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Contraceptive failure related to estimated cycle day of conception relative to the start of the last bleeding episode

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Abstract

Background—The objective of this study was to estimate the menstrual cycle day of conception in women presenting for abortion.

Study design—This was a retrospective chart survey in two urban free-standing abortion clinics.

Results—There were 913 charts reviewed of women presenting for an abortion at less than 63 days gestation as determined by endovaginal ultrasound who were “sure” of the date of their last normal menstrual period. The estimated mean cycle day of conception determined by sonographically estimating length of gestation was 14.6. There were 26/99 (26.3%) of women using cyclic hormonal contraception who conceived before 10 days after the onset of withdrawal bleeding compared to 100/679 (14.7%) who conceived before 10 days after the onset of their last menstrual period who were using all other forms of contraception, including “none” ($p=.005$). No other differences in the proportions conceiving early in the cycle were observed with respect to age, ethnicity, or obesity.

Conclusion—These data suggest that there is a sizeable subset of women who ovulate earlier after onset of withdrawal bleeding when using 21/7 hormonal contraceptives than after onset of menses when not using hormonal contraception. It is possible that women using hormonal contraceptives may have a higher risk of pregnancy if they ovulate sooner after the onset of bleeding.

Keywords

contraception; abortion; ovulation; conception

1. Introduction

It is routine in many abortion clinics to do endovaginal ultrasounds prior to abortions in early gestations to determine the date of conception. Anecdotally, it was observed that many women appeared to have conceived early in their cycles because they had gestational ages

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about a week longer than the expected gestational age based on the number of days since the onset of their last bleeding episode (LBE, which would be the last withdrawal bleed for those using combined hormonal contraception and the last menstrual period (LMP) otherwise).

The probability of pregnancy after a single act of intercourse on a given day of the cycle has been calculated based on women who were trying to conceive [1]. No conceptions occurred outside of the 6 days prior to and including the day of ovulation as determined by urine estrogen and progesterone metabolites [2].

The usual method of using hormonal contraception for 21 days and then taking a 7 day break is effective in most women [3]. There are new hormonal contraceptives with 24 days of hormones and a 4-day break as well as a 3-month cycle [4, 5] and a pill taken continuously with no break. The most common method of contraception in our abortion clinic patients is a mixture of calendar rhythm, withdrawal and condoms [6, 7]. Since most women count the days after their periods as “safe”, early ovulation could cause contraceptive failure in these women as well. Our hypothesis was that there is an important subset of women who ovulate early and for whom the usual pattern of hormonal contraception may therefore have a higher failure rate.

Recent studies have found that there are 2 or 3 waves of ovarian follicular development during the menstrual cycle [8]. This would allow a woman with a regular 28 day cycle to ovulate early or late in that cycle. More than one ovulation per cycle is rare; it was documented in only 2 of 713 cycles using urine metabolites and women's reports of menstrual bleeding [2]. Hilgers et al. confirmed the conventional wisdom that the day of ovulation occurs on average 14 (mean = 13.7, median = 14) days before the day of the start of the next menstrual period [9]. Baird et al. (personal communication) found that the day of peak luteinizing hormone occurs on average 14.1 days before the first day of the next menstrual period [10].

The objective of this study was to determine the cycle day of conception in abortion patients using the history of the last menstrual period and endovaginal ultrasound dating in order to help us better counsel women about contraception after their abortion.

2. Materials and methods

This was a retrospective chart survey of data we routinely collect in our abortion clinics: the LMP dates, whether the cycle is regular and the last period normal, the gestational age of the pregnancy using endovaginal ultrasound and Rossavik and Goldstein criteria [11,12], and what form of contraception was used during the month of conception. The charts of consecutive women who presented at two free-standing urban abortion clinics between January and May 2007 were reviewed. Data were collected from charts of women whose gestational age was less than 63 days from onset of the LBE as estimated by endovaginal ultrasound, and who had been noted to be “sure” about the dates of the onset of their last “period” (strictly, LBE). This information was collected in several ways: each patient was asked when making the appointment about her last period and then she filled in an intake questionnaire on arrival at the clinic. This information was reviewed by the counselor and doctor and recorded in the chart. There was no specific definition of “regular” and “normal” or for how many cycles the menses had been “regular”. The physicians in the two clinics were all experienced abortion in providing abortions and in the use of the Toshiba Capasee and Aquila Esoate ultrasound machines. Rossavik and Goldstein dating was used below 8 weeks gestational age (using the formula: gestational age in days = mean sac diameter in mm + 30 when there was no embryonic structure and otherwise = embryonic length in mm +42) and the machine calculations were used above 8 weeks [11,12]. Charts were considered

ineligible if there was a question about the quality of the ultrasound noted by the physician. This combination of methods is considered to be accurate to within 3 days [11,12].

The date of conception was estimated as the date of the ultrasound minus the estimated gestational age determined sonographically in days (yielding the estimated date of the start of the LBE from ultrasound) plus 13 days (assuming conception occurs on day 14). The cycle day of conception is estimated as the estimated date of conception (from ultrasound) minus the woman's reported date of the start of the LBE plus 1. Cases were excluded if no gestational sac was seen on ultrasound, if the woman's reported start of her LBE was after the calculated date of conception or the calculated cycle day of conception was greater than 40.

The sample size needed to examine possible differences related to ethnicity, age, obesity, and different forms of contraception (and taking into consideration some charts missing data on contraception) was 900 charts. These data were analyzed using SPSS (version 15.0). We analyzed these data to determine what percentage of women conceived "early" (before 10 days after onset of LBE).

Fisher's exact test was used to compare proportions conceiving early among those using cyclic hormonal contraception vs. all other contraceptive methods and among obese vs. non-obese women. Chi-square tests were used to compare these proportions with respect to ethnicity and age (as a categorical variable).

This study was approved by the Research Ethics Board of the University of British Columbia as a retrospective survey without consent forms since the information was that routinely collected in an abortion clinic.

3. Results

There were 913 charts which met the criteria during the study period. The mean age was 28.4 years with a range of 14 to 47 years. The mean gestational age was 42.3 days with a range of 32 to 63 days. About half were white Caucasians and most of the rest of Asian descent (Table 1). The mean cycle day of conception was 14.6 with a range of 1 to 40 and the mode was 15. There were 148/913 (16.2%) who conceived on cycle days 1-9 (Figure 1). There were 26/99 (26.3%) of women using cyclic hormonal contraception who conceived before day 10 of their cycle compared to 100/679 (14.7%) using all other forms of contraception ($p=.005$ based on Fisher's exact test) (Table 2). Data about the method of contraception were missing in 135 women. There were no differences in proportions conceiving early with respect to age, ethnicity, or obesity. Women using cyclic hormonal contraception reported similar length cycles to those who were not (28.3 days vs. 28.6 days, $p=.21$).

4. Discussion

In a sizeable percentage of cases (16%) the date of the start of onset of the LBE determined sonographically was at least 5 days earlier than the date reported by women who were "sure" of this date. We infer that they became pregnant early in the cycle. This means that they could have conceived during the 7-day pill-free interval, if they were using hormonal contraception, and would have been unprotected if using calendar rhythm.

The cycle day of conception in this sample of 913 women is normally distributed with a mean of 14.6 days with a standard deviation of 5.8 (Fig. 1). This distribution is similar to that of the cycle day of intercourse leading to conception in women trying to conceive [1].

This pattern also matches the waves of follicular development described by Pierson and associates [8].

Shorter pill-free intervals may lead to greater efficacy [4, 5]. There is evidence that follicular development occurs during the 7-day pill-free intervals [13-15]. In women who did not have unintended pregnancies, over 60% actually miss at least one pill each month [16], so the fact that many women presenting for abortion say that they missed pills does not necessarily explain the contraceptive failure. The most important risk factor for oral contraceptive failure is a previous failure [17]. Some of these women may repeatedly ovulate during their pill-free intervals.

The limitations of this study include the accuracy of the patient's memory of the date of the onset of her LBE, the accuracy of the ultrasound dating, and the accuracy of the assumption that the date of conception can be estimated as the date of the start of the LBE estimated by ultrasound plus 13. Estimated cycle days of conception late in the cycle would be less accurate because they may include non-viable pregnancies growing slowly and therefore smaller than expected. Women on hormonal contraceptives may have break-through bleeding, and this may interfere with their interpretation of the date of the onset of the LBE. The estimates of the dates of conception include the first few days of the cycle; these probably reflect the imprecision inherent in ultrasound dating. Unfortunately, there is no feasible prospective method of studying unintended pregnancies.

Obesity has been suggested as a risk factor for hormonal contraceptive failure [18,19], but we found no difference in the proportions conceiving early between obese and non-obese women

From our qualitative studies on contraception, we know that asking one question about contraception ("What type of birth control were you using when you got pregnant?") yields very different answers than a series of questions ("Do you also count safe days? Do you also use condoms right after your period ends?") [6, 7] From a study on compliance with oral contraception, we know that actual pills taken were fewer than reported pills taken [14]. These findings suggest that studies about contraceptive failure based on reported contraceptive use rather than actual contraceptive use may be inaccurate. Since women using OCs have lighter bleeds and shorter cycles, it is possible that they have sex more frequently in the 1st 9 days of the cycle, and this might lead to a greater proportion conceiving early. However, couples using condoms, withdrawal and other non-hormonal methods also feel safer and freer to have sex immediately after the period.

5. Conclusion

These data suggest that some women experiencing contraceptive failure conceive within 10 days of the onset of the LBE and therefore were unprotected when using oral contraceptives with a 7-day break or using calendar rhythm. It is important to convey this information when counseling women about the best contraceptive options. It may be better to recommend continuous hormonal contraception or short 3-4 day breaks for such women. Other studies are warranted to confirm these findings.

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Figure 1. Bar graph of the estimated cycle day of conception relative to the start of the last bleeding episode in abortion patients (with normal distribution overlaid)

Table 1
Characteristics of 913 women presenting for abortion

Age in years (mean/range)	28.4/14-47
Ethnicity	
White Caucasian	457 (50.1%)
East Asian	271 (29.7%)
South Asian	141 (15.4%)
Other	44 (4.8%)
Gestational age in days measured by endovaginal ultrasound (mean/range)	44.3/ 32-63
Length of usual cycle in days (mean/range)	28.5/ 21-40
Periods “regular”	879/902 (97.5%)
BMI (mean) (n=826)	23.1/ 16.2-59.9
Cycle day of conception (mean/range)	14.6/ 1-40
Contraception used in month of conception (n=778)	
OC	
Patch	90 (9.9%)
Ring	5 (0.5%)
IUD	4 (0.4%)
Condoms	5 (0.5%)
Rhythm	306 (33.5%)
Withdrawal	53 (5.8%)
Other (including “none”)	71 (7.8%)
	244

Note: missing data on contraception in 135 charts, missing data on “regular or irregular” periods in 11 charts; missing data on BMI in 87 charts

Table 2
Estimated cycle day of conception relative to the start of the last bleeding episode among 778 women presenting for abortion by use of cyclic hormonal contraceptives *versus* other methods

Cycle day of conception	Cyclic hormonal contraception	All other methods of contraception	p-value
1-9	26 (26.3%)	100 (14.7%)	0.005
10-40	73 (73.7%)	579 (85.3%)	
Total	99 (100%)	679 (100%)	