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The Concurrent Calculation of Ovulation Rhythm

Joseph Bernard Doyle, M.D.

PARENTHOOD is life's greatest privilege. We fertile folk who glory in the fact that from our own birth, we are in a progenitive sense immortal are apt to ignore the agonizing heartbreak of the wife to whom parenthood so far has been denied. The modern woman goes into marriage with a curiously paradoxical pair of anxieties. Schooled by the stories of the ladies' magazines, she has a deeply ingrained fear of barrenness together with a fear of the proverbial obstetrical "valley of death." That neither of these anxieties are today justifiable can be seen from the following facts. While one of six marriages is involuntarily sterile, there will nevertheless be born to 100 infertile couples seeking study from 30 to 40 babies. Moreover, maternal mortality rates have gradually declined. For the United States in the last available year, 1947, there were but 2.3 deaths per 1000 live births. Indeed, in our Saint Elizabeth's Hospital, for the first 11 months of 1949 there was but one death in over 1800 deliveries. This death was not due to obstetrics but to an overwhelming toxic myocarditis associated with a Streptococcus Bronchopneumonia on the second day postpartum. Our 1949 mortality was 0.55 per 1000 live births or the equivalent of one-fourth of the gross national maternal mortality.

No one has a deeper interest in the welfare of the obstetrical mother than one to whom the privilege of maternal love was in childhood denied. As a boy of eight in the year 1915 a puzzling question ran through my head. "Why need mothers die?" In the year 1950 there is very little reason why mothers should die if given proper obstetrical care.

Curiously, the answer to the problem of the infertile marriage as well as the problem of postponing the next pregnancy in the sick or disabled mother was found in a little-known piece of laboratory research by Van der Veld¹. In 1900, he showed that

at mid-cycle a rise could be noted in the patient's temperature if recorded daily upon waking. In 1937, over a quarter of a century later, Rubenstein² first revived interest in the fact that during most menstrual cycles the curve of the daily basal temperature is diphasic, i.e. lower in the first part of the cycle than in the second. He correlated the shift in temperature levels with changes in the vaginal smear that had been shown by Shorr and Papanicolaou³ to be attributable to ovarian function. In 1944 Klaffen⁴ showed by experiments with amenorrhic women that the increase in temperature was the function of progesterone. Palmer in 1942⁵ first correlated the shift in basal temperature with ovulation and the duration of the luteal phase subsequent to ovulation. However, it remained for Tompkins⁶ (1944) to correlate the occurrence of pregnancy from isolated intercourse at the time of the temperature shift as a proof of ovulation coinciding with the shift (figure 1). Although, Rock⁷ criticised the method in 1941 as not being reliable, in 1946 he says "the day-to-day curve in change of body temperature on awakening in the morning will point not only to the fact of ovulation but also to the approximate time at which it occurs⁸." In fact, in 1944 Rock and Hertig⁹ had shown from examination of three unfertilized ova as well as from a series of 11 fertilized ova that ovulation took place 14 plus or minus two days before the first day of the next expected period. In 1948 they reported a series of 26 well authenticated conceptuses indicating that ovulation occurred about the 14th day before the expected onset of menstruation¹⁰. Further confirmation of the temperature shift as an index of "optimum

RECORD OF BASAL BODY TEMPERATURES

Joseph B. Doyle, M.D.

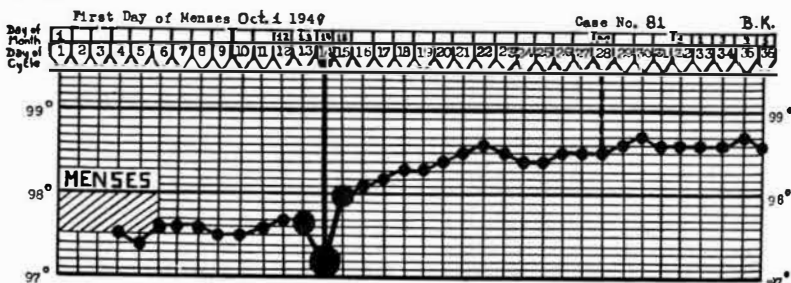
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Fig. 1. Typical thermal shift. Conception on day 14.

fertility time" was obtained by the experiments, in 1945, of Barton and Weisner¹¹, who only obtained pregnancies by artificial insemination* during the three days prior to the shift, the day of the shift, and the day following it. The most direct observations are those of Greulich^{12,13} and co-workers, who were able to inspect biopsies of the ovaries of more than 50 patients in mid-cycle. When a corpus luteum was found it was removed for histologic study. In every case in which a temperature rise had occurred ovulation was found to have taken place. In a few cases the corpus luteum was found before the thermal shift had begun. Thus ovulation usually takes place at about the time the thermal shift begins. But in a few instances ovulation may precede the thermal shift. In one patient it was possible to obtain a continuous electrical recording of rectal temperature for five days at mid-cycle. The thermal shift was found to be a gradual one without abrupt changes.

It is obvious from the above that menstrual rhythm is a fair index of ovulation rhythm. However, calculation of any mathematical relation in which the constant lies in the future is less scientific than concurrent calculation of the actual ovulation itself. The postpartum patient in poor health will have greater peace of mind if she is told that she cannot conceive in this cycle here and now under consideration than if she is told that she probably will not conceive if she continues to be as regular in the future as she has been in the past. Since emotional factors are known to cause unpredictable marked variations in menstrual rhythm it is extremely important to peg the patient's peace of mind on the present, not on the past or the unpredictable future. Yet, unfortunately many sick patients have been given casual information based on hearsay and without the benefit of records of the menstrual cycles which have resulted in pregnancies for which the distracted patient sought tragic "relief" from the abortionist only to die and leave her family without the benefit of a mother's guidance. Only in the hereafter will we know whose was the greater blame, the casual physician who did not take the trouble to keep up-to-date with menstrual physiology or the patient driven to emotional unbalance by anxiety and depression.

The necessity for careful concurrent calculations of ovulation rhythm is best demonstrated by citing the work of Brewer and

Jones¹⁴ (1947) who at the time of operation studied the ovaries of 54 patients who had ovulated. They found that although 60 per cent of the ovulation appeared to have occurred on days 12-13-14-15 with the highest number on day 14, the actual extremes of ovarian rhythm variation in the series of women studied were from day eight to 19. Farris¹⁵ (1948) found ovulation variation from day nine to day 18 in 35 laparotomies. However, Farris in further studies reported in the same article noticed that 60 per cent of his conceptions achieved by isolated coitus or artificial insemination* on known dates of conception occurred on days 11-12-13. Nevertheless, he found that in the 50 conceptions achieved in 46 women there was again a variation during the entire group of from day eight to day 19. He points out, however, that by careful analysis of 208 cycles of these women whose menstrual rhythm varied from 24 days to 35 days: *for any given woman for whom ovulation time was determined over a period of cycles there was more regular ovulation rhythm than menstrual rhythm.* This can be demonstrated in the following chart.

Menses Variation	Cycle	Ovulation
-3 days	77%	93%
-2 days	65%	80%
208 cycles - 50 pregnancies		

(Farris, E. S. *American Journal of Obstetrics*, August, 1948)

Here is proof that carefully kept basal temperature will determine ovulation rhythm which may be more regular than menstrual rhythm.

Rock,¹⁶ (1949) states "the chance of conception in human beings is exceedingly slight, indeed perhaps impossible, if the nearest preceding coitus occurs more than 48 hours before ovulation and the first succeeding coitus more than 12 hours after the escape of the egg from the ovary." Since the ovum is believed to be fertilizing for only 12 hours and at most 24 hours it is obvious that the optimum time for fertility—the optimum time for fruitful marital relationship—lies in the three days preceding the basal temperature shift, the day of the shift and the day after the shift. This is the cardinal point of reproductive physiology around which all other fertility studies revolve.

Because sterility study is the obverse side of the coin, it is understandable that the physiologic changes are extremely important for determining the period of relative infertility. Just after menstruation the mucous secretion from the cervix is scant, viscid, sometimes even gelatinous. Accordingly, particularly if basal temperature charts over a period of six or more months have not revealed early shifts in the basal temperature, it may be said that there exists a *period of dubious but relative infertility* from day one to about day eight. *The period of relative fertility* may be said to extend from day eight to day 22; *the period of optimum fertility* from day 10 to day 16. The actual day of optimum fertility will of course depend upon the determination of the ovulatory dip and the rise which is indicated on the temperature chart—much like the $\sqrt{\quad}$ (square root) insignia so familiar even to the grade school child. *The period of minimal fertility* extends from the day preceding the succeeding menstruation backwards to a point at least four days beyond the achievement of the high phase of the temperature shift; that is, once the square root sign has paralleled off as a plateau for at least four days. Since the ovum probably died 48 hours after the achievement of the high phase, it has been a corpse for the succeeding two days.

The period of minimal fertility exists thereafter until the next menstrual period. This work all gave collaborated evidence to the pioneer work of Ogino¹⁷ who observed at laparotomy that ovulations appeared to have taken place between the 12th and 16th in advance of the first day of the next menstruation. It also confirmed the pioneer work of Knaus¹⁸ who made similar observations on the effect on the uterus of certain endocrines injected into the bloodstream. He concluded that ovulation usually took place between the 14th and 16th day before the next menstruation.

The explanation for the frequency of pregnancies prior to day 14 is probably due to the mucous changes in the cervical secretion which Abarbanel¹⁹ (1948) has shown to occur simultaneously with the thermal shift and to be due to the high level of estrogen production just prior to and concomitant with ovulation. These changes, in brief, are increase in volume, decrease in viscosity, increase in water content and increase in sperm pene-

trability and survival time. He has shown that in a period of only one-three days do sperm routinely survive and remain motile for from 24 to 72 hours; that promptly after the achievement of the high level the cervical mucous changes are reversed. He has proved this to be attributable to progesterone secretion by an ingenious experiment in castrated women using estrogen and progesterone in altering cycles to produce changes in the cervix and a typical temperature shift. In fact, he has shown that these changes can be reversed by changing the type of hormone therapy¹⁹. It is more accurately demonstrated by the Lamar capillary pipette test in which cervical mucus in one pipette is invaginated by another pipette containing semen. He has shown that before and after the ovulatory phase the progress of sperm through the mucus may be reduced to less than 0.25 millimeters per minute, in fact at times the attempts of the spermatozoa to negotiate the mucous barrier failed entirely, whereas at ovulation time when mucus possesses its lowest viscosity, spermatozoa may travel through it at the rate of three millimeters or more per minute.

We have demonstrated this variability *in vivo* by having patients report for postcoital examination subsequent to intercourse during which the cervical spoon (figure 2) has been placed in the vagina²⁰. In the late premenstrual phase even with entire ejaculate (which Rock¹⁶ has estimated between 250,000,000 and 500,000,000 sperm) after several hours of contact very few motile active or immotile sperm can be recovered from the cervical mucus. Reinsertion^{27,28} of the pool in the spoon in the office at ovulation time will demonstrate secondary spermigration²¹ of an active type in the same patient.

Many an infertile couple labor under the delusion that the possibility of pregnancy exists each month, particularly if the wife is regular in menstruating. However, Weinstein has shown by monthly endometrial biopsies (which are an excellent indication objectively of ovulation) that in 40 regularly menstruating women so studied for one year, none ovulated more than 11 times a year and 65 per cent ovulated only six times or less. Here is the best reason why infertile couples should remain on basal temperature charts continuously, for chance alone is not likely to lead them

to marital relationship on the six or less fertile days in their year.

Collaborative postfactum endometrial biopsy which is non-traumatic and cannot interrupt a pregnancy can be similarly achieved by flotation during the first day of the menstrual cycle. The method which will be published shortly, consists of placing the cervical spoon beneath the cervix at the onset of menstrual flow, taping the handle with scotch tape against the perineum over a piece of cotton and inserting tampax as needed to act as a sieve from which the flecks of fleshy endometrium may be swirled in salt solution²². The suspended red cells having been poured

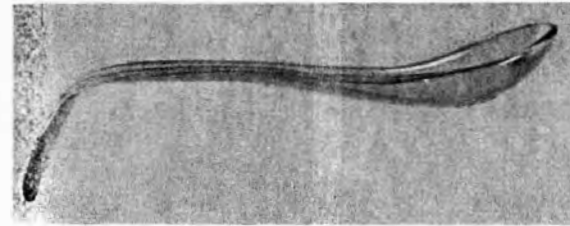


Fig. 2.
The cervical spoon.

off, the endometrial tissue is placed in formalin for the usual type studies.

A similar concurrent test for ovulation may be easily achieved by scraping the posterior vaginal fornix from side to side with the edge of the cervical spoon. The rim of the spoon will present a simple collection of vaginal epithelial cells which, stained with methylene blue or gentian violet, will demonstrate microscopically the curling or cornification effect which accompanies ovulation.

The clinical effectiveness of the periods of minimal fertility so determined can be judged from the statement of Barton and Weisner²³, that "not a single conception resulted if inseminations were carried out more than 24 hours after the high premenstrual level was reached. After the third or fourth day of the high temperature phase the women should be infertile and contraceptives* could be dispensed with until the onset of the next cycle." Davis²⁴ states that in a woman with a typical curve the fertility could be narrowed down to three days or less. The woman who has an atypical curve should refrain from coitus from the ninth or 10th day of the cycle until 48 hours after the rise has reached the postovulation plateau. Eastman²⁵ states it seems to some

observers that the fundamental concept of the diaphragm* as an occlusive agent is fallacious, as one can hardly expect a fit between the rim of the instrument and the vaginal wall close enough to prevent the passage of sperm. He lists as unsuited to the technique patients with extensive relaxation of the vaginal floor and those unable to learn how to insert or remove the diaphragm. This study raises the question as to whether the superior efficacy of the diaphragm over all other procedures has not been greatly exaggerated. Stix²⁶ (1946) states that from one-third to one-half the patients for whom the pessary and jelly* were prescribed give up their use within a year or longer. Latz²⁷ (1942) states that calendar calculation aided by basal temperatures permitted 1000 women to have 49,356 relationships during 11,249 cycles without the occurrence of a single pregnancy.

Summary: 1. Optimum fertility time can be calculated on a concurrent basis by the use of a basal temperature chart and by the observation of the character of cervical mucous changes and vaginal smears. 2. Postfactum ovulation can be accurately and objectively visualized by endometrial biopsy "exfoliative method" using the cervical spoon. 3. Absolute continence is the only complete method of avoiding pregnancy. 4. Periodic continence to the periods of minimal fertility and the period of relative fertility determinable by constant basal temperature determinations offer an accurate simultaneous method of achieving normal marital relationships and relief of physical tension and the achievement of peace of mind. 5. The use of chemical and mechanical spermicides is unnecessary if the physiologic period of minimal fertility is observed.

* The author has quoted scientific data obtained by certain investigators who utilize artificial donor insemination and artificial contraceptives. Such quotation does not constitute approval, real or implied, of artificial donor insemination nor of any type of contraception.

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