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The Occurrence of Ovulation at the Midcycle

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It is commonplace for gynecologists to refer to "midcycle" ovulation of women. This concept has often led to the routine diagnosis of ovulatory status on day 14 of what is expected to be a 28-day menstrual cycle. For example, the postcoital test in an infertile patient, or intercourse to achieve pregnancy in a normally fertile patient, is often timed around day 14 under the assumption that ovulation is occurring then. Advocates of natural family planning (NFP) have criticized the concept of "midcycle" ovulation, because their clinical experience suggests that the natural irregularity of menstrual-cycle length militates against ovulation's occurring with any great frequency on day 14.

This report analyzes the relationship of day 14 and the actual midcycle of the menstrual cycle to each other and to indirect hormonal parameters that more directly estimate the time of ovulation.

Materials and Methods

Twenty-four women, from 20 to 38 years of age, were chosen to participate in this study because of their essentially normal characteristics. They were instructed on how to make and record the mucus observation of the ovulation method of NFP (Billings et al. 1977), how to take and record their oral basal body temperature (BBT), how to apply a vaginal-discharge scoring system, and how to record other intermenstrual symptoms such as bleeding, pain, breast tenderness, and so on. Each participant recorded her mucus observations, oral BBT, and other intermenstrual symptoms for at least three

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cycles before the collection of serum for hormonal analysis began (Hilgers et al. 1978).

On admission to the study, the subjects came to the laboratory between 6 and 10 A.M. for blood-specimen collections. They came on day 5 of the cycle and returned on day 8 for daily sample collections through the fifth day after the Peak symptom (Billings et al. 1977). A final sample for each cycle was drawn on the ninth day after the Peak symptom. We obtained the blood by venepuncture, alternating antecubital veins to minimize trauma. We allowed the blood sample to stand for 30 minutes and then centrifuged it to separate the serum. The serum was removed with disposable Pasteur pipettes and stored in airtight vials at -20° C until submitted to a laboratory for hormonal analysis. Each serum sample was examined by radioimmunoassay for luteinizing hormone (LH), estradiol 17β, and progesterone (Hilgers et al. 1978).

We divided the study cycles into two groups (normal and abnormal), according to the presence or absence of ovulation and normal corpus luteum function, as evaluated by indirect means. A cycle was considered "normal" if (1) there was an LH surge, (2) the luteal phase was 11 or more days long (calculated from the estimated time of ovulation [ETO] to the beginning of the next menses), and (3) the mean progesterone level from the 4th through the 11th day before the next menstruation (M-4 to M-11) was 5 ng/ml or greater.

The ETO has been defined elsewhere (Hilgers et al. 1978). Briefly, we plotted the periovulatory progesterone values on semilog paper to give them a linear progression. The time span during which ovulation was thought most likely to occur was considered to begin when the progesterone level reached 1 ng/ml and to end when the level reached 2.3 ng/ml. The midpoint of this ovulatory time span was designated the ETO. Additional and more nearly complete details on these aspects of our study have been previously published (Hilgers et al. 1978).

Of the 74 menstrual cycles so studied, we accepted 66 as ovulatory (Hilgers et al. 1978). In 65 of these cycles, we knew the length of the cycle; in 1, while we knew the ETO on the day on which it occurred, the subject's pregnancy prevented our ascertaining the length of that cycle. These 66 cycles are the subject of this report.

Results

The length of the menstrual cycles in this study ranged from 23 to 38 days. The mean was 28.8 days.

Table 1 shows the incidence of ETO in relationship to day 14 of the menstrual cycle (N = 66).

Table 2 shows the incidence of ETO in relation to the true midcycle, which we calculated in retrospect by finding the midpoint of the length of the cycle.

TABLE 1
THE INCIDENCE OF ESTIMATED TIME OF OVULATION
IN RELATION TO DAY 14 OF THE MENSTRUAL CYCLE
(N = 66)

DAY OF CYCLE	CYCLES N	ESTIMATED TIME OF OVULATION %	Cumulative %
10	1	1.5	1.5
11	2	3.0	4.5
12	2	3.0	7.5
13	9	13.6	21.1
14	9	13.6	34.7
15	13	19.7	54.4
16	6	9.1	63.5
17	4	6.1	69.6
18	6	9.1	78.7
19	5	7.6	86.3
20	4	6.1	92.4
21	1	1.5	93.9
22	1	1.5	95.4
23	0	0.0	95.4
24	0	0.0	95.4
25	1	1.5	96.9
26	0	0.0	96.9
27	2	3.0	99.9
TOTALS	66	99.9	

14 ± 2 days = 59.0%
15 ± 2 days = 62.1%
X = 16.1 days (14 + 2.1 days)

Discussion

To the authors' knowledge this is the first attempt to analyze the relationship between the midcycle and the ETO. The menstrual cycles we studied had a reasonably normal variation in length, and their mean length was within the range of normal for the population of subjects we studied. However, in spite of the fact that we had selected the study population because of its basically normal characteristics, the incidence of ETO was low around day 14 of the cycle and around the true midcycle.

On the exact day of the midcycle, or on day 14 of the cycle, we found an ETO incidence of only 13.8 and 13.6 percent, respectively. That percentage

TABLE 2
THE INCIDENCE OF ESTIMATED TIME OF OVULATION
IN RELATION TO MIDCYCLE (N = 65)

DAYS BEFORE (-) AND AFTER (+) MIDCYCLE	CYCLES N	ESTIMATED TIME OF OVULATION %	Cumulative %
-2	1	1.5	1.5
-1	8	12.3	13.8
MIDCYCLE	9	13.8	27.6
+1	15	23.1	50.7
+2	10	15.4	66.1
+3	10	15.4	81.5
+4	5	7.7	89.2
+5	4	6.2	95.4
+6	0	0.0	95.4
+7	0	0.0	95.4
+8	3	4.6	100.0
TOTALS	65	100.0	

Midcycle ± 2 days = 66.1%
[Midcycle + 1] ± 2 days = 80.0%

is remarkably low, and the finding should challenge our assumptions about "midcycle" ovulation. Indeed, in this series the range of ETOs around day 14 and the true midcycle is so wide that it is impossible to determine the time of ovulation in this fashion.

There was a 17-day range of ETOs around the 14th day of the cycle, and the highest ±-2-day cluster of ETOs (62.1%) was observed on day 15 ± 2. The range is significantly wider than for the Peak symptom (Hilgers et al. 1978) and for the BBT endpoints (BBT nadir, first day of rise, and coverline) (Hilgers and Bailey 1980).

There was only a 10-day ETO range around the true midcycle, and the highest ±-2-day cluster of ETOs (80.0%) was observed on [midcycle + 1] ± 2 days. This range and this cluster are about the same as for the BBT endpoints (Hilgers and Bailey 1980) but less precise than for the Peak symptom (Hilgers et al. 1978).

Because the true midcycle is always determined in retrospect, it has little practical importance. It cannot be calculated until the cycle is complete.

Day 14 of the cycle can be predicted and therefore should be more useful.

In practice, the assumption is often made that day 14 of the cycle is also the true midcycle. But in only 11 of 65 cycles (16.9%) did midcycle coincide with day 14.

One significant study finding is the high incidence of ETOs after the 14th day of the cycle (65.2%) and after the midcycle (72.4%). Iffy (1963) has suggested that the occurrence of "post mid-cycle conception" might be associated with aging of the ovum and subsequent pregnancy abnormalities. If it were, our data indicate that a significant number of normal subjects would be at risk of developing such abnormalities. This high percentage of ETOs after day 14 or after midcycle tends to speak for its normalcy and to speak against any simple relationship between reproductive abnormalities and post-day-14 or post-midcycle ovulation.

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