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Research article

Efficacy and safety of intrauterine device placement during a planned cesarean section

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ABSTRACT

Objective: Approximately 79% of pregnancies conceived within the first year after delivery are unintended and 50% of the couples report having unprotected intercourse before the first routine postpartum appointment. Unintended pregnancies are associated with unsafe abortions and other poor outcomes. We aimed to determine the efficacy and safety of intrauterine device (IUD) placement during a planned cesarean section (CS) at one year after insertion.

Study Design: A survey-based retrospective cohort study conducted at a university teaching hospital. The study cohort included term pregnant women delivered by a planned CS between December 2016 and July 2020, and data collection and questionnaires were completed in July 2021. In the study group, copper or Levonorgestrel IUDs were placed through the uterine incision after delivery of the fetus and placenta, while women in the control group did not receive an IUD. Other perioperative managements were similar. The primary outcome was unintended pregnancy rate during the first year after delivery.

Results: The study comprised a total of 150 women, with 50 and 100 in the study and control groups, respectively. None of the women in the study group became pregnant, compared with nine (9%) in the controls ($p = 0.03$), of them eight (88.9%) were unplanned. Perioperative outcome was comparable between groups. The rate of contraceptive use one year after delivery was significantly higher in the study group compared to the control group (86.0% vs. 35.0%, respectively, $p < 0.001$).

Conclusion: IUD placement during CS is effective in preventing unintended pregnancies within the first year after delivery, with operative outcomes unaffected.

Implications: Intrauterine device (IUD) placement during a planned cesarean section prevented unintended pregnancies within one year after birth. Additionally, the rate of contraceptive use at one year was significantly higher compared to women who elected not to have an IUD inserted during the cesarean. IUD placement did not affect perioperative outcomes.

1. Introduction

Unintended pregnancies are pregnancies that are unplanned, ill-timed, or undesired and constitute a leading global health concern that imposes substantial medical and socioeconomic burdens on society [1, 2]. Globally, there are 25 million unsafe abortions and 47,000 maternal deaths that occur annually due to unintended pregnancies. Additionally, women who delivered neonates who resulted from unintended pregnancies frequently experienced a delayed initiation of prenatal care, were less likely to breast-feed, and were at risk of physical and mental health problems [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]. A short interval between pregnancies adds additional risks for delivering preterm-birth and low-birthweight infants as well [3]. The cumulative effects can then lead to substantial increases in perinatal deaths and typically higher financial costs [10].

Nearly 45% of pregnancies are unintended, with the incidence in the first year after birth even higher reaching 70% [1], and the low rate of adherence to postpartum contraception is one of the fundamental causes

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of unintended pregnancies [4]. Nearly 75% of women who planned to use postpartum contraception did not attend their first routine postpartum appointment and therefore remained unprotected [1].

The intrauterine device (IUD) constitutes one of the most useful contraceptive methods for postpartum use due to its efficacy in reducing rates of unintended pregnancy, abortions, and short inter-pregnancy intervals [1, 11]. While placement of an IUD during cesarean section (CS) has been found to be easy to perform, and safe [1], there is a paucity of data regarding the impact of IUD placement at CS over an extended period (i.e., one year or more) in preventing unintended pregnancies as compared to routine postpartum care.

In the current study, we determined the pregnancy rates among women who underwent IUD placement at planned CS compared to women who did not and surveyed other outcomes related to IUD insertion at CS after a follow-up of at least one year.

2. Material and methods

This survey-based retrospective cohort study was conducted at a single university teaching hospital on data accrued between December 2016 and July 2020. Data collection and interviews of women for the purpose of completing a questionnaire via telephone at least one year after delivery were completed in July of 2021.

Our study cohort comprised women who underwent a planned CS at term and who delivered a viable neonate. Exclusion criteria were abnormal intraoperative bleeding, uterine abnormalities, infection, and women who wished to have a surgical sterilization. The study group was composed of women who underwent an IUD placement during the procedure. The women could choose either a copper or a levonorgestrel-releasing IUD, usually after consultation with her physician; and a final decision was made 1–3 days prior to the planned CS during the routine preoperative assessment. During CS, the IUD was emplaced manually in a standardized fashion following delivery of the placenta through the uterine incision before closure and positioned with its arms out to the uterine fundus. One hand of the surgeon was situated on the exterior of the uterine fundus to stabilize the uterus and to position the IUD into place. The IUD strings were shortened to nearly 10 cm and then directed with a ring forceps by the surgeon toward the cervix. The control group included pregnant women who underwent a planned CS without IUD insertion. The control group women were selected randomly after matching for ethnicity, gravidity, year of birth, and gestational age at delivery. These matching indices were chosen since in our opinion they may affect future family planning. The groups were matched at a one (study) to two (control) ratio. Other than for the insertion of the IUD, intra- and post-operative managements were similar. At discharge, both groups of women were asked to attend the six-week appointment with their primary physician. For women in the control group, the contraceptive method was determined in consultation with their physician and according to their preferences. An ultrasonographic scan was recommended for the study group at their first appointment to confirm IUD location.

Data were retrieved from the computerized hospital registration records and substantiated by the electronic labor and delivery medical records. All medical records of the study cohort were validated manually.

The women included in our analysis were contacted by telephone at least one year after the CS. After providing oral consent to participate in the study, women were requested to complete a questionnaire via telephone regarding any pregnancy—intended or unintended—that occurred within one year after delivery. They were also asked whether they attended the routine six-week postpartum appointment to obtain any contraceptive and were asked about the method of contraception, if any, used at one year after the CS. Women were additionally asked regarding the time to first intercourse after the CS and whether they would select the same procedure in a future CS, if needed, (Supplement 1).

2.1. Primary outcome

Our primary outcome was the rate of unintended pregnancies during the first year after CS. Secondary outcomes included the duration of surgery, rates of postpartum bleeding and infection, length of hospitalization after surgery, contraceptive use within the first year after CS, rates of spontaneous IUD expulsion at any time after the CS, and the necessity for IUD removal.

2.2. Sample size

Unintended pregnancies range from 5.5% to 60.0% of all pregnancies [10]. We herein assumed that the rate in our population was nearly 30%, and, thus, to detect a reduction from 30% to 10%, 144 women were required in both groups at a 1:2 ratio in the study and control groups, respectively, with an alpha (two-sided) level of 0.05 and 80% power. We estimated that 5% of the women would not be available for follow-up, and we therefore enrolled 150 women (50 and 100 women in the study and control groups, respectively). We thus attained our calculated sample size based on our initial calculation using retrospective data collection beginning in July of 2020 and going back as far as December of 2016.

2.3. Ethics

Ethical approval for this study was obtained from the Local Ethical Committee of Emek Medical Center, Afula, Israel, on 28 July 2020 (registration number 00109-20-EMC). All participants provided informed oral consent before conducting the telephone questionnaire.

2.4. Statistical analysis

Group differences were analyzed via Student's *t* test or Mann-Whitney U test, the latter in the case of non-normally distributed continuous data. Chi-squared or Fisher's exact-probability test was applied to test for group differences in the categorical data. We also conducted Kaplan-Meier survival analysis on the study group at one-year follow-up. We designated statistical significance at $p < 0.05$, and our analyses were performed using SPSS version 21 (IBM SPSS Statistics for Windows, IBM Corp., Armonk, NY, USA).

3. Results

We enrolled a total of 150 women in the present investigation: 50 in the study group and 100 in the control group. All women in both groups were contacted, and all agreed to participate. Within the study group, 25 (50%) women received a copper IUD, 21 (42%) received a levonorgestrel-releasing IUD, and in four women (8%), the type of IUD used could not be established.

Table 1 shows that there were no significant differences in basic maternal characteristics between the two groups, except for an increased incidence of smoking in the study group (10.0%) compared to the control group (1.0%), ($p = 0.02$). We also noted no differences in the duration of the CS procedure, or in the incidence of postpartum hemorrhage or postpartum infection. Length of hospital stay did not differ between the groups (Table 2).

In the first year after the CS, none (0.0%) of the women in the study group underwent a pregnancy, whereas there were nine (9%) unintended pregnancies in the control group ($p = 0.03$). Of the nine pregnancies, eight (88.9%) were unplanned (Table 3). Time to first intercourse after delivery did not differ between the groups ($p = 0.88$).

At the end of the first year after CS, 43 (86%) women in the study group used contraceptives (Table 3). Of the 50 women in the study group, seven (14%) had their IUDs removed less than one year after the CS. One woman (2%) experienced a postpartum hemorrhage before discharge

and her IUD was removed within 24 h after insertion, and in three (6%) women, IUDs were removed due to their abnormal locations in the uterus according to an ultrasound examination. Regarding the remaining IUD removals, one was due to clinical pelvic inflammatory disease (2%), one due to vaginal discharge (2%), and one due to abnormal bleeding (2%). All removals were performed using the standard technique, i.e., grasping and pulling the IUD strings (there were no hysteroscopic removals). One case (2%) of spontaneous expulsion was reported 36 months after the CS.

Thirty-five women in the control group (35/100, 35%) used a contraceptive method by the end of the first year after CS compared to 43/50 (86%) women in the study group ($p < 0.001$) (Table 3). Six (6%) women in the control group also used an IUD within the first year. Of these, one IUD (17%) was expelled spontaneously more than one year after the CS.

Of the study group, 39 of 50 (78%) women reported that they would select the same contraceptive procedure in the future, whereas 59 of 97 (60.8%) women in the control group reported that they would select the same practice, i.e., not to have intra-cesarean IUD placement in the future ($p = 0.04$); this outcome was missing among three women in the latter group.

4. Discussion

The results of the present study revealed that IUD placement at the time of a planned CS prevented unintended pregnancies within the first year after delivery compared to women who elected not to have intra-cesarean IUD placement (0% compared to 9%, respectively), and peri-operative outcomes were not affected by IUD placement. During the first year after the CS, the incidence of contraceptive use was considerably higher among women who underwent intra-cesarean IUD placement compared to controls, and the proportion of women who requested to undergo the same procedure in future cesareans was also higher among women who had previously undergone IUD placement.

The rates of unintended pregnancies have been reported to range between 5.5% and 60.0% [10]. In the United States the rate of unintended pregnancies is approximately 45% [1,12], and were associated with considerable maternal and perinatal morbidity and mortality—typically leading to higher costs compared to planned pregnancies. Use of efficient contraception before the resumption of postpartum ovulations may thus avoid unintended pregnancies and their related consequences [1, 2, 3, 4, 5, 6, 7, 8, 9, 10].

Table 1. Maternal characteristics according to study group.

Variable	Study group (IUD) (N = 50)	Control group (N = 100)	*P* value
Maternal age, years	33.2 ± 5.2 (33, 29–37)	33.4 ± 4.3 (33.5; 30–37)	0.79
Ethnicity	28 (56.0)	59 (59.0)	0.73
Jewish	22 (44.0)	41 (41.0)	
Arab			
Smoking	5 (10.0)	1 (1.0)	0.02
Pregestational body mass index, kg/m^2	26.70 ± 7.02 (24.60, 21.43–32.51)	27.45 ± 5.20 (27.24, 23.55–31.21)	0.51
Gravidity	4.8 ± 1.6 (4, 4.0–5.25)	4.3 ± 1.5 (4, 3.0–5.0)	0.08
Parity	3.8 ± 1.2 (4, 3–4)	3.7 ± 1.1 (4, 3–4)	0.57
Indications for cesarean section	8 (16.0)	17 (17.0)	0.88
Prior 1 cesarean	33 (66.0)	65 (65.0)	0.90
Prior >1 cesarean	2 (4.0)	1 (1.0)	0.26
Placenta previa	4 (8.0)	10 (10.0)	0.69
Non-vertex presentation	3 (6.0)	6 (6.0)	>0.99
Multiple gestation	0 (0.0)	1 (1.0)	>0.99
Macrosomia			

Data are mean ± standard deviation (median, IQR) or N (%).
IUD, intrauterine device; IQR, interquartile range.

Table 2. Outcome of cesarean section according to study group.

Outcome	Study group (N = 50)	Control group (N = 100)	P value	OR (95% CI)
Duration of the cesarean section, min	41.7 ± 11.6 (41, 32–50)	41.4 ± 12.2 (40, 32–48)	0.89	—
Postpartum hemorrhage	1 (2.0)	1 (1.0)	0.62	2.02 (0.12–32.99)
Infection	0 (0.0)	1 (1.0)	>0.99	0.66 (0.03–16.41)
Scar Endometritis	0 (0.0)	0 (0.0)	—	—
Urinary tract Mastitis	3 (6.0)	0 (0.0)	0.07	14.81 (0.75–292.53)
	0 (0.0)	0 (0.0)	—	—
Length of stay, days	5.0 ± 1.8 (4.5, 4.0–5.25)	4.9 ± 1.2 (5.0, 4.0–5.0)	0.67	—

Data are mean ± standard deviation (median, IQR) or N (%), unless otherwise specified.
IUD, intrauterine device; IQR, interquartile range.

Table 3. Pregnancy rate and IUD performance within one year of birth.

	Study group (N = 50)	Control group (N = 100)	*P* vale	OR (95% CI)
Unintended pregnancies in the first year after cesarean	0 (0.0)	9 (9.0)	0.03	0.00 (0.00–0.97)
Unplanned pregnancies in the first year after cesarean	0 (0.0)	8 (8.0)	0.052	0.00 (0.00–1.12)
Time to first intercourse, weeks	6.5 ± 3.8 [5, 4–8]	6.6 ± 3.8 [5, 5–7]	0.88	
IUD at 3 weeks	49 (98%)			
IUD at 6 months	47 (94%)			
IUD at 9 months	45 (90%)			
IUD at 12 months	43 (86%)	6 (6%)	<0.001	96.24 (30.51–303.51)
Contraceptive used at one year after birth	43 (86%)	35 (35%)	<0.001	11.40 (4.65–28.01)
IUD	43	6		
Oral contraceptive	0	21		
Condoms	0	6		
Other	0	2		
None	7	65		
Willingness to use the same contraceptive in a future cesarean	39 (78.0)	59/97 (60.8)	0.04	2.28 (1.04–5.00)

Data are mean ± standard deviation (median, IQR) or N (%).
IUD, intrauterine device; CS, cesarean section; IQR, interquartile range.

A number of women are less likely to apply for postpartum contraception due to inconvenience, difficulties in accessing postpartum care, or concerns regarding an outpatient procedure such as transvaginal IUD insertion. Other women adopt contraception after return of spontaneous ovulation, which is oftentimes too late. Both groups of women are then at an increased risk of having unintended pregnancies.

The IUD is one of the most effective methods used to prevent unintended pregnancies [1]. Globally, nearly 14% of women use IUDs and, as a result, over 99% of unintended pregnancies are prevented in these women within the first year of use [13, 14]. Since birth via CS represents a substantial proportion of all deliveries, placement of an IUD at the time of CS constitutes a promising intervention that might address the unmet needs for postpartum family planning in a number of regions. There are several reasons that make this intervention simple and effective: both the

woman and the obstetrician are present in the same location at the same time, obviating the need for a distinct appointment for contraceptive insertion; the women are, certainly, not pregnant; access to the uterine cavity is abated with a hysterotomy; and compared to traditional transvaginal insertion, the insertion process is quick and adds no appreciable cost or duration to the surgical procedure. Additionally, relative to transvaginal insertion, specific equipment that often produce discomfort, are not required. Intra-cesarean placement also avoids a potentially more difficult insertion through a narrowed endocervical canal weeks after birth and, at times, a challenging position of the uterus, particularly after repeated cesareans [15]. The authors of a recent, large multisite cohort study examined the risk of uterine perforation with IUD insertion and observed complete perforations at their highest rates 4 days to 6 weeks postpartum, whereas none was diagnosed following insertion between within 3 days postpartum [16].

The data from the present study add to the growing body of evidence showing that placement of an IUD at the time of CS leads to an elevated use of effective contraception one year postpartum [8, 9, 17, 18]. Nevertheless, the overall data on the impact of intra-cesarean placement on avoiding unintended pregnancies remain relatively sparse. The results of the present study thus revealed that beyond the reported rise in IUD use, the goal of preventing unintended pregnancies during the first year after delivery following intra-cesarean IUD insertion was also achievable.

Our data additionally proved that the rate of perioperative complications did not differ solely due to IUD insertion. Heller et al. also reported a low complication rate associated with IUD insertion, although they did not include appropriate controls in their study [17].

Satisfaction rates related to intra-cesarean IUD placement were high in other studies, and a majority of the women recommended the method to others [9, 18, 19, 20]. Similarly, in the present study, most of the participants stated that they would opt to have the same procedure performed during future cesareans.

The expulsion rate after intra-cesarean IUD placement is typically between 0% and 20% [7, 9], and ours was low (2%) and occurred more than one year after insertion. This low rate is most likely related to the nature of the operation, i.e., solely a planned cesarean. Relative to an intrapartum cesarean, women undergoing a planned cesarean normally exhibit a closed or minimally dilated cervix. Nevertheless, the concern over high rates of expulsion reported elsewhere [7, 9], probably comprises the reason that intra-cesarean IUD placement has not been incorporated into mainstream practice. However, a shift in our attention to the primary rationale for which the IUD was created—i.e., to prevent or at least reduce the rate of unplanned pregnancies, may ultimately generate more relevant outcomes in terms of women's overall contraceptive needs.

4.1. Strengths and limitations

The principal strengths of this investigation were related to our ability to contact all the eligible women and their high compliance rates in responding to our designated queries. Additionally, the period of follow-up after CS was relatively long, i.e., one year or more. This period is critical in order to explore the impact of continuous use of contraception and its effect in preventing unintended pregnancies. We additionally included a control group to appropriately evaluate the impact of intra-cesarean IUD placement. We acknowledge that the data generated in the present study may not be generalizable to different settings or to other countries where access to and choice of contraceptive methods vary greatly. Furthermore the present study was not powered to detect significant differences in each individual secondary outcomes examined.

5. Conclusion

Placement of an IUD during a planned CS is effective, feasible, and requires only a modicum of training. The procedure is safe and highly acceptable to women, with favorable uptake and continuation rates. Placement of an IUD during CS thus has the potential to prevent unintended pregnancy and to assist women in maintaining healthy interpregnancy intervals.

Declarations

Author contribution statement

Gali Garmi: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Kahdeje Seh Shmali, Noah Zafran, Offer Erez, Shabtai Romano: Performed the experiments; Analyzed and interpreted the data.

Raed Salim: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no competing interests.

Additional information

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