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Chapter 6

Bowel Dysfunction after Hysterectomy for Benign Conditions: Meta-Analysis and Systematic Review

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http://dx.doi.org/10.5772/65769

Abstract

The aim of this study was to determine whether hysterectomy for a benign indication can cause functional gastrointestinal disorders (FGIDs). A systematic review was completed with the studies, which used a prospective design and validated quality of life questionnaires. A search strategy using Medline and Embase allowed the relevant studies published between 1950 and October 2010 to be found. Meta-analyses were also performed using the studies, which had similar research objectives. The search revealed 29 potentially suitable articles, of which 5 used a prospective design and validated quality of life questionnaires. The meta-analyses showed that the type of hysterectomy (total or subtotal) did not have an impact on whether a patient is likely to develop gastrointestinal symptoms post-surgery. The prospective studies did not show that hysterectomy for a benign indication causes FGIDs. The belief that hysterectomy can cause gastrointestinal dysfunction is based on the results of retrospective studies.

Keywords: gastrointestinal dysfunction, hysterectomy

1. Introduction

Hysterectomy is the most common gynaecological procedure that takes place [1], with approximately 100,000 being performed in the United Kingdom each year [2]. Data from 1992 showed that 20% of the women under 55 in England and Wales had a hysterectomy [3], and in 2000, 30% of women aged between 50 and 59 had the operation [4]. Over 80% of hysterectomies are performed for a benign indication [1, 3]. Symptomatic indications include menorrhagia,

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dysmenorrhoea and common pathologies such as uterine leiomyoma, benign ovarian process and endometriosis [1, 5].

There is controversy over whether hysterectomy can cause functional gastrointestinal disorders (FGIDs). Early reports suggested a transient change in bowel function, constipation and decreased bowel frequency [6, 7] as well as increased straining and firmer stool consistency after hysterectomy [7]. Increased anal incontinence has also been reported when bilateral salpingo-oophorectomy (BSO) was also carried out [8]. Irritable bowel syndrome (IBS) was suggested to occur de novo post-hysterectomy as many women date the onset of their symptoms to the time around their operation [9].

Functional gastrointestinal disorders (FGIDs) refer to combinations of chronic or recurrent gastrointestinal symptoms. These include irritable bowel syndrome (IBS), functional constipation, functional diarrhoea and unspecified functional bowel disorder. The female-to-male ratio for FGIDs in most categories, with the commonest being IBS and functional constipation, is 3–4:1. Symptoms are not persistent, may be intermittent, and could change from one disorder to another. Owing that FGIDs have no pathological markers [10], other methods must be used to make a diagnosis. The Rome criteria and the Manning criteria beforehand have been used to discriminate between the different FGIDs [11]. The Rome criteria, originally established by the Rome Foundation [12], have been suggested to define the FGIDs. Diagnostic guidelines have now been set for 28 adults and 17 paediatric FGIDs [13]. The guidelines are focused on five anatomical regions: oesophageal, gastroduodenal, bowel, biliary and anorectal plus an additional category of chronic abdominal pain syndrome [10].

IBS is thought to present with non-gastrointestinal features including various genitourinary and gynaecological symptoms [10] and has been frequently reported amongst women with chronic pelvic pain [14]. Chronic pelvic pain affects 33–39% of women during their lifetime and for some it is an indication for hysterectomy [15]. Further, IBS sufferers were more likely to have a hysterectomy for pain, with less noticeable improvement in symptoms. Pelvic pain typical of gynaecological origin was not more common in IBS than non-IBS sufferers [15].

When a hysterectomy is performed for benign reasons, the operation is performed mainly to improve a patient's quality of life [16], and thus, the emphasis has been placed on avoiding long-term complications. The aim of this meta-analysis is to quantitatively review the available evidence that linked hysterectomy for benign reasons to FGID. Potential sources of bias will be investigated to establish the cause of controversy in the available literature where possible.

2. Methods

No ethics approval was needed

2.1. Objectives

1. To provide an overview and a quantitative assessment of the available evidence on the effect of abdominal hysterectomy for benign disease on bowel function.

http://dx.doi.org/10.5772/65769

2. To eliminate the potential sources of bias in the methodology of published literature.

3. To suggest a strategy for future research.

2.2. Criteria for including studies for this review

A study was included if it had used a prospective design and a validated gastrointestinal quality of life questionnaire (QoLQ) or used physiological studies to assess bowel function before and after hysterectomy for benign reasons.

2.3. Criteria for excluding studies for this review

A study was excluded if there was a malignant indication for the hysterectomy or if a radical hysterectomy was performed. All retrospective studies and those with incomplete data at baseline and/or at follow-up were not included. The prospective studies that did not use validated QoLQs were also excluded; however, if the used questionnaire was found to be validated later on in subsequent studies, the study was included. All studies that were not published in English were excluded as suitable translators were not available.

2.4. Search strategy for this review

A literature search was conducted for publications between 1950 and October 2010 in Medline and Embase. The search terms used were 'hysterectomy' or 'laparoscopic hysterectomy', or 'vaginal hysterectomy'. These were cross-referenced with, 'constipation', or 'defecation', or 'bowel function', or 'faecal incontinence', or 'gastrointestinal', or 'dysfunction', or 'outcome', or 'irritable bowel syndrome', or 'functional colonic diseases', or 'gastrointestinal motility' and 'manometry', or 'anorectal', or 'anorectal physiology'.

2.5. Data synthesis and heterogeneity

The data included in the meta-analyses were that of three papers, which identified constipation as a possible complication of subtotal and total hysterectomy. The three papers [5, 12, 13] provided data about the number of women who suffered with constipation before and 1 year after having had the hysterectomy. The RevMan (4.2) programme was used to analyse these data. The fixed-effect model was chosen, and odds ratios and confidence intervals were calculated. Clinical heterogeneity was assessed using the χ^2 and I^2 values.

3. Results

The search identified a total of 38 potential studies. Six of these used a prospective design and used validated QoLQs. One of the five studies was reported twice with one [1] and 3 years [8] of follow-up, respectively; therefore, only the 3-year follow-up study has been included in this review. Four prospective studies, which used bowel function physiological assessments both before and after the hysterectomy, were also included. **Figure 1** is a flowchart of the studies

that were included and excluded from this review. **Table 1** is a summary of the prospective studies, which were included in the review, and **Table 2** shows the bowel dysfunction outcome measures and the covariates assessed in each of these studies.

The details of the excluded prospective studies are in **Table 3** [6, 9, 15, 22–25]. One of the prospective studies was published twice, one with results of the 3-year follow-up [26] and the other, the 5-year follow-up [24]. This has been included as one study. There were eight studies that were excluded as they included radical hysterectomy or patients who had the operation due to the malignant causes [27–38].

Seven retrospective studies were excluded [7, 39–45], and two studies were excluded due to not being in English, one in Dutch [46] and the other Chinese [47].

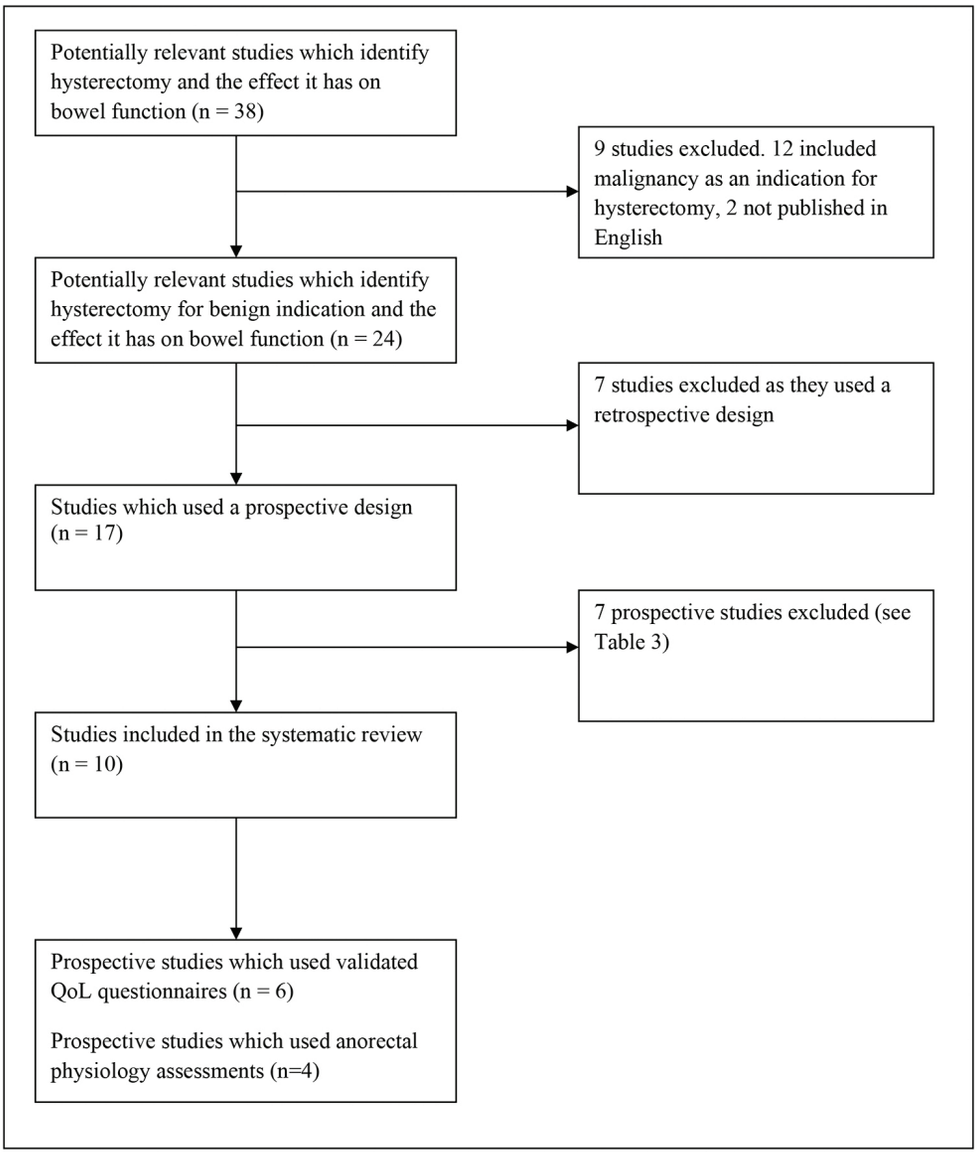


Figure 1. A flow chart to show the included studies.

References	Age range of patients	Type of hysterectomy included	Study and follow-up durations	Sample size at the end of study and drop out rate	Reported outcome
Thakar et al. [5]	29–50 SAH 30–59 TAH	SAH TAH	12 months FU: 6 and 12 months	240 119 SAH 121 TAH 14% drop out	There were no changes in bowel function at the 6- and 12-month follow-ups
Gimbel et al. [12]	47.6 (mean for TAH) 46.6 (mean for SAH)	SAH TAH	12 months FU: 12 months	276 140 TAH 136 SAH 16% drop out	Hysterectomy does not cause de novo constipation in patients. TAH or SAH does not affect this outcome
Gimbel et al. [13]	46.7 (mean TH) 48.2 (mean SH)	TAH, SAH	12 months FU: 12 months	152 64 TAH 88 SAH 18% drop out	Hysterectomy does not cause de novo constipation in patients. TAH or SAH does not affect this outcome
Forsgren et al. [8]	32–78	AH VH	3 years FU: 12 months, 3 years	107 39 VH 52 AH (16 BSO) 11% drop out	Significant increase in anal incontinence in AH patients at 1- and 3-year follow-ups. An increased risk of anal incontinence also associated with a BSO. Significant increase in defecation frequency at both follow-ups in the AH group
Roovers et al. [16]	44 (mean)	TAH, SAH, VH	3 years FU: 3 years	344 158 TAH 91 SAH 85 VH 17% drop out	SAH compared to TAH significantly increased the risk of developing constipation
Lashen et al. [17]	46.5 (mean)	TAH	12 months FU: 6, 12, 24 weeks, 12 months	95 TAH 31% drop out	Transient deterioration in QoL and bowel function at 6 weeks, which improved at 12 weeks, which was sustained at the additional follow-ups Hysterectomy is not associated with a long-term detrimental effect on the bowel
Prior et al. [18]	28–54	VH, AH	6 months FU: 6 weeks, 6 months	26 18 VH 8 TAH 0% drop out	There was a significant increase in rectal sensitivity and decreased threshold volumes required to induce sensations of gas, desire to defecate, urgency and discomfort at both follow-ups
Goffeng et al. [19]	35–66 (45 mean)	SAH TAH	11–18 months	33 21% drop out	Significantly lower rectal volumes before hysterectomy when compared

References	Age range of patients	Type of hysterectomy included	Study and follow-up durations	Sample size at the end of study and drop out rate	Reported outcome
			FU: 3 months, 11–18 months		with controls. Significantly higher threshold post-hysterectomy for eliciting reflex inhibition
Kelly et al. [20]	30–64	AH VH	16 weeks FU: 16 weeks	30 16 AH 14 VH 0% drop out	Significant decrease in the forced voluntary contraction anal pressure in women who had more than five vaginal deliveries
Bharucha et al. [21]	25–66	VH	12 months FU: 2 months, 12 months	19	Post-hysterectomy no difference in anal pressures, rectal compliance and capacity compared to pre-op At 12 months, there was increased rectal contractile response, but clinical significance is uncertain Transient change in the desire to defecate at 2 months, which returned back to baseline (pre-hysterectomy) at 12 months Reduced perception of urgency at 12 months

TAH: total abdominal hysterectomy; SAH: subtotal abdominal hysterectomy; VH: vaginal hysterectomy; AH: abdominal hysterectomy; FU: follow-up.

Table 1. Characteristics of the prospective studies which used validated questionnaires or anorectal physiology.

References	Bowel function primary or secondary	Main outcome measures	Covariates identified
Thakar et al. [5]	Secondary	Constipation, hard stools, straining to move bowels, use of laxatives, urgency, incontinence of flatus	No details were given
Gimbel et al. [12]	Secondary	Constipation	No details were given.
Gimbel et al. [13]	Secondary	Constipation	No details were given
Forsgren et al. [8]	Primary	Bowel-emptying difficulties, daily incomplete bowel evacuation, daily digitation and defecation frequency The CCIS looked specifically at solid incontinence, liquid incontinence and gas incontinence, whether the sufferer wears a pad or has had any lifestyle alterations	Parity, number vaginal deliveries, delivery of a child >4000 g, vaginal laceration at delivery, HRT after hysterectomy, BMI at surgery and at follow-up, concomitant BSO at time hysterectomy Previous obstetric sphincter injury and increased age were significantly

References	Bowel function primary or secondary	Main outcome measures	Covariates identified
			associated with increased post-operative anal incontinence
Roovers et al. [16]	Primary	Constipation both de novo and persistent	Age, BMI, parity, history of abdominal surgery, comorbidity, menorrhagia, metrorrhagia, abdominal pain, dysmenorrhoea, fibroma present on ultrasound, maximal diameter of uterus. History of abdominal surgery significantly increased the risk of development of constipation. None of these were discovered to significantly increase the risk the persistence of constipation
Lashen et al. [17]	Primary	Gastrointestinal symptoms covering a range including abdominal pain, flatus, reflux, diarrhoea, constipation, dysphagia and nausea A self-reported health-related QoL questionnaire was also used	Smoking and laxative use
Prior et al. [18]	Secondary	Maximum anal basal pressure Lowest rectal volume needed to produce sensations of gas, desire to defecate, urgency of defecation, discomfort Rectal compliance Rectal motility index	Details from patients records were compared to the bladder urethrovesical physiology studies and not the anorectal bowel studies
Goffeng et al. [19]	Primary	Gastrointestinal transit time Resting, anal squeeze, first sensation and urge pressures Rectoanal inhibitory reflex Rectal volumes	The weight of the uterus did not affect rectal volume, gastrointestinal transit time
Kelly et al. [20]	Primary	Mean resting pressure Maximal pressure generated by forced voluntary contraction of external anal sphincter Presence/absence of recto-anal inhibitory reflex Rectal sensation Lowest volume to produce a sensation of gas and desire to defecate	Age, this showed a significant negative correlation with mean resting anal pressure More than five vaginal deliveries which caused a significant reduction in the forced voluntary contraction anal pressure
Bharucha et al. [21]	Primary	Anal pressures, anal squeeze and balloon expulsion Rectal pressure, volume, compliance and capacity Sensory thresholds for first sensation, desire to defecate and urgency	No details were given

Table 2. Bowel dysfunction outcome measures (primary or secondary) and the covariates assessed in the studies included in this systematic review.

References	Age range of patients	Type of hysterectomy included	Length study and follow-up times	Sample size at the end of study, drop out rate	Reason for exclusion/ questionnaire used	Bowel changes found
Longstreth et al. [15]	43.0 (mean)	Not mentioned	1 year FU: 1 year	164 5% drop out	The questionnaire used has no reference to another article and no mention of validity	IBS sufferers were more likely to have a hysterectomy due to the pain. The numbers of IBS sufferers before and after the operation were similar
Prior et al. [9]	27–75	VH AH	6 months FU: 6 weeks and 12 months	191 7% drop out	The questionnaire used was based on one used in a previous study. The questionnaire was pretested on patients and controls to check accuracy. No mention of validation	There was a significant decrease in non-IBS pain post-hysterectomy. There was the same number of women who had IBS before and after the hysterectomy. The majority of de novo cases were constipation predominant IBS
Clarke et al. [6]	<30–>55	Not mentioned	3 months FU: 10 days, 6 weeks, 3 months	300 18% drop out	Questionnaires based on evidence from published studies, on information from 35 interviews (some awaiting surgery, others having undergone hysterectomy) and on the advice of a clinician. No mention of validity tests done on the questionnaire	Significant decrease in bowel function at 10 days, with more women describing themselves as constipated. This, however, returned to pre-operative status at 6 weeks
Weber et al. [22]	45.5 (mean)	TAH	14.2 months (mean)FU: 1 year	43 17% drop out	No reference was given for the questionnaire used, no mention of validation.	No significant changes with regard to frequency, straining, bloating and pain. Laxative use became a new problem in 12/23 women and was statistically significant
Kluivers et al. [23]	49.9 (mean LH) 48.1 (mean AH)	AH LH	1 year FU: 12 weeks, 1 year	67 35 LH 32 AH 11% drop out	The DDI was used a Dutch validated questionnaire. The article did not give information on bowel symptoms at baseline	LH and AH did not affect bowel function at the 1-year follow-up
Farquhar et al. [24]	<30–45 years (lowest age not clarified)	Those who had at the conservation	5 years FU: yearly for 3 and 5 year FU	135 47% drop out: 36% lost to follow-up	The questionnaire had been piloted on twenty women which had led to some changes being made. There is no	After 5 years, there were no differences in bowel symptoms before and after hysterectomy

References	Age range of patients	Type of hysterectomy included	Length study and follow-up times	Sample size at the end of study, drop out rate	Reason for exclusion/ questionnaire used	Bowel changes found
		of at least one ovary. Not specified		11% as they went through the menopause and were excluded	clarification as to whether the questionnaire was validated	
Khoshbaten M et al. [25]	47.14 (mean) ± 6.17 years	Not specified	1 year FU: 3 monthly up until 1 year	172 Implied no drop out but not explicitly written	Used a standardised questionnaire based on the Rome II criteria. No mention of validation	IBS confirmed in 8% of the hysterectomy patients at 12 months. No information is given about the symptoms at the various time points

TAH: total abdominal hysterectomy; VH: vaginal hysterectomy; AH: abdominal hysterectomy; LH: laparoscopic hysterectomy.

Table 3. The excluded prospective studies which identified benign reasons for hysterectomy.

3.1. Studies included in the meta-analyses and heterogeneity assessment

Of the five prospective studies which used validated questionnaires, there were only three [5, 12, 13], which had similar features and allowed meta-analyses to be conducted; all used constipation as one of their main outcome measures and published data regarding constipation symptoms in women before and 1 year after total abdominal hysterectomy and subtotal abdominal hysterectomy. These can be found in **Figures 2** and **3**, respectively. A meta-analysis could not be performed on the studies, which used anorectal physiology techniques to assess bowel function [18–20] as they all used different outcome measures. There was no statistical heterogeneity amongst the studies included in the meta-analyses. An I^2 value for both the total and the subtotal hysterectomy was $I^2 = 0$.

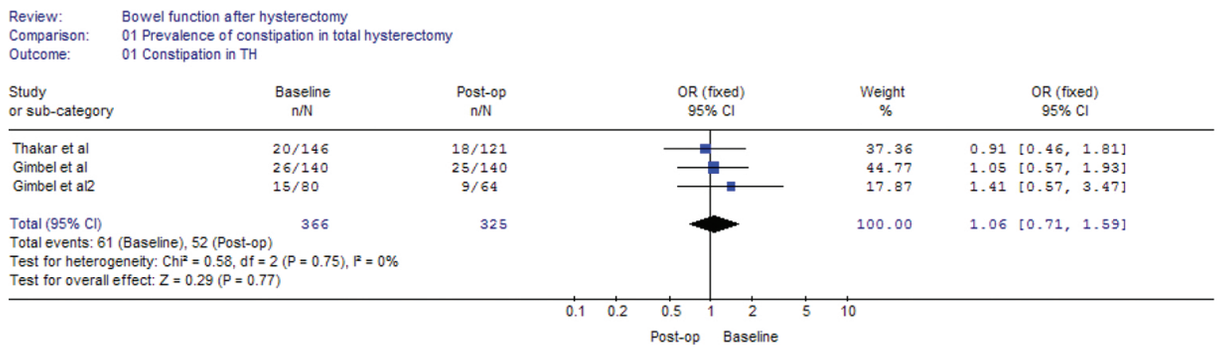


Figure 2. Constipation used as an indicator of bowel function before and after total hysterectomy. Gimbel et al. 2 refers to the Gimbel et al. study of 2005.

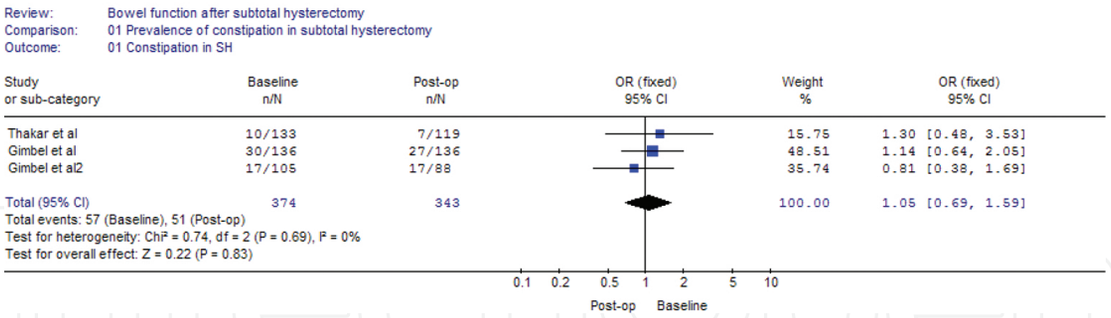


Figure 3. Constipation used as an indicator of bowel function before and after subtotal hysterectomy. Gimbel et al. 2 refers to the Gimbel et al. study of 2005.

3.2. The results of the meta-analyses

There were three studies, which were included in the meta-analyses. The odds ratios and 95% confidence intervals show that for both the total and subtotal abdominal hysterectomy, there was no statistically significant increase in the prevalence of constipation or related symptoms after a hysterectomy. The results for total abdominal hysterectomy were OR 1.06, 95% CI 0.71–1.59 (**Figure 2**) and for subtotal abdominal hysterectomy OR 1.05, 95% CI 0.69–1.59 (**Figure 3**). The studies were homogeneous, see **Figures 2** and **3**.

4. Discussion

Linking hysterectomy to bowel symptoms was first suggested in 1988 [41]. Several supportive retrospective studies followed, which had strong effect on the belief that hysterectomy caused bowel dysfunction. The first prospective study was published in 1990 [15]. Retrospective studies have several limitations most prominent of which is the lack of pre-operative assessment.

The earlier prospective studies were completed in 1992 by Prior et al. [9, 18]: one linking IBS and hysterectomy using a non-validated questionnaire [9] and the other used anorectal physiology techniques [18]. Longstreth et al. [15], Clarke et al. [6], Weber et al. [22] and Farquhar et al. [24] all used non-validated quality of life questionnaires and reported no association between hysterectomy and any change in bowel function. A prospective study excluded from the review [23] used validated questionnaire but offered no pre-operative bowel function assessment. Two retrospective studies used anorectal physiology reporting significant changes post-hysterectomy in one [44] but not in the other [41]. Of the retrospective studies excluded, four used validated questionnaires [7, 40, 42, 45]. They all showed bowel changes after hysterectomy. One retrospective study published used a non-validated questionnaire and reported that those who had vaginal or laparoscopic hysterectomy had a 200% increase in obstructive defecation risk [44].

Irrespective of questionnaire validation, their use has generally been criticised due to the subjective nature of such method. Further, it could be argued that using anorectal physiology

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tests offers objectivity; however [12] unless the patient is symptomatic, the results of such tests are of academic value which was evident in the study by Prior et al. [18]. A prospective design raises issues surrounding follow-up frequency and duration. A longer follow-up period enhances the sensitivity of symptom detection at the expense of specificity unless the symptoms can be dated back to shortly post-hysterectomy. However, a long follow may be better suited when control groups are used. When the patient is used as their own control, a long follow-up is only useful in determining the prognosis of those in whom pathology has been detected. Follow-up duration offers logistic challenges as the participants may not be contactable and their interest in the study may fade. The frequency of administering the assessment tool is important and is subject to the objectives of the study.

Increasing the frequency in the first year offers a better view of the changes in bowel function during convalescence and beyond. The design of the prospective study influences the evidence it yields. Accordingly, longitudinal cohort studies where the patient is her own control can link the operation to bowel dysfunction, while the observational controlled longitudinal studies offer mechanistic explanations.

This review has emphasised the lack of prospective studies using validated bowel function-specific QoLQ to assess bowel function after hysterectomy. The weight of evidence supports that hysterectomy does not increase the prevalence of bowel dysfunction. Of the seven suitable prospective studies which used validated questionnaires, Forsgren et al. found a significant increase in anal incontinence at 1 and 3 years [8], and Roovers et al. suggested an increased risk of constipation after subtotal compared to total hysterectomy [16]. Lashen et al. used three validated QoL questionnaires to provide a holistic assessment of the patients' QoL as well as their bowel symptoms. A transient worsening of bowel symptoms was noted at the 6-week follow-up, but this resolved by 12 weeks and there was no further deterioration noted at subsequent follow-ups [17]. The anorectal physiology studies were conflicting: two studies reporting significant changes after hysterectomy [18, 19] one reported changes only in the women who had more than five vaginal deliveries, [20] and the other found only subtle effects on anorectal sensorimotor functions [21].

Thakar et al. used a randomized double-blind trial to compare the effects of total abdominal hysterectomy (TAH) and subtotal abdominal hysterectomy (SAH). They reported no post-operative change in bowel function irrespective of the method used or other operative variables [5]. The questionnaire they used was referenced to previous work [40] that referred to an earlier study [48], finally leading to an article that was published in 1978 [49]. Although the questionnaire was validated at some point, it was designed before the Rome II criteria were established. Other studies used the same questionnaire [12, 13]. Gimbel et al. (2003) randomised patients into TAH and SAH and reported no significant increase in constipation irrespective of the type of hysterectomy [12, 13]. However, there was a non-significant decrease in constipation reporting among SAH patients (20% pre-operatively to 14% post-operatively).

Others reported increased anal incontinence at 1 and 3 year after TAH [8]. Further, a significant increase in anal incontinence was also reported with concomitant BSO at 1 year, but the numbers decreased by the third year. The vaginal hysterectomy group had an increase in anal incontinence at 3 years only, but no complete incontinence. Analysing the patients' demo-

graphic data revealed that previous obstetric sphincter injury and increased age were associated with the observed increased risk of post-hysterectomy anal incontinence [8]. They published the 1-year follow-up of the same study separately [1], and this was not included in the meta-analysis. They used two questionnaires: the first had been developed by the Swedish Society of Colorectal Surgeons and the second used an index based on the Cleveland Clinic Incontinence Score, which measured the severity of faecal incontinence using an analogue scale [8].

Roovers et al. used strict definition criteria to investigate the development of de novo post-hysterectomy constipation that persisted for the duration of the study's follow-up period. At the 3-year mark, only 2% of the TAH patients developed de novo constipation, while those who had SAH reported a higher rate of constipation which persisted in half the patients who reported pre-operative constipation [16]. The Defecation Distress Inventory (DDI) was collaborated after studying the literature and international definitions, interviewing sufferers of constipation and faecal incontinence and by interviewing three specialists in surgery, and obstetrics and gynaecology.

The anorectal physiology studies were also of importance in this systematic review. Some studies assessed the patients' symptoms [18, 19, 21]. Prior et al. revealed significant changes in the anorectal physiology tests, but did not uncover any changes in gastrointestinal symptoms [18]. Goffeng et al. used interviews and uncovered some significant findings, for example, a decrease in abdominal pain and dyspareunia post-operatively, but were not associated with any changes discovered in the physiology tests [19]. Constipation was not assessed using a specific definition, but was dependent on the participant's subjective recollection. It is imperative to clarify that although gaining an insight into patients' symptoms is important, there was no indication in either study to the validity of the methods used to gain these data.

Kelly et al. did not detect any changes in the mean resting anal pressure after hysterectomy, but forced voluntary contraction anal pressure was significantly lower at 4-month post-operatively. They assigned that to having more than five vaginal births. The mean forced voluntary contraction pressure was significantly lower in these women compared to those who had undergone <5 deliveries. The number of deliveries did not affect the mean resting or maximal forced voluntary contraction pressures. Other physiology tests were not affected by hysterectomy [20]. Bharucha found increased rectal stiffness at 12 months post-hysterectomy, but its significance was uncertain and a reduced perception of rectal urgency at 12 months, which was not statistically significant. A validated bowel symptoms questionnaire was used, but there are not much data published as to the results of the questionnaire [21]. All the anorectal physiology studies [18–20] had small numbers of participants, ranging from 19 to 33 which is under representative of the population. The numbers are small, which could indicate a lack of representation.

Goffeng et al. used interviews as well as the anorectal physiology methods comparing the patients to themselves and a control group. No significant differences were observed for the resting and anal squeeze pressures when hysterectomy patients were compared with the controls, and when pre-operative and post-operative findings were compared. Rectal volumes were significantly lower in the hysterectomy patients before and after the operation compared

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to controls and were not influenced by the uterine weight. Higher thresholds for provoking reflex inhibition were reported in hysterectomy patients post-operatively. There were no significant changes in gastrointestinal transit time or between the total and subtotal hysterectomy group findings [19].

Gimbel et al. [12] and Thakar et al. [5] randomised the women in their studies to total or subtotal abdominal hysterectomy, thus allowing the comparison of the outcomes of the two procedures [5, 12]. It was argued that the lack of blinding and non-randomisation was likely to overestimate the intervention effect, in this case the type of hysterectomy [12].

Roovers et al. and Forsgren et al. had the longest follow-up of 3 years [8, 16]; however, Roovers et al. did not address the ovary status; therefore, it is difficult to verify if oophorectomy had any effect on the risk of incontinence as reported by Forsgren et al. Both studies analysed the impact of patients' demography on the studies' outcomes, which lacked in previous work [5, 12, 13]

The findings of the study by Forsgren et al. were unique in that it was the first study to identify a relationship between hysterectomy and anal incontinence. There are no obvious reasons or underlying mechanisms; however, the type of questionnaire used may explain their findings; until their findings are verified, they should be interpreted with caution [8]. The validity of the questionnaire used by Thakar et al. is also in question as it was developed after the Rome II criteria [5].

The meta-analyses findings used Forrest plots to identify whether constipation was likely to occur after hysterectomy in subtotal and total abdominal hysterectomy. It was evident that the prevalence of constipation did not change post-operatively indicating that hysterectomy did not increase the risk of constipation as previously suggested. Further, the three studies [5, 12, 13] that were included in this meta-analysis comprised more than 300 patients, which is bigger than any individual prospective studies, thus providing a reliable evidence.

Seven prospective studies were excluded for not using validated questionnaires in six studies [6, 15, 18, 22, 24, 25], and the sixth was excluded as they [23] did not give any pre-operative details about bowel function despite using a validated questionnaire (the DDI). Using a validated questionnaire is essential for this type of studies so that the predictive value and reproducibility of the research tools are known; otherwise, the methodology would be flawed. The details of the excluded studies are given in **Table 3**.

All post-radical hysterectomy studies and those in which hysterectomy was carried out for malignancy totalling 12 studies were excluded. Of these studies, six used a prospective design [28, 29, 33, 34, 36, 38] and one used anorectal physiology techniques to assess reporting positive findings after the operation [29]. Barnes et al. also included anorectal physiology techniques and found post-operative changes in all their participants [33]. Pieterse et al. reported that radiotherapy did not affect colorectal motility and that radical hysterectomy had a negative impact on diarrhoea symptoms when compared to controls [27]. The study by Guthrie et al. made conclusions based on the hysterectomy group as a whole. They did not discuss the hysterectomy group who had the operation performed for malignancy separately from those who had the procedure for a benign indication [34]. Veirhout et al. described two case reports

of patients who suffered with severe slow-transit constipation that responded only to left-sided hemicolectomy [32]. Three of the studies used a retrospective design and found that radical hysterectomy induced bowel problems including constipation [28, 31], defecation problems [30], prolonged straining and increased use of laxatives [31].

The rationale for excluding such studies was that radical surgery is likely to be associated with a higher risk of damage to surrounding nerves and pelvic floor. Nerve sparing techniques used with radical hysterectomy have been found to significantly improve morbidity post-op compared to those who had no nerve sparing [35, 36]. Further, those who had a malignancy may also receive adjuvant radiotherapy therapy, which can affect the bowel function and pelvic vasculature. Moreover, there is consistent evidence indicating that cancer along with its therapy and the uncertain future pertinent to it are associated with depression and anxiety potentially leading to psychological problems, which can persist even after successful treatment [50]. These factors in turn are likely to impact on the bowel function [51].

Due to the small numbers of studies that were available for this meta-analysis, it was not possible to produce a funnel plot to assess the publication bias. However, the publication bias is generally speaking inevitable as the studies reporting positive findings are more likely to hit the press. Further, there was evident homogeneity in the included studies supporting the overall effect.

5. Conclusion

Overall, the controversy over whether hysterectomy causes bowel dysfunction stems mainly from the retrospective studies. The weight of evidence in the prospective studies favours that hysterectomy has no effect on bowel function; however, the physiological studies suggest post-operative changes that are not enough to cause symptoms. Future research should incorporate different designs and incorporate both symptomatic assessment using disease-/organ-specific QoL questionnaires and anorectal physiology, so that a global view could be obtained.

Abbreviations

AH	Abdominal hysterectomy
FU	Follow-up
QoLQ	Quality of life questionnaire
SAH	Subtotal abdominal hysterectomy
TAH	Total abdominal hysterectomy
VH	Vaginal hysterectomy

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