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Observational Study

New objective scoring system to clinically assess fecal incontinence

Pankaj Garg, Iwona Sudol-Szopinska, Małgorzata Kolodziejczak, Kaushik Bhattacharya, Gurleen Kaur

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Several scoring systems are used to assess fecal incontinence (FI), among which, the most commonly used are Wexner and Vaizey's scoring systems. However, there are significant lacunae in these scoring systems, due to which they are neither accurate nor comprehensive.

AIM

To develop a new scoring system for FI that is accurate, comprehensive, and easy to use.

METHODS

A pro forma was made in which six types of FI were included: solid, liquid, flatus, mucous, stress, and urge. The weight for each FI was determined by asking a group of patients and laypersons to give a disability score to each type of FI from 0 to 100 (0- least, 100- maximum disability). The disability was assessed on a modified EQ-5D+ (EuroQol) description system, 4D3L (4 dimensions and 3 levels) for each FI. The average score of each FI was calculated, divided by 10, and rounded off to determine the weight of each FI type. The scores for the three levels of frequency of each FI were assigned as never = 0 (No episode of FI ever),

occasional = 1 (≤ 1 episode of FI/ wk), and common = 2 (> 1 episode of FI/ wk), and was termed as frequency score. The score for each FI would be derived by multiplying the frequency score and the weight for that FI type. In the second phase of the study, a group of colorectal surgeons was asked to rank the six FI types in order of severity, and their ranking was compared with the patient and laypersons' rankings.

RESULTS

Fifty patients and 50 laypersons participated in the study. The weight was assigned to each FI (solid-8, liquid-8, urge-7, flatus-6, mucus-6, and stress-5), and a new scoring system was formulated. The maximum possible score was 80 (total incontinence), and the least 0 (no incontinence). The surgeons' ranking of FI severity did not correlate well with patients' and laypersons' rankings of FI, highlighting that surgeons and patients may perceive the severity of FI differently.

CONCLUSION

A new scoring system for FI was formulated, which was simple, logical, comprehensive, and easy to use, and eliminated previous shortcomings. Patients' and surgeons' perceptions of FI severity of FI did not correlate well.

Key Words: Feal incontinence; Scoring system; Urge; Stress; Flatus

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Core tip: There are several scoring systems to assess fecal incontinence (FI), among which, the most commonly used are Wexner's, Vaizey's, and FI Severity Index scoring systems. However, there are major lacunae and shortcomings in these scoring systems, due to which, they are neither accurate and scientific nor comprehensive. We have developed a new scoring system to assess FI, which is better and more accurate than the existing scoring systems. The new system is more comprehensive and simple and easy to use, and most shortcomings of previous scoring systems have been addressed.

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INTRODUCTION

Fecal incontinence (FI) is defined as the accidental leakage of stools, flatus, or mucus and is a common gastrointestinal disorder. It affects between 1% and 16% of the population[1-7]. FI drastically impacts the quality of life, and cause embarrassment, anxiety, fear, or reluctance to go out, often leading to social isolation and the need to carry clothes or wear incontinence pads regularly[1,3,8-13]. The sensitive nature of FI makes it a taboo subject, and many people are reluctant to discuss these with family members or even doctors[2,9,14-16].

There are three scoring systems commonly used to assess FI: Cleveland Clinic or Wexner[17] (Table 1), St. Marks Hospital or Vaizey's[18] (Table 2), and FI Severity Index (FISI)[19] (Table 3). The Wexner and Vaizey scores are the most commonly used[20]. However, there are major lacunae in these scoring systems, due to which they are not an accurate reflection of incontinence level and its correlation with the quality of life.

First, the existing scoring systems are not comprehensive. Wexner scores evaluate only three parameters: solid, liquid, and flatus (gas) FI[17], and Vaizey scores include only four parameters: solid, gas, flatus, and urge (lack of ability to defer defecation for 15 min due to sudden need to defecate)[18]. FISI scores include mucus FI (leakage) as the fifth parameter to evaluate FI but do not include urge FI[19]. None of the scoring systems includes stress FI (leakage of fecal matter or flatus on increasing intraabdominal pressure like coughing, lifting weights, *etc.*) as a parameter to evaluate FI.

Stress FI is an essential independent parameter that should be included in a scoring system. The prevention of stress FI primarily depends on the proper functioning of the external anal sphincter (EAS) and intact straining puborectalis reflex[21]. The latter is a coordinated contraction of EAS and puborectalis muscle on coughing or straining. The damage to EAS and puborectalis during surgery or by peripheral neuritis due to any condition (like diabetes, *etc.*) can cause disruption of straining puborectalis reflex and lead to stress FI[22]. Stress FI is prevalent and is independent of other FIs with distinct etiopathogenesis and treatment, and therefore should be separately evaluated in all patients of FI[22].

Second, the different types of FIs are assigned the same weights in Wexner and Vaizey scoring system[17,18]. This implies that uncontrolled passage of flatus is given equal weight to uncontrolled leakage of solid motion. It does not seem logical and scientifically sound to equate and give equal weights to different types of FI. This was perhaps done for the sake of simplicity[20]. Keeping a scoring system simple and easy to use should be a priority, but it is not justified at the cost of accuracy and sacrifice of scientific principles.

Table 1 Wexner scoring

	Never	Rarely	Sometimes	Usually	Always
Solid	0	1	2	3	4
Liquid	0	1	2	3	4
Gas	0	1	2	3	4
Wears a pad	0	1	2	3	4
Lifestyle alteration	0	1	2	3	4

Rarely: < 1/mo; sometimes: < 1/wk to ≥ 1/mo; usually: < 1/d to ≥ 1/wk; always: ≥ 1/d.

Table 2 Vaizey's scoring

	Never	Rarely	Sometimes	Weekly	Daily
Solid stool incontinence	0	1	2	3	4
Liquid stool incontinence	0	1	2	3	4
Gas incontinence	0	1	2	3	4
Alteration in lifestyle	0	1	2	3	4
	No	Yes			
Need to wear a pad or plug	0	2			
Constipating medication	0	2			
Lack of ability to defer defecation for 15 min	0	4			

Never: No episodes in last 4 wk; rarely: 1 episode in last 4 wk; sometimes: ≥ 1 in last 4 wk but < 1/wk; weekly: ≥ 1/wk to < 1/d; always: ≥ 1/d.

Table 3 Fecal incontinence Severity Index scoring

	≥ 2 times/day (patient/surgeon scores)	Once/day (patient/surgeon scores)	≥ 2 times/week (patient/surgeon scores)	Once/week (patient/surgeon)	1-3 times/month (patient/surgeon scores)
Gas	12/9	11/8	8/6	6/4	4/2
Mucous	12/11	10/9	7/7	5/7	3/5
Liquid	19/18	17/16	13/14	10/13	8/10
Solid	18/19	16/17	13/16	10/14	8/11

Third, there are parameters included in the existing scoring systems that are not a direct measure of the degree or severity of FI. This leads to error (confounding bias). The same symptom is scored multiple times due to the inclusion of parameters like "Need to wear a pad"[17,18], "Alteration in lifestyle"[17,18], and "Need to take a constipating medicine"[18] in the Wexner and Vaizey scoring systems. For example, a patient having liquid or stool FI would also wear a pad daily, would have an alteration in lifestyle, and could also be taking constipating medicines to counter the symptom. This way, the patient with liquid or solid FI would be scored four times for the same symptom. These included questions are not independent types of FI but are corrective actions taken to control the symptoms of FI. So, apart from being the indirect measures, they would cause a multiplicity of scoring as the primary direct symptom (liquid or solid FI) would anyway be getting points.

Fourth, the patient perceptions were not taken into consideration while developing these scoring systems. As any FI scoring system is being developed for the patients, the latter's perception is paramount. It would be incorrect to assume that the surgeons' perception of different FIs would be similar to that of the patients. The FISCI scoring system is the only one that has compared the surgeons' and patients' perceptions and found them to be different, yet they failed to formulate a simple and clear scoring system that was patient-centric[19]. There were several other discrepancies in the FISCI study[23]. The sample size was small (26 surgeons and 34 patients)[19]. The forms were filled by interview as well as through mail. The standard definitions and the disability parameters on the basis of which scoring was made were not used[19]. The lack of proper statistical methods, the scoring system becoming too complex, and no proper weights being

allotted to each FI type were important shortcomings of the FISI system (Table 3). These could be the reasons that the FISI scoring system did not become popular with gastroenterologists and surgeons[19].

Due to these major lacunae in the existing scoring systems (not comprehensive, the different types of FIs were assigned the same weights, parameters included were not a direct measure of the degree or severity of FI, the patient perceptions were not taken into consideration while developing these scoring systems, *etc.*), a need was felt to develop a new scoring system that would be comprehensive, based primarily on patients' and laypersons' perceptions, was scientifically sound, accurate (free of bias or overlapping parameters), faithfully reflected the degree of disability, and yet would be simple and easy to use. Against this background, this study was done in two phases. In the first phase, a new scoring system was developed based on patients' and laypersons' perceptions, and in the second phase, it was analyzed to determine whether patients' perception and surgeons' assessments of the disability of different FIs were similar or not.

MATERIALS AND METHODS

The study was designed in two phases. In the first phase, the assignment of weights to six types of FI and the formulation of a new scoring system based on patients' and laypersons' perceptions were performed. In the second phase, the colorectal surgeons were also interviewed, and their assessment of the severity of different FI types was compared with the rankings of patients and laypersons.

First phase of the study: development of new scoring system

Study group: The first phase of the study comprised the patients and laypersons.

Patients group: (1) Inclusion criteria: the patients were defined as those who knew about FI and could potentially develop it secondary to the treatment of the disease condition they were suffering from. Therefore, patients suffering from anal fistula were included. Since they were experiencing the fear of incontinence, their perception was relevant; and (2) Exclusion criteria: the patients already suffering from any FI were excluded as they would rate their type of incontinence worse than other types.

Laypersons group: The layperson group was included because the patients with FI were expected to be emotionally involved. Therefore, a group that was not directly involved in the disease process was also included. Inclusion criteria: the relatives of the patients suffering from a disease, the treatment of which could potentially cause FI (anal fistula), were included. These persons were aware of the details and the risk of FI in their close relatives but were not actually directly afflicted by the disease. Therefore, they would balance out any extreme response by the patients.

Parameters of FI

The six parameters directly reflecting FI were included: solid, liquid, flatus (gas), urge, stress, and mucus.

Study methodology

Measuring weight for each FI type: The six FI parameters were defined in simple language (English as well as the native language, Hindi), which a patient and layperson could easily understand (Table 4). An interviewer was assigned to interview each person. Both the interviewer and interviewee (study subject) were blinded to the goals or the purpose of the study. The interviewees were shown the proforma, and after they understood the definitions of six FI parameters, they were asked to arrange the six parameters in order of decreasing severity. After this, each parameter was to be assigned numbers (disability score) between 0 and 100. The disability score was the measure of the impact of FI on all aspects of the life of the person. The worst parameter would be assigned a disability score of 100, and all other parameters would be assigned disability scores according to that. The same weight could be assigned to different parameters if the interviewee perceived them as of equal magnitude. In order to guide the interviewee regarding the weight assignment, a modified EQ-5D+ (EuroQol) description system was utilized[24]. EQ-5D+ includes a structured approach in which each health state parameter is described in terms of dimensions and severity levels within each dimension. In the present study, a 4D3L (4 dimensions, 3 levels) description system was used (Table 5). The impact of FI type on four dimensions of daily life, usual routine activity, anxiety/depression, self-esteem, and social life, was assessed, and a maximum of 25 points were assigned to each dimension. Each dimension had three levels, and depending on the severity level of that dimension, the points out of 25 were to be assigned to that dimension (Table 5). For example, an interviewee assessing liquid FI assigns 18 points to usual routine activity (out of 25), 20 points to anxiety/depression (out of 25), 15 points to self-esteem (out of 25), and 22 points to social life dimension (out of 25), then the total disability score assigned to liquid FI would be 75 (out of 100) for that interviewee (Table 5). Similarly, every interviewee would assign disability scores to each of the six types of fecal FIs. The 4D3L system was used to make the procedure objective and also helped the interviewee to fill the proforma easily. The two dimensions, self-esteem and anxiety, are relevant to evaluate the impact of a medical condition and were not given much importance in earlier scoring systems[25,26]. The inclusion of the parameters used as independent parameters in previous scoring systems like "Need to wear a pad"[17,18], "Alteration in lifestyle"[17,18], and "Need to take a constipating medicine"[18], were included as a part of the 4D3L proforma and therefore had an influence on assigning disability score to each type of FI. As discussed above, these parameters are not a type of incontinence, and their independent inclusion in the scoring system would have led to the error.

A pilot study was done before commencing the main study to assess any shortcomings. This was helpful in removing questions that were irrelevant or difficult to comprehend, improving the proforma's content, and making the language

Table 4 Detailed description of different types of incontinence [it was also translated into the local language (Hindi)]

Incontinence	Description
Urge	Whenever there is an urge to pass motion, normally, a person can hold the motion for a few minutes. In urge IC, the person faces difficulty holding the motions whenever there is an urge of passing motions. Although the motion does not come out, the feeling and fear that it will come out force the patient to rush to the toilet
Stress	Whenever there is an increase in pressure inside the tummy like in coughing or lifting weights, a person with normal anal sphincters can tighten his sphincters and hold the motions. A person can hold the motion for a few minutes. In stress IC, on increasing the pressure inside the tummy like in coughing or lifting weights, a little bit of motion or flatus leak from the anus
Mucus	A person with normal anal sphincters has a good anal tone due to which no leakage of mucus (normally present in the rectum as there is saliva in the mouth) occurs. However, in a person with weak sphincters, some mucus may leak out into the area around the anus spontaneously
Flatus	A person with normal anal sphincters has a good anal tone due to which he/she has control over the passage of gas/flatus. The person can hold the gas/flatus for some time. However, in a person with weak sphincters, gas/flatus may leak out of the anus with the person having no control over it
Liquid	A person with normal anal sphincters has a good anal tone due to which no leakage of liquid stool occurs. However, in a person with weak sphincters, some amount of liquid stool may leak out into the area around the anus spontaneously
Solid	A person with normal anal sphincters has a good anal tone due to which no leakage of solid stool occurs. However, in a person with weak sphincters, some amount of solid stool may leak out into the area around the anus spontaneously

Table 5 Four dimensions, 3 levels [modified EQ-5D+ (EuroQoL)] description system utilized in the study and assignment of disability score for each fecal incontinence

Dimension	Dimension description	Perception of severity level
Usual routine activity	Performance of usual role activities such as working at a job, housework, child care, volunteer work, <i>etc.</i> Need to wear a pad, take a constipating medicine	Minimal problems with performing usual activities (0-5)
		Some problems with performing usual activities and moderate alteration in lifestyle (6-15)
		Unable to perform usual activities and severe alteration in lifestyle (16-25)
Anxiety/depression	Negative psychological states include anxiety, depression, behavioral, emotional control, loneliness, <i>etc.</i>	Minimal anxiety or depression (0-5)
		Moderate anxiety or depression (social isolation and loss of appetite) (6-15)
		Extremely anxious or depressed (suicidal ideation) (16-25)
Self-esteem	Perception about self	Minimal loss of self-esteem (0-5)
		Some loss of self-esteem (6-15)
		Marked loss of self-esteem (16-25)
Social life	How frequently the person goes out for socializing, like going to the cinema to watch a movie, going to a party, going out of the station for vacation	Minimal impact on social life (0-5)
		Some loss of social life (6-15)
		Marked curtailment of social life (16-25)

For example, an interviewee assessing liquid fecal incontinence assigns 18 points to Usual routine activity (out of 25), 20 points to anxiety/depression (out of 25), 15 points to self-esteem (out of 25), and 22 points to social life dimension (out of 25), then the total disability score assigned to liquid FI would be 75 (out of 100).

simpler. The subjects in the pilot study were not included in the final study.

Calculating the final weight for each FI type: The data of patients and laypersons were combined. The disability scores for each FI type were tabulated, and the average disability score for each FI type was calculated. The weight for that FI was calculated by dividing the average disability score by 10 and rounding off the number to the nearest whole number (Table 6). This was done for simplicity, as numbers with decimals would have been difficult to use.

Development of a scoring system: Once the weights for each FI type were determined based on patients' and laypersons' perceptions, the three frequencies of each FI type were fixed as never (No episode of FI ever), occasional (≤ 1 episode of FI/ wk) or common (> 1 episode of FI/ wk). These were assigned linear scores of 0, 1 and 2, respectively. The frequency system of never, daily, weekly, monthly or yearly was not used for a few reasons. First, the patients found it difficult to calculate the frequency when there were too many columns. Secondly, the frequency of any FI type could vary in

Table 6 Weight assignment to different types of incontinence by study group

	Solid	Liquid	Flatus	Mucous	Stress	Urge
Patients' (<i>n</i> = 50) average disability score	82.5 ± 19.1	84.8 ± 15.4	58.1 ± 23.6	55.3 ± 21.2	52.0 ± 23.9	68.5 ± 23.5
Laypersons' (<i>n</i> = 50) average disability score	83.0 ± 22.4	81.4 ± 19.2	54.6 ± 21.1	55.2 ± 19.3	48.8 ± 22.0	68.3 ± 22.8
Total average disability score	82.7 ± 20.7	83.1 ± 17.4	56.3 ± 22.3	55.2 ± 20.1	50.4 ± 22.9	68.4 ± 23.0
Division by 10	8.27	8.31	5.63	5.52	5.04	6.84
Final weight (after rounding-off)	8	8	6	6	5	7

frequency over a period of time. Third, increasing the columns would have made the scoring system more cumbersome.

Second phase of the study: comparison of ranking of six types of FI according to severity by patients, laypersons and surgeons

In this phase, the assessment of FI was done by surgeons, and FI ranking in decreasing order of severity was done by three participating groups: patients, laypersons and surgeons. As discussed above, this was not done to assign weights or for formulation of the new scoring system but to check whether there was a correlation between patients, laypersons and colorectal surgeons regarding perception of severity of different types of FI.

Surgeons: Inclusion criteria: colorectal surgeons who had performed at least 30 anal fistula procedures in their surgical career were included. The persons in each group (patients, laypersons and surgeons) were asked to rank the six FI in decreasing order of severity. The most severe FI was given a rank of 6, and the least severe FI was given a rank of 1. The other types of FI were given ranks between 2 and 5, depending on the severity. The average of each FI type in each group was calculated, and the final ranking of FI in the groups was tabulated and compared (Table 7).

Ethics

The study was approved by the Ethics Committee of Adesh Medical College and Hospital, Shahbad, India (reference number AMCH/IEC/2022/02/04).

Statistical analysis

The categorical variables were compared by performing the χ^2 or Fisher's exact test. For normally distributed data, the continuous variables were tested by Student's *t* test when there were two samples, and analysis of variance (ANOVA) there were three or more samples. For non-normally distributed data, the Wilcoxon signed-rank test was performed for paired samples, and Mann-Whitney *U* test for unpaired samples. The significant cut-off point was set at $P < 0.05$.

RESULTS

Fifty patients and 50 laypersons were included in the first phase of the study. All the proformas were filled over a period of 1 year by the same interviewer between March 2022 and March 2023. The mean age was 40.7 ± 11.7 years (41.7 ± 12.0 in patients and 39.8 ± 11.4 in laypersons), and 71 were male (44 in patients and 27 in the laypersons groups).

The mean disability scores assigned to solid, liquid, flatus, mucous, stress, and urge FI by the patients were 82.5 ± 19.1, 84.8 ± 15.4, 58.1 ± 23.6, 55.3 ± 21.2, 52.0 ± 23.9, and 68.5 ± 23.5 respectively and by the laypersons were 83.0 ± 22.4, 81.4 ± 19.2, 54.6 ± 21.1, 55.2 ± 19.3, 48.8 ± 22.0, and 68.3 ± 22.8 respectively (Table 6). The overall mean disability scores assigned to solid, liquid, flatus, mucous, stress, and urge FI were 82.7 ± 20.7, 83.1 ± 17.4, 56.3 ± 22.3, 55.2 ± 20.1, 50.4 ± 22.9, and 68.4 ± 23.0 respectively (Table 6). After dividing these by 10 and rounding them off, the final weights assigned to solid, liquid, flatus, mucous, stress, and urge FI were 8, 8, 6, 6, 5, and 7, respectively (Table 6).

The three frequencies fixed for all FIs were never, occasional and common and were assigned points of 0, 1 and 2, respectively (Table 8). Thus, a new scoring system was finalized (Table 8). The maximum possible score was 80, which implied total incontinence, and the minimum score possible was 0, which implied normal continence (no incontinence) (Table 8).

In the second phase of the study, 50 patients and 50 laypersons from the first phase of the study were included, and 33 colorectal surgeons were interviewed to rank the six different types of FI according to severity. The ranking of the surgeons, patients and laypersons was compared. The perception of the patients and the laypersons correlated well, whereas it did not correlate with the surgeons' perception (Tables 7 and 9). The patients rated liquid FI, while the surgeons perceived solid FI as the most severe (Table 7). After solid and liquid FI, the patients and laypersons ranked urge FI as the most severe, whereas the surgeons ranked stress FI at that level (Table 7). The severity perception of the patients and laypersons regarding solid and urge FI was significantly different from the surgeons ($P < 0.00001$, ANOVA) (Table 9).

Table 7 Comparison of ranking of six types of fecal incontinence as per severity perceived by patients, laypersons and surgeons

Ranking	Patients (n = 50)		Laypersons (n = 50)		Surgeons (n = 33)	
	Type of FI	Ranking mean ± SD	Type of FI	Ranking mean ± SD	Type of FI	Ranking mean ± SD
Most severe to least severe						
6	Liquid	4.73 ± 1.25	Solid	4.80 ± 1.50	Solid	6.0 ± 0.0
5	Solid	4.51 ± 1.50	Liquid	4.64 ± 1.35	Liquid	5.0 ± 0.0
4	Urge	3.65 ± 1.52	Urge	3.70 ± 1.44	Stress	2.90 ± 1.07
3	Flatus	2.87 ± 1.50	Flatus	2.72 ± 1.45	Mucous	2.81 ± 0.91
2	Mucous	2.57 ± 1.38	Mucous	2.70 ± 1.44	Flatus	2.57 ± 1.06
1	Stress	2.53 ± 1.53	Stress	2.46 ± 1.38	Urge	1.69 ± 1.07

The persons in each group (patients, laypersons and surgeons) were asked to rank the six types of fecal incontinence (FI) in decreasing order of severity. The most severe was given 6 points, and the least severe FI was given 1 point. The average of each FI type in each group was calculated, and the final ranking of FI in that group was calculated.

Table 8 New scoring system

Incontinence type	Weight	Frequency			Maximum score
		Never (points)	Occasional (points) (≤ 1 episode/ wk)	Common (points) (> 1 episode/ wk)	
Solid	8	0	1	2	16
Liquid	8	0	1	2	16
Urge	7	0	1	2	14
Flatus	6	0	1	2	12
Mucus	6	0	1	2	12
Stress	5	0	1	2	10
Total					80

Score in a cell = Weight for that incontinence type × frequency points. For example, a person with occasional liquid incontinence would have an $8 \times 1 = 8$ score. Maximum possible score = 80 (total incontinence), minimum score possible = 0 (no incontinence).

Table 9 Difference in mean ranking six types of fecal incontinence as per severity perceived by patients, laypersons and surgeons

Type of FI	Ranking mean ± SD			Significance (ANOVA)
	Patients (n = 50)	Laypersons (n = 50)	Surgeons (n = 33)	
Solid	4.51 ± 1.50	4.80 ± 1.50	6.00 ± 0.00	$P < 0.00001$
Liquid	4.73 ± 1.25	4.64 ± 1.35	5.00 ± 0.00	$P = 0.35$
Urge	3.65 ± 1.52	3.70 ± 1.44	1.69 ± 1.07	$P < 0.00001$
Flatus	2.87 ± 1.50	2.72 ± 1.45	2.57 ± 1.06	$P = 0.88$
Mucous	2.57 ± 1.38	2.70 ± 1.44	2.81 ± 0.91	$P = 0.90$
Stress	2.53 ± 1.53	2.46 ± 1.38	2.90 ± 1.07	$P = 0.29$

The persons in each group (patients, laypersons, and surgeons) were asked to rank the six fecal incontinence (FI) in decreasing order of severity. The most severe was given 6, and the least severe FI was given 1 point. The average of each FI type in each group was calculated and compared.

DISCUSSION

The objective scoring of FI is an important and necessary tool, especially for gastroenterologists, gastrointestinal and colorectal surgeons, and neurologists. Out of the few scoring systems published, the Wexner and Vaizey scoring systems

are the most popular and commonly used[17,18]. However, as discussed above, there are a few major shortcomings in these scoring systems, due to which they are not accurate, comprehensive, and bias-free. In the present system, it was attempted to remove the lacunae of existing scoring systems (Table 10).

FI missed out in previous scoring systems, such as urge in Wexner, mucous in Wexner and Vaizey, and stress FI in all previous systems, were included in the new scoring system[18]. The new system is the first in which all six types of FI were included: solid, liquid, flatus, mucus, stress, and urge. It is logical to include all these six FI in a scoring system as all of these are distinct, and the presence of any of these indicates a malfunction in the coordinated function of a portion of the sphincter mechanism.

The biggest lacuna in the Wexner and Vaizey scores is that all types of FIs are assigned the same weight (Tables 1 and 2)[17,18]. In fact, no attempt was made to assign differential weights to different types of FI[18]. It is difficult to understand how all types of FI could be assigned exactly the same scores when all six FI types are different. The present study highlighted that weights calculated for different FIs could have significant variations ranging from 5 (urge FI) to 8 (liquid and solid FI) (Tables 6 and 8). Therefore, assigning these FIs equal weight was too simplistic and a source of significant error.

In the past, patients' perceptions were not given due importance, or it was assumed that surgeons' and patients' perceptions would be similar. We were of the opinion that the patients' subjective perception should be the basis of any FI scoring system. If there is any discrepancy between surgeons' and patients' perceptions regarding FI, then the patients' perceptions should be given priority over surgeons' perceptions. Even taking an average of both would be inappropriate. This is because, ultimately, the patients are the sufferers, and before making any decision regarding a treatment/surgery, fellow patients' perceptions would be of more relevance to any patient. Therefore, we did not include surgeons' perceptions in determining the weight of the different types of FI. In the second phase of the study, we compared the severity ranking of different FI according to the patients, laypersons, and surgeons' perceptions. The patients' and layperson's ranking of different FI was similar, but both were significantly different from the surgeons' rankings (Tables 7 and 9).

In the FISI scoring system, as in the present study, the surgeons' and patients' perceptions were different as the surgeons gave more importance to solid than liquid FI (Tables 3, 7, and 9). The reason mentioned in the FISI study was that surgeons viewed solid FI as a reflection of sphincter integrity and the adequacy of surgical repairs[19]. It was further discussed that professionals tended to assign a higher value to more severe elements, whereas patients placed greater importance on more common events[19,27]. In such a scenario where discrepancy arises, the patients' perception should be given priority in formulating a scoring system, and it would be inappropriate to force surgeons' opinions on the patients.

The FISI study also had several lacunae. When compared to the present study, the sample size in the FISI study was smaller ($n = 34$ vs 100 in the present study)[19]. About one-third of patients (12/34) in the FISI study completed the questionnaire through email[19]. Also, their questionnaire was not detailed and contained a single 20-cell table that was to be filled by the patients (Table 3)[19]. Each cell had to be assigned a number between 1 and 20 according to the severity, and no number could be repeated (Table 3)[19]. This step in their methodology could lead to error as two different cells could be perceived to be of similar severity by patients and could have deserved the same number (*e.g.*, mucus leakage once weekly could be perceived as severe as gas leakage once daily by the patient). Also, the present study showed that detailed definitions (Table 4) and the EuroQol descriptive system (Table 5) helped to guide the patients to understand the parameters properly and filling the charts accordingly. In our study, the interviewer took at least 1 h in every case to accurately fill out the chart. It seemed highly improbable that such detailed charts could be filled appropriately *via* email, as was done in the FISI study[19]. The proper statistical methods were also not followed in the FISI study, such as assigning weights to each FI type, linear increase in scores on the increasing frequency of symptoms, *etc.* Therefore, the end result of FISI scoring was haphazard and not amenable to usage (Table 3). This was perhaps the main reason that the FISI scoring system did not become popular and was not widely utilized. All the existing lacunae were removed in the present study, and the latter utilized detailed and sound scientific methods and in a much larger sample than in the FISI study (Table 10).

In the present study, like in the FISI study[19], the surgeons perceived solid FI as the worst, while the patients perceived liquid FI as the worst. Another interesting aspect was that after excluding solid and liquid FI, the surgeons perceived stress FI while patients and laypersons perceived urge FI as the worst (Table 7). On detailed questioning, most surgeons opined that in stress FI, there was actual leakage of fecal matter, while in urge FI, one had to rush to the toilet, and actual leakage could be prevented in most cases. In contrast, the patients and laypersons opined that stress FI would only happen when there was stress (lifting weights, and coughing, *etc.*), and many times, such stressful situations (and hence stress FI) could be avoided (not lifting weights) or curtailed (coughing lightly) but in urge FI, the person had to rush to the toilet every time, and this would hamper the quality of life in a bigger way. It was difficult to ascertain the reason behind this difference in perception between the surgeons and patients.

The parameters included in the existing scoring systems (Wexner and Vaizey) which were not a type of FI and were not a direct measure of the degree of FI like "Need to wear a pad"[17,18], "Alteration in lifestyle"[17,18], and "Need to take a constipating medicine"[18], which led to error, were excluded as parameters in the new scoring system. Rather, these were included in the 4D3L [modified EQ-5D+ (EuroQol)] description system (Table 5), which served as the basis for assigning weights to different types of FI. As discussed above, these parameters are the outcome/side effects of FI, and adding them as separate parameters for scoring was leading to a confounding bias.

It is pertinent that there is an optimal balance between scientific soundness and simplicity of a scoring system. Steps were taken to simplify the new scoring system, such as rounding off the assigned weights to the nearest whole number and decreasing the frequency of FI episodes from 5 (earlier scoring systems) (daily, weekly, monthly, yearly and never) to 3 (common, occasional and never). During the pilot study, it was realized that dividing the symptoms (episodes) into

Table 10 Comparison of existing scoring systems with new scoring system

	Wexner	Vaizey	FISI	NSS
Comprehensive	No	No	No	Yes
FI type included: urge FI	No	Yes	No	Yes
FI type included: mucous FI	No	No	Yes	Yes
Presence of confounding parameters like “Need to wear a pad”, “Need to take constipating medicine”, and “Alteration of lifestyle”	Yes	Yes	No	No
Assigning weights to each FI by an objective method	No	No	No	Yes
Inclusion of patient perceptions (<i>n</i>)	0	0	34	50
Inclusion of laypersons’ perceptions (<i>n</i>)	0	0	0	50
Simple and easy to use	+++++	+++++	+	+++++
Detailed structured definitions	No	No	No	Yes
In-depth disability scores based on an objective description system	No	No	No	4D3L [modified EQ-5D+ (EuroQol)] used

FI: Fecal incontinence.

daily, weekly or monthly was difficult for the patients as the frequency of FI episodes is not strictly regular or periodic. Therefore, the broad categories of FI episodes as common or occasional made the scoring task easier for the patient while also simplifying the system without significantly impacting the scientific quotient. In contrast, giving equal weight to all types of FI for the sake of simplicity would be inappropriate as that would significantly compromise accuracy.

The subjective evaluation of study subjects could lead to deviation of the results. Therefore, several steps were taken to maximize objectivity while developing the new scoring system. First, in the proforma, the six FI parameters were defined in simple as well as two languages (English and the native language, Hindi), which a patient and layperson could easily understand. Second, both the interviewer and interviewee were blinded to the goals or purpose of the study. Third, all the proformas were filled out by the same interviewer. Fourth, to increase objectivity while filling out the proforma by the study subjects, a modified EQ-5D+ (EuroQol), 4D3L descriptive system was utilized. Scoring (0–25) was also utilized in each dimension to guide study subjects and to increase objectivity.

The study had some limitations. The new scoring system was not tested for inter- and intra-observer variability and test–retest reliability. However, these are planned for the next phase of the study. The validity of the new scoring system could not be checked because there was no gold standard against which it could be validated. The system was based on assigning weights and had more types of FI, due to which it was fundamentally different from the commonly used Wexner and Vaizey scoring systems. Nonetheless, this was a single-center study, and the new scoring system should be validated in a larger sample, preferably in multiple centers.

CONCLUSION

The new scoring system to objectively assess and grade FI clinically is more accurate than the existing scoring systems. It is simple and easy to use, and addresses most of the shortcomings of previous scoring systems. However, further studies are needed to corroborate the results of the present study.

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ARTICLE HIGHLIGHTS

Research background

Fecal incontinence (FI) is a common problem. Its assessment is difficult, and an objective scoring system needs to be developed so that FI can be evaluated uniformly all across the globe.

Research objectives

To develop a new effective, and scientifically sound scoring system in which the shortcomings of the existing scoring

systems are removed.

Research motivation

The existing scoring systems had many lacunae, due to which they were not scientifically accurate.

Research methods

A proforma was made in simple language in which all definitions of FI were included so that the study participants (patients and laypersons) could understand them. The study participants were then assigned disability scores (ranging from 0 to 100) for each type of FI based on a modified EQ-5D+ (EuroQol) descriptive system. The average score of each type of FI was calculated, divided by 10, and rounded off to determine the weight of each type. In the second phase of the study, a group of colorectal surgeons was asked to rank the six FI types in order of severity, and their ranking was compared with that of the patients and laypersons.

Research results

One hundred participants (50 patients and 50 laypersons) were included in the study. A new scoring system was formulated in which the maximum possible score was 80 (total incontinence), and the least 0 (no incontinence). The surgeons' ranking of FI severity differed significantly from the patients' and the laypersons' rankings, highlighting that the surgeons and the patients may perceive the severity of different FIs differently.

Research conclusions

A new scoring system for FI was formulated, which was simple, logical, comprehensive, and easy to use. The perceptions of patients and surgeons regarding the severity of different FIs differed significantly.

Research perspectives

The new scoring system would be useful for clinicians worldwide to objectively assess FI in the clinical setting.

FOOTNOTES

Author contributions: Garg P conceived and designed the study, collected and analyzed the data, revised the data, and finally approved and submitted the manuscript (Guarantor of the study); Sudol-Szopińska I collected and analyzed the data, revised the data, finally approved and submitted the manuscript; Kołodziejczak M critically analyzed the data, reviewed and edited the manuscript, finally approved and submitted the manuscript; Bhattacharya K analyzed the data, revised the data, finally approved and submitted the manuscript; Kaur G analyzed the data, revised the data, and finally approved and submitted the manuscript.

Institutional review board statement: The study was approved by the Ethics Committee of Adesh Medical College and Hospital (Approval No. AMCH/IEC/2022/02/04).

Informed consent statement: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

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