THE
Journal of Obstetrics & Gynaecology of India

VOLUME XXXIV No. 3 JUNE 1984

CLINICAL EVALUATION OF ENDOCRINE PROFILE BY BBT RECORDS IN DYSOVULATORY INFERTILITY

by

B. N. CHAKRAVARTY,* M.O. (Cal.), F.R.C.O.G. (Lond.)

and

SIDDHARTHA CHATTOPADHYAY,** M.B.,B.S. (Cal.)

Introduction

It is known that Basal Body Temperature BBT chart indicates ovulatory status and perhaps in addition, reflects the extent of functional adequacy of corpus luteum in the luteal phase. But it appeared from our study that almost the entire reproductive endocrine profile, normal or abnormal, is to a large extent, imaged in the BBT if this is correctly recorded and judiciously interpreted.

Objective of Study

In recent years with advancing knowledge in reproductive endocrinology various drugs are being used for induction of ovulation and luteal support in dysovulatory infertility. The term 'dysovulatory' includes infertility associated with non-ovulation, infrequent or oligo-ovulation, corpus luteum inadequacy and discordant follicular phase. The indication and use of specific drug is based on the report of radioimmunoassay and if facilities do not exist, the drugs are used empirically accepting a 'trial and error' basis. Even if facilities are available, daily sampling of blood or urine is inconvenient to the patient, costly in laboratory charges and the hormone profile that is obtained, while important in research studies, usually offer little value in clinical management. From practical point of view, it may not be possible to assess the hormonal status in an infertile woman by radioimmunoassay every day.

Record of BBT does not involve any cost and at the same time gives an overview of the ovulatory status and endocrine profile monthwise during the period, she is under treatment with ovulation inducing drugs.

Material

Over the last 10 years each infertile woman attending the clinic has been asked to record BBT while programming other investigations for infertility. During this period (from January '73 to December '82) 3462 infertile women attended the clinic and systematic record of relevant data including the BBT chart have been

*Professor, Obstetrics and Gynaecology, N.R.S. Medical College and Hospital.

**Post Graduate Student, B. R. Singh Hospital, Calcutta.

Accepted for publication on 30-8-83.

analysed in all cases. One thousand five hundred and twenty-one had dysovulatory infertility giving an incidence of 43.93 per cent. The diagnosis of dysovulatory infertility was based primarily on BBT pattern and cervical mucus supplemented in some cases by endometrial biopsy and vaginal cytology. The interpretation of BBT patterns was subsequently correlated in 112 cases by estimation of hormones using blood and urine samples (Table I).

TABLE I

Correlation Between Abnormal BBT and Endocrine Profile (estimated from blood or urine)

No. of cases investigated endocrinologically	112
BBT pattern substantiated by endocrine assay	70
Inconclusive by endocrine assay	42

Criteria for Recording BBT

The temperature is taken in the morning immediately on awakening and before arising. Reading and recording the temperature immediately after it is taken is not necessary. Attempting to read the thermometer while not yet fully awake may contribute not only to lack of precision but also to arousing antagonism against the method. The advantage of recording the temperature at leisure later in the day outweigh any slight error due to very minor contraction of the mercury column.

A thermometer especially designed for recording basal temperature with an expanded scale over a limited range and having an easily visualised mercury column is the choice for correct recording but for an intelligent patient an ordinary thermometer is equally good.

It is preferable to record the temperature about the same time each day. When significant variation in waking time occurs (more than one hour) fluctuations due to the diurnal variations in basal temperature may complicate the temperature chart record (Vollman 1977). Such episodes of variable waking time (more than one hour) occur very infrequently in a month. However, a method for correcting temperatures for differing waking times has been proposed recently by Royston *et al* (1980).

The temperature can be taken orally, vaginally or rectally. Oral temperatures are slightly lower than vaginal or rectal, but the biphasic pattern of the ovulatory cycle is similar for all three records. In this series, oral temperature has been recorded.

Thermognic Hormones

It is well known that progesterone has a thermogenic action which is mediated through central nervous system (Southan and Gonzaga, 1965). Androgens, like progesterone, have the similar effect. Rise of temperature during the menstrual cycles is due to appearance of increased blood concentrations of these hormones.

Types of BBT and Their Interpretations

Basically there are three types of BBT recordings, biphasic, monophasic and discordant. It has been observed that upper and lower limits of basal temperature varies between 96.4°F to 98.5°F. Presuming 97.4°F to 97.6°F as the base line or cover line, temperature fluctuating above and below this line in any phase of menstrual cycle or throughout the menstrual month would be considered as discordant. Day to day fluctuation of at least 0.2°F to 0.4°F is considered as 'discordant'. Monophasic variety may be of two types. In one, the temperature remains persistently elevated above the 'cover line' and this has been designated in the present communication as 'elevated monophasic'. In

the other, the temperature remains below the cover line which has been described as 'low monophasic'. In monophasic variety too, either the temperature remains persistently flat throughout the month or there may be day to day variation, which has been considered as discordant monophasic. In the present study, such type of discordancy has been specifically noted in the low monophasic variety.

Summarising our observations and to some extent corroborating with others (Marshall, 1963) it appears that there could be at least 8 types of temperature recordings indicating different types of endocrine profile. These are:—

TABLE II

Types of BBT in Different Endocrine Profile

Types of BBT	Endocine Profile
Biphasic	Normal ovulatory
Elevated monophasic	Androgenic P.C.O. Hyperprolactinaemia with hyperadrenalism
Low 'flat' monophasic	Hypothyroidism Hypogonad. Hypogonadism. P.O.F.
Low 'discordant' monophasic	Hyperprolactinaemia without hyperadrenalism
Discordant throughout	P.C.O. (Oestrogenic)
Short luteal	Insufficient progesterone
Discordant luteal	Fluctuating progesterone
Discordant follicular	Early phase of hyperactive adrenal (initial phase of androgenic P.C.O.)

1. *Biphasic*

Biphasic BBT indicates normal ovulatory pattern. The shift or rise in basal body temperature which occurs at the time of ovulation is usually of the order of 0.3°F to 0.5°F. It is not essential that there will be always a thermal 'dip' before a sharp rise and Marshall (1963) concluded that the rise could be one of three types. An acute rise with an elevation of at least 0.4°F (0.2°C) between two consecutive days, a slow gradual rise usually over 3 to 5 days but occasionally longer, or a step-like rise. In a study carried out by Marshall (1963) only 10 per cent of cycles had a dip preceding the temperature rise. Temperature charts illustrating three types of shifts are shown in Figs. 1a, 1b and 1c.

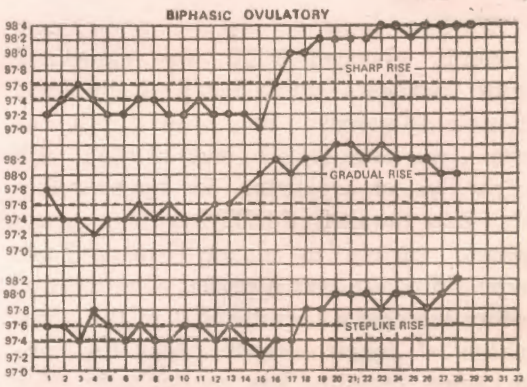

Fig. 1 b, c

2. *Elevated Monophasic*

Basal body temperature persistently remains above 97.8°F throughout the cycle (Fig. 2). Because of absence of progesterone, it may be presumed that elevated monophasic BBT is the effect of an elevated level of androgen in the circula-

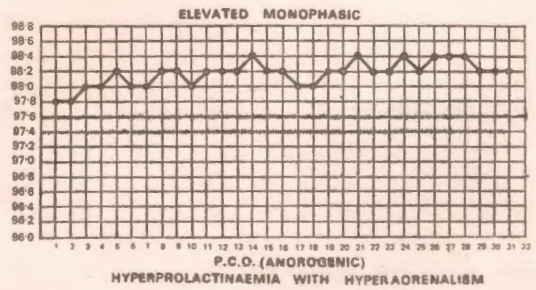

Fig. 2

tion. We have observed such types of persistent elevation in androgenic polycystic ovarian disease and in very few cases of hyperprolactinaemia. It has been documented that excess adrenal androgen in response to ACTH stimulation may cause hyperovarianism and other manifestations of PCO (Greenblatt, 1965). It has also been shown that patients with hyperprolactinaemia may have elevated ketosteroids and hirsutism (Carter *et al* 1977).

We have observed that majority of persistently elevated BBT was associated with androgenic PCO, the prolactin level remaining normal. In a small number of cases, we have found elevated BBT with high rise of prolactin. In hyperprolactinaemia, the shift of BBT from low monophasic variety to elevated monophasic type did occur over a period of months or years indicating thereby that in the iiitial phase of hyperprolactinaemia the temperature remains low monophasic (this type will be detailed subsequently) and if the state of hyperprolactinaemia continues, this will bring about hyperadrenalism and hyperovarianism (similar to androgenic PCO) leading to an elevated monophasic BBT pattern.

A clinical differentiation between hyperprolactinaemia and androgenic PCO resulting in elevated BBT has been observed during the course of treatment with Dexamethasone. The cervical mucus becomes abundant with maximum threadibility (Spinnberkiet) following induction with Dexamethasone in cases of androgenic PCO. Whereas in hyperprolactinaemic elevated BBT the cervical changes in midcycle following Dexamethasone induction reman negative.

Our concept of elevated monophasic BBT associated with androgenic PCO and persistent hyperprolactinaemia has been corroborated by Radioimmunoassay in 13 cases and therapeutic trial with Dexamethasone in 222 cases (Tables III and IV).

TABLE III

Abnormal BBT Pattern Substantiated by Endocrine Assay (70 cases)

Types of abnormal BBT		No. of cases investigated endocrinologically		Endocrine Profile
Low flat monophasic	30	16	F.S.H. L.H.	Marked elevation (P.O.F.)
		4	F.S.H. L.H.	Modest reduction (Hypogonad. Hypogonadism)
		10	T.S.H.	Elevated.
Low discordant monophasic	27		Prolactin	Elevated.
Elevated monophasic	13	8	Cortisol 17-KS	Elevated.
		5	Prolactin	Elevated.

TABLE IV

Clinical Response to Ovulation Inducing and Luteal Phase Supporting Drugs in Women with Abnormal BBT Pattern (1521 *cases*)

Types of abnormal BBT	No. of cases	Correction of BBT pattern following treatment	Conception
Low monophasic	543	321 (59.1%)	105 (32.7%)
Elevated monophasic	222	102 (45.9%)	42 (41.1%)
Discordant throughout	104	57 (54.8%)	12 (21.1%)
Discordant follicular phase	33	11 (33.3%)	2 (18.1%)
Discordant luteal phase	290	196 (67.6%)	61 (31.1%)
Short luteal	329	205 (62.3%)	93 (45.3%)
	1521	982	315

3. *Persistently Flat Low Monophasic*

In hypogonadotrophic hypogonadism, hypothyroidism and premature ovarian failure, the basal body temperature remains persistently low and flat (Fig. 3).

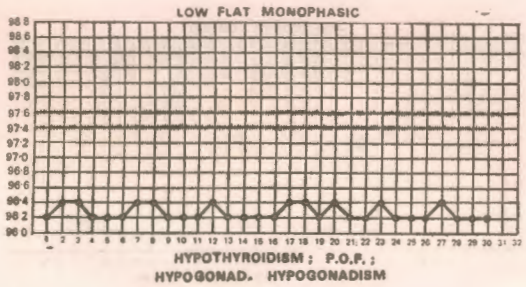

Fig. 3

Apart from clinical features of menstrual deficiency and definite stigma of hypothyroidism, the differential diagnosis has to be corroborated by biochemical studies and radioimmunoassay technique. Alternatively, failure to induce ovulation or menstruation either by clomiphene or by gonadotrophins leads to the suspicion of hypothyroidism or premature ovarian failure. Confirmation of diagnosis of premature ovarian failure has to be made by ovarian biopsy.

4. *Discordant Low Monophasic*

The temperature remains well below 97.6°F but there is day to day fluctuation ranging between 96° to 97.6°F (Fig. 4).

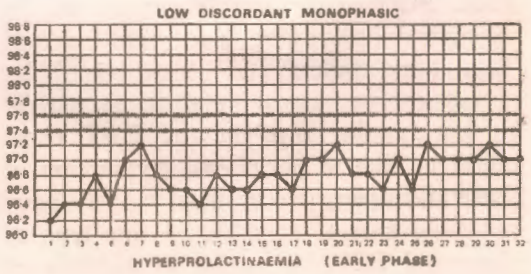

Fig. 4

This type of BBT is specific for majority of cases of hyperprolactinaemia. This has been corroborated in our study by radioimmunoassay in 27 cases.

The small spikes in the temperature chart possibly indicate the beginning of adrenal stimulation and if this state is allowed to continue for some time, excess amount of adrenal androgen will be elaborated, the peripheral biologic effect of which will lead to a persistently elevated morphasic BBT.

5. *Discordant Throughout the Month not Specifically Low*

In this variety there is day to day variation—sometimes below 97.6°F and the next day this may go above 97.6°F. This type of irrelevancy continues throughout the month (Fig. 5). Such abnormal BBT

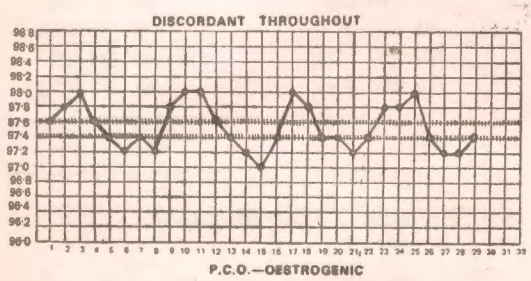

Fig. 5

in our experience was observed in oestrogenic PCO where steroidogenesis in the ovary is defective due to enzymatic defect. The sharp 'spikes' can be explained by monaromatised ovarian androgens, whereas the regular 'dips' in the BBT chart could be due to peripheral conversion of these androgens into oestrogens. We have not been able to corroborate this type of abnormal BBT by serial estimations of hormones by radioimmunoassay but we have been able to substantiate our views to considerable extent by therapeutic trial of induction of ovulation with clomiphene and HCG in 104 cases exhibiting such type of discordant BBT.

6. *Short Luteal BBT*

In this variety ovulation occurs at a later date of menstrual cycle usually between 20th to 24th day and the luteal phase is extremely short (Fig. 6). The treatment consists of antedating ovulation and helping nidation by luteal support (Progesterone, allyl oestrinol or HCG). This was corroborated in our study by therapeutic trial in 329 cases.

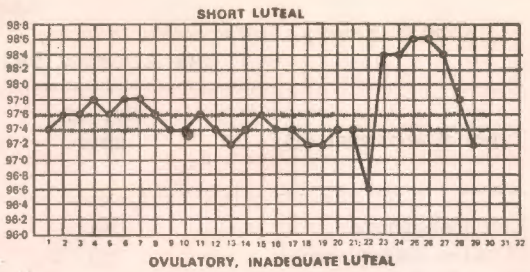

Fig. 6

7. *Discordant Luteal BBT*

This is a type of ovulatory BBT but another variety of inadequacy of luteal phase (Fig. 7). Because of fluctuations of

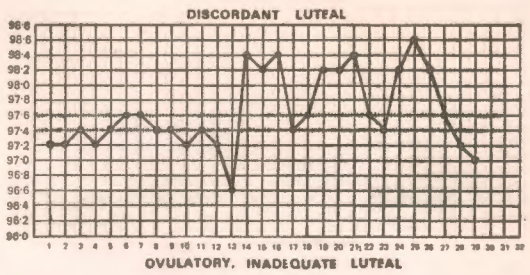

Fig. 7

blood concentration of progesterone there are frequent dips of the temperature in the luteal phase. This can be corrected only by luteal support with luteotrophic drugs. In the present series, correcion could be achieved in 196 out of 290 cases.

8. *Discordant Follicular Phase BBT*

This is also a variety of ovulatory biphasic BBT but there are few isolated

spikes of temperature above 97.6°F in the follicular phase (Fig. 8). This type of

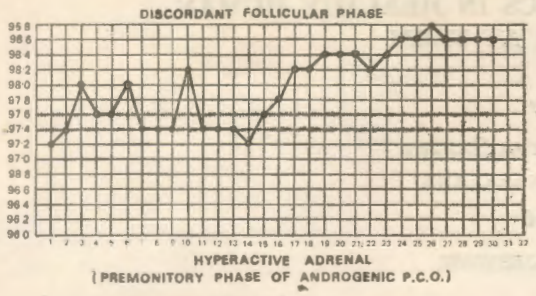

Fig. 8

BBT appears to be a transitional variety between a typical biphasic ovulatory BBT and a sustained elevated monophasic type. The discordancy in the follicular phase is perhaps due to the earlier manifestation of adrenal hyperactivity. If she remains infertile for quite some time she will ultimately have elevated monophasic BBT indicating nonovulation due to stress induced polycystic ovarian disease (Chakravarty *et al* 1980). Suppression of ACTH by dexamethasone in the follicular phase only may revert the BBT pattern to normal biphasic pattern.

Summary

1. Apart from ovulatory biphasic BBT which have been documented over the years, seven additional varieties of BBT presumably reflecting the apparent endocrine profile of dysovulatory infertility have been recorded and interpreted.

2. The interpretations have been substantiated partly by report of radioimmunoassay and partly by therapeutic trial of specific ovulation inducing drugs for different varieties of dysovulatory infertility.

3. From practical management point of view, precise record and judicious interpretation of these abnormal BBT may substitute the inconvenient and costly estimations of hormones from blood and urine.

4. Besides detection of abnormal endocrine profile, BBT record supplemented by study of cervical mucus appear to be useful clinical guides for selection of drugs for treatment of dysovulatory infertility.

References

1. Carter, J. N., Gomez, F. and Friesen, H. G.: Endocrine Causes of Menstrual Disorders. Edited by James R. Givens, Page 115, published by Year Book Medical Publishers, Chicago, London, 1977.
2. Chakravarty, B. N., Gun, K. M. and Mukherjee, S.: Indian J. Psycosomatic, Obstet. Gynaec., I, Page 20, 1980.
3. Greenblatt, R. B.: The Hirsut Female, Ed. R. B. Greenblatt. Pub. Charles C. Thomas, P. 160, 1965.
4. Marshall, J.: Brit. Med. J. 1: 102, 1963.
5. Royston, J. P., Abrams, R. M., Higgins, M. P. and Flynn, A.: Brit. J. Obstet. Gynaec. **87: 1123, 1980.**
6. Southan, S. L. and Gonzaga, F. P.: Am. J. Obstet. Gynaec. **91: 141, 1965.**
7. Vollman, R. F.: The Menstrual Cycle Vol. 7 of Major Problems in Obstetrics and Gynaecology, W. B. Saunders, Philadelphia, Vol. 7, 1977.