# **Risk Factors for Chronic Pain after Hysterectomy**

A Nationwide Questionnaire and Database Study

Birgitte Brandsborg, M.D.,\* Lone Nikolajsen, M.D., Ph.D.,† Charlotte T. Hansen, M.D.,‡ Henrik Kehlet, M.D., Ph.D.,§ Troels S. Jensen, M.D., Ph.D.||

*Background:* Women scheduled to undergo hysterectomy for benign indications frequently have preoperative pelvic pain, but it is largely unknown why pain in some cases persists or even develops after surgery. This nationwide questionnaire and database study describes pain and identifies risk factors for chronic postsurgical pain 1 yr after hysterectomy for benign indications.

*Methods:* A pain questionnaire was mailed to 1,299 women 1 yr after hysterectomy. The response rate was 90.3%, and the presence of persistent pain was correlated to indication for surgery, surgical procedure, type of anesthesia, and other perioperative data.

*Results:* Pain was reported by 31.9% 1 yr after hysterectomy (chronic pain), and 13.7% had pain more than 2 days a week. Pain was not present before surgery in 14.9% of women with chronic postsurgical pain. Risk factors for chronic pain were preoperative pelvic pain (odds ratio [OR], 3.25; 95% confidence interval [CI], 2.40–4.41), previous cesarean delivery (OR, 1.54; CI, 1.06–2.26), pain as the main indication for surgery (OR, 2.98; CI, 1.54–5.77), and pain problems elsewhere (OR, 3.19; CI, 2.29–4.44). Vaginal hysterectomy *versus* total abdominal hysterectomy was not significantly associated with a lower risk of chronic pain (OR, 0.70; CI, 0.46–1.06). Importantly, spinal *versus* general anesthesia was associated with less chronic pain (OR, 0.42; CI, 0.21–0.85).

*Conclusions:* Thirty-two percent had chronic pain after hysterectomy, and risk factors were comparable to those seen in other operations. Interestingly, spinal anesthesia was associated with a lower frequency of chronic pain, justifying prospective study of spinal anesthesia for patients with a high risk for development of chronic postsurgical pain.

CHRONIC postsurgical pain has until recently been a neglected phenomenon.<sup>1-3</sup> Several studies, however, have shown that surgery *per se* carries a significant risk for chronic or long-lasting pain. This is seen not only after major surgery such as amputation and thoracotomy, but also after minor procedures such as inguinal

This article is featured in "This Month in Anesthesiology." Please see this issue of ANESTHESIOLOGY, page 5A. herniorrhaphy, where the risk of chronic pain is estimated to be 6-7%.<sup>1-3</sup> Identification of risk factors for chronic postsurgical pain is important because it implies a possibility for preventing such pain. So far, type of surgery, preoperative pain, and acute postoperative pain have been identified as risk factors, as well as psychosocial factors, and more recently, it has been suggested that genetic factors are involved.<sup>3</sup>

Chronic pain is a frequent symptom in gynecologic disorders, but to what extent gynecologic surgery in itself causes chronic pain is largely unknown. Prospective studies of hysterectomy for benign conditions suggest that although most women are relieved of pain, 4.7-26.2% still report pain 1 yr after the operation.<sup>4-10</sup> The criteria used to define pain are not similar in these studies, and this may explain in part this range of pain prevalence. Furthermore, none of the studies have pain as the primary outcome parameter, and therefore, pain is not described in detail regarding location, intensity, frequency, and possible etiology of pain. Based on this, the aim of this study was to describe these aspects of chronic postsurgical pain 1 yr after hysterectomy and to identify possible risk factors related to the development of chronic pain. We combined clinical data from a national registry with a postal questionnaire 1 yr after hysterectomy. The Danish Hysterectomy Database (DHD) was established in 2003 with the purpose of studying and improving the outcome of hysterectomy, and it includes only hysterectomy performed for benign indications. More than 90% of hysterectomies for benign indications performed in Denmark are registered in DHD, and data include preoperative diagnosis, type of surgery and anesthesia, complications, and other factors registered by the treating physicians.

# **Materials and Methods**

The study was approved by the steering group of DHD and registered according to the Danish law of Data Protection. Studies based on questionnaires or registers are not to be notified to the Danish National Committee on Biomedical Research Ethics.

#### Patients and Questionnaire

All women registered in DHD between October 1, 2003 and April 1, 2004 were identified (n = 1,299). A pain questionnaire with a prestamped return envelope was mailed to 1,299 women between February 15, 2005 and March 15, 2005 (range, 12.3–15.2 months after the

<sup>\*</sup> Research Fellow, † Consultant, || Professor, Danish Pain Research Center, Aarhus University Hospital. ‡ Research Fellow, The Danish Hysterectomy Database, Department of Obstetrics and Gynecology, Hvidovre University Hospital, Hvidovre, Denmark. § Professor, Section of Surgical Pathophysiology, Rigshospitalet, Copenhagen, Denmark.

Received from the Danish Pain Research Center, Aarhus University Hospital, Aarhus, Denmark. Submitted for publication July 6, 2006. Accepted for publication January 25, 2007. Supported by a grant from the Lundbeck Foundation, Hellerup, Denmark, and the Institute of Clinical Medicine, Faculty of Health Sciences, University of Aarhus, Aarhus, Denmark. Presented as a poster at the 11th World Congress on Pain, Sydney, Australia, August 22–26, 2005.

Address correspondence to Dr. Brandsborg: Danish Pain Research Center, Aarhus University Hospital, Norrebrogade 44, Building 1 A, DK-8000 Aarhus C, Denmark. birgitte.brandsborg@ki.au.dk. Individual article reprints may be purchased through the Journal Web site, www.anesthesiology.org.

operation). If not returned within 5 weeks, a reminder was sent. The questionnaire was in Danish, and it included the McGill short-form questionnaire and additional questions specified for posthysterectomy pain (for an English translation of the questionnaire, see appendix). Chronic pain was defined as pelvic pain within the last 3 months, corresponding to "yes" in question 15: Have you had pain in the pelvic region within the last 3 months? (Both pain that was present before the operation and pain that has come after the operation. Pain related to sexual intercourse is not included in this question, but comes later in the questionnaire.)

Other questions included intensity, frequency, and location of pain both before hysterectomy and at the time of the survey, together with use of analgesics and others treatments, as, for example, physiotherapy and acupuncture. General questions were related to previous abdominal surgery, pain problems elsewhere, and occupation.

#### Statistical Analysis

Returned questionnaires were identified by a patient number and responses were manually entered into a database. For the subsequent analysis, data from the DHD were linked to the questionnaire data. The statistical software was Intercooled Stata version 9 (StataCorp LP, College Station, TX). Descriptive statistics using median (range) and mean (SD) were used where appropriate. The chi-square test was used to compare categorical variables. Eight main risk factors were chosen for a multivariate logistic regression model. The choice of risk factors was based on the current knowledge about risk factors for chronic postsurgical pain and clinical experience. The dependent variable was chronic pain (question 15). The independent variables were (1) preoperative pelvic pain, (2) previous cesarean delivery, (3) pain problems elsewhere, (4) indication for hysterectomy, (5) type of hysterectomy, (6) spinal anesthesia, (7) epidural anesthesia during surgery, and (8) postoperative epidural analgesia. Variables 4 and 5 were categorical based on the categories registered in the DHD, and the reference variables were leiomyoma and total abdominal hysterectomy, respectively. The other variables were all dichotomous. We chose cesarean delivery as a risk factor instead of previous pelvic surgery for two reasons: Previous studies have found chronic pain after cesarean delivery, and women's recall of a previous cesarean delivery is likely to be more accurate than the recall of other surgical procedures.<sup>11,12</sup> Postoperative complications were not included in the regression model because details about severity were not provided in the DHD. All P values less than 0.05 were considered to be statistically significant.

Inclusion in the final analysis required complete data with respect to question 1: Did you have pain in the pelvic region before the operation? (yes/no/do not remember); question 15: Have you had pain in the pelvic



Fig. 1. Flowchart of the patients.

region within the last 3 months? (yes/no); and the eight variables included in the regression model.

# Results

The questionnaire was returned by 1,173 women (90.3%). Three women had died, and 123 women did not return the questionnaire. Thirty-eight of the 1,173 respondents were excluded from the final analysis (20 returned a blank questionnaire, 6 returned a very incomplete questionnaire, and 12 had missing data with regard to variables included in the regression analysis). This left 1,135 questionnaires (87.4%) for evaluation (fig. 1). Basic demographic data and primary indication are listed in table 1. Type of hysterectomy and method of anesthesia are listed in table 2.

Overall, the included questionnaires had few missing data. The median response rate to each question was 98.6% (range, 78.6–100%). The lowest response rates were observed in question 23c (78.6%): Have you sought other treatments for the pain?; question 13b (85.3%): If

Table 1. Baseline Characteristics (n = 1,135)

Age, yr	48 (33-88)
Body mass index, kg/m <sup>2</sup> (n = 1,106)	24.8 (16.1-48.2)
Follow-up, months	13.4 (12.3–15.2)
Occupation (n = 1,084)	
Employed	767 (70.8)
Unemployed	44 (4.1)
Retired	239 (22.0)
Other	34 (3.1)
Primary indication	
Leiomyoma	322 (28.4)
Menorrhagia	204 (18.0)
Metrorrhagia	199 (17.5)
Prolapse	146 (12.9)
Dysmenorrhea	70 (6.2)
Pain	49 (4.3)
Cervical dysplasia	42 (3.7)
Endometriosis	15 (1.3)
Other	88 (7.8)

Data are median (range) or n (%).

		Pain before Surgery	Pain at Follow-up
Previous pelvic/abdominal surgery*	552 (48.6)	387 (70.1)	213 (38.6)
Previous cesarean delivery	156 (13.7)	103 (66.0)	68 (43.6)
Hysterectomy			
Total abdominal	618 (54.5)	409 (66.2)	206 (33.3)
Subtotal abdominal	131 (11.5)	84 (64.1)	52 (39.7)
Vaginal	333 (29.3)	176 (52.9)	83 (24.9)
LAVH	39 (3.4)	26 (66.7)	17 (43.6)
Laparoscopic	14 (1.2)	8 (57.1)	4 (28.6)
Abdominal incision (n = $749$ )			
Pfannenstiel	467 (62.4)	318 (68.1)	156 (33.4)
Joel-Cohen	118 (15.8)	82 (69.5)	49 (41.5)
Vertical	160 (21.4)	92 (57.5)	53 (33.1)
Data missing	4 (0.5)		
Anesthesia			
General	721 (63.5)	441 (61.2)	242 (33.6)
Spinal	76 (6.7)	33 (43.4)	11 (14.5)
Epidural alone	6 (0.5)	3 (50.0)	4 (66.7)
General + epidural/spinal	332 (29.3)	226 (68.1)	105 (31.6)
Complication <sup>†</sup>			
Bleeding/hemorrhage	50 (4.4)	32 (64.0)	24 (48.0)
Pain	13 (1.1)	12 (92.3)	8 (61.5)
Wound infection	8 (0.7)	7 (87.5)	6 (75.0)
Other complications (various, less frequent)	42 (3.7)	30 (71.4)	17 (40.5)
Duration of surgery, median (range), min	64 (20–256)	64 (20–203)	65 (20–230)

Table 2. Pain before and after Hysterectomy in Relation to Surgical Procedure, Anesthesia, and Complications (n = 1,135)

Data are n (%) or median (range).

\* Including cesarean delivery. † Complications during primary hospital stay. Some patients had several complications.

LAVH = laparoscopically assisted vaginal hysterectomy.

you were initially pain free, how long after the operation did you acquire pain?; and question 17 (89.8%): Where is your pain located?" The remaining questions were all answered by more than 94.5% of women. All results refer to complete data for all 1,135 women except where otherwise mentioned.

We compared the 1,135 included women with the 164 not included (3 died, 123 nonresponders, and 38 excluded). The two groups were similar with regard to age, duration of surgery, and body mass index (Wilcoxon rank sum test, P > 0.1). The type of incision and the type of anesthesia was not different between the groups (chi-square test, P > 0.1). The surgical methods used were similar except for vaginal hysterectomy that was more frequent among the not-included women (38.4% *vs.* 29.3%; chi-square test, P = 0.0183). Prolapse was more frequently the main indication for surgery among the not-included women (20.1% *vs.* 12.9%; chi-square test, P = 0.0117).

The multiple regression model was significantly better than chance (P < 0.000), and with regard to sensitivity and specificity, the area under the receiver operator curve was 0.7471.

#### Pain Characteristics

Hysterectomy improved pain in most women (tables 2 and 3). However, 362 women (31.9%) had pain in the pelvic area 1 yr after surgery. The most common pain location was in the middle of the pelvic region, but 70

women reported pain located in the abdominal scar. The most common McGill pain descriptors were "shooting" (51.9%) and "sharp" (25.1%), and the average pain intensity was 4 (range, 0–10), whereas the worst pain intensity was 6 (range, 1–10) on a 0–10 numeric rating scale. Analgesics were used because of pelvic pain by 161 of the pain patients (44.5%), and 139 of these used acetaminophen and/or nonsteroid antiinflammatory drugs. Eighty-five women (23.5%) used other treatments for their pain (*e.g.*, physiotherapy, acupuncture, massage).

Fifty-four (14.9%) of the women with chronic pain did not recall having pain before the operation. The surgical procedures in these women were abdominal hysterectomy (66.7%), vaginal hysterectomy (31.5%), and laparoscopically assisted vaginal hysterectomy (1.9%). Average pain intensity was 4 (range, 1–10), worst pain intensity was 5 (range, 1–10), and pain affected daily living "a lot" or "very much" in 16.7% (n = 9). Pain was most frequently located in the middle of the pelvic region (n = 15) and in the abdominal scar (n = 15).

#### Pain and Indication for Hysterectomy

The primary indications for hysterectomy are listed in table 1. In the multivariate logistic regression, we included the primary indication for hysterectomy as a categorical variable, and leiomyoma was chosen as the reference value (table 4). A recall of pain before hysterectomy was also included. There was an increased odds ratio for pain at follow-up if pain was the primary indi-

#### Table 3. Pain Characteristics

	Before Surgery	At Follow-up
Pelvic pain frequency (n = $1,135$ )		
Total	703 (61.9)	362 (31.9)
Age $\leq$ 48 yr (n = 601)	447 (74.4)	243 (40.4)
Age > 48 yr (n = 534)	256 (47.9)	119 (22.3)
Frequency $(n = 703/362)$		, , , , , , , , , , , , , , , , , , ,
Constantly	93 (13.2)	24 (6.6)
Every day	212 (30.2)	68 (18.8)
$\geq$ 2 days a week	204 (29.0)	64 (17.7)
< 2 days a week	190 (27.0)	201 (55.5)
Data missing	4 (0.6)	5 (1.4)
Location (may be several) (n = $703/362$ )		
Middle of pelvis	525 (74.7)	163 (45.0)
Lower back	269 (38.3)	44 (12.2)
Vagina	96 (13.7)	107 (29.6)
Groin	151 (21.5)	105 (29.0)
Abdominal scar	NA	70 (19.3)
Other	128 (18.2)	136 (37.6)
Data missing	6 (0.9)	37 (10.2)
Pain intensity, median (range) (n = $703/362$ )		
Average	5 (0–10)	4 (0–10)
At its worst	8 (1–10)	6 (1–10)
Data missing	5 (0.7)	7 (1.9)
Sleep disturbed by the pelvic pain (n = $703/362$ )		. ()
Sleep disturbed	449 (63.9)	111 (30.7)
Data missing	0	9 (2.5)
Analaesic consumption (n = $703/362$ )		- ()
Total	516 (73.4)	161 (44.5)
Paracetamol	321 (45.7)	105 (29.0)
NSAID	239 (34.0)	57 (15.7)
Opioids and other	27 (3.8)	22 (6.1)
Data missing	3 (0.4)	8 (2.2)
Effect of pain on daily living (n = $703/362$ )		
Not at all	22 (3.1)	96 (26.5)
Some	277 (39.4)	194 (53.6)
A lot	260 (37.0)	52 (14.4)
Verv much	143 (20.3)	14 (3.9)
Data missing	1 (0.1)	6 (1.7)
Pain during sexual intercourse (n = $1.135$ )		
Every time	158 (13.9)	43 (3.8)
> 50% of times	209 (18.4)	53 (4.7)
Data missing	16 (1.4)	19 (1.7)
Pain problems elsewhere $(n = 1.135)$		
Total		759 (66.9)
Analgesics for this pain (n $=$ 759)		571 (75.2)

Data are n (%) or median (range).

NA = not applicable; NSAID = nonsteroidal antiinflammatory drug.

cation for hysterectomy (odds ratio [OR], 2.98; 95% confidence interval [CI], 1.54-5.77).

# Pain and Surgery

The different surgical procedures are listed in table 2. Multivariate logistic regression including all the surgical procedures showed no difference in chronic pain between total abdominal hysterectomy and vaginal hysterectomy (OR, 0.70; CI, 0.46–1.06), and likewise, no difference was found for total *versus* subtotal abdominal hysterectomy (OR, 1.20; CI, 0.77–1.86) (table 4). The type of abdominal incision (Joel-Cohen or Pfannenstiel) did not significantly influence chronic postsurgical pain, but there was a trend toward less pain after Pfannenstiel incision (chi-square test, OR, 0.71; CI, 0.47-1.07). A subsequent analysis of the 70 patients who reported scar pain showed no differences between incision location. Few patients had a laparoscopic hysterectomy (n = 14), not allowing for statistical analysis.

Previous pelvic or abdominal surgery was reported by 552 women (48.6%; table 2), and procedures were cesarean delivery (n = 156), appendectomy (n = 107), sterilization (n = 104), myomectomy (n = 30), extrauterine pregnancy (n = 41), surgery related to adnexa (n = 119), and other abdominal/pelvic procedures (n = 176). Previous cesarean delivery was associated with an increased risk of having chronic postsurgical pain (multiple logistic regression, OR, 1.54; CI, 1.06–2.26). Previ-

	Odds Ratio (CI) for Pain at Follow-up	P Value
1. Preoperative pelvic pain	3.25 (2.40–4.41)	0.000*
2. Previous cesarean delivery	1.54 (1.06–2.26)	0.025*
3. Pain problems elsewhere	3.19 (2.29-4.44)	0.000*
4. Primary indication for surgery		0.045*
Leiomyoma	1.00 (Reference variable)	
Menorrhagia	1.30 (0.86–1.98)	0.214
Metrorrhagia	1.45 (0.95–2.20)	0.082
Prolapse	1.53 (0.82–2.87)	0.186
Dysmenorrhea	1.32 (0.74–2.36)	0.348
Pain	2.98 (1.54–5.77)	0.001*
Cervical dysplasia	1.91 (0.87–4.20)	0.107
Endometriosis	2.60 (0.86-7.86)	0.092
Other	1.18 (0.67–2.06)	0.563
5. Type of hysterectomy		0.264
Total abdominal	1.00 (Reference variable)	
Subtotal abdominal	1.20 (0.77–1.86)	0.427
Vaginal	0.70 (0.46–1.06)	0.091
Laparoscopically assisted vaginal hysterectomy	1.27 (0.62–2.60)	0.510
Laparoscopic	0.70 (0.19–2.57)	0.590
6. Spinal anesthesia	0.42 (0.21–0.85)	0.017*
7. Epidural during surgery	0.76 (0.50–1.17)	0.216
8. Postoperative epidural	1.02 (0.66–1.59)	0.927

Table 4. Multiple Logistic Regression of Risk Factors for Persistent Posthysterectomy Pain (n = 1,135)

The dependent variable is chronic pain, defined as a "yes" to question 15 in the questionnaire. Independent variables 4 and 5 are categorical, and the others are dichotomous. Model statistics: P value < 0.0001 (chi-square), 95% confidence interval (Cl). Statistically significant, \* P < 0.05.

ous pelvic or abdominal surgery in general was tested *post hoc* in the regression model by replacing cesarean delivery, and a similar association with chronic pain was found (OR, 1.44; CI, 1.09–1.90).

# Pain and Anesthesia

Types of anesthesia are listed in table 2. Overall, 334 women had epidural anesthesia during surgery, most often in combination with general anesthesia (n = 325). In the multiple logistic regression model, spinal anesthesia was associated with a reduced OR for chronic pain (OR, 0.42; CI, 0.21-0.85). Epidural anesthesia during surgery and epidural anesthesia in the postoperative period did not have this association (OR, 0.76; CI, 0.50–1.17 and OR, 1.02; CI, 0.66–1.59, respectively).

# Complications

One hundred and thirteen complications during primary hospital stay were registered in 94 patients (8.3%), and the most frequent complications were bleeding/ hemorrhage, pain, and infection (table 2). The complications were not included in the regression analysis, but 41 women with a primary complication reported chronic pain, and a chi-square test showed chronic pain to be more frequent in women with complications (chisquare, OR, 1.74; CI, 1.10–2.72).

#### Pain Problems Elsewhere

A pain problem elsewhere was defined as pain not related to the pelvic region or the operation in the woman's own opinion. At the time of completing the questionnaire, 66.3% of all women had experienced pain problems elsewhere during the past 3 months, and 25.0% had pain daily or constantly. By far, the most common sites of pain were the head, neck, shoulder, or lower back region (83.9%). Among the women with pain problems elsewhere, 75.2% used analgesics, and 17.1% took pain medication daily. Women with pain problems elsewhere had an increased risk of having chronic postsurgical pain (OR, 3.19; CI, 2.29-4.44).

#### Discussion

In this study, we found a pain prevalence of 31.9% 1 yr after hysterectomy, and the risk factors identified by multiple logistic regression were preoperative pelvic pain, pain as an indication for surgery, previous cesarean delivery, and pain problems elsewhere. In addition, we found that spinal anesthesia was associated with a reduced risk of chronic pain 1 yr after hysterectomy.

Thirty-two percent of women had pelvic pain 1 yr after hysterectomy, and 260 (22.9%) had pain that affected their daily living. Other studies of hysterectomy have found pain frequencies that vary from 4.7% to 26.2% in long-term follow-up, but details are lacking regarding pain frequency, intensity, and location.<sup>4-10</sup> Pelvic pain is a frequent symptom in fertile women, and posthysterectomy pain may reflect pain in a normal population.<sup>13</sup> The 3-month prevalence of pain among women aged 18-49yr is found to be 14.7% in the United States and 24.0% in the United Kingdom.<sup>4,5,7,9,14,15</sup> However, we found a pain prevalence of 40.4% among women aged up to 49 yr, indicating a pain prevalence above the average population.

Significant risk factors identified in this study were primarily related to preoperative status. In the questionnaire, a recall bias could cause a higher report of preoperative pelvic pain in women with chronic postsurgical pain, but pain as the primary indication was registered preoperatively in the DHD, suggesting that preoperative pelvic pain is a true risk factor. Previous pelvic surgery, including cesarean delivery, was associated with an increased risk of chronic postsurgical pain, a relation also described previously. A questionnaire study 1 yr after cesarean delivery described daily or almost daily scar pain in 5.8% of women, and another study found previous cesarean delivery to be associated with chronic pelvic pain.<sup>11,12</sup> The mechanisms by which preoperative pelvic pain or previous surgery leads to chronic pain may be both physiologic and psychosocial. From human and animal studies, it is known that peripheral nerve trauma may induce neuroplastic changes in the central nervous system (central sensitization), leading to abnormal processing of sensory input from the site of injury, even after healing of the wound.<sup>3,16,17</sup> If sensitization of the central nervous system is present preoperatively, and this may be the case for both preoperative pelvic pain and previous surgery, postsurgical neuroplastic changes may be enhanced and lead to chronic pain. Psychosocial factors are of major importance in chronic pelvic pain, but the relative contribution in the case of posthysterectomy pain is still unknown. Future prospective studies, including preoperative and postoperative quantitative sensory testing, may clarify the exact contribution of preoperative sensitization to postsurgical pain. Recent studies have found suprathreshold heat pain stimuli and pressure pain tolerance to be predictors of acute postoperative pain.<sup>18-20</sup> It has, however, never been examined in hysterectomy patients whether preoperative sensory changes can predict pain on long-term follow-up.

Surprisingly, the type of surgical procedure did not affect chronic pain frequency despite the obvious difference between an abdominal and a vaginal approach, but it is possible that the segmental noxious input to the central nervous system is comparable. There was a tendency, though, toward vaginal hysterectomy being associated with less chronic pain compared with total abdominal hysterectomy (OR, 0.70; CI, 0.46-1.06; P =0.091). Also, the type of incision in abdominal hysterectomy, e.g., Pfannenstiel, Joel-Cohen, or vertical incision, did not relate to chronic postsurgical pain (table 2). Pfannenstiel incision did, however, have a tendency toward less chronic pain compared with the Joel-Cohen incision (chi-square test, OR, 0.71; CI, 0.47-1.07; P =0.0985). The Joel-Cohen incision is considered to be less traumatic because the tissue is pulled apart rather than cut, but this may also damage the sensory nerves and contribute to central sensitization.

Importantly, spinal anesthesia was associated with a

lower frequency of chronic pelvic pain, whereas epidural anesthesia did not influence chronic pain significantly. Epidural anesthesia was previously thought to have a protective role against central sensitization during surgery, but this theory has later been rejected.<sup>21-23</sup> It is possible that the stronger blockade of central impulse traffic in spinal anesthesia may have a protective effect for the development of chronic pain in some patients. This notion is supported by a study of cesarean delivery in which general compared with spinal anesthesia was associated with a higher frequency of chronic pain after 1 yr.<sup>11</sup> Other factors may be involved in cesarean delivery, because general anesthesia usually is restricted to urgent surgery. In contrast to the present findings, a recent, randomized study of spinal versus general anesthesia in 89 women scheduled to undergo vaginal hysterectomy found no difference in pain at 12 weeks' follow-up.<sup>24</sup> However, that study had some limitations. The mean pain intensities, recorded on an 11-point verbal numeric rating scale, were 0.0 (SD  $\pm 0.2$ ) versus 0.1 (SD  $\pm 0.3$ ) after 12 weeks (spinal vs. general anesthesia), and accordingly, intergroup differences will be difficult to demonstrate. Also, the exclusion rate before randomization was high, and treatment assignment was not blinded to either patient or study personnel.

In conclusion, preoperative status is important for the development of chronic pain, and this supports the hypothesis that previous noxious input to the central nervous system may play the most important role, perhaps together with genetic and psychosocial factors. It is unknown whether central sensitization is present preoperatively in some patients (e.g., with preoperative pelvic pain), and also, the natural course of such changes after hysterectomy and their correlation to chronic postsurgical pain are unknown.<sup>16</sup> Future studies should aim at describing the preoperative status in detail, including pain characteristics, quantitative sensory testing, and psychological profile, with postoperative follow-up of all tests. The current observation that spinal anesthesia, and hence a more complete block of afferent noxious activity, has a protective role for development of chronic pain is interesting and calls for a future, randomized study to address this issue.

The authors thank Helle Obenhausen Andersen (Secretary, Danish Pain Research Center, Aarhus University Hospital, Aarhus, Denmark) for excellent secretarial assistance through all the phases of this study.

# References

1. Macrae WA: Chronic pain after surgery. Br J Anaesth 2001; 87:88-98

2. Perkins FM, Kehlet H: Chronic pain as an outcome of surgery: A review of predictive factors. Anesthesiology 2000; 93:1123-33

3. Kehlet H, Jensen TS, Woolf CJ: Persistent postsurgical pain: Risk factors and prevention. Lancet 2006; 367:1618-25

4. Hartmann KE, Ma C, Lamvu GM, Langenberg PW, Steege JF, Kjerulff KH: Quality of life and sexual function after hysterectomy in women with preoperative pain and depression. Obstet Gynecol 2004; 104:701-9

5. Gimbel H, Zobbe V, Andersen BM, Filtenborg T, Gluud C, Tabor A: Ran-

domised controlled trial of total compared with subtotal hysterectomy with one-year follow up results. BJOG 2003; 110:1088-98

6. Thakar R, Ayers S, Clarkson P, Stanton S, Manyonda I: Outcomes after total *versus* subtotal abdominal hysterectomy. N Engl J Med 2002; 347:1318-25

 Kjerulff KH, Langenberg PW, Rhodes JC, Harvey LA, Guzinski GM, Stolley PD: Effectiveness of hysterectomy. Obstet Gynecol 2000; 95:319–26

8. Meltomaa SS, Makinen JI, Taalikka MO, Helenius HY: One-year cohort of abdominal, vaginal, and laparoscopic hysterectomies: Complications and subjective outcomes. J Am Coll Surg 1999; 189:389-96

9. Carlson KJ, Miller BA, Fowler FJ Jr: The Maine Women's Health Study: I. Outcomes of hysterectomy. Obstet Gynecol 1994; 83:556-65

10. Hillis SD, Marchbanks PA, Peterson HB: The effectiveness of hysterectomy for chronic pelvic pain. Obstet Gynecol 1995; 86:941-5

11. Nikolajsen L, Sorensen HC, Jensen TS, Kehlet H: Chronic pain following caesarean section. Acta Anaesthesiol Scand 2004; 48:111-6

12. Almeida EC, Nogueira AA, Candido dos Reis FJ, Rosae Silva JC: Cesarean section as a cause of chronic pelvic pain. Int J Gynaecol Obstet 2002; 79:101-4

13. Latthe P, Mignini L, Gray R, Hills R, Khan K: Factors predisposing women to chronic pelvic pain: Systematic review. BMJ 2006; 332:749-55

14. Mathias SD, Kuppermann M, Liberman RF, Lipschutz RC, Steege JF: Chronic pelvic pain: Prevalence, health-related quality of life, and economic correlates. Obstet Gynecol 1996; 87:321-7

15. Zondervan KT, Yudkin PL, Vessey MP, Jenkinson CP, Dawes MG, Barlow DH, Kennedy SH: The community prevalence of chronic pelvic pain in women and associated illness behaviour. Br J Gen Pract 2001; 51:541-7

17. Woolf CJ, Salter MW: Neuronal plasticity: Increasing the gain in pain. Science 2000; 288:1765-9

18. Pan PH, Coghill R, Houle TT, Seid MH, Lindel WM, Parker RL, Washburn SA, Harris L, Eisenach JC: Multifactorial preoperative predictors for postcesarean section pain and analgesic requirement. ANESTHESIOLOGY 2006; 104:417-25

19. Hsu YW, Somma J, Hung YC, Tsai PS, Yang CH, Chen CC: Predicting postoperative pain by preoperative pressure pain assessment. ANESTHESIOLOGY 2005; 103:613-8

20. Granot M, Lowenstein L, Yarnitsky D, Tamir A, Zimmer EZ: Postcesarean section pain prediction by preoperative experimental pain assessment. An STHE-STOLOGY 2003; 98:1422-6

21. Bach S, Noreng MF, Tjellden NU: Phantom limb pain in amputees during the first 12 months following limb amputation, after preoperative lumbar epidural blockade. Pain 1988; 33:297-301

22. Nikolajsen L, Ilkjaer S, Christensen JH, Kroner K, Jensen TS: Randomised trial of epidural bupivacaine and morphine in prevention of stump and phantom pain in lower-limb amputation. Lancet 1997; 350:1353-7

23. Katz J, Cohen L: Preventive analgesia is associated with reduced pain disability 3 weeks but not 6 months after major gynecologic surgery by laparotomy. ANESTHESIOLOGY 2004; 101:169-74

24. Sprung J, Sanders MS, Warner ME, Gebhart JB, Stanhope CR, Jankowski CJ, Liedl L, Schroeder DR, Brown DR, Warner DO: Pain relief and functional status after vaginal hysterectomy: intrathecal *versus* general anesthesia. Can J Anaesth 2006; 53:690-700

# Appendix

It is very i	mportant t	hat you answer <b>all</b> ques	tions; otherwise we	e will not b	be able to	use the q	uestionnair	e.		
The most C	tions are a	oncern the time <b>before</b>	correct answer Ser	o this over	nnle:					
	had a bye	torootomy?	correct answer. See		ipie.					
nave you	nau a nys	Vee								
		Yes		0						
	<b>D</b> : 1	NO		2	• • • • • •			11		
1.	Dia you r	have pain in the pelvic	region before the	operation	(vve as	к тог аш кіп	as of pain	that you te	el came tro	om the
	pelvic reg	ion, except pain relate	d to sexual interco	ourse , be	cause this	s is conside	ered in ano	ther quest	ion.)	
		Yes		1						
		No		2	Go to qu	estion 9				
		I don't remember		3	Go to qu	estion 9				
2.	How ofte	n did you have <u>pain</u> in	the pelvic region	before the	e operati	<u>on</u> ?				
		Constantly		1						
		Every day, but not con	stantly	2						
		2 or more days a week		.3						
		Less than 2 days a we	ek	4						
3.	Where wa	as the pain <u>located</u> bet	fore the operation	? (You ma	y name s	everal loca	tions.)			
		In the middle of the pe	lvic region	1	In the gr	oin		. 4		
		In the lower back		2	Other, pl	ease spec	ify:			
		In the vagina		3						
4.	a.	What was your average	ae pain level befor	re the ope	ration? (	0 is no pail	n and 10 is	the worst	possible pa	ain: please
		circle one number.)	<u> </u>		(					,,,
		0 1 2	3	4	5	6	7	8	9	10
	h	What was your pain li	ke at its worst?	7	0	0	,	0	0	10
			رد مد این <u>این این این</u>	4	5	6	7	8	a	10
5	Did the n	ain interfere with your	sleen before the	- oneration	2	0	,	0	5	10
5.	Dia tile p	Voc	<u>sleep</u> before the		•					
		No.		0						
6	-	Did you take medicati				hofovo the	anavation			
0.	a.	Vee					operation	i t		
		Ne		1	Flease s	pecity				• •
	h		how offen you to	∠ Non-diac	+:					
	D.	Il yes, please specily	now onen you too		uon:					
				0						
		2 or more days a week		2						
-	<b>D</b> : 1	Less than 2 days a we	ек	3						
7.	Dia your	pain increase in any or	t these situations	before the	e operati	on?				
		<b>D</b> .		res	INO		now			
	a.	Running		1	2	3				
	b.	Wearing tight clothes .		1	2	3				
	с.	Having sexual intercou	rse	1	2	3				
	d.	Carrying heavy things .		1	2	3				
_	e.	Other situations?								
8.	How muc	ch did the pelvic pain <u>a</u>	iffect your daily liv	ing befor	e the ope	eration?				
		Not at all		1						
		Some		2						
		A lot		3						
		Very much		4						
9.	a.	Did you have pain du	ring sexual interco	ourse befo	ore the op	peration?				
		Yes				1				
		No				2	Go to qu	estion 10		
		I did not have intercour	rse because of the	pain		3	Go to qu	estion 10		
		I did not have intercour	rse for other reasor	าร		4	Go to qu	estion 10		
	b.	How often did you ha	ve pain during sex	xual interc	ourse?					
		Every time I had sex		1						
		More than half of the ti	me	2						
		Less often		3						
	с.	How much did the pa	in during sexual ir	ntercourse	e affect y	ou?				
		Not at all		1						
		Some		2						
		A lot		3						
		Very much		4						
10.	a.	Have you previously h	ad an operation i	n vour ab	domen o	r the pelvi	c region?			
		Yes		1						
		No		2						
	b.	If ves, please energify	the type of operat	tion						
11.	How mar	w children have you di	ven birth to? (Circ	le "0" if vo	u have n	ot aiven hi	 rth)			
	a. <u>Ina</u>	Normal vaginal delivery	/	0	1	2	3	4	5 or more	Ż
	b.	Cesarean delivery		õ	1	2	3	4	5 or more	)

Anesthesiology, V 106, No 5, May 2007 Copyright © by the American Society of Anesthesiologists. Unauthorized reproduction of this article is prohibited.

12.	The next questions concern the time just <b>after</b> the opera <b>What was your</b> <u>average</u> pain level on the <u>first day</u> after circle one number.)	ition, and esp the operatio	pecially how y n? (0 is no pa	you feel nov ain and 10 is	w. s the wors	t possible	pain; please
13.	0 1 2 3 4 <b>a. For <u>how long after the operation</u> did you ha</b> situation.)	5 ave pain? (Cir	6 rcle only the	7 answer tha	8 It most clo	9 osely desc	10 ribes your
	I don't know/I don't remember			. 1			
	1–3 months			. 3			
	I still have pain, ever since the operation			5			
	<ul><li>I still have pain, it started some time after the</li><li>If (6), how long after the operation did you</li></ul>	operation acquire pain		. 6		Answer	also b
14.	How does the skin around the scar feel when you to	uch it with a	finger? (Ans	swer this qu	estion on	ly if you h	ave an
	abdominal scar.) If you had the operation through the vagina, mark here:						
	Normal sensation			1			
	Reduced sensation (the skin feels numb)			2			
	Other, please write:			4			
15.	Have you had pain in the pelvic region within the last 3	months? (Bo	oth pain that v	was present	before th	e operatior	1
	comes later in the questionnaire.)	sexual interco	ourse is not if	nciuaea in t	nis questio	on, dut	
	Yes			1			
16	No	 hin the last (	months?	2		Go to q	uestion 25
10.	Constantly		/ montais	1			
	Every day, but not constantly			2			
	Less than 2 days a week			3 4			
17.	Where is your pain located? (You may name several loc	cations.)					
	In the middle of the pelvic region 1 In the vagina	Other	, please spe	city:			•
	In the groin						
	In the lower back						
18.	Please shade the area of your pain on the body map:	:					
		J					
		$\boldsymbol{\mathcal{A}}$					
	$\langle \mathbf{r} \mathbf{v} \rangle$		11				
		$\mathcal{A}$	シマ	2			
		)					
			$+ \lambda$				
		1	1				
			$\mathbf{A}$				
	$\langle \langle \rangle \rangle$						
19.	Does one or more of these words describe the pain	vou feel? (Cir	rcle one or m	nore.)			
	Throbbing	Splitti	ng		11		
	Shooting 2 Hot/burning 7 Stabbing 3 Aching 8	Fearfu	/exhausting		12 13		
	Sharp 4 Heavy 9	Sicke	ning	 	14		
	Cramping 5 Tender 10	) Punis	hing/cruel		15		
20.	a. What is your average pain level? (0 is no pa	in and 10 is t	he worst pos	ssible pain;	please cii	 rcle one nu	umber.)
	0 1 2 3 4	5	6	7	8	9	10
	b. What is your pain like at its worst? 0   1   2   3   4	5	6	7	8	9	10
21.	Does your pain <u>increase</u> in any of these site	uations?	5		U	0	10
	Ye Bunning	s No	l don't k	now			
	a. Running	2 2	3				
	c. Having sexual intercourse	2	3				
	d. Carrying heavy things	2	3				

Anesthesiology, V 106, No 5, May 2007 Copyright © by the American Society of Anesthesiologists. Unauthorized reproduction of this article is prohibited.

22.	Has pa	in in the pelvic region interfered w	<u>ith your sleep</u> du	ring the last 3 months?
		Yes	1	
		No	2	
23.	а.	Do you take any medication for	the pain in the p	elvic region?
		Yes	. 1	Please specify:
		No	2	
	b.	If yes, how often do you take n	nedication for this	pain?
		Every day	1	
		2 or more days a week	2	
		Less than 2 days a week	3	
	c.	Have you sought other treatme	nts for the pain?	(For example, physiotherapy, acupuncture)
		Yes	. 1	Please specify:
		No	2	
24.	How m	uch does the pain affect your dail	y living now?	
		Not at all	1	A lot
		Some	2	Very much 4
25.	а.	Have you had pain during sexu	al intercourse wit	hin the last <u>3 months</u> ?
		Yes		. 1
		No		2 Go to question 26
		I have not had intercourse becau	se of the pain	. 3 Go to question 26
		I have not had intercourse for oth	er reasons	. 4 Go to question 26
	b.	If yes, how often have you had	pain during sexua	al intercourse?
		Every time I have sexual intercou	rse	. 1
		More than half of the times		2
		Less often		. 3
	c.	If yes, how much does your pa	n during sexual in	ntercourse affect you?
		Not at all		. 1
		Some		2
		A lot		. 3
		Very much		. 4
26.	a.	Have you had pain problems <u>el</u>	<u>sewhere</u> within th	e last <u>3 months</u> ? (For example, headache, back pain, chest
		pain, neck pain)		
		Yes	1	
		No	2	Go to question 27
	b.	Where is the pain located?		
	с.	How often do you have this pai	n? (The most frequ	ient pain )
		Constantly	1	
		Every day, but not constantly	2	
		2 or more days a week	3	
		Less than 2 days a week	4	
	d.	Do you take any medication for	the pain?	
		Yes	1	Please specify:
		No	2	
	e.	If yes, how <u>often</u> do you take n	edication for the	se pain problems?
		Every day	1	
		2 or more days a week	2	
		Less than 2 days a week	3	
	f.	Have you sought other treatme	nts for the pain?	(For example, physiotherapy, acupuncture)
		Yes	1	Please specify:
		No	2	
27.	How we	ould you describe your employme	nt situation?	
		Full-time job 1 E	arly retirement	4 Working at home 7
		Part-time job 2 R	etired	. 5 Other?
		Unemployed 3 S	tudent	6
28.	How of	d are you?years		
29.	May we	e contact you by phone or e-mail i	f we have further	questions or if we can offer you an examination or
	treatme	ent?		
		No	1	
		Yes	2	E-mail address:
		Phone:		Best time for phone calls:
	Thank y	you very much		
	for takir	ng time to complete this questionnai	re!	