PATHOGENESIS OF REMOTE POST-HEMORRHOIDECTOMY DYSCHESIA

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Hemorrhoidectomy is associated with relief of patient's symptoms in the vast majority of cases yet a few patients continue to complain of any of their original symptoms or acquire new ones. The cause of remote post-hemorrhoidectomy dyschesia may be suggested clinically, e.g. anal stricture. Frequently, the cause is not clear. This study included 21 patients (7 males and 14 females) with an average age of 38.8 (±10.3) years. They presented with dyschesia > 3 months after hemorrhoidectomy. Defecation was assessed by employing a new analytical system: the Hydraulic / Efficiency Analysis of Defecation or the "HEAD" system. Digitized video recordings and X-ray images of video-defecography were analyzed on basis of hydraulic concepts of flow in pipes to calculate head loss during defecation. Efficiency analysis assessed the process of defecatory morphoconversion by a factor, overall defecatory efficiency, ODE. Morphoconversion subfunction efficiency analysis revealed the underlying functional disorder. Accordingly, an objective diagnosis of the severity and cause of dyschesia was possible. The underlying disorder could be identified in all cases. Organic lesions (anal strictures, fissures, rectoanal intussusception) were the cause in 10 patients with system decompensation in five of them. Defecatory dyssynergia was the cause in 11 patients with decompensation in six cases. Patient's judgment of the severity of dyschesia did not correlate with measured severity. Four forms of dyssynergia were identified: pelvic, pelvi-anal, pelvi-anorectal, and anal. The precise diagnosis of the cause of dyschesia allowed selection of the appropriate line of therapy in all cases.

Keywords : ***Post-hemorrhoidectomy dyschesia - Hydraulic / efficiency analysis of defecation.***

INTRODUCTION

Despite the appearance of several new modalities for the treatment of hemorrhoids, hemorrhoidectomy is still the gold standard in therapy[1]. It proved to be superior to alternative methods in the long-term results[(2)] as reflected by the degree of patient satisfaction[(3)] even with the relatively higher incidence of remote complications that may reach 23%[(4)].

Most of the defecatory symptoms are relieved by hemorrhoidectomy. Rarely, they persist or new symptoms develop. The cause of post-hemorrhoidectomy dyschesia may be suggested on clinical basis, e.g. anal stricture. In other cases, the cause is not clear even with resorting to advanced anorectal physiology tests.

These tests are currently associated with several difficulties in interpretation and do not reflect the defecatory function in a comprehensive way. A global assessment of defecatory function requires a system that is based on solid scientific concepts, requires minimized personal judgment, and correlates tightly with clinical concepts. This work presents a proposed system for the precise assessment of defecatory function. The ***"Hydraulic / Efficiency Analysis of Defecation"***, or the ***"HEAD"*** system, was employed in a group of patients who complained of remote post-hemorrhoidectomy dyschesia to identify the factors involved in its pathogenesis.

MATERIAL AND METHODS

This study included 21 consecutive patients (7 males and 14 females), Table I. They presented with distressing dyschesia more than 3 months after hemorrhoidectomy. A thorough history was taken from all patients, Every patient was asked to judge the severity of his/her dyschesia by referring to a devised scale, Table II. Clinically, the anal canal was assessed together with gynecological and neurological evaluation. The "HEAD" system was developed in two stages (1 and 2) and applied to each patient in four others (3 to 6), Table III.

Stage 1: Defining anorectal hydraulic morphology

The anorectal system (ARS), in a hydraulic view, is a continuous tube that has three distinct components: the junction (at the level of the puborectalis), a superior segment (the rectum above), and an inferior segment (the anal canal below). The ARS has three basic anorectal morphological settings (AMSs): 1) AMS_b: baseline, resting continence, 2) AMS_d: defecatory setting, and 3) AMS_c: dynamic continence (active, i.e. intentional, or reactive, i.e. reflex).

To achieve continence or defecation efficiently, the ARS has to modify its morphology to hydraulically suit the intended function (by modifying its internal resistances). The process of anorectal morphological conversion, AMC, includes 3 basic patterns: 1) AMC_{bd}, required to initiate the defecation process, 2) AMC_{bc}, required to react to a leak threat, and 3) AMC_{dc}, required to interrupt an ongoing defecation, (Fig. 1).

The AMC_{bd} includes individual components called morphoconversion subfunctions. They include junctional angle divergence (JAD), inferior segment shortening (ISS), and inferior segment widening (ISW).

Stage 2: Defining defecatory efficiency

Hypothetical defecation in the AMS_c is associated with maximal possible energy loss, i.e. zero% defecatory efficiency ***(setting X)***. In contrast, a hypothetical setting with the least possible energy loss, i.e. 100% efficiency, ***(setting M)*** entails extreme shortening of the inferior segment and its widening to coincide with superior segment diameter. At any particular defecation ***(setting A)***, efficiency of the system is defined by positioning actual energy loss over a percentile scale that extends between calculated losses in the two hypothetical extremes described above. This produces an expression for the overall defecatory efficiency (ODE). Morphoconversion subfunction efficiency (MSE) is assessed on the same basis.

Stage 3: Data acquisition

Video defecography was done for every patient, employing a modified thick barium sulfate preparation. The patient was studied in an isolated, silent, compartment. Two lateral view films (resting and squeezing) were acquired. Defecation was then recorded on videotapes. Films and videotapes were reviewed for organic lesions. They were then digitized by scanning films and encoding videos. The digital video record (30 frames/second) was converted into separate image files. The first and last frames to show visible progression of contrast in the inferior segment (progression frame one, PF_1, and X, PF_x) were identified, magnified, adjusted, and finally analyzed, (Fig. 2,3).

Basic morphological and hydraulic parameters were assessed in PF_1 and PF_x, Table IV. Defecographic parameters were assessed according to the recommendations of the "Tripartite Consensus Conference, 1999"[(5)].

Stage 4: Hydraulic analysis

The contrast material, upon rheometry, proved to be: power law, non-Newtonian (viscosity varied with the shear rate according to the power law), shear thinning (viscosity decreased with shear), and rheopectic (viscosity increased with time)[(6,7)]. Calculation of the shear rate (equation 1)[(7)], apparent viscosity (equations 2,3)[(6)], and Reynolds number was required in every case (equation 4)[8], Table V.

The total head loss (representing energy loss) was calculated in actual defecation ***(setting A)*** according to a modification of the classical Darcy equation (equations 5,6)[9], after considering extra-losses due to tube bending (elbow factor), rectocele, or exit narrowing, Table V. These were calculated on the same basis as pipe fitting losses in standard engineering systems[8,9] but the equation constants (K factors) required interpolation and extrapolation of standard engineering values because of the wider variations in the ARS, (Fig. 4.)

Stage 5: Efficiency analysis

The total head loss was calculated, for every act, in the two hypothetical settings ***(settings X and M)*** explained above (equations 7,8). The ODE and three MSEs (for JAD, ISS, and ISW) were also calculated (equations 9 and 10: A, B, and C), Table V.

Stage 6: Clinical correlations

The MSE parameters defined the specific area of mechanical dysfunction in the system while ODE reflected whether the system had become decompensated or not. Planning for therapy was based on the diagnosed disorder and severity of mechanical derangement.

RESULTS

Clinical and basic radiological data

Pertinent clinical data are presented in Table I. The type of the hemorrhoidectomy was confirmed in 14 patients (12 open transfixion-ligation of piles and 2 closed hemorrhoidectomies). Significant organic lesions were detected clinically in 11 patients and radiologically in 2 others, Table VIII, Fig.s 5 and 6.

Defecatory head loss

Table VI shows total head loss and its components in all patients. Head loss occurred mainly in the inferior segment followed by superior segment. Extra-losses (due to bending, sudden contraction at junction, widening by rectocele, and loss due to a narrow exit) were all negligible.

Diagnosis of the cause of dyschesia

All patients had abnormalities in the defecatory function (on basis of MSEs) but only 11 patients had significant deterioration in defecatory efficiency (ODE < 75%). In the other 10 patients, the system functioned efficiently despite MSE abnormalities, i.e. compensated dysfunction.

Defecatory dyssynergia was diagnosed in 11 patients where the dysfunction was not explained by an organic lesion. It was decompensated in 6 patients and compensated in 5 others. Four forms were identified, Table VII.

Organic lesions explained dysfunction in 10 cases. In 3 cases of significant rectoceles (> 3 cm in diameter), dyschesia was attributed to disorders other than the lesion, Table VIII.

Evaluation of clinical and radiological assessment

Subjective (patient-based) and objective ("HEAD"-based) assessment of the severity of dyschesia showed no correlation, Fig. 7. In comparison with the "HEAD" results, clinical examination, alone, could correctly point to the underlying cause of dyschesia in 8 patients (38%). Defecography improved this figure to 48%, Table VIII.

The majority of the clinically diagnosed anal strictures (80%) proved to compromise ODE. In contrast, none of the significant rectoceles (> 3 cm, in 3 patients), rectoanal intussusceptions (in 2 patients), or anal fissures (in 2 patients) compromised ODE.

Decision of therapy

The precise diagnosis of dyschesia by the "HEAD" approach guided therapy by addressing the cause of dyschesia. Four patients with strictures required diamond-flap anoplasty with internal sphincterotomy while the fifth was managed conservatively. Biofeedback therapy was decided, in association with bulk formers and other conservative measures, for patients with dyssynergia. The three patients with significant rectoceles (who proved to have dyssynergia) required biofeedback therapy before surgical correction of the rectocele. Patients with anal fissures had fissurectomy and internal sphincterotomy.

Items	*All*	*Males*	*Females*
Number	21	7	14
Age (years)	38.8 (±10.3)	40.3 (±15.6)	38 (±7.1)
Duration since surgery (months)	9.2 (±5.1)	12 (±6.6)	7.9 (±3.8)
Onset of dyschesia (patients)			
. Prior to surgery but worsened or did not improve after it.	5	1	4
. Started after surgery.	16	6	10
Average score for severity (according to the patient).	6.4 (±1.7)	6.9 (±2.2)	6.2 (±1.4)

Table I: ***Patients and dyschesia***

Points	*Description*
0	Never difficult.
1	Rarely difficult.
2	More frequently normal than difficult.
3	More frequently difficult than normal.
4	Always difficult but never fails.
5	Always difficult and occasionally fails.
6	Always difficult and more frequently fails than succeeds.
7	Always difficult and rarely succeeds without assistance.
8	Always difficult, never succeeds without assistance.
9	Always difficult, never succeeds without assistance and even this may fail.
10	Always difficult, never succeeds without assistance which usually fails.

Table II: ***Patient's scale for severity of initiation dyschesia***
(Descriptions refer to initiation of defecation without assistance. Assistance includes: digital support of perineum or extraction of stools, enema, or laxative).

Phase	Stage	Step	Definition
I			**Development of concepts & design of the "HEAD" system**
	1	1	Defining anorectal hydraulic morphology.
	2	2	Defining defecatory efficiency.
II			**Application of the "HEAD" system**
	3		**Data acquisition**
		3	Scanning of basic X-ray images.
		4	Encoding video records into computer files.
		5	Extracting defecatory part of computer video file.
		6	Converting into separate sequential images.
		7	PF processing: selection, magnification, and correction.
		8	Measurement of defecographic parameters.
		9	Calculation of basic hydraulic parameters.
	4		**Hydraulic analysis**
		10	Measurement of rheological characters of material.
		11	Calculation of shear rate in both segments.
		12	Calculation of apparent viscosity in every case.
		13	Determining the nature of flow (Reynolds number).
		14	Determining the value of K factors.
		15	Calculation of actual head loss.
	5		**Efficiency analysis**
		16	Calculating head loss in the two hypothetical settings.
		17	Calculating ODE.
		18	Calculation of MSEs.
	6		**Clinical correlations**
		19	Diagnosis of the cause of dyschesia.
		20	Planning for treatment.

Table III: ***The "HEAD" system: phases, stages and steps.***

	Parameter	Definition of the considered value
1	W_{ss}: width of superior segment	Average of: PF_1 and PF_x values
2	L_{ss}: length of superior segment	Value of PF_1
3	W_{is}: width of inferior segment	Average of: PF_1 and PF_x values
4	L_{is}: length of inferior segment	Value of PF_x
5	ARA: anorectal angle	Average of: PF_1 and PF_x values
6	Diameter of a significant rectocele (> 3 cm)	Maximal value
7	T_{1x} : time interval between PF_1 and PF_x.	Defined from frame numbers.
8	V_{is}: average velocity in the inferior segment.	Distance made by the leading edge over the period T_{1x} divided by T_{1x}.
9	V_{ss}: average velocity in the superior segment.	By comparing diameters of segments (flow rate is constant).

Table IV: ***Measured and calculated parameters in the process of data acquisition (from progression frames, PFs).***

	Equation
1	To calculate shear rate in a particular IS. $\acute{Y} = \{(3n+1)/n\} . \{Q/(\pi . r^3)\}$
2	The standard power law equation for non-Newtonian fluids $T = C\acute{Y}^{n}$
3	To calculate apparent viscosity at a time by re-arranging equation 2. $T = (C\acute{Y}^{n-1})\acute{Y}$ $T = \mu_{app}\acute{Y}$ $\mu_{app} = T/\acute{Y}$
4	To calculate Reynolds number. $R_E = \rho V d / \mu$
5	Darcy-Weisbach formula for head loss $H = f(L/d)(V^2/2g)$ $f = 64/R_E$
6	Head loss in *setting A* $\mathbf{H_a = S_a + I_a + E_a + C_a + W_a + X_a}$ $H_a = [f_{sa}(L_{sa}/d_{sa})(V_{sa}^2/2g)] + [f_{ia}(L_{ia}/d_{ia})(V_{ia}^2/2g)] + [K_{ea}(V_{ia}^2/2g)] + [K_{ca}(V_{ia}^2/2g)] + [(V_{ua}-V_{da})^2/2g] + [(V_{ia}^2/2g)]$
7	Head loss in *setting X* $\mathbf{H_x = S_x + I_x + E_x + C_x + W_x + X_x}$ $H_x = [f_{sx}(L_{sx}/d_{sx})(V_{sx}^2/2g)] + [f_{ix}(L_{ix}/d_{ix})(V_{ix}^2/2g)] + [K_e(V_{ix}^2/2g)] + [K_c(V_{ix}^2/2g)] + [(V_{ux}-V_{dx})^2/2g] + [(V_{ix}^2/2g)]$
8	Head loss in *setting M* $\mathbf{H_m = S_a}$ $H_m = f_{sa}(L_{sa}/d_{sa})(V_{sa}^2/2g)$
9	To calculate ODE $ODE = 100 - [100 (H_a - H_m) / (H_x - H_m)]$
10	To calculate MSEs $MSE_{JAD} = 100 - [100 (E_a / E_x)]$ A $MSE_{ISS} = 100 - [100 (I_a / I_{h1})]$ B $MSE_{ISW} = 100 - [100 (I_a / I_{h2})]$ C

Table V: Employed equations. Abbreviations – Ý: ***Shear rate, n: flow behavior index, Q: flow rate, π: 3.14, r: radius of tube, T: shear stress, μ: viscosity, C: consistency index, R_E: Reynolds number, ρ: density, V: velocity, d: diameter, H: head loss, S: head loss in superior segment, I: head loss in inferior segment, E: head loss due to elbow factor, C: head loss due to sudden contracti1on of tube, W: head loss due to tube widening (rectocele), X: head loss due to narrow exit, f: Darcy friction factor, L: length of segment, g: gravity, K: K-factor, ODE: Overall defecatory efficiency, MSE: morphoconversion subfunction efficiency.***

Subscripts – app: ***apparent, a: in setting A, x: in setting X, m: in setting M, S: in superior segment, I: in inferior segment, u: upstream, d: downstream, JAD: junctional angle divergence, ISS: inferior segment shortening, ISW: inferior segment widening, h1: hypothetical setting with L_{ix} and d_{ia}, h2: hypothetical setting with L_{ia} and d_{ix}, e: elbow, c: tube contraction.***
References – equations 1-5 are presented in text. Equations 6-10 were devised in the course of the study.

	SS	*IS*	*Elbow*	*Contraction*	*Rectocele*	*Exit*	*Total*
1	632	4466	0.1054	0.1776			5098
2	67	31739	0.0626	0.0877			31806
3	659	21989	0.0855	0.1913		0.4070	22648
4	2074	40586	0.5323	0.2661			42661
5	9320	7240	0.2027	0.1853			16560
6	67	31050	0.0779	0.1078		0.2225	31116
7	228	11365	0.0214	0.0257			11593
8	310	30350	0.0380	0.0680			30661
9	372	18834	0.1118	0.1525	0.3118		19207
10	260	156646	0.4897	0.1920			156907
11	76	26210	0.0621	0.0547	0.1123		26286
12	57	20733	0.0065	0.0091		0.0185	20789
13	31	22115	0.0065	0.0119		0.0240	22146
14	112	10811	0.0063	0.0145			10923
15	2340	3394	0.0003	0.0125			5734
16	1507	17508	0.0349	0.1606			19015
17	3227	13975	0.0246	0.1721			17202
18	65	69416	0.0191	0.0786		0.1588	69481
19	36	59933	0.0265	0.0778			59968
20	1936	38010	0.0897	0.1990	0.4162		39946
21	559	19549	0.0852	0.1154			20107
Av	1139	31234	0.0995	0.1124	0.2801	0.1662	32374
SD	± 2090	± 33245	± 0.1452	± 0.0764	± 0.1544	± 0.1607	± 32798
%	7.57%	92.43%	0.0004%	0.0006%	0.001%	0.0006%	100%

Table VI*: Head loss due to flow in the superior segment (SS), inferior segment (IS), and due to losses due to tube bending (elbow), sudden tube contraction, tube widening (rectocele) and narrow exit (Av: average, SD: standard deviation,* **%***: of total head loss - head loss is measured in units of* 10^{-5} *meter).*

Etiological group		*ODE*	*ISW*	*ISS*	*JAD*	*P*	*Comment*
Organic causes		L	L			5	The lesion lowered certain subfunctional efficiency + overall system efficiency.
			L			3	The lesion lowered certain subfunctional efficiency but did not lower system efficiency.
			L	L		2	
Decompensated Dyssynergia	I	L		L		0	Dyssynergia lowered certain subfunctional efficiency + overall system efficiency.
	II	L	L	L		3	
	III	L	L	L	L	3	
	IV	L	L			0	
Compensated dyssynergia	I			L		2	Dyssynergia lowered certain subfunctional efficiency but did not lower overall system efficiency.
	II		L	L		2	
	III		L	L	L	0	
	IV		L			1	

Table VII: *The "HEAD" basis for diagnosis of the cause of dyschesia (P = number of patients, L = low value, blank cells mean normal values). Dyssynergia syndromes are: I: Pelvic (poor pubococcygeal response), II: Pelvi-anal (as I + anal sphincter contraction), III: Pelvi-anorectal (as II + contraction of puborectalis), and IV: Anal (isolated anal sphincter contraction)*

			Clinical results		"HEAD" results				Conclusion
N	*S*	*ss*	*Examination*	*Defecography*	*ODE*	*JAD*	*ISS*	*ISW*	
1	F	7	None	None	88.45	93.12	65.16	80.34	D, I (c)
2	M	9	Abscess	Narrow IS	70.48	91.66	59.74	28.24	2ry spasm
3	M	8	Stricture	Narrow IS	68.04	95.17	48.40	35.83	Stricture
4	F	6	None	PRS	47.13	0.00	0.00	0.00	D, III
5	F	5	None	None	94.29	89.09	70.51	78.49	D, I (c)
6	M	9	Stricture	Narrow IS	48.94	76.89	35.55	22.86	Stricture
7	F	8	None	Narrow IS	69.53	85.00	47.46	42.19	D, II
8	M	6	None	Narrow IS	80.50	93.34	62.61	45.74	D, II (c)
9	M	4	Rectocele	Narrow IS	58.74	90.99	53.93	24.06	D, II
10	F	6	None	Narrow IS	46.85	2.21	16.97	36.25	D, III
11	F	9	Rectocele	PRS	64.09	72.84	53.37	32.49	D, III
12	F	5	Stricture	Narrow IS	82.25	95.64	82.81	0.00	Stricture (c)
13	F	6	Stricture	Narrow IS	73.64	96.31	74.58	0.00	Stricture
14	F	6	Anal fissure	Narrow IS	86.87	97.69	78.14	37.43	Anal fissure (c)
15	F	8	None	None	95.94	99.95	85.01	73.10	D, IV (c)
16	F	7	None	Intussusception	76.88	96.44	45.81	54.76	Intussusception (c)
17	F	5	None	None	87.87	98.20	47.92	73.66	D, II (c)
18	F	4	Stricture	Narrow IS	66.76	98.30	66.76	0.44	Stricture
19	M	8	Anal fissure	Narrow IS	81.99	98.70	81.99	1.76	Anal fissure (c)
20	F	5	Rectocele	Rectocele	46.13	84.38	4.73	45.00	D, II
21	M	4	None	Intussusception	86.54	87.05	45.30	71.49	Intussusception (c)

Table VIII: ***Clinical and radiological findings, efficiency parameters, and final diagnosis in all patients [N = number, S = sex, ss = severity score according to the patient, ODE, JAD, ISS and ISW are explained in text, PRS = puborectalis syndrome, IS = inferior segment, D = defecatory dyssynergia, (c) = compensated]***

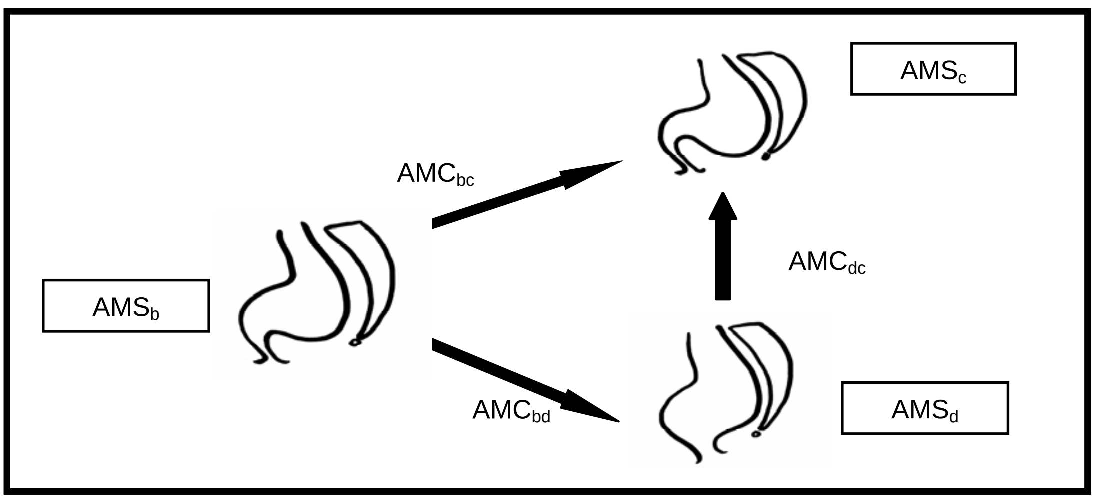
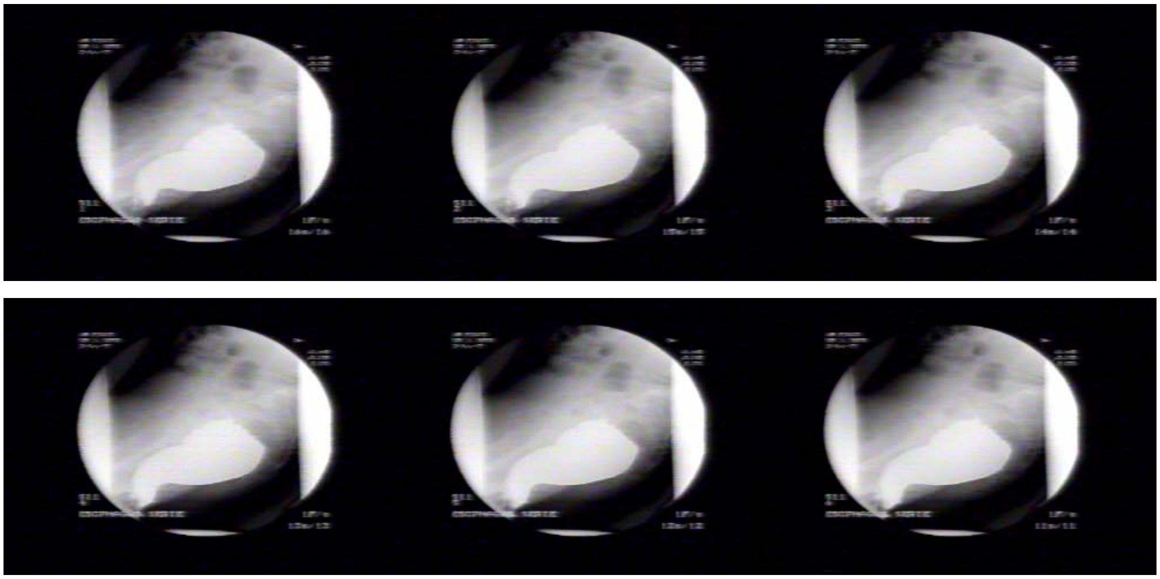
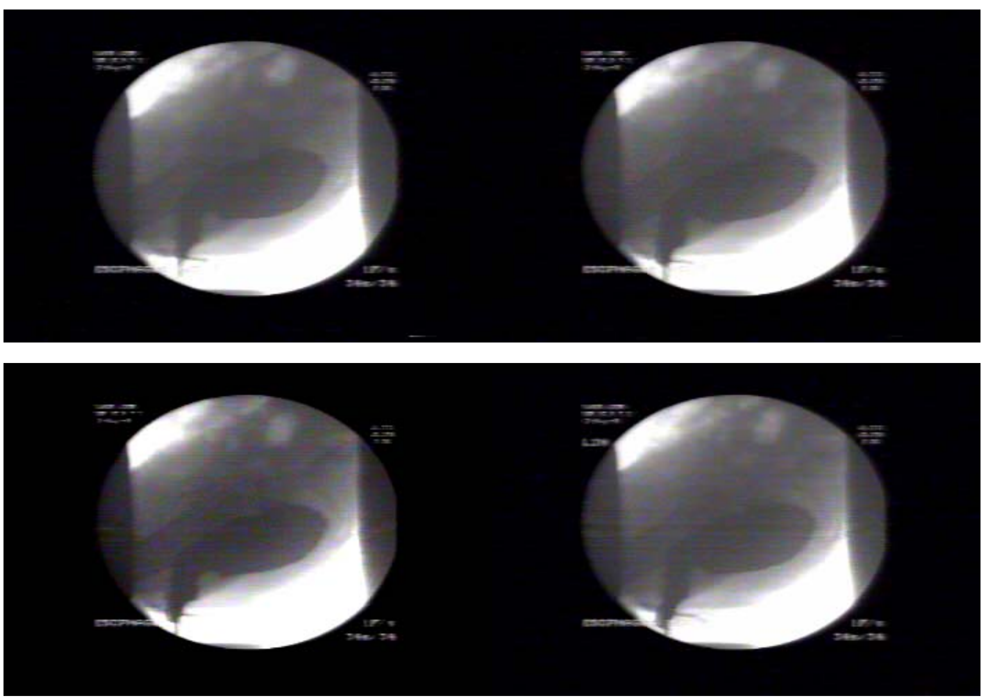


Fig. (1): Anorectal morphological settings (AMSs) and conversions (AMCs). Details are explained in text.



1	15	30
45	60	75

Fig. (2): PFs (1, 15, 30, 45, 60, 75) of a patient who had normal ODE.



1	45
90	135

Fig. (3): PFs (1, 45, 90, 135) of a patient who had low ODE due to anal stricture.

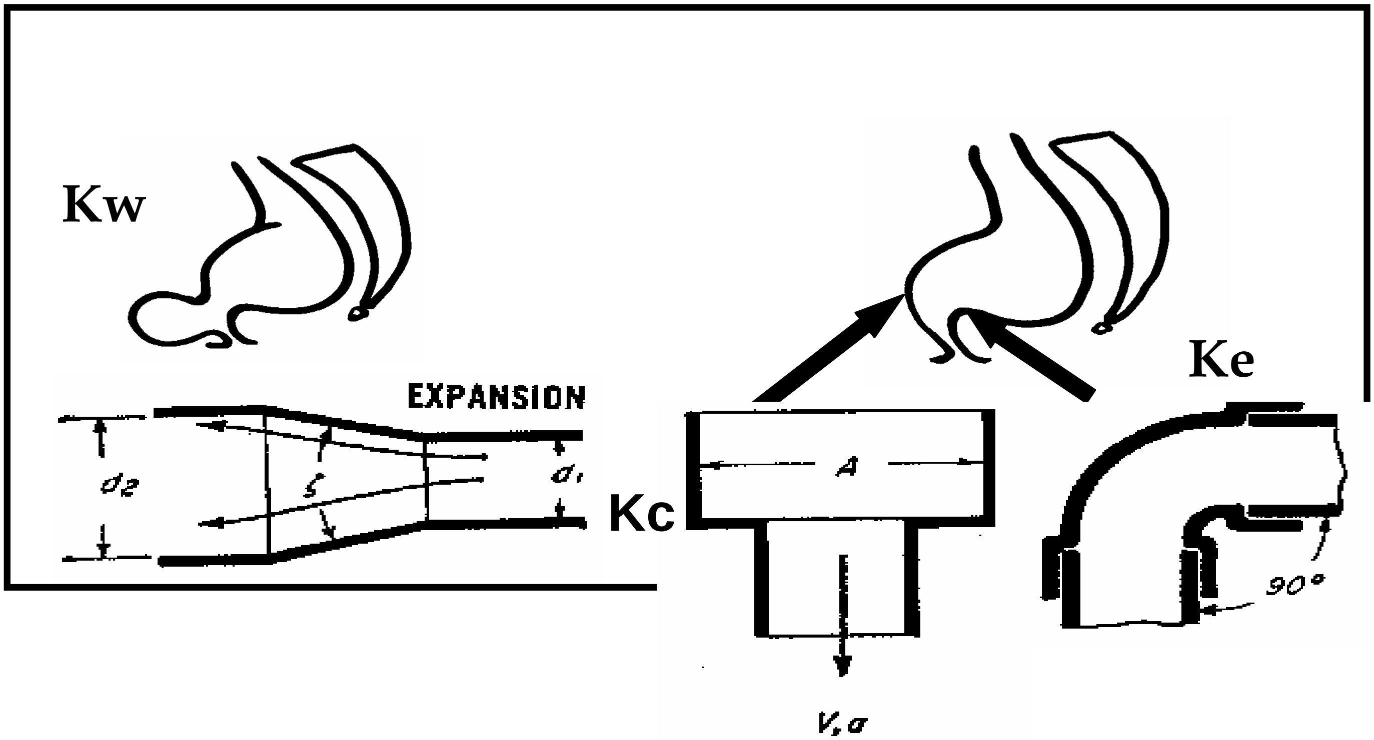


Fig. (4): The engineering basis for K-factors and adaptation to the defecatory system:
Kc: K factor for sudden contraction (interval between segments).
Ke: K factor for elbow (bending at anorectal junction).
Kw: K factor for widening (due to rectocele).

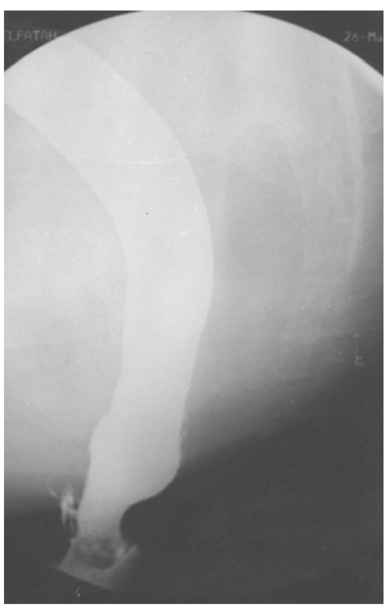


Fig. (5): Defecographic appearance of recto-anal intussusception.

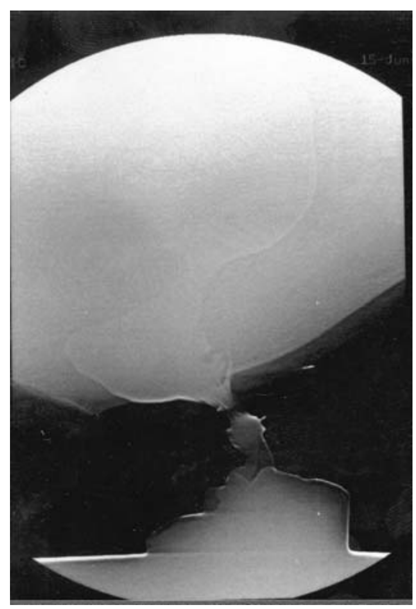


Fig. (6): Defecographic appearance of anterior rectocele.

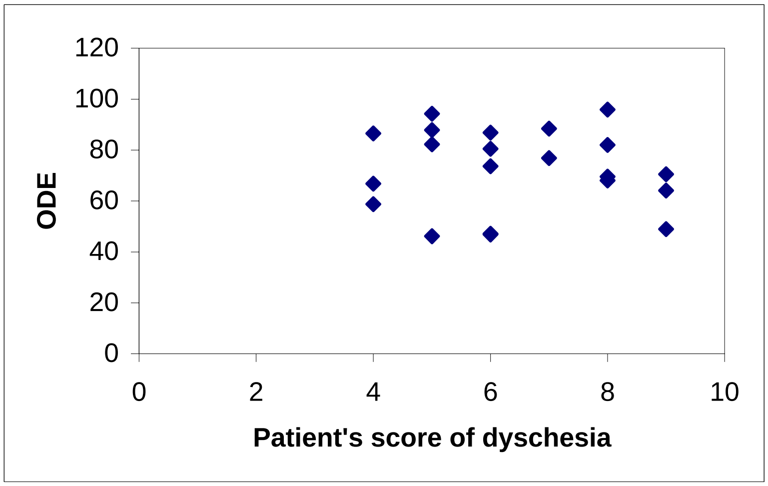


Fig. (7): Comparing patient-based assessment of severity of dyschesia (according to devised scale 0-10) and the value of ODE (%). No correlation is observed.

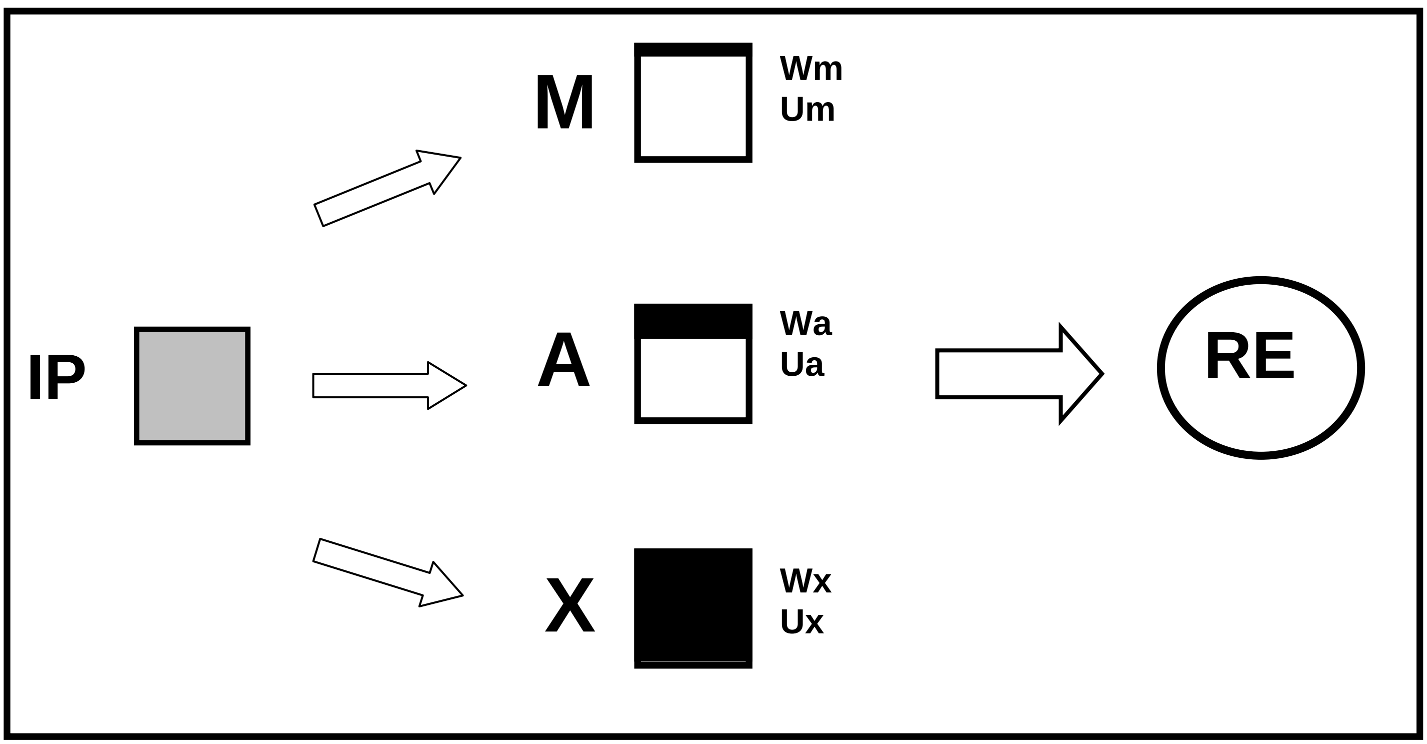


Fig. (8): System efficiency on basis of the three generations of the efficiency theory:

1) *The classical theory relates utilized output to total input (Ua/IP).*
2) *Schafer's approach relates required effect to utilized output (RE/Ua).*
3) *Intrinsic efficiency relates utilized output to system's potential minimum and maximum [Ua/(Um-Ux)].*

Grey (IP): input energy. White (U): utilized energy output (invested in the required effect),
Black (W): wasted energy output (dissipated into the surrounding as heat due to resistances).

DISCUSSION

Methodology

The commonly employed tests for assessment of defecation are associated with several problems. First, they focus on isolated defecatory events, e.g. contraction of selected muscles in EMG, which do not reflect the actual process of defecation. Second, most of them are non-physiologic as they are not done during actual defecation. They depend on patient's imagination of defecation in absence of normal provocative sensory input and normal system's dynamic responses. Third, their results are difficult to link, e.g. anorectal angle and length of anal canal in defecography. They require a lot of observer's personal judgment to interpret.

Previous attempts to reach a global assessment of defecation by integrating or comparing results of different tests were associated with difficulties in synchronizing observed events, and in formulating relations between heterogeneous elements (EMG signals, manometry pressures and defecography measurements).

The proposed approach for assessment of defecatory function (the "HEAD" system) employed video-defecographic data. Defecography was selected because of its physiological nature. It studies actual defecation, in an isolated compartment, of a substance that is close to stools in nature, and with the patient in the sitting position. In addition, its measuring techniques are standardized and results are reproducible with accepted reliability[10,11].

The proposed system was based on an energy approach. This approach has been previously employed in voiding[12]. Adaptation of the engineering standards for head loss in pipes to the defecatory system provided a global concept that incorporated all forms of defecatory disorders that mechanically jeopardize defecation.

System performance was assessed on basis of the third generation of the efficiency theory. The first theory was originally designed for engines[(13)] while the second was modified for biological systems[(14)]. The principle employed in this work was previously applied to voiding[(15,16)]. It evaluates efficiency of the system by comparing actual performance with extreme states, Fig. 8.

Diagnosis of the causes of dyschesia

All the clinically or radiologically identified lesions, except rectoceles, contributed to dyschesia by inducing subfunction abnormalities. In addition, anal strictures were frequently associated with a compromise in the overall system efficiency (in 80% of cases) while fissures and rectoanal intussusceptions were not. Anal strictures were previously reported to occur in 0.5 to 4% of patients after hemorrhoidectomy[17]. The main causes are surgery for extensive piles, associated anal pathology, and technical error (confluent circumanal excision of skin without intervening bridges). Conservative measures as bulk laxatives and anal dilatation may improve the condition but recurrences are high[(18,19)]. Internal sphincterotomy may be useful in selected cases[(17,20)]. Anoplasty (Y-V or diamond flap anoplasty) usually relieves obstruction[(21,22)].

The negligible contribution of rectocele to total head loss supports the previous doubts about its role in dyschesia that were based on indirect evidences as: absence of dyschesia in many women with rectocele[(23)], improvement of rectocele-associated dyschesia by biofeedback therapy[(24)], and lack of correlation between dyschesia improvement and degree of success of corrective surgery for rectocele[(25)].

The "HEAD" system defined defecatory dyssynergia as mechanical derangement of defecation (low MSEs) in absence of an explaining organic lesion. Dyssynergia reflects abnormal muscular response or lack of coordination.

Contrary to previous concepts, defecation was recently viewed as a dynamic process with active, coordinated contribution of pelvic floor muscles. Puborectalis contraction was reported to occur during normal defecation[(26-28)] and in patients who had no dyschesia[(29)]. Contraction of the puborectalis during normal defecation was observed to be always associated with contraction of the pubococcygeus[(26,30)].

Contraction of the pubococcygeus during defecation produces effects on the pelvic floor, anal canal, and the puborectalis-external sphincter complex. It supports the pelvic floor against the raised intra-abdominal pressure. Absence of this effect produces defecation difficulty[(23,31)]. Increased pelvic descent was observed as a common feature in the MRI and defecography of patients with obstructed defecation[(32,33)]. The pubococcygeus elevates, shortens, and widens the anal canal. This effect has been suggested by its insertion into the intersphincteric plane of anal canal as demonstrated anatomically and by MRI[(34,35)]. It was also supported by observed drop of anal pressure during its contraction[(36)].

Contraction of the puborectalis during defecation shares the pubococcygeus in elevating pelvic floor. On the other hand, it tends to compromise defecation by accentuating the anorectal angle and elongating the anal canal by stretching it. The first action was shown in this study to produce negligible head loss while the second is opposed and buffered by contraction of the pubococcygeus (which shortens the anal canal). This explains why puborectalis contraction may be associated with a normal defecation. Accordingly, the pubococcygeus appears to be a key player in defecation that contributes to a dynamic, coordinated defecatory pattern while its laxity and passiveness result in a strain-dependent one. Both patterns have been observed to occur in normal individuals and to alternate in the same persons[26].

The proposed system contributed to the diagnosis of defecatory dyssynergia in three ways. It provided a diagnosis based on the degree of functional derangement instead of observing discrete events. It identified different forms of dyssynergia, Table VII. It could also differentiate between compensated and decompensated systems by evaluating overall efficiency.

The proposed approach is limited to the mechanical causes for dyschesia. It cannot cover other factors that may contribute to it as weak contractility of rectal wall muscles (rectal akinesia)[37], and disturbed anal sensations observed in patients with anorectal diseases which disturbs defecatory adjustment[38]. Psychosocial factors should also be considered. Psychological impairment was identified in 65% of a group of patients with dyschesia[39].

The low diagnostic accuracy of clinical and simple radiographic examination, as revealed in this work, supports resorting to this sort of analysis for the precise diagnosis of the underlying disorder. It is not clear, on basis of the current study, whether the identified functional disorders had originally contributed to the pathogenesis of hemorrhoids or they were secondary to the disease. Some of the disorders described in this work, e.g. strictures, can be directly attributed to the operation. Others could have been present in association with hemorrhoids yet they were masked by the more distressing or annoying symptoms of the disease. Careful history taking may lead to identify those patients with advanced dyschesia preoperatively.

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