

Hysterectomy and sexual wellbeing: prospective observational study of vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy

Jan-Paul W R Roovers, Johanna G van der Bom, C Huub van der Vaart, A Peter M Heintz on behalf of the Hysterectomy Vaginal versus Abdominal study group

Abstract

Objectives To compare the effects of vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy on sexual wellbeing.

Design Prospective observational study over six months.

Setting 13 teaching and non-teaching hospitals in the Netherlands.

Participants 413 women who underwent hysterectomy for benign disease other than symptomatic prolapse of the uterus and endometriosis.

Main outcome measures Reported sexual pleasure, sexual activity, and bothersome sexual problems.

Results Sexual pleasure significantly improved in all patients, independent of the type of hysterectomy. The prevalence of one or more bothersome sexual problems six months after vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy was 43% (38/89), 41% (31/76), and 39% (57/145), respectively (χ^2 test, $P=0.88$).

Conclusion Sexual pleasure improves after vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy. The persistence and development of bothersome problems during sexual activity were similar for all three techniques.

Introduction

Hysterectomy is the most common major gynaecological operation in the United Kingdom and United States.^{1,2} In the Netherlands, 32% of women will need hysterectomy during their lifetime.³ Historically the uterus has been regarded as the regulator and controller of important physiological functions, a sexual organ, a source of energy and vitality, and a maintainer of youth and attractiveness.⁴ Women are concerned that hysterectomy may affect their sexual wellbeing or their sexual attractiveness. Hysterectomy has been reported as having adverse as well as beneficial effects on sexual wellbeing.⁵⁻¹⁰

Because hysterectomy disrupts the local nerve supply and anatomical relations of the pelvic organs, it has been thought that the function of these organs may be adversely affected. The idea that sexual wellbeing may

differ according to type of hysterectomy is based on the hypothesis that the techniques damage the innervation and supportive structures of the pelvic floor differently. During hysterectomy the pelvic plexus may be damaged in four ways: the main branches of the plexus passing beneath the uterine arteries may be damaged during the division of the cardinal ligaments¹¹; the major part of the vesical innervation, which enters the bladder base before spreading throughout the detrusor muscle, may be damaged during blunt dissection of the bladder from the uterus and cervix¹¹; the extensive dissection of the paravaginal tissue may disrupt the pelvic neurons passing from the lateral aspect of the vagina¹²; or the removal of the cervix results in loss of a large segment of intimately related plexus.¹²

Of all potential anatomical sites where damage to the pelvic plexus may occur, only damage to the cervix has been evaluated. Many believe that the cervix should be preserved for sexual wellbeing, as supported by quantitative evidence from one study.⁸ Another study, however, reported a beneficial effect of its removal.⁹

Recently, a randomised controlled trial showed similar effects of total and subtotal hysterectomy on sexual wellbeing.² However, merely reporting the incidence of sexual problems is insufficient. Symptoms may not affect sexual pleasure if they do not interfere with normal sexual wellbeing—that is, only symptoms that are regarded as bothersome by the patient are likely to adversely affect sexual pleasure. To what extent these bothersome symptoms differ between total and subtotal hysterectomy has not been investigated.

If vaginal and abdominal removal of the uterus are both technically feasible, gynaecologists generally select vaginal hysterectomy because of reduced length of hospital stay, fewer complications, and reduced costs.¹³⁻¹⁵ We compared the effects of vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy on sexual wellbeing.

Participants and methods

We recruited consecutive women who had been offered hysterectomy for a benign indication between January 1999 and July 2000. Exclusion criteria were

Department of Obstetrics and Gynaecology, University Medical Center Utrecht, 3584 CX Utrecht, Netherlands

Jan-Paul W R Roovers registrar

C Huub van der Vaart consultant

A Peter M Heintz professor of gynaecology

Julius Centre for Health Sciences and Primary Care, University Medical Centre Utrecht, Netherlands

Johanna G van der Bom assistant professor of epidemiology

Correspondence to: J-P Roovers j_proovers@hotmail.com

bmj.com 2003;327:774



Members of the study group and selected questions from the questionnaire appear on bmj.com

endometriosis and symptomatic prolapse of the uterus as indications for hysterectomy.

Our prospective observational study took place in 13 teaching and non-teaching hospitals in the Netherlands over six months. Written informed consent was obtained from all patients.

Gynaecologists were free to choose a surgical hysterectomy technique. Perioperative treatment was similar in all participating hospitals. All women received perioperative prophylaxis for deep vein thrombosis and a single dose of intravenous prophylactic antibiotic during surgery. A 14 French gauge Foley indwelling catheter with a 5 ml balloon was used to catheterise the bladder after surgery. This was removed after 24 hours. In case of bladder retention (twice a residual volume after voiding of more than 100 ml), the patient started clean intermittent self catheterisation. Analgesia was the same in all patients.

Objectives and outcome measures

We compared the effects of different hysterectomy techniques on sexual wellbeing. All patients completed a questionnaire for screening sexual dysfunctions before hysterectomy and six months after surgery.^{16 17} Six months was chosen on the basis of a study that showed that it may take this long for damage to pelvic innervation to recover.¹⁸ Furthermore, six months may be long enough for patients to adapt to the hysterectomy. In this study, gynaecologists advised their patients to withhold sexual activity for six weeks after surgery.¹⁸

The questionnaire comprised 36 questions, which assessed the presence, frequency (measured with a five point Likert scale ranging from hardly ever to always), and experienced discomfort of sexual dysfunctions (measured with a five point Likert scale ranging from not at all to severely). The first 16 questions concerned the general perception of the patient's own sexuality and frequency of sexual activity. The next 18 questions concerned different types of problems during sexual activity. Questions were selected from this part of the questionnaire to identify patients with bothersome problems with lubrication, orgasm, pain or sensation in the genitals, and arousal (see table on bmj.com). We regarded symptoms to be bothersome when scored as "I am bothered," "I am much bothered," or "I am severely bothered." We regarded symptoms not to be bothersome when scored as "slightly bothered" or when the symptom was not present.

We decided not to include the frequency of occurrence of symptoms in the analysis for two reasons. Firstly, because the frequency of occurrence depends on frequency of intercourse, it is difficult to interpret and, secondly, we think that a patient's experience concerns all aspects of a dysfunction, the frequency of occurrence included. The last two questions of the questionnaire concerned general satisfaction about sexuality (score 0 to 10). A higher score indicated more satisfaction.

Potential confounders

Data were collected on the maximum diameter of the uterus as assessed by ultrasonography, comorbidities (requiring drugs for diabetes, hypertension, hypercholesterolaemia, hyperthyroidism, hypothyroidism, chronic obstructive pulmonary disease, or rheumatoid arthritis), duration of the operation, estimated blood

loss, size of prolapse of the uterus in centimetres above the hymen (expressed as a negative number) or below the hymen (expressed as a positive number) as measured when pulling down the uterus under anaesthesia, simultaneously performed surgical procedures, complications due to surgery, and duration of hospital stay.

Analysis

The sample size calculation was based on studies that reported sexual problems in 40% of patients who had undergone hysterectomy.^{2 4} A 20% difference in the persistence or development of a sexual symptom (40% in one group and 60% in the other) was considered clinically relevant. We required 76 patients in each group to detect such a difference with a power of 80% and a significance level of 5%.

We compared the number of patients who were sexually active, the reported frequency of intercourse, and the general satisfaction with sexuality both before and six months after surgery. The main analysis concerned only patients who were sexually active both before and after hysterectomy, and their characteristics were compared between surgical techniques. Comparisons were made between all pairs (three comparisons). We decided not to adjust for multiple testing because we did not want to miss potentially important findings.¹⁹

We compared between groups the prevalence of bothersome sexual problems that persisted or developed after surgery. Statistical significance was determined by the χ^2 test. Findings were also stratified according to the presence or absence of the symptoms before hysterectomy. Logistic regression analysis was used to calculate odds ratios and 95% confidence intervals when the prevalence of persistent or newly developed symptoms differed by more than 10% between two groups. The odds ratios were adjusted for differences in other determinants of sexual wellbeing in multivariable logistic regression analysis. These included age, number of children, body mass index, size of uterus, prolapse of uterus, indication for hysterectomy, use of antidepressants, comorbidity, and duration of relationship with partner. A P value of <0.05 was considered statistically significant. We analysed the data with SPSS 10.0.

Results

Overall, 413 of 477 patients agreed to take part in our study. Because 13 hospitals participated, there was a time delay in informing everybody that the target had been reached, and we therefore achieved over the required number of patients. Of the 379 participating patients who had a male partner, 352 (93%) responded six months after surgery. Responders and non-responders had similar characteristics.

Sexual activity both before and after surgery did not differ between groups (table 1). In addition, of the patients who were sexually active, the frequency of intercourse was similar both before and after hysterectomy for all three techniques (data not shown). The general satisfaction about sexuality improved after all techniques. We observed no differences in improvement for the three techniques.

Table 1 Sexual activity and reported general satisfaction about sexuality in 352 women before and after hysterectomy, according to type of surgery. Values are numbers (percentages) of patients unless stated otherwise

| Characteristic | Vaginal hysterectomy (n=104) | | P value | Subtotal abdominal hysterectomy (n=84) | | P value | Total abdominal hysterectomy (n=164) | | P value |
|---------------------------------|------------------------------|---------------|---------|----------------------------------------|---------------|---------|--------------------------------------|---------------|---------|
| | Before surgery | After surgery | | Before surgery | After surgery | | Before surgery | After surgery | |
| Sexually active* | | | | | | | | | |
| Yes | 92 | 89 (97) | | 76 | 76 (100) | | 152 | 145 (95) | |
| No | 12 | 8 (68) | | 8 | 6 (75) | | 12 | 3 (25) | |
| Mean (SE) general satisfaction* | 7.0 (0.2) | 7.5 (0.2) | 0.014 | 7.0 (0.2) | 7.5 (0.2) | 0.016 | 6.9 (0.2) | 7.4 (0.2) | 0.006 |

*Data for both sexually active and not sexually active patients.

Of the 352 patients who responded, 310 reported being sexually active both before and after surgery. These 310 patients were included in the further analysis: 89 (29%) underwent vaginal hysterectomy, 76 (25%) underwent subtotal abdominal hysterectomy, and 145 (47%) underwent abdominal hysterectomy. Table 2 shows their characteristics. Ten patients who had been sexually active before surgery were no longer sexually active six months after surgery. Of the 32 patients who were not sexually active before hysterectomy, 17 (53%) became sexually active after surgery. We found no statistically significant differences among the surgical techniques for those patients who remained or became sexually active. Patient characteristics and distribution of types of hysterectomy were similar between hospitals. Statistically significant differences among the groups were observed for maximum diameter of the uterus, prolapse of the uterus, indication for hysterectomy,

and comorbidity. The groups had a similar frequency of bothersome sexual problems before hysterectomy.

Table 3 shows the prevalence of bothersome problems during sexual activity that persisted or developed six months after surgery in all three groups. Overall after surgery there was a reduction in all sexual problems reported before hysterectomy; we found no statistically significant differences between the groups.

Compared with patients who had undergone vaginal hysterectomy those who had undergone total or subtotal abdominal hysterectomy had an increased, but not statistically significant, prevalence of persisting problems with lubrication (total, adjusted odds ratio 1.6, 95% confidence interval 0.7 to 3.6; subtotal 2.3, 0.4 to 11.9) and persisting problems with arousal (total, 1.2, 0.6 to 2.5; subtotal, 2.1, 0.5 to 8.6). Problems with sensation in the genitals more often persisted after

Table 2 Patient characteristics and reported bothersome sexual problems before hysterectomy of 310 patients who were sexually active before and after hysterectomy, according to type of surgery. Values are numbers (percentages) of patients unless stated otherwise

| Characteristic | Vaginal hysterectomy (n=89) | Subtotal abdominal hysterectomy (n=76) | Total abdominal hysterectomy (n=145) | P value* |
|---------------------------------------------------------|-----------------------------|----------------------------------------|--------------------------------------|----------|
| Patient characteristics | | | | |
| Mean (SD) age (years) | 43.1 (5.3) | 43.4 (5.5) | 44.4 (6.3) | 0.20† |
| Mean (SD) No of children | 2.1 (0.8) | 1.9 (1.1) | 1.9 (1.2) | 0.16† |
| Mean (SD) body mass index (kg/m ²) | 25.6 (4.1) | 24.8 (3.9) | 25.5 (4.0) | 0.40† |
| Mean (SD) maximum diameter of uterus (cm) | 8.1 (1.4) | 10.2 (3.8) | 11.0 (3.4) | <0.01† |
| Mean (SD) prolapse of uterus (cm)‡ | -2.7 (1.9) | -6.0 (2.4) | -6.6 (2.4) | <0.01† |
| Indication for hysterectomy§: | | | | |
| Menorrhagia | 63 (71) | 60 (79) | 88 (61) | 0.03 |
| Metrorrhagia | 38 (43) | 18 (24) | 38 (26) | 0.01 |
| Abdominal pain | 17 (19) | 31 (41) | 48 (33) | 0.01 |
| Dysmenorrhoea | 25 (28) | 22 (29) | 31 (21) | 0.30 |
| Other | 12 (13) | 4 (5) | 11 (8) | 0.15 |
| Premenopausal | 78 (88) | 68 (89) | 130 (90) | 0.92 |
| History of abdominal surgery | 34 (38) | 31 (41) | 55 (38) | 0.89 |
| Comorbidity | 34 (38) | 12 (17) | 49 (35) | 0.09 |
| Mean (SD) duration of relationship with partner (years) | 20.0 (8.2) | 19.0 (9.3) | 20.5 (9.0) | 0.57† |
| Frequency of sexual activity | | | | |
| Once a month or less | 16 (18) | 12 (16) | 34 (23) | |
| Once a week to once a month | 44 (49) | 37 (49) | 69 (48) | 0.43 |
| More than once a week | 29 (33) | 27 (35) | 42 (29) | |
| Bothersome sexual problems before hysterectomy | | | | |
| Problems with lubrication | 25 (28) | 22 (29) | 39 (27) | 0.96 |
| Problems with orgasm | 27 (30) | 23 (30) | 35 (24) | 0.61 |
| Problems with genital pain | 26 (29) | 16 (21) | 45 (31) | 0.31 |
| Problems with sensation in genitals | 6 (7) | 9 (12) | 13 (9) | 0.52 |
| Problems with arousal | 30 (34) | 26 (34) | 44 (30) | 0.82 |
| Any sexual problem present | 49 (55) | 43 (57) | 81 (56) | 1.00 |

* χ^2 test.

†Calculated with analysis of variance.

‡Measured under anaesthesia by pulling down cervix with forceps.

§Not mutually exclusive.

Table 3 Women's reported bothersome sexual problems that persisted or developed six months after hysterectomy, according to type of surgery. Values are numbers (percentages) of patients unless stated otherwise

| Reported bothersome sexual problem before hysterectomy | Vaginal hysterectomy (n=89) | | Subtotal abdominal hysterectomy (n=76) | | Total abdominal hysterectomy (n=145) | | P value* |
|--------------------------------------------------------|-----------------------------|---------------|----------------------------------------|---------------|--------------------------------------|---------------|----------|
| | Before surgery | After surgery | Before surgery | After surgery | Before surgery | After surgery | |
| Problems with lubrication: | 89 | 14 (16) | 76 | 18 (24) | 145 | 36 (25) | 0.24 |
| Present | 25 | 9 (36) | 22 | 12 (54) | 39 | 22 (56) | 0.25 |
| Not present | 64 | 5 (8) | 54 | 6 (11) | 106 | 14 (13) | 0.56 |
| Problems with orgasm: | 89 | 19 (21) | 76 | 16 (21) | 145 | 32 (22) | 0.98 |
| Present | 27 | 13 (48) | 23 | 11 (48) | 35 | 18 (51) | 0.95 |
| Not present | 62 | 6 (10) | 53 | 5 (9) | 110 | 14 (13) | 0.75 |
| Problems with genital pain: | 89 | 15 (17) | 76 | 10 (13) | 145 | 25 (17) | 0.72 |
| Present | 26 | 8 (31) | 16 | 5 (31) | 45 | 18 (40) | 0.68 |
| Not present | 63 | 7 (11) | 60 | 5 (8) | 100 | 7 (7) | 0.66 |
| Problems with sensation in genitals: | 89 | 5 (6) | 76 | 7 (9) | 145 | 12 (8) | 0.65 |
| Present | 6 | 1 (17) | 9 | 3 (33) | 13 | 5 (38) | 0.64 |
| Not present | 83 | 4 (5) | 67 | 4 (6) | 132 | 7 (5) | 0.94 |
| Problems with arousal: | 89 | 16 (18) | 76 | 16 (21) | 145 | 33 (23) | 0.68 |
| Present | 30 | 12 (40) | 26 | 14 (54) | 44 | 23 (52) | 0.50 |
| Not present | 59 | 4 (7) | 50 | 2 (4) | 101 | 10 (10) | 0.42 |
| Any sexual problem: | 89 | 38 (43) | 76 | 31 (41) | 145 | 57 (39) | 0.88 |
| Present | 49 | 29 (59) | 43 | 23 (54) | 81 | 45 (56) | 0.85 |
| Not present | 40 | 9 (23) | 33 | 8 (24) | 64 | 12 (19) | 0.80 |

* χ^2 test.

total or subtotal abdominal hysterectomy than after vaginal hysterectomy. The number of patients who reported bothersome problems with sensation in the genitals before hysterectomy was too low to allow multivariate analysis.

Of the 173 patients who reported one or more bothersome sexual problems before hysterectomy, the problems were still reported by 29 (59%) after vaginal hysterectomy, 23 (54%) after subtotal abdominal hysterectomy, and 45 (56%) after total abdominal hysterectomy. New sexual problems developed in 9 (23%) patients after vaginal hysterectomy, 8 (24%) patients after subtotal abdominal hysterectomy, and 12 (19%) patients after total abdominal hysterectomy.

Discussion

Sexual wellbeing improves after vaginal hysterectomy, subtotal abdominal hysterectomy, and total abdominal hysterectomy. The type of technique does not seem to determine the persistence or development of bothersome problems during sexual activity. Our study was based on a multicentre cohort study of 413 women who underwent one of these techniques. Data were prospectively collected and potential confounders documented. A validated questionnaire measured sexual function.

Limitations of study

Our study has several limitations. Firstly, the size of our study population may have been too small to detect slight differences. Although we obtained the required number of patients according to the power calculation, we question whether differences that are not observed in a sample size of 413 patients have any clinical relevance. Secondly, the patients were not randomised according to type of hysterectomy. Therefore, our results may have been confounded by baseline differences in factors that influence sexual wellbeing. We therefore prospectively documented potential confounders, and we used logistic regression analysis to adjust for these. Ideally, we would have performed a

randomised controlled trial, but too few gynaecologists were willing to participate. The gynaecologist's decision to perform a surgical technique depends on personal preference and technical skills. The indication for hysterectomy also plays a part. Patients with unexplained abdominal pain are more likely to undergo abdominal surgery. However, there is considerable overlap between indications and operation techniques. It is therefore possible to adjust for prognostic differences between the groups.

Studies evaluating the effects of type of hysterectomy on sexual wellbeing have mainly focused on removal of the cervix.^{2,8,9} One study suggested that removal of the cervix adversely affects sexuality.⁸ In this study the first author interviewed the patients in whom he had performed the operation. Recently, a randomised controlled trial compared the effects of total and subtotal hysterectomy on sexuality.² The characteristics of the participating patients were comparable to those in our study. As with our study, removal of the cervix had no adverse effect on sexuality. Apparently, more extensive disruption of local innervation and anatomical relations during total hysterectomy does not lead to more sexual dysfunction. It has been suggested that substantial pelvic organ dysfunction is uncommon after both total and subtotal hysterectomy, as the most significant autonomic nerve content is located in the middle to lateral third of the sacral and cardinal ligaments.²⁰ When performing simple hysterectomy, only the medial third of these ligaments is interrupted.

Our study is the first to focus on sexual problems that are experienced as bothersome. We know of no studies that compare the effects of vaginal and abdominal hysterectomy on sexuality. In our study we observed no statistically significant differences in the persistence or development of bothersome sexual problems. A trend was observed towards a higher prevalence of persisting problems with lubrication and arousal after subtotal or total abdominal hysterectomy. This needs to be confirmed in a larger study.

What is already known on this topic

Hysterectomy is the most common major gynaecological operation

Women are concerned that hysterectomy will affect their sexual attractiveness

Effects on sexual wellbeing may depend on the surgical technique

What this study adds

Sexual pleasure improves after hysterectomy

Sexual problems before surgery are less common after surgery

De novo sexual problems after hysterectomy are scarce

Sexual wellbeing does not depend on the surgical technique

Contributors: All authors conceived and designed the study, drafted the manuscript, and approved the final manuscript. JPWRR and JGvdB analysed and interpreted the data. CHvdV interpreted the data. APMH will act as guarantor for the paper.

Funding: None.

Competing interests: None declared.

Ethical approval: This study was approved by all local ethical committees.

- 1 Department of Health. *Hospital episode statistics*. London: DoH, 1998-99.
- 2 Thakar R, Ayers S, Clarkson P, Stanton SL, Manyonda I. Outcomes after total versus subtotal abdominal hysterectomy. *N Engl J Med* 2002;347:1318-25.

- 3 Hoogendoorn D. The odds on hysterectomy and estimation of the number of cancer deaths prevented by hysterectomies in their current incidence. *Ned Tijdschr Geneesk* 1984;128(41):1937-40.
- 4 Sloan D. The emotional and psychosexual aspects of hysterectomy. *Am J Obstet Gynecol* 1978;131:598-605.
- 5 Rhodes JC, Kjerulff KH, Langenberg PW, Guzinski GM. Hysterectomy and sexual functioning. *JAMA* 1999;282:1934-41.
- 6 Helstrom L, Lundberg PO, Sorbom D, Backstrom T. Sexuality after hysterectomy: a factor analysis of women's sexual lives before and after subtotal hysterectomy. *Obstet Gynecol* 1993;81:357-62.
- 7 Helstrom L, Sorbom D, Backstrom T. Influence of partner relationship on sexuality after subtotal hysterectomy. *Acta Obstet Gynecol Scand* 1995;74:142-6.
- 8 Kilkku P, Gronroos M, Hirvonen T, Rauramo L. Supravaginal uterine amputation vs. hysterectomy. Effects on libido and orgasm. *Acta Obstet Gynecol Scand* 1983;62:147-52.
- 9 Virtanen H, Makinen J, Tenho T, Kiihholma P, Pitkanen Y, Hirvonen T. Effects of abdominal hysterectomy on urinary and sexual symptoms. *Br J Urol* 1993;72:868-72.
- 10 Polivy J. Psychological reactions to hysterectomy: a critical review. *Am J Obstet Gynecol* 1974;118:417-26.
- 11 Smith PH, Ballantyne B. The neuroanatomical basis of denervation of the urinary bladder following major pelvic surgery. *Br J Surg* 1968;55:929-33.
- 12 Parys BT, Haylen B, Hutton JL, Parsons KE. The effect of simple hysterectomy on vesicourethral function. *Br J Urol* 1989;64:594-9.
- 13 Van den Eeden SK, Glasser M, Mathias SD, Colwell HH, Pasta DJ, Kunz K. Quality of life, health care utilization, and costs among women undergoing hysterectomy in a managed-care setting. *Am J Obstet Gynecol* 1998;178:91-100.
- 14 Kovac SR. Hysterectomy outcomes in patients with similar indications. *Obstet Gynecol* 2000;95:787-93.
- 15 Davies A, Vizza E, Bournas N, O'Connor H, Magos A. How to increase the proportion of hysterectomies performed vaginally. *Am J Obstet Gynecol* 1998;179:1008-12.
- 16 Vroege JA, Zeijlemaker BYW, Scheers MM. Sexual functioning of adult patients with meningomyelocele. *Eur Urol* 1998;34:25-9.
- 17 Vroege JA, Gijs L, Hengeveld MW. Classification of sexual dysfunctions in women. *J Sex Marital Ther* 2001;27:237-43.
- 18 Sultan AH, Kamm MA, Hudson CN. Pudendal nerve damage during labour: prospective study before and after childbirth. *Br J Obstet Gynecol* 1994;101:22-8.
- 19 Rothman KJ. No adjustments are needed for multiple comparisons. *Epidemiology* 1990;1:43-6.
- 20 Butler-Manuel SA, Buttery LDK, A'Hern RP, Polak JM, Barton DPJ. Pelvic nerve plexus trauma at radical hysterectomy and simple hysterectomy: the nerve content of the uterine supporting ligaments. *Cancer* 2000;89:834-41.

(Accepted 18 July 2003)