REVIEW

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Outcome of Colectomy for Slow Transit Constipation

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Objective
To review the outcome data for colectomy performed for patients with slow transit constipation (STC).

Background
The outcome of surgical intervention in patients with STC is unpredictable. This may be a consequence of the lack of effectiveness of such interventions or may reflect heterogeneity within this group of patients.

Methods
The authors reviewed the data of all series in the English language that document the outcome of colectomy in ≥10 patients in the treatment of STC.

Results
Thirty-two series fulfilled the entry criteria. There was widespread variability in patient satisfaction rates after colectomy (39% to 100%), reflecting large differences in the incidence of postoperative complications and in long-term functional results. Outcome was dependent on several clinical and pathophysiologic findings and on the type of study, the population studied, and the surgical procedure used.

Conclusions
It may be possible to predict outcome on the basis of preoperative clinical and pathophysiologic findings. This review suggests a rationale for the selection of patients for colectomy.

Constipation is the second most commonly self-reported gastrointestinal symptom, affecting 2% to 34% of populations studied.[1,2] After routine investigations to exclude an organic etiology as a cause of symptoms, a subgroup of patients with intractable symptoms are offered specialist referral for further investigation. Such patients, who usually have a long history of severe constipation, can be further divided on the basis of anorectal physiologic investigations and transit studies into those who have a reduction in the propulsive capacity of all or part of the colon, or slow transit constipation (STC), those who have an isolated disorder of rectal evacuation, and those who have both. A further, larger proportion of patients in this group have no major abnormality on these investigations; these constitute a group with "normal transit constipation" or "constipation-predominant irritable bowel syndrome." A small number have the separate distinct condition of megacolon or megarectum, which is characterized radiologically. Some of these patients are managed medically, but a proportion will seek a surgical opinion for amelioration of their symptoms.

Surgery for STC has been loosely based on a concept of the pathology (colonic stasis) since the beginning of the century,[3,4] and little seems to have changed to date. Colectomy and ileorectal anastomosis has remained the treatment of choice for STC in preference to other surgical options, such as limited resection.[5] The outcome from such surgery is highly variable, with widespread variability in both satisfaction rates and the incidence of postoperative complications.

The aim of this article is to review the outcome of colectomy in the treatment of STC. On the basis of preoperative clinical and pathophysiologic findings, this review makes observations with respect to predictive factors in the success or failure after surgery and discusses a rationale for selection of candidates for colectomy.

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Table 1. STUDY DATA

Outcome Parameters		
Patient satisfaction/success rate (%)		
Postoperative complications	Small bowel obstruction (%)	
	Reoperation (%)	
Measures of functional results	Postoperative bowel habit (%)	
	Diarrhea (%)	
	Incontinence (%)	
	Recurrent constipation (%)	
	Pain (%)	
	Stoma formation (%)	
Study & Preoperative Variables		
General	Year of publication	
	Population studied	
	Number of patients	
	Length of follow-up	
	Design of study	
	Prospective/retrospective	
	Method of data acquisition	
	Method of judging successful outcome	
Clinical data	Age and sex of patients	
	Age of onset	
	Duration of constipation	
	Historical findings suggestive of possible etiology	
Physiologic data	Gastrointestinal physiology	Colonic transit studies
		Anorectal physiology
		Upper gastrointestinal studies
	Other tests of autonomic function	Urodynamic studies
		Noninvasive cardiovascular tests

METHODS

Inclusion Criteria

All publications that fulfilled the following criteria were included:

1. Publication in the English language
2. Patients documented in the manuscript as having slow colonic transit of any cause
3. Outcome described in $\geq$10 patients
4. Surgery included excision of all or part of the colon and restored the continuity of the bowel by primary anastomosis (*i.e.*, subtotal or segmental colectomy).

Studies were not excluded on the basis of design (prospective or retrospective) or length of follow-up; however, one study was excluded on the basis of data repetition.[6]

Data were collected for several outcome parameters to allow comparison between studies (Table 1). Other data variables collected included general study data (*e.g.*, study design, outcome measures used, length of follow-up) and preoperative clinical and physiologic data.

RESULTS

Overall Outcome Results

Thirty-two studies, published between 1981 and 1988, fulfilled the entry criteria.[5,7–37] Overall patient success or satisfaction rates, documented in 31 studies, varied from 39% to 100% (Table 2).

Methods Used in Outcome Assessment

The methods used to assess overall patient success or satisfaction rates varied between studies. Only half of the 31 studies that documented success or satisfaction rates stated the method of data acquisition (Table 3). Of the studies where it was documented, most used questionnaire-based methodology with or without interview and/or clinical examination. Only two studies assessed outcome objectively using personnel not involved in the surgical care of the patient. In all others where stated, such data collection was led by the clinician. Data were not collected blindly in any study. The method by which patient success or satisfaction rates had been calculated was documented in 25 studies. In 14 series, a satisfactory outcome was based on the patient's judgment alone, although data regarding functional outcome were collected for all these studies. In a further five series, the patient was encouraged to include a measure of bowel function in the assessment of the success of the operation, and a further six studies used functional measures alone. No study was controlled with respect to the outcome from other surgical or medical interventions, or no treatment.

Table 2. SATISFACTION OR SUCCESS RATES AFTER COLECTOMY

Author	Year	Number	Satisfaction/ Success (%)
Hughes	1981	17	80
Keighley & Shouler	1984	10	90
Preston	1984	21	63
Todd	1985	16	88
Krishnamurthy	1985	12	100
Leon	1987	13	77
Walsh	1987	19	65
Akervall	1988	12	67
Kamm	1988	44	50
Vasilevsky	1988	51	71
Zenilman	1989	12	100
Beck	1989	14	100
Yoshioka & Keighley	1989	40	58
Kuijpers	1990	12	50
Coremans	1990	11	60
Pemberton	1991	38	100
Wexner	1991	16	94
Rex	1992	14	86
Sunderland	1992	18	89
Piccirillo	1995	54	94
Redmond	1995	34	90 (13*)
Christianson & Rasmussen	1996	12	92
de Graaf	1996	44	67/63†
Lubowski	1996	52	90
Pluta	1996	24	92
Platell	1996	96	82
Ho	1997	24	96
Nyam	1997	74	87
Hasegawa	1998	76	39
You	1998	40	92/100‡
Bernini	1998	106	56/78 (75)§

n = 31; median = 86%; range: 39–100%

* Figures for patients without or with a generalized gastrointestinal disorder, respectively.
† Figures for IRA/left hemicolectomy, respectively.
‡ Figure after subsequent IRA for three patients originally having segmental resection with recurrent constipation.
§ Figures for patients with or without nonrelaxing pelvic floor, respectively, and overall satisfaction rates.

Postoperative Morbidity Rates and Functional Outcome

Postoperative morbidity rates of small bowel obstruction (with or without reoperation), documented in 22 series, varied from 2% to 71% (median 18%); this resulted in reoperation in 0% to 50% of patients (median 14%) (Table 4).

Functional outcome measures are shown in Table 5 and were often poorly documented. Postoperative bowel habit was numerically quantified in only 20 series, with median or mean bowel habit figures available in only 14 series (range of medians/means: 1.3 to 5 times per day, median 2.9). The percentage incidence of diarrhea was documented in 16 series (range 0% to 46%, median 14%). Methods varied markedly in the definition of diarrhea. Numeric frequency criteria were used in three studies (>3 bowel movements per day[14] or >5 movements per day[11,37]), consistency (loose or watery stools) was used in three studies,[30,33,35] and the need to use antidiarrheal medications was used in a further three studies.[21,23,29] In all others, diarrhea was defined by the patient, or the criteria used were not stated (seven studies). The percentage incidence of incontinence was documented in 16 series (range 0% to 52%, median 14%) but was numerically scored in only 1 study.[29] Rates of recurrent constipation were recorded in 15 series (range 0% to 33%, median 9%). Objective criteria were documented in two studies (≤2 bowel movements per week).[14,28] In others, constipation was reported by patients as "persistent defecatory difficulty," defined by the need for continued laxative use, or the definition was not stated.

The percentage of patients who still had abdominal pain was documented in 14 series (range 0% to 90%, median 41%). As a result of poor functional outcome—in particular, diarrhea and incontinence or recurrent constipation—a permanent ileostomy was performed in up to 28% of patients[34] (median 5%, range 0% to 28%). Mortality rates, documented in 23 series, varied from 0% to 6%.[12]

Table 3. METHODS OF ASSESSING SUCCESSFUL OR SATISFACTORY OUTCOME

	No. of Studies	Objective	Blind
Method of Data Acquisition			
Not stated	15	NK	NK
Questionnaire-based	11	2	0
Interview-based	5	0	0
Total	31	2	0
Success/Satisfaction Rate Based on			
Not stated	6		
Patient's judgment only	14		
Measure of function and patient's judgment	5		
Function only	6		
Total	31		

NK, not known.

Table 4. SMALL BOWEL OBSTRUCTION AFTER COLECTOMY FOR SLOW TRANSIT CONSTIPATION

Author	Year	Number	Small Bowel Obstruction (%)	Reoperation (%)
Hughes	1981	17	50	50
Preston	1984	21	33	14
Leon	1987	13	38	31
Walsh	1987	19	NS	33
Akervall	1988	12	33	33
Kamm	1988	44	NS	38
Vasilevsky	1988	51	36	24
Zenilman	1989	12	8	0
Beck	1989	14	7	NS
Yoshioka & Keighley	1989	40	10	3
Pemberton	1991	38	11	8
Wexner	1991	16	25	0
Rex	1992	14	29	22
Sunderland	1992	18	10	10
Piccirillo	1995	54	9	6
Redmond	1995	34	18	NS
de Graaf	1996	44	2	2
Lubowski	1996	52	17	14
Pluta	1996	24	21	10
Platell	1996	96	NS	36
Ghosh	1996	21	71	NS
Ho	1997	24	13/29*	13/0*
Nyam	1997	74	9	7
Hasegawa	1998	76	NS	45
You	1998	40	5	3
Bernini	1998	106	29	18
		n=	22	23
		median=	18%	14%
		range=	2–71%	0–50%

* Figures for open and laparoscopic techniques, respectively.
NS, not stated.

Effect of General Study Variables on Outcomes

There was no difference in outcome with respect to year of publication, but the population studied appeared to have a marked effect on results. Studies performed in the United States (n = 11) demonstrated success rates of 75% to 100% (median 94%). Studies in the United Kingdom and Europe had median success rates of 64% and 67%, respectively (Table 6). Although there was no overall direct correlation between length of follow-up and success rates, for study groups that had published results at two or more time points, the percentage of successful outcomes appeared to decrease with time (Table 7).

The type of study design had a marked effect on satisfaction or success rates (Table 8). Prospective studies were superior (n = 16, median 90%, range 50% to 100%) to retrospective studies (n = 13, median 67%, range 39% to 100%).

Effect of Clinical Findings on Outcomes

It was difficult to compare outcome studies because of lack of clinical detail regarding patient selection. The term *constipation* includes both subjective and objective aspects, and in practice patients present when their personal situation is unsatisfactory. Attempts have been made to define constipation by objective criteria,[2] but few studies prospectively[29,35] or retrospectively[32] included only patients who fulfilled such criteria. Other studies, although they did not document such inclusion criteria, nevertheless included patients who would have fulfilled these criteria based on documented preoperative findings.[11,18,21–23]

It is evident that patients with slow colonic transit fall into a number of clinical subgroups based on history. In the few previous studies in which such clinical information was documented, there was often a mixture of patients from the various clinically defined groups (*e.g.*, chronic idiopathic, or onset after pelvic surgery or neurologic disease[36]). In other studies in which comment was made regarding etiology, this mixture may be inferred from the range of symptom duration (*e.g.*, 1 to 70 years[28]) and the age of patients (*e.g.*, 17 to 78 years[25]). Some studies included patients with radiologic evidence of idiopathic megabowel and even Hirschsprung's disease without subsequent stratification of the results of surgery for these distinct conditions.[18] Preston et al[5] documented substantial detail with respect to patient history. Patients who first presented in adulthood and who had undergone a previous hysterectomy had a comparatively worse outcome than those whose disease arose *de novo* in childhood. This was also the case in the study by Akervall et al[13] but was not borne out by the study by Walsh et al.[12] In the latter study, the onset of symptoms in six patients coincided with pelvic surgery, and the results of surgery were documented as satisfactory in four of the five available for follow-up. In the only two studies to document a "lifelong" history of symptoms in all patients (reflected in one study by the younger age range of patients [17 to 40 years][24]), the outcomes were good (89% and 100%).[17,24]

The coexistence of psychiatric problems had a generally bad influence on long-term outcome.[14,30,34]

Preoperative Physiologic Tests

The extent of reported preoperative physiologic assessment was highly variable, both with respect to anorectal physiologic testing (*i.e.*, anorectal manometry, evacuation proctography, rectal sensory testing) and also, surprisingly, to testing of colonic transit. This may have allowed some series to contain patients who in fact had normal transit. Table 9 demonstrates that studies can be divided into two groups according to whether basic physiology was complete (essential tests were regarded to be a minimum of anorectal manometry, defecography, and transit study performed in all patients) or incomplete. There was wider variability in outcome in the group with incomplete physiology (median

Table 5. FUNCTIONAL OUTCOME

Author	Year	Number	Bowel Habit/Day (median/range)	Incontinence (%)	Diarrhea (%)	Recurrent Constipation (%)	Pain (%)	Stoma (%)
Hughes	1981	17	NS	NS	NS	NS	NS	20
Preston	1984	21	3	37/0*	44/0*	31/100*	50	10
Leon	1987	13	0.1 to 3	38	46	NS	31	7
Walsh	1987	19	58% normal	NS	6	17	NS	18
Akervall	1988	12	NS	NS	NS	33	33	25
Kamm	1988	44	50% normal	14	39	11	71	14
Vasilevsky	1988	51	2.8	2	NS	NS	NS	2
Zenilman	1989	12	2.7	17	0	0	NS	0
Beck	1989	14	2	0	0	NS	NS	0
Yoshioka & Keighley	1989	40	3	NS	33	NS	39	15
Pemberton	1991	38	2–4	0	0	0	NS	0
Wexner	1991	16	3.5	NS	NS	NS	NS	0
Rex	1992	14	1.3	13	6	6	NS	6
Sunderland	1992	18	4	NS	NS	NS	NS	5
Piccirillo	1995	54	3.7	24	NS	2	10	0
Redmond	1995	34	3/0.7	NS	5/20	5/80	0/70	5/5†
de Graaf	1996	44	NS	14	14	18/29	90	7
Lubowski	1996	52	4	12	14	2	52	2
Pluta	1996	24	2.6	NS	33	NS	17	0
Platell	1996	96	5	52	NS	NS	55	9
Christiansen & Rasmussen	1996	12	NS	8	17	17	25	0
Ghosh	1996	21	NS	NS	NS	NS	90	14
Ho	1997	24	2.4	0	0	NS	NS	0
Nyam	1997	74	4/2‡	1	<10	0	NS	0
Hasegawa	1998	76	NS	NS	NS	NS	NS	28
You	1998	40	NS	NS	0	8	NS	0
Bernini	1998	106	2.1/2.8§	20	15	38/4§	43	NS
27 studies	n =		20 (14¶)	16	16	15	14	26
	median =		2.9/day	14%	14%	9%	41%	5%
	range =		1.3–5	0–52%	0–46%	0–33%	0–90%	0–28%

NS, not stated.
* Figures for IRA/left hemicolectomy, respectively.
† Figures for patients without or with GID, respectively.
‡ Figures for IRA without or with pelvic floor disorder & biofeedback.
§ Figures for patients with or without nonrelaxing puborectalis, respectively.
¶ Number of studies where median bowel habit is documented.

satisfaction rate 80% [range 39% to 100%]) than in the group with complete physiology (median satisfaction rate 89% [range 63% to 100%]).

Colonic Transit

Studies in which all patients had proven slow transit generally had superior outcomes to those with incomplete investigation of transit (median outcome 90% *vs.* 67%, respectively). The influence of the pattern of colonic motility disturbance (*i.e.*, generalized *vs.* left segmental) on outcome after surgical intervention remained unclear, but this may affect surgical decision making.

Anorectal Physiology

When anorectal physiology had been assessed, some of the studies demonstrated a deleterious effect of untreated disorders of rectal evacuation[19,34] or rectal hyposensation[13,30]; others did not.[14] Some groups had treated coexistent abnormalities of the pelvic floor by preoperative retraining[33] or rectopexy at the time of colectomy[25] with excellent results. However, a recent study of 106 patients demonstrated that despite preoperative biofeedback training, patients with a nonrelaxing pelvic floor (n = 16) had significantly higher rates of recurrent defecatory difficulty and lower satisfaction rates after colectomy.[37]

Upper Gastrointestinal Studies

It is generally accepted that patients with a generalized gastrointestinal disorder (GID) rather than an isolated disorder of colorectal dysmotility have poorer outcomes than other patients after colectomy.[19,26,36] A fall in the long-term success rate (as a result of recurrent constipation or intractable diar-

Table 6. OUTCOME BY POPULATION

Author	Year	Number	Satisfaction (%)
Australia/New Zealand (3 studies, range 80–90%, median 82%)			
Hughes	1981	17	80
Lubowski	1996	52	90
Platell	1996	96	82
Europe (6 studies, range 50–92%, median 67%)			
Vasilevsky	1988	51	71
Akervall	1988	12	67
Kuijpers	1990	12	50
Coremans	1990	11	60
Christianson & Rasmussen	1996	12	92
de Graaf	1996	44	67/63*
U.K. (8 studies, range 39–89%, median 64%)			
Keighley & Shouler	1984	10	90
Preston	1984	16	63
Todd	1985	16	88
Walsh	1987	19	65
Kamm	1988	44	50
Yoshioka & Keighley	1989	40	58
Sunderland	1992	18	89
Hasegawa	1998	76	39
United States (11 studies, range 75–100%, median 94%)			
Krishnamurthy	1985	12	100
Leon	1987	13	77
Zenilman	1989	12	100
Beck	1989	14	100
Pemberton	1991	38	100
Wexner	1991	16	94
Rex	1992	14	86
Piccirillo	1995	54	94
Redmond	1995	34	90/13†
Nyam	1997	74	87
Bernini	1998	106	56/78 (75)‡
Canada			
Pluta	1996	25	71
S.E. Asia/China			
Ho	1997	24	96
You	1998	40	92/100§

* Figures for IRA/left hemicolectomy, respectively.
† Figures for patients without or with GID, respectively.
‡ Figures for patients with or without nonrelaxing puborectalis, respectively, and overall satisfaction rate.
§ Figures for open and laparoscopic techniques, respectively.

rhea) was demonstrated by a long-term prospective study by Redmond et al (successful outcome 90% no GID *vs.* 13% GID).[26] Likewise, Ghosh et al[36] showed a high postoperative morbidity rate from recurrent small bowel obstruction (70%) in patients with GID. This study, which also included urodynamics and autonomic function tests, showed a strong but not statistically significant trend toward increased postoperative morbidity rates in patients with these more widespread abnormalities of autonomic function.

Type of Resection

Where selection for extent of colectomy was not based on segmental transit studies, results for limited subtotal resections, either subtotal colectomy with cecorectal anastomosis[5,38] or ileosigmoid anastomosis,[21] proved generally inferior to those for subtotal colectomy with ileorectal anastomosis (Table 10). Similarly, the results of segmental resection (hemicolectomy) for colonic inertia were disappointing. In the few patients who underwent left hemicolectomy, two studies had 100% failure rates,[5,39] although the two patients in a study by Kamm et al[14] who subsequently underwent distal colonic and rectal excision remained well 2 and 3 years after surgery.

Degraaf et al[28] used the segmental transit methodology described by Arhan et al[40] to select patients for partial left colectomy or subtotal colectomy. Although the results as a whole were disappointing, the study concluded that in terms of complications and functional outcome, there was little difference between procedures and that a more limited resection was therefore a reasonable option in this selected group. More recently, You et al[35] reported the use of left, right, or subtotal colectomy based on segmental transit time measurements with excellent results. In the three patients in whom constipation recurred after segmental resection, a subtotal colectomy was undertaken successfully at a later date.

Although it is a more radical procedure, ileoanal pouch surgery as a second operation for patients in whom constipation persisted after subtotal colectomy has had some success in previous studies with small patient numbers.[18,41,42] However, in a larger, more recent study, half of the eight patients required pouch excision for persistent symptoms.[43] In the only study that used ileoanal pouch anastomosis as a primary treatment for six patients with slow transit, the results were not stratified from the other 97 patients undergoing pouch surgery for other reasons.[44]

Table 7. OUTCOME BY LENGTH OF FOLLOW-UP

Author	Year	Number	Follow-Up (years)	Satisfaction (%)
Keighley & Shouler	1984	10	NS	90
Yoshioka & Keighley	1989	40	3	58
Hasegawa	1998	76	2–21	39
Preston	1984	16	3	63
Kamm	1988	44	1–15	50
Pemberton	1991	38	1.7	100
Nyam	1997	74	4.7	87
Wexner	1991	16	1.2	94
Piccirillo	1995	54	2.2	94
Krishnamurthy	1985	12	NS	100
Leon	1987	13	2.7	77

NS, not stated.

Table 8. OUTCOME BY TYPE OF STUDY

Author	Year	Type	Number
Keighley & Shouler	1984	P	90
Krishnamurthy	1985	P	100
Leon	1987	P	77
Zenilman	1989	P	100
Kuijpers	1990	P	50
Pemberton	1991	P	100
Wexner	1991	P	94
Rex	1992	P	86
Sunderland	1992	P	89
Piccirillo	1995	P	94
Redmond	1995	P	90/13*
Christianson & Rasmussen	1996	P	92
de Graaf	1996	P	67/63†
Lubowski	1996	P	90
Pluta	1996	P	92
Nyam	1997	P	87
You	1998	P	92/100§
Hughes	1981	R	80
Preston	1984	R	63
Walsh	1987	R	65
Akervall	1988	R	67
Kamm	1988	R	50
Vasilevsky	1988	R	71
Beck	1989	R	100
Yoshioka & Keighley	1989	R	58
Coremans	1990	R	60
Platell	1996	R	82
Ho	1997	R	96
Hasegawa	1998	R	39
Bernini	1998	R	56/78 (75)‡
n =	17 (P)		13 (R)
Median =	90% (P)		67% (R)
Range =	50–100% (P)		39–100% (R)

P, prospective; R, retrospective.
* Figures for patients without or with GID, respectively.
† Figures for IRA/left hemicolectomy, respectively.
‡ Figures for patients with or without nonrelaxing puborectalis, respectively, and overall satisfaction rate.
§ Figure after subsequent IRA for three patients originally having segmental resection with recurrent constipation.

DISCUSSION

Assessing Outcome

The increasing incidence of complications and recurrent symptoms with time after surgery suggests that studies should be prospective and should have long-term follow-up. We have not found any previous study that compares outcomes with those of other surgical treatments (*e.g.*, permanent ileostomy) or with those when no surgery is undertaken; this would obviously be desirable in a future study. Outcome measures should include postoperative complications and functional outcome measures, ideally using accepted questionnaire-based protocols that assess quality of life and even psychiatric morbidity (*e.g.*, the Hospital Anxiety Depression Scale[45]) as well as gastrointestinal function (*e.g.*, the Wexner incontinence score[46]). Objectivity could be maximized by using external assessment by a separate unit.

It is clear that several different etiologic groups can be defined on the basis of the clinical history, and that patients undergoing colectomy are therefore likely to be heterogeneous in terms of etiology. Most cases of slow transit arise *de novo* in early childhood and are labeled chronic and idiopathic.[47] The etiology of such idiopathic cases remains unclear and is probably itself heterogeneous. However, a proportion of patients with intractable STC present in later life. Some of these patients have no obvious trigger for their complaints; other cases follow events such as hysterectomy[48] or childbirth.[49] An additional group includes patients whose constipation appears to follow a recognized acute or chronic neural injury. This subgroup includes myenteric damage (diabetes, Chagas', laxative abuse), spinal injury (trauma, tumor), and central nervous system disease (Parkinson's, cerebrovascular accident, demyelination [*e.g.*, multiple sclerosis]).

It remains unclear what independent effect the variation in etiology of STC has on outcome. However, the response to surgery might be expected to be different for diseases with diverse pathogenesis. For example, if the cause of post-hysterectomy STC is extrinsic anatomic pelvic denervation, it is unlikely to have the same response to the same surgical procedure as chronic idiopathic STC that might be considered to arise from a "congenital," intrinsic enteric problem, as evidenced by some pathologic studies.[50,51] Likewise, the degree and extent of central denervation seen with spinal transection must be expected to have an effect on outcome. Further, it has been demonstrated that different etiologic subgroups based on clinical history have a different profile of pathophysiologic abnormality.[49,52,53] This is especially true when comparing patients with chronic idiopathic STC and patients whose problems arise after pelvic surgery. Such physiologic differences also influence outcome. Future studies should therefore attempt to stratify results based on etiologic groups. Patients with radiologic evidence of idiopathic megabowel are likely to represent a distinct entity and should not be grouped with STC patients when considering outcome.

Evaluation and Selection of Patients for Colectomy

A scheme for the evaluation and selection of patients with STC as candidates for colectomy is presented in Figure 1.

Clinical and Psychological Evaluation

Because the definition of constipation includes both subjective and objective aspects, there is often variation in the main symptoms reported. If a patient's reported symptoms do not equate well with those primarily addressed by colectomy for slow transit (*e.g.*, infrequency of bowel habit), the benefit of surgery may be reduced.

Table 9. OUTCOME VERSUS PHYSIOLOGY

Author	Year	Type of Study	Number	Anorectal Studies	Transit Studies	Satisfaction (%)
Series with complete physiology, 12 studies, range 63–100%, median 89%						
Coremans	1990	R	11	M,D,E	T	60
Pemberton	1991	P	38	M,D,E, Bexp, Dscint	T	100
Wexner	1991	P	16	M,D,E	T	94
Rex	1992	P	14	M,D,RS	T	86
Piccirillo	1995	P	54	M,D,E	T	94
Redmond	1995	P	34	M,D,E,Col M	T	90/13†
Christianson & Rasmussen	1996	P	12	M,D,RS	T	92
de Graaf	1996	P	44	M,D,E	T	67/63‡
Lubowski	1996	P	52	M,D,E*	T, I	90
Nyam	1997	P	74	M,D,Bexp,Dscint	T, I	87
You	1998	P	40	M,D,Bexp	T	92/100§
Bernini	1998	R	106	M,D,E*	T	56/78 (75)¶
Series with incomplete physiology, 19 studies, range 39–100%, median 80%						
Hughes	1981	R	17	NS	n.s	80
Keighley & Shouler	1984	P	10	D,E,Sig M	T	90
Preston	1984	R	21	RAIR,RS	T	63
Krishnamurthy	1985	P	12	None	None	100
Todd	1985	NS	16	NS	n.s	88
Leon	1987	P	13	NS	n.s	77
Walsh	1987	R	19	M*	T*	65
Akervall	1988	R	12	M,RC,RS,Sig M	T*	67
Kamm	1988	R	44	E,Bexp*	T*	50
Vasilevsky	1988	R	51	M*	T*	71
Beck	1989	R	14	M	T*	100
Yoshioka & Keighley	1989	R	40	M,E,RS in all, Sig M*	T*	58
Zenilman	1989	P	12	M	T	100
Kuijpers	1990	P	12	D,E	T	50
Sunderland	1992	P	18	D	T	89
Plattell	1996	R	96	M,D*	T	82
Pluta	1996	P	24	M,RS,Co M	T	92
Ho	1997	R	24	M,E,RS,RC	T	96
Hasegawa	1998	R	76	NS	n.s	39

* Incomplete investigations.
† Figures for patients without or with GID, respectively.
‡ Figures for IRA/left hemicolectomy, respectively.
§ Figure after subsequent IRA for three patients originally having segmental resection with recurrent constipation.
¶ Figures for patients with or without nonrelaxing puborectalis, respectively, and overall satisfaction rate.
Bexp, balloon expulsion; Col M, colonic manometry; D, defecating proctography; Dscint, defecating scintigraphy; I, I^{111} scintigraphic transit study; E, electromyography; M, anorectal manometry; NS, not stated; RAIR, rectoanal inhibitory reflex; RC, rectal compliance; RS, rectal sensory testing; Sig M, sigmoid manometry; T, transit study (radiopaque markers).

Indeed, symptoms such as bloating and abdominal pain are not generally improved by surgery.[14] Symptom scoring systems[53] may help to discriminate patients who will benefit from surgery in the future. Kamm et al[14] noted that patients with the greatest psychological problems may have the lowest tolerance for abdominal pain and seek surgical treatment, and it is clear from recent series that the presence of severe psychological problems adversely influences outcome.[14,30,34] Referral for formal psychological investigation[54–56] is therefore recommended, especially in patients where such a disorder is suspected or is known to be present from the patient interview before surgery is considered.

Preoperative Physiologic Evaluation

This review demonstrates that outcome from surgery for STC is influenced by variation in pathophysiology. Because colectomy aims to address the problem of disordered colonic motility, such a motility disturbance should at least be inferred (on the basis that even when prolonged colonic manometry is available, the benefits are not proven[57]) by a positive transit study. Although previous studies have shown that radiopaque markers are adequate for screening for STC, they are not considered sufficiently discriminatory in showing different sites of transit delay.[58,59] Preoperative isotope scintigraphy is therefore advised[60] to assess the

Table 10. OUTCOME VS. TYPE OF OPERATION

Author	Year	Number	Type of Operation	Satisfaction/Success (%)
3 studies, range 50–81%, median 58%				
Kamm	1988	44	IRA/CRA	50
Yoshioka & Keighley	1989	40	IRA/CRA/ISA	58
Platell	1996	96	IRA/CRA	81
5 studies, range 50–100%, median 77%				
Krishnamurthy	1985	12	IRA/ISA	100
Leon	1987	13	IRA/ISA	77
Vasilevsky	1988	51	IRA/ISA	71
Kuijpers	1990	12	IRA/ISA	50
Pemberton	1991	38	IRA/ISA	100
18 studies, range 60–100%, median 90%				
Hughes	1981	10	IRA only	80
Keighley & Schouler	1984	10	IRA only	90
Todd	1985	16	IRA only	88
Walsh	1987	19	IRA only	65
Akervall	1988	12	IRA only	67
Zenilman	1989	12	IRA only	100
Beck	1989	14	IRA only	100
Coremans	1990	11	IRA only	60
Wexner	1991	16	IRA only	94
Rex	1992	16	IRA only	86
Sunderland	1992	18	IRA only	89
Piccirillo	1995	54	IRA only	94
Redmond	1995	34	IRA only	90/13*
Lubowski	1996	52	IRA only	90
Pluta	1996	24	IRA only	92
Ho	1997	24	17 IRA, 7 laparoscopic IRA	96
Nyam	1997	74	IRA (52) IRA + training (22)	87
Bernini	1998	106	IRA only	56/78(75)†

IRA, ileorectal anastomosis; CRA, cecorectal anastomosis; ISA, ileosigmoid anastomosis.
* Figures for patients without or with a GID, respectively.
† Figures for patients with or without nonrelaxing puborectalis, respectively, and overall satisfaction rate.

influence of transit pattern on outcome from subtotal colectomy or selected segmental resections.[28,35] Patients with isolated rectosigmoid retention of radiopaque markers or isolated functional rectosigmoid holdup of isotope[61,62] who have proctographic evidence of significant pelvic outlet obstruction should probably be excluded from colectomy on the basis that they are unlikely to benefit from a procedure directed at correcting slow colonic transit.

Some studies have demonstrated a deleterious effect of untreated disorders of rectal evacuation,[19,34,37] and therefore consideration should be given to excluding this group from colectomy unless these problems are satisfactorily addressed by preoperative retraining[33] (or the patients are treated at the time of surgery[25]). Rectal hyposensation is well documented in patients with STC[63] and may also adversely affect outcome.[13,30]

The presence of upper gastrointestinal dysmotility is well documented in idiopathic STC[64] and should act as a contraindication to surgical intervention because of both the high risk of postoperative complications and long-term failure rates.[19,26,36] Upper gastrointestinal motility studies should therefore be performed in any patient in whom surgery is being considered. It is generally agreed that the sensitivity and discriminatory value of manometric studies (antroduodenal and esophageal) is superior to that of gastric emptying studies and small bowel transit studies (see review by Camilleri et al[65]). Although the presence of urodynamic,[66] autonomic, and other neurologic abnormalities[67] has been documented in subgroups of patients with chronic idiopathic STC, their role in guiding clinical management is not yet established.[36] Attention to refining the selection of patients who might benefit from colectomy for slow transit, on the basis of physiologic investigation, has been shown to improve outcome.[24,33]

CONCLUSION

This review documents the high variability of outcomes after colectomy for patients with STC. Surgery for this condition should probably be considered only in a highly

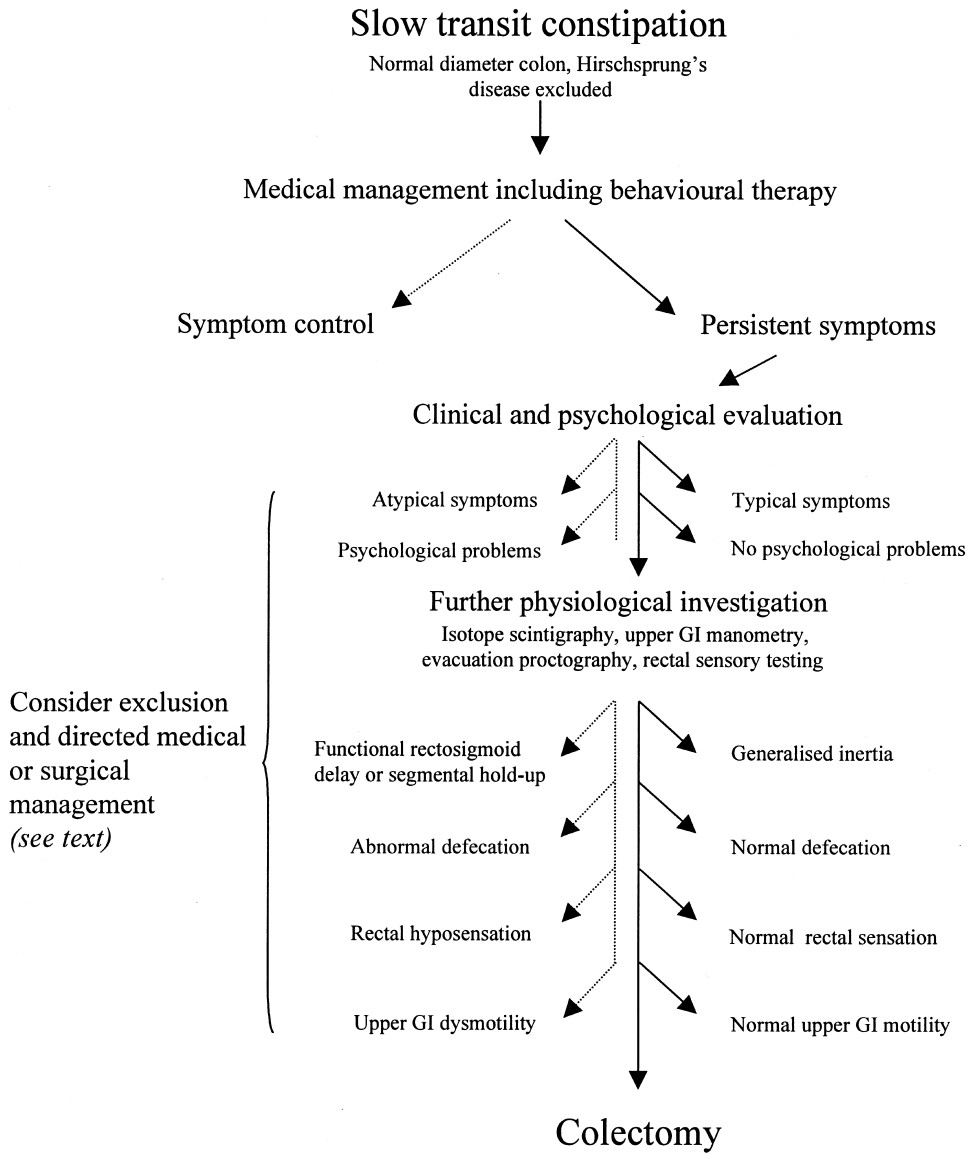

Figure 1. Schematic for the evaluation and selection for colectomy of patients with slow transit constipation, highlighting clinical and physiologic criteria. Dotted line indicates pathways for exclusion; solid line indicates pathways for inclusion.

selected group of patients who fulfill certain clinical and physiologic criteria. Future studies should be directed at further establishing these criteria using a design that has sufficient stratification of patients to allow reasonable interpretation of outcome results. On such a basis, surgery may be directed in a more evidence-based fashion.

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