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LAPAROSCOPIC SURGERY IN INFERTILE WOMEN WITH MINIMAL OR MILD ENDOMETRIOSIS

SYLVIE MARCOUX, M.D., PH.D., RODOLPHE MAHEUX, M.D., SYLVIE BÉRUBÉ, M.Sc.,
AND THE CANADIAN COLLABORATIVE GROUP ON ENDOMETRIOSIS*

ABSTRACT

Background Minimal or mild endometriosis is frequently diagnosed in infertile women. It is often treated by resection or ablation of the lesions, but whether this improves fertility has not been established. We carried out a randomized, controlled trial to determine whether laparoscopic surgery enhanced fecundity in infertile women with minimal or mild endometriosis.

Methods We studied 341 infertile women 20 to 39 years of age with minimal or mild endometriosis. During diagnostic laparoscopy the women were randomly assigned to undergo resection or ablation of visible endometriosis or diagnostic laparoscopy only. They were followed for 36 weeks after the laparoscopy or, for those who became pregnant during that interval, for up to 20 weeks of pregnancy.

Results Among the 172 women who had resection or ablation of endometriosis, 50 became pregnant and had pregnancies that continued for 20 weeks or longer, as compared with 29 of the 169 women in the diagnostic-laparoscopy group (cumulative probabilities, 30.7 percent and 17.7 percent, respectively; $P=0.006$ by the log-rank test). The corresponding rates of fecundity were 4.7 and 2.4 per 100 person-months (rate ratio, 1.9; 95 percent confidence interval, 1.2 to 3.1). Fetal losses occurred in 20.6 percent of all the recognized pregnancies in the laparoscopic-surgery group and in 21.6 percent of all those in the diagnostic-laparoscopy group ($P=0.91$). Four minor operative complications (intestinal contusion, slight tear of the tubal serosa, difficult pneumoperitoneum, and vascular trauma) were reported (three in the surgery group and one in the control group).

Conclusions Laparoscopic resection or ablation of minimal and mild endometriosis enhances fecundity in infertile women. (N Engl J Med 1997;337:217-22.)

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ENDOMETRIOSIS affects 2.5 to 3.3 percent of women of reproductive age¹ and is diagnosed in 20 to 68 percent of the women studied for infertility.²⁻⁵ The main visible features of the minimal and mild stages of endometriosis are peritoneal or ovarian endometriotic implants and filmy adhesions on the fallopian tubes or ovaries. The causal link between these lesions and infertility is much debated,⁶⁻⁹ as is the value of resection or ablation of them as a treatment for infertility.

Operative laparoscopy for endometriosis consists of electrocautery or laser destruction of endometriotic implants and adhesiolysis. Pooled data¹⁰ from one quasi-randomized study¹¹ and five cohort studies¹²⁻¹⁶ suggest that laparoscopic surgery is superior to treatment with danazol or no treatment in terms of the incidence of pregnancy (summary odds ratio, 2.7; 95 percent confidence interval, 2.1 to 3.5). However, the results of these studies were heterogeneous, and the validity of cohort studies of laparoscopic surgery is uncertain. The quasi-randomized study included 123 infertile women with mild endometriosis in whom other infertility factors were absent or had been corrected.¹¹ That trial found that laparoscopic surgery was superior to diagnostic laparoscopy in enhancing the probability of pregnancy in the subsequent eight months (60.8 percent vs. 18.5 percent), but it had methodologic flaws: treatment allocation was unblinded, randomization occurred before laparoscopy, 42 women were excluded.

From the Centre Hospitalier Universitaire de Québec, Pavillon Saint-François d'Assise (S.M., R.M., S.B.), and Laval University Epidemiology Research Group (S.M., S.B.), Québec, Canada. Address reprint requests to Dr. Maheux at the Centre Hospitalier Universitaire de Québec, Pavillon Saint-François d'Assise, 10 rue de l'Espinay, Québec, QC G1L 3L5, Canada.

*The investigators and centers participating in the Collaborative Group are listed in the Appendix.

ed, most likely after treatment allocation, and the base-line comparability of the two groups, cointerventions, and withdrawals were not reported.

The primary objective of this randomized, controlled multicenter trial was to assess whether laparoscopic resection or ablation of minimal and mild endometriosis, as compared with diagnostic laparoscopy only, increased the cumulative probability of pregnancy during the 36 weeks after the laparoscopy and increased the likelihood that those pregnancies would be carried beyond 20 weeks.

METHODS

Eligibility

The study subjects were recruited between October 1, 1992, and April 15, 1996, among infertile women scheduled for diagnostic laparoscopy at 25 hospitals in Canada. The eligibility criteria to be met before the laparoscopy were the following: age between 20 and 39 years; infertility (at least 12 consecutive months of unprotected intercourse in unsuccessful attempts to become pregnant); normal ovulatory cycles (regular 24-to-35-day cycles with either a biphasic basal-temperature curve or serum progesterone concentrations of at least 3 ng per milliliter [9.6 nmol per liter], or secretory changes on endometrial biopsy); partner's semen sample containing at least 20 million motile spermatozoa (volume \times concentration \times percentage with normal motility); no previous surgical treatment for endometriosis; no medical treatment for endometriosis in the previous 9 months; no ovulatory-drug therapy or intrauterine insemination with partner's sperm in the previous month; no other medical or surgical treatment for infertility in the previous 3 months; no previous oophorectomy or salpingectomy; no history of pelvic inflammatory disease; and no severe pelvic pain precluding expectant management. The study protocol was approved by the appropriate review committee at each hospital, and all the women gave written consent before the laparoscopy was performed.

Diagnostic Laparoscopy and Randomization

Diagnostic laparoscopies were performed on any day of the menstrual cycle, with the patient under general anesthesia. The diagnosis of endometriosis required the presence of one or more typical bluish or black lesions. The stage of endometriosis was determined according to the revised classification of the American Fertility Society (R-AFS).¹⁷ Endometriotic implants on the peritoneum or ovaries are scored according to diameter and depth, whereas the scoring of adhesions takes into account the density and degree of enclosure. Total R-AFS scores (implants and adhesions) from 1 to 5, 6 to 15, 16 to 40, and 41 to 150 correspond to minimal (stage I), mild (stage II), moderate (stage III), and severe (stage IV) endometriosis, respectively. Women with adhesions precluding adequate visualization of a tube or ovary were ineligible for the study, as were women in whom the laparoscopic tubal-patency test revealed complete obstruction of one or both tubes, unless hysterosalpingography in the previous year had indicated that both tubes were patent.

Once the final assessment of eligibility was completed, eligible women with minimal or mild endometriosis were randomly assigned to surgery or to diagnostic laparoscopy only. A surgical assistant called the centralized randomization service while the patient was still anesthetized. The randomization was stratified according to hospital and balanced for every two to six assignments.

Study Groups

The laparoscopic surgical treatment involved the destruction or removal of all visible endometriotic implants and the lysis of ad-

hesions. The choice of instruments was left to the surgeon. In the diagnostic-laparoscopy group, removal of implants and adhesiolysis were not allowed. For both groups, pelvic lavage with warm Ringer's lactate solution, leaving 200 ml of the solution in the peritoneal cavity at closure, was recommended. No antiadhesive therapies or prophylactic antibiotics were allowed.

Follow-up

The women were followed for 36 weeks or, for those who became pregnant during that interval, for up to 20 weeks of pregnancy. Every eight weeks, each woman was contacted by telephone to find out whether she was pregnant, schedule a pregnancy test when appropriate, record the date of her last menstrual period, and ascertain whether she still wished to become pregnant. Women reported in a diary the dates of their menstrual periods and of sexual intercourse. Throughout the follow-up period, the women and their physicians were asked to avoid any medical or surgical treatment for infertility or endometriosis. Nevertheless, the type and date of any cointerventions were documented at each follow-up call.

End Points

The primary outcome was the occurrence, in the first 36 weeks after the laparoscopy, of an intrauterine pregnancy that was carried beyond 20 weeks. The follow-up ended at 20 weeks because fetal losses are rare after that time and treatment-group assignment was not likely to affect later pregnancy outcomes.

All the women who became pregnant had ultrasonography. The gestational age was based on the date of the last menstrual period when this date was concordant (absolute difference, ≤ 10 days) with ultrasound dating or on ultrasonography when the two methods yielded discordant results. The vital status of the fetus was confirmed after 20 weeks of pregnancy either by fetal-heart auscultation or ultrasonography. Women were considered to be not pregnant at the end of the 36-week follow-up period if a serum pregnancy test was negative, less than 21 days had elapsed since the first day of the last menstrual period, or 21 days had elapsed since the last menstrual period but normal menstrual bleeding was documented in the next cycle.

Secondary outcomes included the duration of anesthesia, blood loss as estimated by the gynecologist, and intraoperative and postoperative complications. The latter were documented during the first follow-up telephone call and through review of the women's medical records when needed.

Statistical Analysis

The date of entry into the study was the date of the laparoscopy. For women who became pregnant, the numbers of person-days of follow-up were calculated up to the date of the last menstrual period before conception. Data on women lost to follow-up were censored at the date of the last menstrual period. Data on women who did not become pregnant were censored 36 weeks after laparoscopy or on September 1, 1996, whichever came first.

The crude probabilities of pregnancies were calculated by using Kaplan-Meier survival analysis.¹⁸ The 95 percent confidence intervals for the risk ratios were calculated by using Taylor's series expansion. Survival curves were compared by means of the log-rank test.¹⁹ The fecundity rate corresponds to the number of pregnancies per 100 person-months of follow-up.²⁰ Cox proportional-hazards regression analysis²¹ was used to adjust the fecundity rate ratio for prognostic factors. Means, medians, and percentages were compared by unpaired two-sided t-tests, Wilcoxon rank-sum tests, and two-sided chi-square tests, respectively. We ascertained that 330 women were required for us to detect a 15 percent difference in the primary end point ($\alpha = 0.05$, $\beta = 0.20$, two-tailed test) if the expected probability in the control group was between 15 and 30 percent.

RESULTS

Among the 967 women initially invited to participate in the study, 717 (74 percent) agreed to do so. They were similar to the women who declined to participate with regard to age (mean, 31 years in each group) and duration of infertility (32 months in the women who agreed to participate and 35 months in those who declined), but they were less likely to have primary infertility (defined as no previous pregnancy; 70 percent and 82 percent, $P=0.05$). Of the 717 women, 369 were found to be ineligible during the laparoscopy; for nearly two thirds of those, the reason was that the diagnosis of endometriosis was not confirmed.

Of the 348 remaining women, 176 were assigned to the laparoscopic-surgery group and 172 to the diagnostic-laparoscopy group. Seven women were randomly assigned to one or the other group but had no follow-up. One had a uterine septum, and the others were ineligible because they had no typical lesions (one woman), blocked fallopian tubes (two), recent hormonal therapy for infertility (one), and an R-AFS score greater than 15 (two).

The remaining 341 women (172 in the laparoscopic-surgery group and 169 in the diagnostic-laparoscopy group) satisfied the eligibility criteria, except for 1 woman in each group whose partner's semen sample did not contain 20 million motile sperm. The base-line characteristics of the women are shown in Table 1. Twelve women (3.5 percent) — seven in the laparoscopic-surgery group and five in the diagnostic-laparoscopy group — had a previous diagnosis of endometriosis. Tubal patency was documented during the laparoscopy in 99 percent and 98 percent of the women in the laparoscopic-surgery group and the diagnostic-laparoscopy group, respectively, and by previous hysterosalpingography in the remainder. The proportion of women whose status at the end of the 36-week follow-up was confirmed by a pregnancy test (67 percent) did not differ between the two groups.

Laparoscopic Procedures

None of the women in the diagnostic-laparoscopy group had any treatment for their endometriosis, whereas all the women in the laparoscopic-surgery group underwent resection or ablation of visible lesions or adhesions. The implants were destroyed by cautery only (78 percent), laser only (19 percent), or a combination (3 percent). Lysis of periadnexial adhesions was performed in 14 percent of the women in the laparoscopic-surgery group. Additional surgical procedures were reported in nine women in the laparoscopic-surgery group and seven in the diagnostic-laparoscopy group. Four women in each group had dilation and curettage; three in each group underwent polypectomy, excision of a cyst, or myomec-

TABLE 1. BASE-LINE CHARACTERISTICS OF INFERTILE WOMEN WITH MINIMAL OR MILD ENDOMETRIOSIS AND OPERATIVE COMPLICATIONS, ACCORDING TO STUDY GROUP.*

CHARACTERISTIC	LAPAROSCOPIC-SURGERY GROUP (N = 172)	DIAGNOSTIC-LAPAROSCOPY GROUP (N = 169)
Age (yr)	31±3	30±4
<30 (%)	36	45
30–34 (%)	49	44
≥35 (%)	15	11
Body-mass index†	23±4	23±4
Education (yr)	14±3	14±3
Caffeine intake (mg/day)	271±238	302±291
Smoking status (%)		
Nonsmoker	72	71
Smoker, <20 cigarettes/day	19	16
Smoker, ≥20 cigarettes/day	9	13
Primary infertility (%)‡	66	75
Duration of infertility (mo)	31±16	31±16
12–24 (%)	44	42
25–36 (%)	34	35
>36 (%)	22	23
Coital frequency in previous 3 months (no./mo)	10±4	10±4
Motile sperm count (×10 ⁻⁶)	181±154	197±196
<14% normal forms in semen (no.)	3	1
Cycle length, previous 6 months (days)	29±2	29±2
Laparoscopic findings		
Median R-AFS score§	4	4
Minimal endometriosis (%)	62	67
Superficial lesions only (%)	52	57
Lesions on peritoneum only (%)	60	70
Adhesions (%)	16	18
Fibroid (%)	11	7
Partial tubal occlusion (%)	8	5
Intraoperative complications (no.)		
Intestinal contusion	1	0
Slight tear of tubal serosa	1	0
Difficult pneumoperitoneum	1	0
Vascular trauma	0	1
Duration of anesthesia (min)	46±19	33±13
Postoperative complications (no.)		
Wound infection or hematoma	7	5
Urinary tract infection	3	1

*Plus-minus values are means ±SD.

†Body-mass index is the weight in kilograms divided by the square of the height in meters.

‡Primary infertility was defined as not having had a previous pregnancy.

§R-AFS denotes the American Fertility Society revised classification of endometriosis. Endometriotic implants on the peritoneum or ovaries are given a score according to diameter and depth, whereas adhesions are scored with the density and degree of enclosure taken into account. Total R-AFS scores (implants and adhesions) from 1 to 5, 6 to 15, 16 to 40, and 41 to 150 correspond to minimal (stage I), mild (stage II), moderate (stage III), and severe (stage IV) endometriosis, respectively.

omy; and two women in the laparoscopic-surgery group underwent section of a uterosacral ligament or a presacral neurectomy. No woman had oophorectomy or salpingectomy. Intraperitoneal antiadhesion adjuvants (dextran 70, Hyskon, Pharmacia) were used in 11 women, all in the laparoscopic-surgery group.

Operative laparoscopy increased the mean duration of anesthesia (from induction to end of incision closure) by 13 minutes ($P < 0.001$) (Table 1). In none of the women was the estimated amount of blood lost greater than 100 ml. Four women had minor intraoperative complications, but none required laparotomy or transfusion. Sixteen women (5.8 percent in the laparoscopic-surgery group and 3.6 percent in the diagnostic-laparoscopy group, $P = 0.46$) reported minor postoperative complications.

Withdrawals and Cointerventions

Similar numbers of women in each group withdrew from the study after the operation (Table 2). Eighteen of them agreed to be contacted 36 weeks after the laparoscopy. At that time none were pregnant or had given birth. However, no attempt was made to ascertain whether any women had become pregnant and then had abortions after withdrawal from the study.

Sixteen women in each group reported at least one cointervention during follow-up (Table 3). Six women, five of them from the diagnostic-laparoscopy group, had in vitro fertilization or superovulation. The median time from the operation to the first cointervention (approximately 180 days) was similar in the two groups.

Treatment Effect on Fecundity

Laparoscopic surgery increased the cumulative probability of a pregnancy that lasted more than 20 weeks by 73 percent in the first 36 weeks after the procedure (30.7 percent, as compared with 17.7 percent for diagnostic laparoscopy alone; cumulative incidence ratio, 1.7; 95 percent confidence interval, 1.2 to 2.6; $P = 0.006$) (Table 4 and Fig. 1). The corresponding fecundity rates (rates of 20-week pregnancies) were 4.7 and 2.4 per 100 person-months in the laparoscopic-surgery group and diagnostic-laparoscopy group, respectively (rate ratio, 1.9; 95 percent confidence interval, 1.2 to 3.1). Simultaneous adjustment for age, caffeine intake, smoking, motile-sperm count, type and duration of infertility, partial tubal occlusion, and site of lesions did not affect this estimate (adjusted rate ratio, 1.9; 95 percent confidence interval, 1.2 to 3.0).

In the 284 women who did not have adhesions, the destruction of implants also increased the 36-week cumulative probability of a pregnancy that lasted more than 20 weeks (cumulative incidence ratio,

TABLE 2. DESCRIPTION OF WITHDRAWALS ACCORDING TO STUDY GROUP.

WITHDRAWALS	LAPAROSCOPIC-SURGERY GROUP (N=172)	DIAGNOSTIC-LAPAROSCOPY GROUP (N=169)	P VALUE
No. of women (%)	9 (5.2)	12 (7.1)	0.47*
Reason for withdrawal (no. of patients)			
Discontinued interest in pregnancy, separation, or adoption	5	6	
Discontinued interest in the study	3	2	
Desire to be treated	1	3	
Unspecified	0	1	
Median duration of follow-up before withdrawal (days)	100	133	0.32†
20-week pregnancy (no.)			
Yes	0	0	
No	7	11	
No information	2	1	

*This P value was determined by the generalized chi-square test.
 †This P value was determined by the Wilcoxon rank-sum test.

TABLE 3. DESCRIPTION OF COINTERVENTIONS ACCORDING TO STUDY GROUP.

COINTERVENTIONS	LAPAROSCOPIC-SURGERY GROUP (N=172)	DIAGNOSTIC-LAPAROSCOPY GROUP (N=169)	P VALUE
No. of women (%)	16 (9.3)	16 (9.5)	0.96*
Type of cointervention†			
IVF	0	2	
Superovulation and IUI	0	3	
IVF and IUI	1	0	
Induction of ovulation	12	9	
Progestative agent	1	0	
Excision of cyst	0	1	
Contraception‡	2	1	
Median days of follow-up at first cointervention	178	182	0.51§

*This P value was determined by the generalized chi-square test.
 †IVF denotes in vitro fertilization, and IUI intrauterine insemination.
 ‡Reasons for temporary contraception were immunization against rubella, the use of malaria prophylaxis, and severe pelvic pain.
 §This P value was determined by the Wilcoxon rank-sum test.

1.6; 95 percent confidence interval, 1.1 to 2.5; $P = 0.02$ by the log-rank test).

Early fetal losses occurred with the same frequency in the laparoscopic-surgery group (13 of 63 pregnancies, 20.6 percent) as in the diagnostic-laparoscopy group (8 of 37 pregnancies, 21.6 percent;

TABLE 4. FECUNDITY RATES AND CUMULATIVE PROBABILITIES OF PREGNANCY IN INFERTILE WOMEN WITH MINIMAL OR MILD ENDOMETRIOSIS, ACCORDING TO STUDY GROUP.

OUTCOME	LAPAROSCOPIC-SURGERY GROUP (N = 172)	DIAGNOSTIC-LAPAROSCOPY GROUP (N = 169)	RR (95% CI)*
Pregnancies carried beyond 20 weeks (no.)	50	29	
Fecundity rate (per 100 person-months)	4.7	2.4	1.9 (1.2-3.1)
36-week cumulative probability (%)	30.7	17.7	1.7 (1.2-2.6)
Recognized pregnancies (no.)	63	37	
Fecundity rate (per 100 person-months)	6.1	3.2	1.9 (1.3-2.9)
36-week cumulative probability (%)	37.5	22.5	1.7 (1.2-2.3)

*The rate ratio (RR) is the ratio of the fecundity rates or the ratio of the 36-week cumulative probabilities in the two groups (the value in the laparoscopic-surgery group was divided by the corresponding value in the diagnostic-laparoscopy group). CI denotes confidence interval.

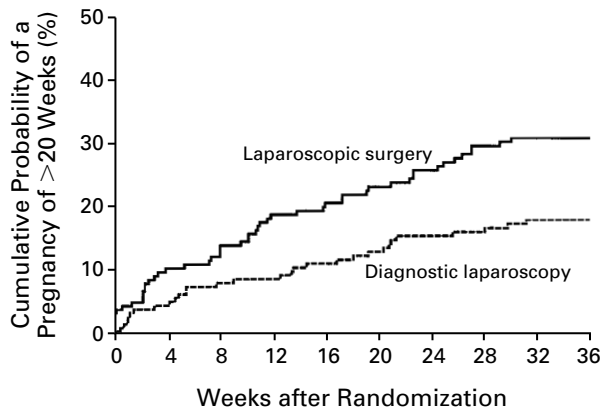


Figure 1. Cumulative Probability of a Pregnancy Carried Beyond 20 Weeks in the 36 Weeks after Laparoscopy in Women with Endometriosis, According to Study Group.

Six women assigned to the laparoscopic-surgery group and one woman assigned to the diagnostic-laparoscopy group became pregnant during the cycle in which the laparoscopy was performed. In these women, the actual interval between the laparoscopy and the date of the last menstrual period ranged from 0 to -14 days.

$P=0.91$). Three fetal losses were due to ectopic pregnancies (two in the laparoscopic-surgery group and one in the diagnostic-laparoscopy group).

DISCUSSION

We found that resection or ablation of minimal and mild endometriosis, as compared with diagnostic laparoscopy alone, increased the likelihood of

pregnancy in infertile women. The shape of the incidence curves suggests that this difference would have remained the same had the follow-up been longer. The women were assigned to a treatment group during the laparoscopy after the staging of endometriosis was completed in order to prevent the exclusion of women after randomization and biased staging of endometriosis due to knowledge of the treatment group.

Four of the 79 women whose pregnancies lasted 20 weeks, all in the diagnostic-laparoscopy group, each reported a cointervention during the cycle of conception (clomiphene citrate therapy in two women and superovulation and intrauterine insemination in one woman) or during the preceding cycle (cyst excision in one woman). If these cointerventions contributed to the occurrence of the pregnancies, there would be a slight underestimation of the effect of the laparoscopic surgery.

We did not require histologic confirmation of suspected endometriotic lesions because it is not routine practice to obtain a histologic diagnosis before proceeding to the destruction of lesions. Furthermore, removal of lesions by biopsy, especially in women who have few lesions, is a form of surgical treatment. In order to reduce the risk that women without endometriosis were enrolled in the trial, we required that typical lesions be seen. If some women without endometriosis had nevertheless been included, the results would have underestimated the efficacy of laparoscopic surgery in women who had endometriosis, because women without endometriosis would be unlikely to benefit from the intervention.

Fetal losses occurred in approximately 20 percent of the recognized pregnancies, irrespective of the study group. These results do not support the view that the treatment of endometriosis reduces the risk of spontaneous abortion in infertile women.²²⁻²⁴

Several observations support the validity of our results. The ratio of minimal to mild endometriosis (1.8) in the women we studied is close to the ratios reported in other studies of infertile women (2.0 to 2.4).^{2,3,5} The fecundity rate in the diagnostic-laparoscopy group (3.2 per 100 person-months) is similar to the rate estimated in four groups of untreated infertile women with mild endometriosis (3 per 100 person-months).²⁵

Our results have important implications. First, they provide infertile couples and their physicians with useful figures on which to base decisions about laparoscopy. The absolute increase in the 36-week probability of a pregnancy carried beyond 20 weeks that was attributable to laparoscopic surgery was 13 percent. Stated differently, one in eight women²⁶ with minimal or mild endometriosis should benefit from resection or ablation of endometriosis. Second, operative laparoscopy can be performed at the same time as the diagnostic laparoscopy; it prolongs the

laparoscopy by only a few minutes, entails few risks, and can be done on an outpatient basis. We therefore recommend that minimal or mild endometriosis diagnosed during laparoscopy for infertility be resected or ablated at that time. Third, the monthly fecundity rate among women who underwent laparoscopic surgery (6.1 percent) was much lower than the rate expected in fertile women (20 percent).²⁰ This indicates that the destruction of visible endometriotic implants and adhesiolysis do not affect all factors by which minimal and mild endometriosis contributes to infertility or that factors other than endometriosis interfere with fertility.

In conclusion, laparoscopic surgery in infertile women with minimal or mild endometriosis is effective in increasing their fecundity while involving minimal risk.

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APPENDIX

The following centers and investigators participated in this study (values in parentheses denote the numbers of patients recruited; names in parentheses are those of the research nurse coordinators): **Study coordination:** M. Langevin; *Grace Maternity Hospital and Victoria General Hospital, Halifax:* G. Graves (23), W. Wrixon (4), and J. O'Keane (5) (G. Mackay); *Hôpital de Chicoutimi, Chicoutimi:* S. Gagnon (7), T. Mechas (4), and P. Fisch (3) (G. Hamel); *Hôpital du Saint-Sacrement, Québec:* P. Blanchet (4) and P. Laberge (3) (F. Champoux); *Pavillon Centre Hospitalier de l'Université Laval, Centre Hospitalier Universitaire de Québec, Québec:* P. Dupont (1) and J.E. Rioux (R. Richard, L. Laganière); *Pavillon St-François d'Assise, Centre Hospitalier Universitaire de Québec, Québec:* R. Maheux (32), J. Bergeron (4), and M. Villeneuve (6) (M. Langevin, M. Lacroix); *Centre Hospitalier de la Région de l'Amiante, Thetford Mines:* S.R. Gagnon (2) (J. Fleury); *Hôtel-Dieu, Arthabaska:* L. St-Pierre (8); *Centre Hospitalier Universitaire de Sherbrooke, Sherbrooke:* Y. Aïmelk (9) (J.M. Quintin); *Hôpital Maisonneuve-Rosemont, Montreal:* P. Miron (6), P. St-Michel (2), and G. Faucher (1) (M.J. Caron, C. Bernier); *Hôpital Sacré-Coeur, Montreal:* J. Lorrain (20), R. Chemaly (2), and R. Sabbah (1) (D. Perreault, L. Vincelli); *Hôpital St-Luc, Montreal:* F. Bissonnette (33), Y. Girard (7), and J. Benoit (3) (M. Sergerie); *Royal Victoria Hospital, Montreal:* T. Falcone (12), R. Hemmings (1), and T. Tulandi (1) (M. Gagnon, C. Foley); *Cité de la Santé, Laval:* P. Choquette (49), Y. Barry (1), F. Durocher (1), and Y. Piché (1) (M. Collin); *Ottawa Civic Hospital, Ottawa:* G. Lefebvre (3); *Kingston General Hospital, Kingston:* R.L. Reid (3) (J. Reid, J. Smith); *Toronto General Hospital, Toronto:* E. Greenblatt (2) (L. Gotlieb); *Chedoke-McMaster Hospital, Hamilton:* J. Collins (1) and S. Daya (2) (J. Gunby); *Orillia Soldier's Memorial Hospital, Orillia:* R.U. Johnston (1) (D. Farlinger); *London University Hospital, London:* A. Yuzpe (17) and I. Tummon (9) (D. Slota); *St. Joseph's Hospital, London:* G.A. Vilos (22) (E. Vilos); *Health Sciences Center, Winnipeg:* J. Kredentser (10) (E. Wall); *University of Alberta Hospital, Edmonton:* J.Z. Scott (3) and A.P. Cheung (2) (L. Nordstrom); *Fraser-Burrard Hospital Society, Vancouver:* N. Racette (9) (D. White); *University Hospital-Shaughnessy Site, Vancouver:* M. Fluker (1) (D. White).

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