariate analysis.

There are certain limitations to our study. This was a small retrospective study. The symptoms of fecal incontinence or its severity may be affected by different factors apart from anatomical abnormalities, such as health status and physical limitations [20], which were not evaluated in this study. There could have been the risk of information bias as patients were asked to report the symptom score, leading to possible over- or under-description of fecal incontinence. The study population comes from a single tertiary care center, and our findings may not be generalizable to all patients with rectal intussusception and fecal incontinence.

In conclusion, this study demonstrated that a reduction in IAS function was more common not only in patients with rectoanal intussusception, but also in those without rectocele. When surgical treatment is considered in patients with rectal intussusception and fecal incontinence, careful diagnostic

assessment prior to surgery and appropriate choice of the procedure is mandatory in these patients, because the perineal approach using a circular stapler may be associated with a reduction in sphincter pressure [21]. Further studies are necessary to confirm the results of this study.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Research involving human participants and/or animals This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethical Committee of Kameda Medical Center (2018-214).

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