

## Bibliography:

### Significant Pelvic Floor Papers from the Unit since 2000.

1. BMJ. 2011; 342: (published 1<sup>st</sup> February 2011)

The assessment and management of rectal prolapse, rectal intussusception, rectocele and enterocele in adults. (clinical review)

Jones OM, Cunningham C, Lindsey I.

2. Colorectal Dis. 2011 Feb;13(2):121-2. doi: 10.1111/j.1463-1318.2010.02540.x.

Laparoscopic colorectal surgery: the end of the beginning.

Cunningham C, Lindsey I.

3. Surg Endoscopy. 2010 Dec 8. [Epub ahead of print]

Controversy in the treatment of symptomatic internal rectal prolapse: suspension or resection?

Festen S, van Geloven AA, D'Hoore A, Lindsey I, Gerhards MF.

4. Gastroenterol Clin Biol. 2010 Nov;34(11):584-6. Epub 2010 Nov 3.

The emerging role of internal rectal prolapse in the aetiology of faecal incontinence.

Collinson R, Harmston C, Cunningham C, Lindsey I.

5. Neurogastroenterol Motil. 2011 Feb;23(2):151-4, e30. doi: 10.1111/j.1365-2982.2010.01625.x. Epub 2010 Nov 26.

Rectal hyposensitivity is uncommon and unlikely to be the central cause of obstructed defecation in patients with high-grade internal rectal prolapse.

Wijffels NA, Angelucci G, Ashrafi A, Jones OM, Cunningham C, Lindsey I.

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#### Abstract

BACKGROUND: There are several causes of obstructed defecation one of which is thought to be internal rectal prolapse. Operations directed at internal prolapse, such as laparoscopic ventral rectopexy, may improve obstructed defecation symptoms significantly. It is not clear whether the obstructed defecation with internal

prolapse is a mechanical phenomenon or whether it results changes in rectal sensitivity. This study aimed to evaluate rectal sensory function in patients with obstructed defecation and high-grade internal rectal prolapse. METHODS: This study represents a retrospective review of a prospectively collected database of patients attending a tertiary referral pelvic floor unit. Patients with high-grade (recto-anal) intussusception formed the basis of this study. Rectal sensory function was determined by intrarectal balloon inflation. Three parameters (sensory threshold, urge to defecate and maximum tolerated volumes) were recorded. Abnormal sensitivity was defined as partial (one or two parameters abnormal) or total (all three abnormal).

KEY RESULTS: Four hundred and eight patients with high-grade internal rectal prolapse both with and without obstructed defecation symptoms were studied. Two hundred and forty one (59%) had normal sensation. Eighteen (4%) had total hyposensitivity and three (1%) total hypersensitivity. A further 96 (24%) had partial hyposensitivity whilst 50 (12%) had partial hypersensitivity. Neither hypersensitivity nor hyposensitivity differed between patients with and without symptoms of obstructed defecation.

CONCLUSIONS & INFERENCES: Rectal hyposensitivity is relatively uncommon in patients with high-grade internal rectal prolapse and obstructed defecation. Internal rectal prolapse may cause obstructed defecation through a mechanical process. It does not appear that rectal hyposensitivity plays a significant part in the pathological process.

6. Colorectal Dis 2010 Oct 19. doi: 10.1111/j.1463-1318.2010.02455.x. [Epub ahead of print]

Isolated colonic inertia is not usually the cause of chronic constipation.

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#### Abstract

Introduction: Chronic constipation is classified as outlet obstruction, colonic inertia or both. We aimed to determine the incidence of isolated colonic inertia in chronic constipation and to study symptom pattern in those with prolonged colonic transit time. Methods: Chronic constipation patients were classified radiologically by surgeon-reported defaecating proctography and transit study into four groups: isolated outlet obstruction, isolated colonic inertia, outlet obstruction plus colonic inertia or normal. Symptom patterns were defined as stool infrequency (twice weekly or less) or frequent unsuccessful evacuations (more than twice weekly). Results: Of 541 patients with chronic constipation, 289 (53%) were classified as isolated outlet obstruction, 26 (5%) isolated colonic inertia, 159 (29%) outlet obstruction plus colonic inertia and 67 (12%) normal. Of 448 patients (83%) with outlet obstruction, 35% had additional colonic inertia. Only 14% of those with prolonged colonic transit time had isolated colonic inertia. Frequent unsuccessful evacuations rather than stool infrequency was the commonest symptom pattern in all three disease groups, (isolated outlet obstruction 86%, isolated colonic inertia 54% and outlet obstruction plus colonic inertia 63%). Conclusion: Isolated colonic inertia is an unusual cause of chronic constipation. Most patients with colonic inertia have associated outlet obstruction. These data question the clinical significance of isolated colonic inertia.

7. Colorectal Dis 2010 Sep 22. doi: 10.1111/j.1463-1318.2010.02422.x. [Epub ahead of print]

What causes chronic idiopathic perineal pain?

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#### Abstract

Aim: Chronic idiopathic perineal pain (CIPP) is poorly understood. Underlying structural abnormalities have been clinically suspected but rarely demonstrated objectively. The condition has been frequently considered to be a psychological disorder. We aimed to evaluate how commonly a structural explanation for such pain symptoms is identified. Method: Patients seen in a pelvic floor clinic with severe chronic functional anorectal pain classified as CIPP (study group) were prospectively registered on a pelvic floor database and underwent

pelvic floor work up (defaecating proctography, anorectal physiology, anal ultrasound +/- rectal examination under anaesthetic). A control group was formed by patients with obstructed defaecation with or without faecal incontinence with advanced posterior compartment prolapse. Results: Of fifty nine patients with CIPP (80% female, mean age 53, range 22-84 years) representing 5% of all pelvic floor presentations, 33 (56%) had CIPP alone and 26 (44%) CIPP with obstructed defaecation. Thirty five (59%) had an underlying high grade internal rectal prolapse (73% CIPP+obstructed defaecation vs CIPP alone 48%,  $p<0.05$ ). Anorectal pain was present in 50% of 543 controls with advanced posterior compartment prolapse. Conclusion: High-grade internal rectal prolapse commonly underlies CIPP, particularly when obstructed defaecation is present. Chronic anorectal pain is a common under-recognised subsidiary symptom in patients with advanced posterior compartment prolapse presenting primarily with obstructed defaecation or faecal incontinence.

8. Colorectal Dis. 2010 Aug;12(8):729-30.

Conservatism in perineoproctology.

Lindsey I.

9. Colorectal Dis 2010 Jun;12(6):512-4.

Commentary: Best practice in rectal prolapse.

Lindsey I.

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Comment on:

- Colorectal Dis. 2010 Jun;12(6):515-25.
- Colorectal Dis. 2010 Jun;12(6):504-12.

10. ANZ J Surg. 2010 Apr;80(4):205-7.

Paradigm shifts in the management of faecal incontinence.

Jones OM, Cunningham C, Lindsey I.

11. Colorectal Dis. 2010 May 17. [Epub ahead of print]

A contraction response of the internal anal sphincter to Botulinum toxin: Does low-pressure chronic anal fissure have a different pathophysiology?

Lindsey I, Jones OM, Cunningham C.

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## Abstract

**ABSTRACT** Background: A subset of low-pressure fissure is not associated with typical internal anal sphincter hypertonia and may involve a different pathophysiological mechanism. We aimed to assess the manometric response of the internal anal sphincter to botulinum toxin in low compared to high pressure fissures. Method: Twenty five units of botulinum toxin (Botox(TM)) were injected directly into the internal anal sphincter. Maximum resting pressure (MRP) and maximum squeeze increment (MSI) were documented at baseline and 4 weeks after injection. Results: Nine (31%) of 29 patients had a low pressure fissure. Those with an anterior fissure had a significantly lower median baseline MRP than those with a posterior fissure (66 vs 83 mmHg,, p = 0.009). Significantly more patients with low pressure fissure developed a contraction or no response (78% vs 30%, difference 48%, 95% CI 14%-82%, p = 0.006). Those developing a contraction response had a lower mean baseline MRP than those developing a relaxation response (56 vs 86 mmHg, difference 30mmHg, 95% CI 17% to 43%, p < 0.001). Conclusion: Botulinum toxin appears to have an atypical contraction effect on the internal anal sphincter in low pressure (usually anterior) fissure. This may be accounted for blockade of acetylcholine released at parasympathetic nerve terminals and at the sympathetic ganglion (relaxation). Low pressure may be physiologically different from high pressure fissure.

12. Colorectal Dis. 2010 Mar 21. [Epub ahead of print]

The relationship between internal rectal prolapse and internal anal sphincter function.

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## Abstract

**ABSTRACT** Aim: Faecal incontinence is commonly seen in patients with internal rectal prolapse, though the mechanism is not clear. This study assessed the relationship between internal rectal prolapse and anal sphincter function. Methods: Patients with both internal rectal prolapse diagnosed on proctography and those with external rectal prolapse were identified from a prospective database generated from a tertiary referral pelvic floor clinic. The results of anorectal manometry results were analysed and the relationship between sphincter pressure and grade of prolapse was assessed. Results: A total of 515 patients were identified with clinical evidence of external rectal prolapse or proctographic evidence of internal and external prolapse. There were 88 with grade 5 or external prolapse [mean maximum resting pressure 28.5 (standard error 2.1) mmHg], 156 with grade 4 prolapse [44.0 (1.8) mmHg ], 153 with grade 3 prolapse [49.2 (1.6) mmHg], 88 with grade 2 prolapse [56.2 (2.1) mmHg] and 29 patients with grade 1 rectal prolapse [56.8 (4.5) mmHg]. There was a significant reduction in the mean maximum resting pressure with increasing grade of prolapse from grade 2 to 5. By contrast, there was no relationship between prolapse grade and mean maximum squeeze pressure, except in patients with ERP in whom the squeeze pressure was significantly lower compared with patients with IRP. Conclusion: This is the first large scale study to show the relationship between internal prolapse and maximum resting pressure. The observation that squeeze pressure is unchanged suggests that the effect of internal prolapse on continence occurs mainly through a reduction of internal anal sphincter tone.

13. Colorectal Dis. 2010 Feb 20. [Epub ahead of print]

LAPAROSCOPIC ANTERIOR RECTOPEXY FOR EXTERNAL RECTAL PROLAPSE IS SAFE AND EFFECTIVE IN THE ELDERLY. DOES THIS MAKE PERINEAL PROCEDURES OBSOLETE?

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## Abstract

**ABSTRACT Objective:** To assess the safety of laparoscopic ventral rectopexy in elderly patients, compared with perineal approaches. **Background:** Perineal approaches are considered to be the "gold standard" in treating elderly patients with external rectal prolapse (ERP) because morbidity and mortality are lower compared with trans-abdominal approaches. Higher recurrence rates and poorer function are tolerated as a compromise. **Method:** The prospectively collected databases from two tertiary referral pelvic floor units were interrogated to identify outcome in patients of 80 or more years of age with full thickness ERP treated by laparoscopic ventral rectopexy. Primary end-points were age, ASA-grade, mortality, major and minor morbidity. Secondary end points were length of stay (LOS) and recurrence. **Results:** Between January 2002 and December 2008, 80 (median age 84 (80-97) years) patients underwent rectopexy. The average ASA grade was 2.44 (sd +/- 0.57) [ASA I(2), II(42), III(35), IV(1)]. The median LOS was 3 days (range 1-37). There was no mortality and 10 (13%) patients had complications (1 major and 9 minor). At a median follow up of 23 (2 - 82) months, two (3%) patients developed a recurrent full thickness prolapse. **Conclusion:** Laparoscopic ventral rectopexy is safe to treat full-thickness ERP in elderly patients. Mortality, morbidity and hospital stay are comparable with published rates for perineal procedures, with a tenfold lower recurrence.

14. Br J Surg 2010 Feb;97(2):167-76.

Randomized clinical trial of symptom control after stapled anopexy or diathermy excision for haemorrhoid prolapse.

Nyström PO, Qvist N, Raahave D, Lindsey I, Mortensen N; Stapled or Open Pile Procedure (STOPP) trial study group.

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Comment in:

- Br J Surg. 2010 Jun;97(6):961; author reply 961-2.

**Abstract**

**BACKGROUND:** : This multicentre randomized clinical trial studied how symptoms improved after either stapled anopexy or diathermy excision of haemorrhoids.

**METHODS:** : The study involved 18 hospitals in Sweden, Denmark and the UK. Some 207 patients were randomized to either anopexy or Milligan-Morgan haemorrhoidectomy, of whom 90 in each group were operated on. Patients reported symptoms before surgery and after 1 year. Daily postoperative pain scores were recorded in a patient diary. Surgeons evaluated the anal anatomy before surgery and after 1 year.

**RESULTS:** : Correction of prolapse in the anopexy and haemorrhoidectomy groups was similar at 1 year (88 and 90 per cent respectively;  $P = 0.80$ ). Freedom from symptoms was obtained in 44 and 69 per cent respectively ( $P = 0.002$ ). Stapled anopexy was associated with less postoperative pain, which resolved more quickly ( $P = 0.004$ ). Significant improvements were noted in anal continence and well-being 1 year after both operations ( $P < 0.001$ ). Excessive pain was the most common complication after diathermy excision and disturbed bowel function after stapled anopexy.

**CONCLUSION:** : Haemorrhoidal prolapse was corrected equally by either operation. Diathermy haemorrhoidectomy gave better symptom relief but was more painful. Neither operation provided complete cure but well-being was greatly improved. Registration number: ISRCTN68315343 (<http://www.controlled-trials.com>).

15. Colorectal Dis. 2009 Feb;11(2):203-7. Epub 2008 May 3.

Botulinum toxin reduces anal spasm but has no effect on pain after haemorrhoidectomy.

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#### Abstract

**OBJECTIVE:** Pain following haemorrhoidectomy is due to a combination of factors including spasm of the internal sphincter, an open wound and local infection. In this study, we investigated the effect of botulinum toxin on postoperative pain following Milligan-Morgan haemorrhoidectomy.

**METHOD:** A prospective randomized controlled trial was conducted in 32 patients undergoing haemorrhoidectomy. Routine postoperative care included metronidazole and bupivacaine. Patients were also given an inter-sphincteric injection of either placebo or botulinum toxin (150 units). Maximal resting pressure (MRP) and maximal squeeze pressure (MSP) were measured postoperatively. A linear analogue score was used to assess postoperative pain. The sample size calculation was calculated to show one standard deviation difference between groups. The primary endpoint was reduction in postoperative pain.

**RESULTS:** The MRP was significantly lower in the botulinum toxin group (mean 50.5 mmHg; 95% CI 39.77-61.23) compared with the placebo group (mean 64.94 mmHg; 95% CI 55.65-74.22) ( $P = 0.04$ ) at week 6. At week 12 there was no significant difference in MRP between the two groups. In contrast MSP was significantly lower in the botulinum toxin group at weeks 6 and 12 (mean 87.1 mmHg; 95% CI 66.9-107.1) compared with the placebo group (mean 185.8 mmHg; 95% CI 134.2-237.4) at week 12 ( $P = 0.0014$ ). There was no significant effect on overall or maximal pain scores. Median time for return to normal activities was not significantly different between groups.

**CONCLUSION:** Botulinum toxin reduces anal spasm but has no significant effect on postoperative pain.

16. *Colorectal Dis.* 2009 Jan;11(1):11-2. Epub 2008 May 3.

Surgery for internal rectal prolapse.

Collinson R, Cunningham C, Lindsey I.

Colorectal Pelvic Floor Service, Department of Colorectal Surgery, Oxford, UK.

Comment in:

- *Colorectal Dis.* 2009 May;11(4):430.

17. *Colorectal Dis.* 2009 Jan;11(1):77-83. Epub 2008 Apr 28.

Rectal intussusception and unexplained faecal incontinence: findings of a proctographic study.

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#### Abstract

**BACKGROUND:** The aetiology of faecal incontinence is multifactorial, yet there remains an approach to assessment and treatment that focusses on the sphincter. Rectal intussusception (RI) is underdiagnosed and manifests primarily as obstructed defecation. Yet greater than 50% of these patients admit to faecal incontinence on closer questioning. We aimed to evaluate the incidence of RI at evacuation proctography selectively undertaken in the evaluation of patients with faecal incontinence.

**METHOD:** Patients with faecal incontinence seen in a pelvic floor clinic were evaluated with anorectal physiology and ultrasound. Where the faecal incontinence was not fully explained by physiology and ultrasound, evacuation proctography was undertaken. Studies were classified as 'normal', 'low-grade RI' (recto-rectal), 'high-grade RI' (recto-anal) or 'anismus'.

RESULTS: Forty patients underwent evacuation proctography (33 women, 83%). Median age was 63 years (range 34-77 years). Seven patients (17%) had a normal proctogram. Three (8%) had recto-rectal RI. Twenty-five (63%) demonstrated recto-anal RI. Five patients (12%) had anismus.

CONCLUSION: Recto-anal intussusception is common in patients undergoing selective evacuation proctography for investigation of faecal incontinence. The role of recto-anal intussusception in the multifactorial aetiology of faecal incontinence has been largely overlooked. Evacuation proctography should be considered as part of routine work-up of patients with faecal incontinence.

18. Colorectal Dis. 2010 Feb;12(2):97-104. Epub 2009 Sep 26.

Laparoscopic ventral rectopexy for internal rectal prolapse: short-term functional results.

Collinson R, Wijffels N, Cunningham C, Lindsey I.

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Comment in:

- Colorectal Dis. 2010 Feb;12(2):83-4.

Abstract

OBJECTIVE: Over the last 15 years, posterior rectopexy, which causes rectal autonomic denervation, was discredited for internal rectal prolapse because of poor results. The condition became medical, managed largely by biofeedback. We aimed to audit the short-term functional results of autonomic nerve-sparing laparoscopic ventral rectopexy (LVR) for internal rectal prolapse.

METHOD: Prospectively collected data on LVR for internal rectal prolapse were analysed. End-points were changes in bowel function (Wexner Constipation Score and Fecal Incontinence Severity Index) at 3 and 12 months. Analysis was performed using Mann-Whitney U-test for unpaired data and Wilcoxon signed rank test for paired data (two-sided p-test). Functional outcomes were compared with those achieved previously for external rectal prolapse (ERP).

RESULTS: Seventy-five patients underwent LVR (median age 58, range 25-88 years, median follow up was 12 months). Mortality (0%), major (0%) and minor morbidity (4%) were acceptably low. Median length of stay was 2 days. Preoperative constipation (median Wexner score 12) and faecal incontinence (median FISI score 28) improved significantly at 3 months (Wexner 4, FISI 8, both  $P < 0.0001$ ) and 12 months (Wexner 5, FISI 8, both  $P < 0.0001$ ). No patient had worse function. Functional outcomes were similar to those for ERP.

CONCLUSION: Laparoscopic ventral rectopexy for internal rectal prolapse improves symptoms of obstructed defaecation and faecal incontinence in the short-term. This establishes proof of concept for a nerve-sparing surgical treatment for internal rectal prolapse.

19. Colorectal Dis. 2010 Jul;12(7 Online):e158-62. Epub 2009 Aug 5.

Enterocoele is a marker of severe pelvic floor weakness.

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Abstract

OBJECTIVE: The aim was to evaluate the relationship between the presence of an enterocoele and grade of rectal prolapse (RP).

METHOD: Defaecating proctograms of consecutive patients presenting to the Oxford Pelvic Floor Clinic between January 2004 and November 2008 were analysed. Patients were included if they had full thickness

internal (grades 1-4 prolapse) or external RP (grade 5 prolapse). All those included were analysed with regards to the presence of an enterocele.

RESULTS: Three hundred and seventy-one patients [322 (87%) women and 49 (23%) men] were found to have a degree of RP. One out of eight (12.5%) patients with grade 1 RP, 10/42 (18.5%) with grade 2 RP, 34/125 (27%) with grade 3 RP, 62/135 (46%) with grade 4 RP and 23/49 (47%) with grade 5 full thickness external RP had an enterocele present. This was a statistically significant trend (Pearson chi(2) test  $P < 0.0002$ ). There was a significantly higher proportion of enteroceles in women [125/322 (39%) than in men (5/49 (10%)] ( $P < 0.0001$ ) and a higher likelihood of having an enterocele with advancing age ( $P < 0.0001$ ). Within the study, there was no significant difference in the proportion of nulliparous and parous women with enteroceles ( $P = 0.8$ ); there were a significantly higher proportion of enteroceles in hysterectomized women ( $P = 0.015$ ).

CONCLUSIONS: Enterocele is increasingly seen with advancing RP severity. This suggests that the two findings are part of the same pelvic floor process. These data support the hypothesis that enterocele is a marker of severe pelvic floor weakness. Enterocele is seen more frequently in females particularly after hysterectomy.

20. Colorectal Dis. 2010 Aug;12(8):822-30.

What is the natural history of internal rectal prolapse?

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#### Abstract

AIM: The nature and clinical significance of internal rectal prolapse is controversial. Its natural history is unclear. Longitudinal cohort studies show rare progression to external prolapse but lack adequate follow-up. We aimed to study the relationship of age to various stages of internal rectal prolapse using the Oxford Rectal Prolapse Grade (ORPG) and evaluate the influence of sex and vaginal delivery on this relationship.

METHOD: Internal rectal prolapsed (IRP) diagnosed at proctography and external rectal prolapse were graded using the ORPG. Age, sex and obstetric history were documented. Mean age of each prolapse grade (1-5) was analysed and regression analysis performed for age and prolapse. Subgroup analyses were made for males, and females with (V+) and without (V0) history of vaginal delivery.

RESULTS: Sixty males (11%) and 471 females (89%) were studied. The difference in the mean ages of each group was statistically significant (grade 1, 38.6; grade 2, 52.1; grade 3, 56.0; grade 4, 60.3 and grade 5, 66.5,  $P < 0.0001$ ). On average male (8.7 years) and V0-group (8.0 years) were younger than V+ group (95% CI difference 4.5-12.9 years,  $P < 0.0001$ , and 3.8-12.2 years,  $P < 0.0001$ , respectively). Males and V0-group had weaker correlation between age and prolapse grade ( $r = 0.16$  and  $r = 0.17$ , respectively, vs 0.41), and a faster prolapse progression rate than the V+ group.

CONCLUSION: These data demonstrate a strong relationship between age and prolapse grade, supporting the view of internal rectal prolapse as a precursor to external prolapse in the spectrum of rectal prolapse disease.

21. Colorectal Dis. 2010 Jun;12(6):526-32. Epub 2009 Apr 10.

Laparoscopic ventral rectopexy for external rectal prolapse improves constipation and avoids de novo constipation.

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#### Abstract

**OBJECTIVE:** Abdominal rectopexy is ideal for otherwise healthy patients with rectal prolapse because of low recurrence, yet after posterior rectopexy, half of the patients complain of severe constipation. Resection mitigates this dysfunction but risks a pelvic anastomosis. The novel nerve-sparing ventral rectopexy appears to avoid postero-lateral rectal dissection denervation and thus postoperative constipation. We aimed to evaluate our functional results with laparoscopic ventral rectopexy.

**METHOD:** Consecutive rectal prolapse patients undergoing laparoscopic ventral rectopexy were prospectively assessed (Wexner Constipation and Faecal Incontinence Severity Index scores) pre-, 3 months postoperatively, and late (> 12 months).

**RESULTS:** Sixty-five consecutive patients with external rectal prolapse (median age 72 years, 34% > 80 years, median follow up 19 months) underwent laparoscopic ventral rectopexy. There was one recurrence (2%) and one conversion. Morbidity (17%) and mortality (0%) were low. Median operating time was 140 min and median length of stay 2 days. At 3 months, constipation was improved in 72% and mildly induced in 2% (median pre- and postoperative Wexner scores 9 vs 4,  $P < 0.0001$ ). Continence was improved in 83% and mild incontinence was induced or worsened in 5% (median pre- and postoperative incontinence score 40 vs 4,  $P < 0.0001$ ). Significant improvement in both constipation and incontinence ( $P < 0.0001$ ) remained at median 24 months late follow-up.

**CONCLUSION:** Ventral rectopexy has a recurrent prolapse rate of < 5%, similar to that of posterior rectopexy. Its correction of preoperative constipation and avoidance of de novo constipation appear superior to historical functional results of posterior rectopexy. A laparoscopic approach allows low morbidity and short hospital stay, even in those patients over 80 years of age in whom a perineal approach is usually preferred for safety.

22. Colorectal Dis. 2010 Jul;12(7 Online):e135-9. Epub 2009 Apr 10.

Incontinence following sphincter division for treatment of anal fistula.

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#### Abstract

**OBJECTIVE:** Management of anal fistula poses problems because of competing goals of cure and maintenance of continence. There is increasing recognition of significant rates of incontinence after sphincter-dividing anal surgery. We aimed to determine cure and continence status in a cohort of anal fistula patients managed by both sphincter-dividing and conserving approaches.

**METHOD:** Data on fistula, healing and continence status were gathered by patient questionnaire (Cleveland Clinic incontinence questionnaire), telephone interview and chart review. Fistulae were defined as simple (low risk of incontinence) or complex (high risk). Surgery was defined as sphincter conservation and sphincter division. Incontinence was graded by traditional severity scale (minor/major). Fistula healing was defined as absence of acute or chronic sepsis symptoms from surgery to date of last follow-up.

**RESULTS:** One hundred and twenty-eight patients were evaluated (out of whom 71% were male subjects, age range 17-82, median age 45 years). Fifty-two percent of the fistulae were complex and 48% were simple, of which 51% and 85% underwent sphincter division respectively. Healing rates were higher for sphincter division than conservation (87% vs 73%,  $P = 0.06$ ). Complex fistulae undergoing sphincter division led to a higher rate of major incontinence (13%) than sphincter conservation (0%) ( $P = 0.03$ ). For simple fistulae treated by sphincter division, major (5%) and minor incontinence (11%) was not inconsiderable.

**CONCLUSION:** Though cure rates are excellent, incontinence rates remain unacceptably high following sphincter division for complex fistulae and are not insignificant even for simple fistulae. More sphincter conservation should be undertaken.

23. Ann R Coll Surg Engl 2010 Jan;92(1):85-6.

Comment on: Stapled transanal resection of the rectum (STARR) for obstructed defaecation syndrome.

Harmston C, Jones OM, Cunningham C, Lindsey I.

Comment on:

- Ann R Coll Surg Engl. 2009 May;91(4):287-91.

24. Ann Surg. 2008 Dec;248(6):1092-7.

Laparoscopic resection for diverticular disease: follow-up of 500 consecutive patients.

Jones OM, Stevenson AR, Clark D, Stitz RW, Lumley JW.

Royal Brisbane Hospital, Herston, Australia.

Comment in:

- Ann Surg. 2009 Mar;249(3):548-9; author reply 549.
- Ann Surg. 2009 Jul;250(1):174-5; author reply 175.

Abstract

**OBJECTIVE:** To examine morbidity, mortality, conversion rates, and disease recurrence after laparoscopic resection of complicated and uncomplicated diverticular disease in a single center.

**SUMMARY BACKGROUND DATA:** In contrast to colorectal cancer, there are few large studies of laparoscopic or open resection for diverticular disease.

**METHODS:** This study represents a retrospective analysis of a prospectively collected database of all laparoscopic resections for uncomplicated and complicated diverticulitis from a single center.

**RESULTS:** Five hundred patients (305 female) were identified (median age 58; range, 26-89). Recurrent diverticulitis was the most common indication for surgery (77%), followed by perforation (10%) and fistulation (9%). Median operating time was 120 minutes (range, 45-285) and median length of hospital stay was 4 (2-33) days. The splenic flexure was routinely mobilized. There was 1 (0.2%) 30-day and in-hospital death and 55 (11%) patients had major morbidity after the procedure. Conversion to an open operation was performed in 14 (2.8%) cases. Dense adhesions were the most common cause for conversion (6 patients). Among patients with complicated diverticulitis, the conversion rate was 5.3%, whereas for those with uncomplicated disease, it was 2.1% ( $P = ns$ ). Operating time and length of hospital stay do not differ significantly between patients with complicated and uncomplicated diverticulitis. The conversion rate has come down from 8% for the first 100 cases to 1.5% for the last 400 cases ( $P = 0.002$ ). To our knowledge, there have been no cases of recurrent diverticulitis.

**CONCLUSIONS:** Laparoscopic resection even in complicated cases of diverticulitis is safe and effective. It can be achieved with short operating times and length of stay in conjunction with very low rates of morbidity and mortality. Adherence to surgical principles including routine mobilization of the splenic flexure and anastomosis onto the rectum may explain the absence of disease recurrence in our experience.

25. Colorectal Dis. 2009 Jun;11(5):489-95. Epub 2008 Jul 15.

Preservation of sexual and bladder function after laparoscopic rectal surgery.

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Abstract

**BACKGROUND:** There have recently been reports of higher levels of bladder and sexual dysfunction in men after laparoscopic rectal surgery when compared with those undergoing open surgery. This has led some surgeons to question the role of the laparoscopic approach to rectal surgery.

**METHOD:** This study represents a retrospective analysis of a prospectively collected database for a single unit, comprising 2406 patients undergoing laparoscopic colorectal surgery. Bladder function, potency and ejaculation were assessed at postoperative clinic visits for men undergoing laparoscopic low or ultra-low anterior resection and abdominoperineal excision of the rectum.

**RESULTS:** A total of 101 males were identified (median age 62 years: range 20-90 years). Urinary dysfunction was reported by six (6%) patients. Six (6%) patients had sexual dysfunction, manifesting as retrograde ejaculation in four patients and erectile dysfunction in a further two patients.

**CONCLUSIONS:** The low rates of sexual dysfunction in this unit may be attributable to pelvic dissection only being undertaken by experienced, dedicated laparoscopic colorectal surgeons. Laparoscopic restorative surgery for rectal cancer has been performed here only since 2001 after considerable experience accrued in operating on benign rectal disease and colon cancer. Studies from elsewhere reporting poorer functional outcomes have probably included a significant number of patients on the surgeons' 'learning curve'.

26. *Ann R Coll Surg Engl.* 2007 Sep;89(6):574-9.

Towards safer treatments for benign anorectal disease: the pharmacological manipulation of the internal anal sphincter.

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#### Abstract

**INTRODUCTION:** The internal anal sphincter (IAS) is an important structure that is responsible for the majority of resting tone of the sphincter complex. It has a central role in continence and damage to the muscle has serious implications. Injury is most frequently from obstetric trauma though iatrogenic injury from proctological surgery is also common. This review expands on how developments in understanding of the pharmacology of IAS might identify drug treatments as alternatives for proctological conditions such as anal fissure, avoiding the risk of sphincter injury. It also examines the role of pharmacology in treatment of those patients with established incontinence.

**RESULTS:** Much of the basic physiology and pharmacology of the IAS has been established through in vitro analysis, particularly in the superfusion organ bath. Further analysis has been undertaken using animal models such the pig. Clinical trials have established the efficacy of a number of agents for reducing IAS tone including glyceryl trinitrate and botulinum toxin. These drugs are probably safer, but less effective, than surgery for sphincter spasm, as is seen in anal fissure, though surgery alone or in combination with drug treatment may be appropriate for some patients. In vitro analysis and small-scale clinical trials suggest that phenylephrine and methoxamine may have a role in treating patients with incontinence primarily attributable to inadequate IAS function.

**CONCLUSIONS:** The pharmacology of IAS has been extensively studied in the laboratory, both in vitro and in animal models. In a short time, this laboratory work has been applied to clinical problems after testing in clinical trials. It is likely, however, that the best drugs and the optimal targets for manipulation have not yet been identified.

27. *Dis Colon Rectum.* 2007 May;50(5):682-3; author reply 683.

The antinociceptive effects of botulinum toxin therapy for anal fissure are unproven.

Jones OM.

Comment on:

- Dis Colon Rectum. 2006 Jul;49(7):1078-9.

28. Dis Colon Rectum. 2006 Oct;49(10):1574-80.

Randomized clinical trial of botulinum toxin plus glyceryl trinitrate vs. botulinum toxin alone for medically resistant chronic anal fissure: overall poor healing rates.

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#### Abstract

**PURPOSE:** This study was designed to assess whether addition of glyceryl trinitrate to botulinum toxin improves the healing rate of glyceryl trinitrate-resistant fissures over that achieved with botulinum toxin alone.

**METHODS:** Patients were randomized between botulinum toxin plus glyceryl trinitrate (Group A) and botulinum toxin plus placebo paste (Group B). Patients were seen at baseline, four and eight weeks, and six months. The primary end point was fissure healing at eight weeks. Secondary end points were symptomatic relief, need for surgery, side effects, and reduction in maximum resting and squeeze pressures.

**RESULTS:** Thirty patients were randomized. Two-thirds of patients had maximum anal resting pressures below or within the normal range at entry to the study. Healing rates in both treatment groups were disappointing. There was a nonsignificant trend to better outcomes in Group A compared with Group B in terms of fissure healing (47 vs. 27 percent), symptomatic improvement (87 vs. 67 percent), and resort to surgery (27 vs. 47 percent).

**CONCLUSIONS:** There is some evidence to suggest that combining glyceryl trinitrate with botulinum toxin is superior to the use of botulinum toxin alone for glyceryl trinitrate-resistant anal fissure. The poor healing rate may reflect the fact that many of the patients did not have significant anal spasm at trial entry.

29. Dis Colon Rectum. 2005 Feb;48(2):349-52.

Digital rectal examination of sphincter pressures in chronic anal fissure is unreliable.

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#### Abstract

**PURPOSE:** Chronic anal fissure is said to be associated with internal sphincter hypertonia. However, an unknown proportion of fissures may be associated with normal or even low resting pressures and may subsequently be resistant to pharmacological treatments or at risk from surgical treatments, both of which aim to reduce sphincter hypertonia. This study investigated the ability of surgeons to detect low or normal pressure fissures by digital rectal examination.

**METHODS:** Patients with chronic anal fissure were assessed prospectively. The results of anal manometry performed on these patients were compared with digital rectal assessment of sphincter tone undertaken by a surgeon blinded to the manometry results.

**RESULTS:** Forty consecutive patients (21 male) with chronic anal fissure were studied. Twenty-two (55 percent) had normal maximum resting pressure and a further 3 (8 percent) had low pressures on anal manometry. On clinical assessment, only five (13 percent) patients were evaluated as having no anal hypertonia. Clinical assessment of anal tone correctly identified 14 of 15 patients with high manometric maximum resting pressure (sensitivity, 93 percent), yet detected only 4 of 25 patients with normal or low pressures (specificity, 16

percent). The positive predictive value of clinical assessment of anal tone was 40 percent and the negative predictive value, 80 percent.

CONCLUSIONS: The incidence of patients with chronic anal fissure without high manometric maximum resting pressure is higher than previously reported. The ability of surgeons to identify this group clinically was poor. It is reasonable to treat all patients primarily medically, and then selectively investigate by manometry those patients who fail medical therapy before considering lateral sphincterotomy.

30. Dis Colon Rectum. 2005 Jan;48(1):37-42.

Denonvilliers' fascia lies anterior to the fascia propria and rectal dissection plane in total mesorectal excision.

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#### Abstract

PURPOSE: Opinion is divided whether Denonvilliers' fascia lies anterior or posterior to the anatomic fascia propria plane of anterior rectal dissection in total mesorectal excision. This study was designed to evaluate this anatomic relationship by assessing the presence or absence of Denonvilliers' fascia on the anterior surface of the extraperitoneal rectum in specimens resected for both nonanterior and anterior rectal cancer in males.

METHODS: Surgical specimens were collected prospectively from males undergoing total mesorectal excision for mid and low rectal cancer, with a deep dissection of the anterior extraperitoneal rectum to the pelvic floor. Specimens were histopathologically analyzed using best practice methods for rectal cancer. The anterior aspects of the extraperitoneal rectal sections were examined microscopically for the presence or absence of Denonvilliers' fascia.

RESULTS: Thirty rectal specimens were examined. Denonvilliers' fascia was present in 12 (40 percent) and absent in 18 specimens (60 percent). Denonvilliers' fascia was significantly more frequently present when tumor involved (55 percent) rather than spared the anterior rectal quadrant (10 percent; difference between groups 45 percent; 95 percent confidence interval, 30-60 percent;  $P = 0.024$ , Fisher's exact test).

CONCLUSIONS: When tumors were nonanterior, rectal dissection was conducted on fascia propria in the usual anatomic plane, and Denonvilliers' fascia was not present on the specimen. It was almost exclusively found in anterior tumors, deliberately taken by a radical extra-anatomic anterior dissection in the extramesorectal dissection plane. Denonvilliers' fascia lies anterior to the anatomic fascia propria plane of anterior rectal dissection and is more closely applied to the prostate than the rectum.

31. Dis Colon Rectum. 2004 Dec;47(12):2217-8; author reply 2218.

Pharmacologic treatments maintain an important role in the treatment of anal fissure.

Jones OM, Lindsey I.

Comment on:

- Dis Colon Rectum. 2004 Jan;47(1):35-8.

32. Dis Colon Rectum. 2004 Nov;47(11):1947-52.

Fissurectomy-botulinum toxin: a novel sphincter-sparing procedure for medically resistant chronic anal fissure.

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#### Abstract

**BACKGROUND:** Botulinum toxin heals only approximately one-half of glyceryl trinitrate-resistant chronic anal fissures, perhaps because chemical sphincterotomy alone treats internal sphincter spasm but not chronic fissure fibrosis. We aimed to assess whether a novel procedure, fissurectomy-botulinum toxin, improves the healing rate of medically resistant fissures over that achieved with botulinum toxin alone.

**METHODS:** A prospective pilot study of chronic fissure patients failing medical therapy was undertaken. Fissurectomy was performed, with excision of the fibrotic fissure edges, curetting of the fissure base, and excision of the sentinel pile if present. Twenty-five units of botulinum toxin (Botox) were injected into the internal sphincter. The primary end point was fissure healing, and secondary end points were improvement in symptoms, need for lateral internal sphincterotomy, and side effects.

**RESULTS:** Thirty patients underwent fissurectomy-botulinum toxin (57 percent female; median age, 39 years). Nineteen patients had failed glyceryl trinitrate, whereas 11 had failure of both glyceryl trinitrate and botulinum toxin. At a median of 16.4 weeks follow-up, 28 fissures (93 percent) were healed. Two fissures (7 percent) remained unhealed but were symptomatically better and avoided lateral internal sphincterotomy. Two patients (7 percent) experienced transitory flatus incontinence.

**CONCLUSION:** Fissurectomy-botulinum toxin heals over 90 percent of fissures resistant to medical therapy. Fissurectomy-botulinum toxin allows patients with medically resistant fissures to achieve a high rate of healing while avoiding the risk of incontinence associated with lateral internal sphincterotomy.

33. Dis Colon Rectum. 2003 Jan;46(1):14-9.

Nocturnal penile tumescence is diminished but not ablated in postproctectomy impotence.

Lindsey I, Cunningham C, George BD, Mortensen NJ.

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#### Abstract

**PURPOSE:** We aimed to assess objectively the integrity of the parasympathetic neural pathway that controls the inflow choke vessels to the corpora cavernosa in a group of male patients with postproctectomy erectile dysfunction.

**METHODS:** The study group was male patients with erectile dysfunction after proctectomy for rectal cancer and inflammatory bowel disease identified by sexual function questionnaire. The group underwent two consecutive nights of home nocturnal penile tumescence monitoring with the Nocturnal Electrobioimpedance Volumetric Assessment device. The control group was also monitored. It comprised preoperative potent patients with rectal cancer and inflammatory bowel disease who had not yet undergone a variety of surgical procedures. Demographics and nocturnal penile tumescence parameters were recorded, including number, duration, and percentage increase in penile volume of tumescent events.

**RESULTS:** Thirty-four impotent study group and 28 potent control group patients underwent nocturnal penile tumescence monitoring. The groups were well matched for mean age (difference, 1.4 years; 95 percent confidence interval, -5.8 to 8.6 years) and proportion with rectal cancer (difference, 6 percent; 95 percent confidence interval, -1 to 13 percent). The number of nocturnal penile tumescent events was greater for the potent group than for the control group (mean rank, 40.4 vs. 24.2;  $P = 0.0004$ ). There was no significant difference between the mean duration (difference, 2.6 minutes; mean rank, 27.9 vs. 34.4;  $P = 0.16$ ) or the mean penile volume increase (difference, 5.4 percent increase; mean rank, 30.6 vs. 32.6;  $P = 0.66$ ) for tumescent events between the study and control groups. Mean age was significantly higher in complete than in partial impotence (60.9 vs. 53.1 years; difference, 7.8 years; 95 percent confidence interval, 0.1 to 15.5 years). There was a nonsignificant trend to a lower mean number of tumescence events among sildenafil responders than among nonresponders (3.5 vs. 4.8 events; mean rank, 11.2 vs. 17.3;  $P = 0.14$ ).

CONCLUSION: Nocturnal penile tumescence activity is diminished but not ablated by the trauma of surgical dissection. This suggests that some of the cavernous nerves that govern inflow to the corpora cavernosa are intact after surgery and that the nerve lesion responsible for erectile dysfunction is partial, and it explains why the response to sildenafil in such patients is surprisingly high.

34. Dis Colon Rectum. 2002 Dec;45(12):1608-15.

A randomized, controlled trial of fibrin glue vs. conventional treatment for anal fistula.

Lindsey I, Smilgin-Humphreys MM, Cunningham C, Mortensen NJ, George BD.

Department of Colorectal Surgery, John Radcliffe Hospital, Oxford, United Kingdom.

Comment in:

- Dis Colon Rectum. 2003 Aug;46(8):1148; author reply 1149.

#### Abstract

**PURPOSE:** Fibrin glue is a novel treatment for anal fistulas and possesses many advantages in the treatment of difficult high fistulas. Fibrin glue treatment is simple and repeatable; failure does not compromise further treatment options; and sphincter function is preserved. We aimed to compare the outcomes of patients with low and high anal fistulas randomly assigned to either fibrin glue or conventional treatment.

**METHODS:** Patients with simple fistulas (low fistulas) and complex fistulas (high, Crohn's, and low fistulas with compromised sphincters) were randomly assigned to either fibrin glue or conventional treatment (fistulotomy or loose seton insertion with or without subsequent advancement flap). Patients with rectovaginal fistulas and anal fistulas associated with chronic cavities, acute sepsis, and side branches were excluded. The primary end point was fistula healing. Secondary end points were complications, changes in preoperative continence score, changes in maximum resting and squeeze pressure, satisfaction scores, and pain scores and time off work (simple fistulas only).

**RESULTS:** Patients in the fibrin glue and conventional treatment arms were well matched for gender, median age, duration of fistula symptoms, and follow-up. Fibrin glue healed three (50 percent) of six and fistulotomy seven (100 percent) of seven simple fistulas (difference, 50 percent; confidence interval, 10 to 90 percent;  $P=0.06$ , Fisher's exact probability test). There was no change in baseline incontinence score, maximum resting pressures, or squeeze pressures between the study arms. Return to work was quicker in the glue arm, but pain scores were similar and satisfaction scores higher in the fistulotomy group. Fibrin glue healed 9 (69 percent) of 13 and conventional treatment 2 (13 percent) of 16 complex fistulas (difference, 56 percent; 95 percent confidence interval, 25.9 to 86.1 percent;  $P=0.003$ , Fisher's exact probability test). There was no change in baseline incontinence score, maximum resting pressures, or squeeze pressures in either study arm.

Satisfaction scores were higher in the fibrin glue group.

**CONCLUSIONS:** No advantage was found for fibrin glue over fistulotomy for simple fistulas, but fibrin glue healed more complex fistulas than conventional treatment and with higher patient satisfaction.

35. Br J Surg. 2002 Dec;89(12):1493-4.

Iatrogenic impotence and rectal dissection.

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36. Dis Colon Rectum. 2002 Nov;45(11):1561-2; author reply 1562-3.

Importance of the anterior plane of rectal mobilization.

Lindsey I, Mortensen N.

Comment on:

- Dis Colon Rectum. 2002 Jan;45(1):1-8; discussion 8-9.

37. Dis Colon Rectum. 2002 Jun;45(6):727-32.

Randomized, double-blind, placebo-controlled trial of sildenafil (Viagra) for erectile dysfunction after rectal excision for cancer and inflammatory bowel disease.

Lindsey I, George B, Kettlewell M, Mortensen N.

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#### Abstract

**PURPOSE:** Controlled trials have demonstrated the efficacy of sildenafil for "mixed etiology" erectile dysfunction, but this may not be the case if there is underlying pelvic parasympathetic nerve damage. We aimed to determine the efficacy of sildenafil after rectal excision for rectal cancer and inflammatory bowel disease.

**METHODS:** Patients with erectile dysfunction after rectal excision were randomly assigned in a double-blind manner to sildenafil or placebo groups. After unblinding, placebo patients crossed over to open sildenafil. Primary end points were improvement in erectile function on a global efficacy question and erectile function questionnaire scores. Secondary end points were frequency and severity of side effects.

**RESULTS:** Thirty-two patients were randomly assigned, and two dropped out before randomization. Fourteen received sildenafil, and 18 received placebo. Eleven (79 percent) of 14 responded to sildenafil, on global efficacy assessment, compared with 3 (17 percent) of 18 taking placebo (mean difference, 61.9 percent; 95 percent confidence interval, 34.4 to 89.4 percent;  $P = 0.0009$ ). Sildenafil improved both erectile function domain scores (mean difference, 13.3; 95 percent confidence interval, 7.9 to 18.7;  $P = 0.0001$ ) and total International Index of Erectile Function scores (mean difference, 30.6; 95 percent confidence interval, 18.7 to 42.6;  $P < 0.0001$ ) from pretreatment baseline scores. Placebo did not produce improvement in either erectile function (mean difference, 1.7; 95 percent confidence interval, -0.8 to 4.2;  $P = 0.16$ ) or total International Index of Erectile Function scores (mean difference, 5; 95 percent confidence interval, -1.1 to 11.1;  $P = 0.1$ ). Ten (100 percent) of 10 crossover patients not responding to placebo did respond to sildenafil (difference, 100 percent;  $P < 0.0001$ ). Sildenafil improved both erectile function domain scores (mean difference, 16.8; 95 percent confidence interval, 9.7 to 24;  $P = 0.002$ ) and total International Index of Erectile Function scores (mean difference, 29.5; 95 percent confidence interval, 15.8 to 43.2;  $P = 0.003$ ) from precrossover baseline scores. Seven (50 percent) of 14 patients on sildenafil compared with 4 (22 percent) of 18 on placebo experienced side effects (difference, 28 percent; 95 percent confidence interval, -4.4 to 60.4 percent;  $P = 0.14$ ), 91 percent of which were mild and well tolerated.

**CONCLUSION:** Sildenafil completely reverses or satisfactorily improves postproctectomy erectile dysfunction in 79 percent of patients. Side effects are usually mild and well tolerated. The damage incurred by the pelvic nerves after proctectomy, less profound than after prostatectomy, is likely to result in a partial parasympathetic nerve lesion.

38. Dis Colon Rectum. 2001 Jun;44(6):831-5.

Impotence after mesorectal and close rectal dissection for inflammatory bowel disease.

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#### Abstract

**PURPOSE:** Close rectal dissection is a surgical technique used by some surgeons in inflammatory bowel disease. It is performed within the mesorectum, close to the rectal muscle wall, with the aim of minimizing damage to the pelvic sexual nerves. Other surgeons dissect in the more anatomical mesorectal plane. Our aim was to determine whether close rectal dissection is more protective of the pelvic sexual nerves than mesorectal dissection.

**METHOD:** Patients undergoing surgery for inflammatory bowel disease were entered prospectively into a database. Male patients were mailed a standardized, validated, urologic impotence questionnaire: the International Index of Erectile Function.

**RESULTS:** There was an 81 percent response rate. Six of 156 assessable patients were totally impotent (3.8 percent). They were all in the 50-year-old to 70-year-old age group, with no impotence in patients younger than 50 years old. Twenty-one patients complained of minor diminution of erectile function (13.5 percent), where sexual activity was still possible. There was no statistical difference in the rate of complete (2.2 percent vs. 4.5 percent,  $P = 0.67$ ) or partial (13.5 percent vs. 13.3 percent,  $P = 0.99$ ) impotence between close rectal and mesorectal dissection (Fisher's exact test). There were no ejaculatory difficulties. The time elapsed since surgery ranged from 2.7 months to 192.7 months, with a median of 74.5 months.

**CONCLUSION:** Rectal excision for inflammatory bowel disease can be conducted with low rates of impotence. Minor degrees of erectile dysfunction may be more common than currently recognized. We could not demonstrate that close rectal dissection significantly protects the patient from impotence compared with operating in the anatomical mesorectal plane. Age appears to be the most important risk factor for postoperative impotence.

39. Br J Surg. 2000 Oct;87(10):1288-99.

Anatomy of Denonvilliers' fascia and pelvic nerves, impotence, and implications for the colorectal surgeon.

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Comment in:

- Br J Surg. 2001 Jun;88(6):888.

#### Abstract

**BACKGROUND:** The development and anatomy of Denonvilliers' fascia have been controversial for many years and confusion exists about its operative appearance. Better appreciation of this poorly understood anatomy, and its significance for impotence after rectal dissection, may lead to further functional improvements in pelvic surgery.

**METHOD:** A literature review of the embryology and anatomy of Denonvilliers' fascia and impotence after pelvic rectal surgery was undertaken.

**RESULTS:** Denonvilliers' fascia has no macroscopically discernible layers. The so-called posterior layer refers to the fascia propria of the rectum. The incidence of erectile and ejaculatory dysfunction after rectal excision is high in older patients, and when performed for rectal cancer. There is no consensus about the relationship of Denonvilliers' fascia to the plane of anterior dissection for rectal cancer.

**CONCLUSION:** Colorectal surgeons should focus on the important anatomy between the rectum and the prostate to improve functional outcomes after rectal excision. A classification of the available anterior dissection planes is proposed. Surgeons should be encouraged to document the plane used as well as outcome in terms of sexual function.

40. Dis Colon Rectum. 2004 Oct;47(10):1643-9.

Patterns of fecal incontinence after anal surgery.

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#### Abstract

**PURPOSE:** Conservative anal surgery, with maximum preservation of the anal sphincters and continence, is becoming increasingly possible with the emergence of new sphincter-sparing treatments. Many surgeons remain skeptical, however, of the nature and impact of incontinence after anal surgery. We aimed to characterize the patterns of anal sphincter injury in patients with fecal incontinence after anal surgery.

**METHODS:** We reviewed our fecal incontinence database and studied a subset developing incontinence after anal surgery. Maximum resting and squeeze pressures and the distal high-pressure zone to mid-anal canal resting pressure gradient were evaluated. Anal ultrasounds were evaluated and specific postoperative lesions were characterized.

**RESULTS:** Patterns of sphincter injury in 93 patients with fecal incontinence after manual dilation, internal sphincterotomy, fistulotomy, and hemorrhoidectomy were studied. The internal sphincter was almost universally injured, in a pattern specific to the underlying procedure. One-third of patients had a related surgical external sphincter injury. Two-thirds of women had an unrelated obstetric external sphincter injury. The distal resting pressure was typically reduced, with reversal of the normal resting pressure gradient of the anal canal in 89 percent of patients. Maximum squeeze pressure was normal in 52 percent.

**CONCLUSION:** Incontinence after anal surgery is characterized by the virtually universal presence of an internal sphincter injury, which is distal in the high-pressure zone, resulting in a reversal of the normal resting pressure gradient in the anal canal. These data support concerns that non-sphincter-sparing anal surgery leads to fecal incontinence and is increasingly difficult to justify given the availability of modern sphincter-sparing approaches.

41. Br J Surg. 2004 Mar;91(3):270-9.

Chronic anal fissure.

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Comment in:

- Br J Surg. 2004 Aug;91(8):1073-4.
- Br J Surg. 2004 Jun;91(6):779-80.

#### Abstract

**BACKGROUND:** The treatment of chronic anal fissure has shifted in recent years from surgical to medical.

**METHODS:** A Medline search of studies relevant to modern management of chronic anal fissure was undertaken.

**RESULTS:** Traditional surgery that permanently weakens the internal sphincter is associated with a risk of incontinence. Medical therapies temporarily relax the internal sphincter and pose no such danger, but their limited efficacy has led to displacement rather than replacement of traditional surgery. Emerging medical therapies promise continued improvement and new sphincter-sparing surgery may render traditional surgery redundant.

**CONCLUSION:** First-line use of medical therapy cures most chronic anal fissures cheaply and conveniently. The few non-responders can be targeted for sphincter assessment before traditional surgery. If the initial good results of new sphincter-sparing surgery are confirmed, it may be possible to avoid any risk of incontinence, while achieving high rates of fissure healing.

42. Br J Surg. 2004 Feb;91(2):224-8.

Mechanism of action of botulinum toxin on the internal anal sphincter.

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#### Abstract

**BACKGROUND:** Botulinum toxin is an effective treatment for anal fissure. Manometric studies support an apparent action of botulinum toxin on the internal anal sphincter (IAS). This aim of this study was to establish the underlying mechanism.

**METHODS:** Porcine IAS strips were suspended in a superfusion organ bath and allowed to equilibrate. Electrical field stimulation (EFS) was applied with parameters that induced nitrenergic relaxation followed by noradrenaline-mediated contraction. These responses were compared before and after addition of botulinum toxin.

**RESULTS:** All strips developed myogenic tone, which was slightly increased following the addition of botulinum toxin. EFS-induced nitrenergic relaxation was unaffected by toxin treatment. However, EFS-induced contraction was significantly reduced by toxin treatment. 1,1-dimethyl-4-phenylpiperazinium iodide (DMPP), a nicotinic agonist, caused muscle strip contraction, which was blocked by guanethidine, implying the presence of sympathetic ganglia within the IAS. Botulinum toxin significantly attenuated DMPP-induced contraction.

**CONCLUSION:** In the treatment of anal fissure the major effect of botulinum toxin on the IAS is blockade of sympathetic (noradrenaline mediated) neural output. This is probably a postganglionic action, involving a reduction in noradrenaline release at the neuromuscular junction. Botulinum toxin has no significant effect on nitrenergic transmission, which is probably not vesicular in nature.

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43. Br J Surg. 2003 Jul;90(7):872-6.

L-Erythro-methoxamine is more potent than phenylephrine in effecting contraction of internal anal sphincter in vitro.

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#### Abstract

**BACKGROUND:** Topical phenylephrine has been shown to increase resting anal canal pressure in normal and incontinent individuals. However, high concentrations of gel (10-40 per cent) are required that may cause local side-effects. The aim of this study was to determine whether methoxamine, another alpha-1-adrenoceptor agonist, might be a more potent alternative to phenylephrine.

**METHODS:** Porcine internal anal sphincter (IAS) tissue was cut into strips, suspended in a superfusion organ bath and allowed to equilibrate. Strips were subjected to each drug under test for 20 s, sufficient to obtain stable tone. Phenylephrine, methoxamine (1 : 1 : 1 : 1 ratio of its four isomers) and each of the individual isomers of methoxamine were evaluated in turn.

**RESULTS:** In vitro, methoxamine racemate and phenylephrine were similarly potent in causing contraction of IAS strips (mean(s.e.m.) dose giving half maximal effect (EC(50)) at 74.7(16.5) versus 58.3(13.4) micro M respectively;  $P = 0.443$ ). However, one of the methoxamine isomers, L-erythro-methoxamine (EC(50) 17.6(3.7) micro M), was significantly more potent than the other three isomers, methoxamine racemate and phenylephrine ( $P = 0.002$ ).

**CONCLUSION:** L-Erythro-methoxamine is four times more potent than phenylephrine and is a possible treatment for incontinence. Trials are under way to examine the efficacy of L-erythro-methoxamine in vivo.

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44. Dis Colon Rectum. 2003 Mar;46(3):361-6.

Botulinum toxin as second-line therapy for chronic anal fissure failing 0.2 percent glyceryl trinitrate.

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#### Abstract

**PURPOSE:** Glyceryl trinitrate paste is used by many as first-line therapy for chronic anal fissure but heals only approximately 50 to 60 percent of fissures. We use botulinum toxin as second-line therapy after failed glyceryl trinitrate and aimed to evaluate efficacy, side effects, and patient preference.

**METHODS:** A prospective, nonrandomized, open-label study of patients with chronic anal fissure failing a course of glyceryl trinitrate treated with 20 units of botulinum toxin A injected into the internal sphincter was conducted. Symptomatic relief, visual healing of fissures, side effects, and patient preference were assessed at 8-week follow-up.

**RESULTS:** Forty patients underwent botulinum toxin treatment. Twenty-nine patients (73 percent) overall were improved symptomatically and avoided surgery. Seventeen fissures (43 percent) were healed, whereas 23 fissures (57 percent) remained unhealed. Of the unhealed fissures, 5 (12 percent) were asymptomatic, 7 (18 percent) were symptomatically much improved, and 11 (27 percent) were no better symptomatically and came to surgery. Discomfort associated with injection was minimal. Of 34 patients undergoing botulinum toxin injection in the clinic, 24 (71 percent) preferred botulinum toxin, 7 glyceryl trinitrate (20 percent; difference = 51 percent; 95 percent confidence interval = 31-71 percent), and 9 percent were undecided. Transient minor incontinence symptoms were noted in 7 patients (18 percent).

**CONCLUSIONS:** Second-line botulinum toxin injection improves symptoms in approximately three-quarters of patients after failed primary glyceryl trinitrate therapy and at least in the short term avoids surgical sphincterotomy. Botulinum toxin heals approximately one-half of these fissures. Discomfort and side effects were minimal. A policy of first-line glyceryl trinitrate/second-line botulinum toxin will avoid sphincterotomy in 85 to 90 percent. Higher rates of healing may be achieved by giving botulinum toxin as first-line therapy, or addressing the chronic fibrotic nature of the fissure.

45. Dis Colon Rectum. 2002 Apr;45(4):530-6.

Phosphodiesterase inhibitors cause relaxation of the internal anal sphincter in vitro.

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#### Abstract

**PURPOSE:** Pharmacologic treatments are gaining widespread acceptance as first-line therapy for anal fissure. However, existing treatments have limited clinical usefulness because of side effects and incomplete healing rates.

**METHODS:** Fresh human surgical resection specimens containing internal anal sphincter and rectal circular muscle were collected. Strips of smooth muscle were cut from each muscle group and mounted in a superfusion organ bath. The effects of increasing concentrations of phosphodiesterase inhibitors were evaluated.

**RESULTS:** All phosphodiesterase inhibitors tested caused a dose-dependent reduction in the tone of the internal anal sphincter, with potencies as follows: vinpocetine (phosphodiesterase-1 inhibitor; 50 percent maximum inhibition concentration = 0.87 +/- 0.10 microM), erythro-9-(2-hydroxy-3-nonyl) adenine hydrochloride (phosphodiesterase-2 inhibitor; 32 +/- 4.8 microM), trequinsin (phosphodiesterase-3 inhibitor; 0.28 +/- 0.041 microM), rolipram (phosphodiesterase-4 inhibitor; 63 +/- 9 microM), zaprinast (phosphodiesterase-1,5,6,9,11 inhibitor; 3 +/- 0.69 microM), and dipyridamole (phosphodiesterase-5,6,8,10,11 inhibitor; 5.5 +/- 2 microM). Although all inhibitors were also effective on rectal circular muscle strips, erythro-9-(2-hydroxy-3-nonyl) adenine hydrochloride, trequinsin, and rolipram were at least an order of magnitude more potent in this tissue than in the internal anal sphincter.

CONCLUSIONS: There are several functionally important phosphodiesterases in the internal anal sphincter and rectal circular muscle. Both adenosine 3', 5'-cyclic monophosphate and guanosine 3',5'-cyclic monophosphate appear to be important in the myogenic tone of the internal anal sphincter, and this study provides further evidence of the sphincteric specialization of this tissue. Phosphodiesterase inhibitors might represent a new therapy for the treatment of anal fissure.

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The physiology, pharmacology and therapeutic manipulation of the internal anal sphincter.

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#### Abstract

Recent research into the physiology and pharmacology of the internal anal sphincter has elucidated the importance of this structure in health and disease. Its pharmacological manipulation for therapeutic gain has focused mainly on agents to reduce internal anal sphincter tone, a 'chemical sphincterotomy' that might heal chronic anal fissure. However, drugs to increase sphincter tone, and augment intermittent and appropriate relaxation are also being evaluated. The initial results with this medical approach to anorectal disease have often been disappointing, failing to match the results achievable with surgery, and many of these drugs have a high rate of side effects in the short term. However, clinical trials have yet to establish the optimum doses, dose intervals and routes of administration for many of these therapies. Furthermore, it is uncertain whether this medical approach should be applied to all patients or just to an as yet undefined subgroup. Certainly, even in the current environment of uncertainty, there is little reason not to try medical manipulation of the internal sphincter as first-line treatment. Surgery remains an option for treatment failures; patients responding to pharmacological manipulation of the internal anal sphincter are spared the long term risks of continence that are inherent in many surgical procedures on the anorectum.