

OVULATION AFTER UNILATERAL OVARIOTOMY

by

KAMALA ACHARI,* M.B., M.S., F.R.C.O.G., F.I.C.S.

SHANKAR PRIYA, B.Sc., M.B., M.S.

and

LEENA PRIYA, M.B., M.S.

The role of the ovary in the physiology of reproduction is a paramount one. Bonney (1947) observed during laparotomy that if one ovary contains a graffian follicle, the other ovary does not show any activity; he suggested that the various genital and extra-genital functions of the ovarian hormones are distributed between the two gonads. Whitelaw (1951) observed that unilateral ovariectomy or oophorectomy does not influence the reproductive and endocrine function of the woman. He believed in the Lipschutz law of follicular constancy which suggested that after unilateral oophorectomy there is maintenance of normal ovarian function through hypertrophy and greater activity of the remaining ovary.

We feel that every ovarian cyst, except the derivatives of the graffian follicle and corpus luteum, however benign, has got the potentiality to become malignant. After ovarian resection there are chances of leaving behind such potentially malignant tissues. Besides Reynolds (1952) has shown that where there is marked distortion of the spiral arteries of the ovary small cysts were present

nearby. According to him non-neoplastic ovarian cyst may be the result of unfavourable haemodynamic condition. Therefore, simple resection of the cyst will result in subsequent follicular cyst formation and consequent menstrual irregularity. Ovarian resection in this way also has always got a disadvantage over ovariectomy, which completely removes the chance of recurrence and/or malignancy, or formation of functional cyst. The object of our analysis is to establish that ovarian function after unilateral ovariectomy is fully maintained.

From January 1960 to December 1965, in the six years period, there were 65 cases who had ovariectomy under our personal care. Patients selected were women of reproductive age or had undergone unilateral ovariectomy. Women having malignant ovarian tumour or those above the age of 40 were excluded from this analysis. Every case had a careful study for any menstrual dysfunction before the operative procedure. Three months' interval was given for stabilization of ovarian function. The functional state of the ovary was determined by the dual study of vaginal smear in one complete menstrual cycle, or for 6 weeks in menstrual dysfunction, and examination of the endometrial pattern. Vaginal smear

*Senior Lecturer in Obstetrics & Gynaecology, P. W. Medical College, Patna, Bihar.

Received for publication on 22-1-67.

was taken at 4 days' interval. A careful history of any post-operative menstrual dysfunction was taken in each case. Endometrial biopsy was done on the 24th-28th day of the menstrual cycle. To determine the presence of ovulation, progesterone effect in smear pattern and secretory activity of the endometrium was noted; 3 main types of cytological pattern were seen in this series of cases. The classification of vaginal pattern, as described by de-Allende and Orias (1950) with slight modification was followed throughout this series.

(1) *Fluctuating cornification index with progesterone effect (PE)*

This is characteristic of the normal ovulatory cycle. The percentage of cornification, beginning relatively low at the end of menstruation, rises more or less regularly to a maximum which varies according to the case from 45%-90% in the middle of the cycle, thereafter, falling more or less

suddenly and remaining low until the next menstruation. The cells show curling and folding appearance which characterises progesterone activity by the 20th to 24th day of menstruation.

(2) *Low cornification index (No PE)*

The level of cornification is low (below 15%) and is constant, without great oscillation. There is absence of progesterone effect, folding or clumping of the cells was not seen even towards the end of the cycle.

(3) *Persistently high cornification (No PE)*

This is characterised by variable percentage of cornification, but always above 40%. It may exist from 24th to 35th day before the cornification level drops and menstruation occurs.

The results of 65 cases of unilateral ovariectomy have been studied, and their age incidence is analysed.

TABLE I
Shows the Age Incidence of Benign Ovarian Tumour with Unilateral Ovariectomy

	Total no. of cases	10 - 15 years No. (%)	16 - 20 years No. (%)	21 - 25 years No. (%)	26 - 30 years No. (%)	31 - 35 years No. (%)	36 - 40 years No. (%)
Pseudomucinous cyst.	25	—	—	—	7 (28%)	15 (60%)	3 (12%)
Papilliferous cyst.	7	—	—	—	2 (28.57%)	4 (37.14%)	1 (14.29%)
Cystoma simplex and twisted cyst.	8	—	—	1 (12.5%)	1 (12.5%)	3 (37.5%)	3 (37.5%)
Dermoid cyst.	9	—	4 (44.44%)	3 (33.33%)	2 (22.22%)	—	—
Granulosa cyst.	2	2 (100%)	—	—	—	—	—
Endometrial cyst.	4	—	—	—	1 (25%)	2 (50%)	1 (25%)
Follicular cyst.	6	—	—	4 (66.66%)	2 (33.33%)	—	—
Tubo-ovarian lump with atretic follicular cyst.	4	—	—	1 (25%)	1 (25%)	2 (50%)	—
	65	2 (3%)	4 (6.2%)	9 (13.8%)	16 (24.7%)	26 (40%)	8 (12.3%)

Out of 25 pseudomucinous cysts 88% were in the age group below 36, and 12% above and near 40 years of age. In the case of endometrial cysts 25% belonged to the younger age group and the rest (75%) to the age group of above thirty. All those with dermoid cysts were below 30 years of age. Some of them had come solely for the purpose of treatment of infertility and menstrual dysfunction. Cent per cent of the granulosa cysts were in the prepuberty age group. The papilliferous cysts were seen between the ages of 26-40, maximum incidence being in the age group of 31-35 years, 25% in the age group of 36-40, 25% before the age of 30. The atretic follicular cysts with ectopic pregnancy were seen in women between 21-35 years; there were only 4 cases, two of which were in women of 31-35 years of age.

Table II gives the type of benign ovarian tumour where unilateral ovariectomy was done and the relation to the menstrual cycle before and after operation.

In 25 cases of pseudomucinous cystadenoma 23 had regular menstrual pattern, 2 had irregular cycles. Regularity of menstruation was established in 24 out of 25 cases within 3 months of operation. One case continued to have irregular pattern despite the operation, or perhaps as she was 40 years old at the time of ovariectomy, the irregularity was due to approaching menopause and had no relationship with ovariectomy whatsoever. The smear picture gave an appearance of subnormal ovarian function. There were 7 cases of papilliferous cysts. The menstrual cycle was regular before and after operation in all of them. Out of 9 cases of dermoid cysts, 3 had irregular menstrual cycles. One of these patients had amenorrhoea of 6 months without any evidence of pregnancy. Two out of these had infertility as well, indicating an anovulatory type of menstruation; 6 had regular menstruation. After ovariectomy all the 9 cases had regular menstrual cycles. Both the cases of granulosa cell tumour had ir-

TABLE II

	Total no. of cases	Before operation		After operation	
		Regular menstrual cycle	Irregular menstrual cycle	Regular menstrual cycle	Irregular menstrual cycle
		No. (%)	No. (%)	No. (%)	No. (%)
Pseudomucinous cyst.	25	23 (92%)	2 (8%)	24 (96%)	1 (4%)
Papilliferous cyst.	7	7 (100%)	—	7 (100%)	—
Cystoma simplex and twisted cyst.	8	5 (62.5%)	3 (37.5%)	6 (75%)	2 (25%)
Dermoid cyst.	9	6 (66.6%)	3 (33.3%)	9 (100%)	—
Granulosa cyst.	2	—	2	2 (10%)	—
Endometrial cyst.	4	2 (50%)	2 (50%)	4 (100%)	—
Follicular cyst.	6	4 (66.6%)	2 (33.3%)	4 (66.6%)	2 (33.3%)
Tubo-ovarian lump with atretic follicular cyst.	4	—	4 (100%)	2 (50%)	2 (50%)
	65	47 (73.8%)	18 (26.2%)	58 (89.2%)	7 (10.8%)

regular vaginal bleeding before operation and belong to the prepuberty age group. Menorrhagia was maintained in 50% of cases who had removal of unilateral ovaries with atretic follicular cysts. In cases of endometrial cysts, two had irregular vaginal bleeding which became normal after operation. It appears that in a few cases the remaining ovarian tissue was not capable of maintaining an adequate functional level with regard to the production of the ovum. But if the menstrual history of these patients was seen these patients had suffered from menstrual difficulties and most probably had anovulatory cycles even before the unilateral ovariectomy. The abnormal ovarian function was maintained in the remaining ovary in spite of the operation or the remaining ovary may have been damaged as a result of the lesion for which the ovary was removed.

Table III shows the age incidence and the types of menstrual cycle before and after unilateral ovariectomy.

patients who had regular menstrual patterns before ovariectomy became irregular after surgery. In the younger age group, i.e., between 10-25 years, there were 15 cases out of which 6 had irregular periods before operation. After operation the menstrual cycle was corrected in all except one. Compared to this, the upper age group had 50 cases, 12 of these had irregular cycles before operation which was corrected in only 6 cases after unilateral ovariectomy. This indicates that unilateral ovariectomy had better results in the younger age group than in the older, since in the older group the menstrual irregularities were attributed to factors other than the ovarian tumour for which the treatment was carried out.

Table IV shows the vaginal smear pattern in different types of benign ovarian tumour.

Out of 65 cases who were under investigation from 3 months to 2 years following operation, 7 cases showed abnormal type of smear indicating lack of ovulation.

TABLE III

Age groups in year	No. of cases	Before operation		After operation	
		Regular No. (%)	Irregular No. (%)	Regular No. (%)	Irregular No. (%)
10 - 15	2	—	2 (10%)	2 (10%)	—
16 - 20	4	4 (10%)	—	4 (10%)	—
21 - 25	9	5 (53.5%)	4 (44.4%)	8 (88.8%)	1 (11.1%)
26 - 30	16	12 (75.0%)	4 (25.0%)	14 (88.2%)	2 (11.8%)
31 - 35	26	21 (80.9%)	5 (19.2%)	24 (92.31%)	2 (7.69%)
36 - 40	8	5 (62.1%)	3 (37.1%)	6 (75.0%)	2 (25.0%)
Total	65	47 (75.3%)	18 (24.7%)	58 (89.2%)	7 (10.8%)

75.3% had regular and 24.7% had irregular cycles before operation; after surgery the cycles remained uncorrected in 10.8% only. None of the

Cornification curve in 65 cases of unilateral ovariectomy according to the age incidence.

89.2% cases had fluctuating corni-

TABLE IV

Types of tumour	No. of cases	Fluctuating cornification (without PE) No. (%)	Constantly low cornification (without PE) No. (%)	Constantly high cornification (without PE) No. (%)
Pseudomucinous cyst.	25	24 (96%)	—	1 (4%)
Papilliferous cyst.	7	7 (100%)	—	—
Cystoma simplex and twisted cyst.	8	6 (75%)	2 (25%)	—
Dermoid cyst.	9	9 (100%)	—	—
Granulosa cyst.	2	2 (100%)	—	—
Endometrial cyst.	4	4 (100%)	—	—
Follicular cyst.	6	4 (50%)	1 (25%)	1 (25%)
Tubo-ovarian lump with atretic follicular cyst.	4	4 (50%)	1 (25%)	1 (25%)
	65	58 (89.2%)	4 (6.2%)	3 (4.6%)

TABLE V

Age groups in years	No. of cases	Fluctuating cornification (with PE) No. (%)	Constantly low cornification (with PE) No. (%)	Constantly high cornification (with PE) No. (%)
10 - 15	2	2 (100%)	—	—
16 - 20	4	4 (100%)	—	—
21 - 25	9	8 (77.7%)	1 (22.3%)	—
26 - 30	16	14 (88.2%)	1 (5.9%)	1 (5.9%)
31 - 35	26	24 (92%)	1 (4%)	1 (4%)
36 - 40	8	6 (75%)	1 (12.5%)	1 (12.5%)
Total	65	58 (89.2%)	4 (6.2%)	3 (4.6%)

fication smears showing progesterone effect. Between the ages of 21-25, one case had low cornification throughout the menstrual cycle; she had oligomenorrhoea and sterility before operation, after operation also she continued to have infertility. Between the ages of 31-35, 2 cases had atypical hypertrophic vaginal smear indicating lack of ovulation; they had removal of one-sided ovarian simple serous cyst. Perhaps the remaining ovary was also damaged by the same pathological process which indicated the re-

moval of the ovary primarily. Between the ages of 36-40, 3 cases had dystrophic type of smears. One of them developed signs of ovarian dysfunction characterised by metropathic type of bleeding. Endometrial biopsy failed to show any progestational changes. She had hysterectomy 2½ years after unilateral ovariectomy. The remaining ovary contained a follicular cyst.

Table VI gives the endometrial biopsy of 65 cases of unilateral ovariectomy with relation to age.

TABLE VI

Age groups in year	No of cases	Progestational endometrium No. (%)	Moderate oestro- genic endo- metrium No. (%)	Oestrogenic hyperplasia No. (%)
10 - 15	2	2 (100%)	—	—
16 - 20	4	4 (100%)	—	—
21 - 25	9	8 (77.7%)	1 (22.3%)	—
26 - 30	16	14 (88.2%)	1 (5.9%)	1 (5.9%)
31 - 35	26	24 (92.0%)	1 (4.0%)	1 (4.0%)
36 - 40	8	6 (75.0%)	1 (12.5%)	1 (12.5%)
Total	65	58 (89.2%)	4 (6.2%)	3 (4.6%)

In 89.2% there was progestational endometrium, indicating normal ovarian function after unilateral ovariectomy.

Discussion

Conservation of ovarian tissue in women during the reproductive period has been indoctrinated in gynaecological practice since the time of Bonney (1947). Marshall (1928), Meigs (1943), Dockerty (1945) have stressed the preservation of ovarian tissue during the child-bearing period. Bonney (1947) stated that the ovary in full activity exercises no less than seven functions, and that these were distributed between the two ovaries. In certain instances the ovary may be partly or fully functional, while the other may be functioning less. In women with this ovarian peculiarity the removal of one ovary results in loss of function. Thus the menstrual function may permanently cease. The patient previously fertile may become sterile or exhibit the neuro-muscular disturbance of menopause. Whitelaw (1951) observed that the remaining ovary after unilateral ovariectomy or oophorectomy assumes all the functions

formally exercised by both the ovaries. He suggested that investigation by combined study of basal body temperature curve and endometrial biopsies is best indication of ovarian function. Venning & Browne (1947) considered that the vaginal smear is an accurate method in the diagnosis of ovulation. In this present series of cases investigated there is a close correlation between the appearance of cytological pattern and luteal phase as displayed by the uterine endometrium. Therefore, we have found the vaginal smear method of hormonal estimation confirmed by endometrial biopsy as the most satisfactory method.

Sixty-five unilaterally ovariectomised women, all under the age of 40 were studied. In each case one ovary had been completely removed 3-4 months prior to investigation. Since all the patients were under our personal care the detailed history of the pre-ovariotomy state had been recorded. Though no control studies of ovarian function were made previous to the operation by either cytology or endometrial biopsy, the menstrual history gave a working idea of the cyclical changes in the ovary.

Out of 65 cases, 26.2% had menstrual irregularity before operation (Table 2). Some of them belonged to the group of those ovarian tumours or cysts which are known to be associated with menstrual dysfunction, e.g. granulosa cell and follicular cyst. Menstrual irregularity was also seen in some of the so-called non-functioning ovarian tumours (Table 2).

Out of 18 cases who had menstrual irregularity, 11 cases regained a normal menstrual pattern and 7 continued to have irregular cycles. None of the cases who had regular menstrual cycle before developed irregularity after ovariectomy. The cases where ovarian dysfunction persisted belonged to the age group of 35-40 years. We feel the age factor itself might have been responsible for maintenance of ovarian dysfunction (Table 3). After ovariectomy, in 89.2% of cases the cytological pattern and endometrium indicated presence of ovulation. Hypoovarian function was seen in 6.2% and high cornification in 4.6% (Table 4). The cases in the latter group probably developed follicular cysts for which the previous ovary was removed. The endometrial pattern showed secretory type in 89.2% (Table 6) confirming our vaginal smear observations. Whitelaw (1951) assumed, after studying large series of normal and sterility cases, that anovulatory cycles occur in 5% of normally fertile per-

sons and in 15% of sterile women. According to him in a total of 350 endometrial biopsies and 42 unilaterally oophorectomised women, absence of progesterone was noted in 0.4% of cases. In other words ovulation occurred in more than 99% of cases of unilateral oophorectomised cases. In our series of cases ovulation was seen in 89.2%. Therefore, we feel unilateral ovariectomy does not in any way bring about lack of ovulation. The ovarian function is fully taken up by the other ovary and should be considered in every case of benign ovarian tumour.

References

1. Bonney, V.: J. Mount Sinai Hospital. New York. 14: 152, 1947.
2. de-Allende, I. L. C. and Orias, O.: Cytology of the Human Vagina New York, 1950, Hoeber.
3. Dockerty, M. B.: Surg. Gynec. & Obst. Internal Obst. Surg. 81: 179, 1945.
4. Marshall, J. M.: Proc. Mayochin. 3: 4, 1928.
5. Meigs, J. V.: N. England J. M. 228: 52, 1943.
6. Reynolds, S. R. M.: Physiological Bases of Gynec. & Obst. Illinois, 1952, Thomas.
7. Venning, E. H. and Browne, J. S. L.: Endocrinology. 21: 711, 1947.
8. Whitelaw, M. J.: Surg. Gynec & Obst. 92: 747, 1951.