

Growth and Rupture of Ovarian Follicle in Pakistani Females

R ANWAAR

Department of Anatomy, Allama Iqbal Medical College, Lahore
Correspondence to Dr. Rubina Anwaar, Assistant Professor

60 ladies with regular menstrual cycles were selected. Pelvic ultrasonography was done to see the size of maturing follicles, on 10th, 12th and 14th days of cycle. Rate of growth was found to be 0.2mm/day. The follicular rupture occurred at 2.45cm.

Key words: menstrual cycle, ovarian cycle, follicle, and infertility.

Ultrasound for ovulation monitoring is done between Day 10-16. Ovulation scans allow the doctor to determine accurately when the egg matures and when women ovulate. These scans form the basis for most infertility treatments. Daily or alternate scans are done to visualize the growing follicle, which looks like a black bubble on the screen. The follicle grows at about 1-2 mm per day, and a mature follicle is about 18-25 mm in size. Please remember that ultrasound will not allow us to see the egg directly - this is located inside the follicle and is too small to be visualized by ultrasound.

Female reproductive cycle: A woman's reproductive system must produce sex hormones and functional gametes and also be able to protect and support a developing embryo and nourish the newborn infant. The principal organs of the female reproductive system are the ovaries, the uterine tubes (Fallopian tubes or oviducts), the uterus, the vagina, and the components of the external genitalia. As in males, a variety of accessory glands secrete into the female reproductive tract.

During their reproductive years women experience monthly cycles of changes in their ovaries and uterus. There are actually 2 overlapping cycles that cover about 28 days: the ovarian cycle and the uterine cycle.

1. The **ovarian cycle** includes the maturation of ova, the ova containing/nourishing structure called the follicle, oogenesis, ovulation, and the degradation of the follicle: This cycle develops an oocyte for fertilization. The most common cause of female infertility is ovulation disorders.¹
2. The **uterine cycle** prepares the endometrial layer (innermost) layer of the uterus for the implantation and development of the fertilized ovum and/or initiates shedding of this lining if implantation does not occur.
3. Both cycles are controlled by many hormones secreted from various parts of the body.²
4. The cycles begin at puberty, are interrupted only by pregnancy, and cease at the time of menopause.
5. The cyclic durations vary from woman to woman and even in the same woman from time to time.
6. Women who exercise very strenuously or have very low or high levels of body fat may experience a temporary cessation of these cycles, a condition called amenorrhea.

7. The ovarian and uterine cycles are sometimes collectively called the **menstrual cycle**.

Oogenesis (occurs in the ovaries): Ovum production, or oogenesis, begins before a woman's birth, accelerates at puberty, and ends at menopause. Between puberty and menopause, oogenesis occurs on a monthly basis as part of the ovarian cycle. Estrogens play a major role in folliculogenesis.^{3,4} Unlike the situation in the male gonads, the oogonia, or stem cells of females, complete their mitotic divisions before birth. Between the third and seventh months of fetal development, the daughter cells, or primary oocytes, prepare to undergo meiosis. They proceed as far as prophase of meiosis I, but at that time the process comes to a halt. The primary oocytes then remain in a state of suspended development until the individual reaches puberty. At that time, rising levels of follicle stimulating hormone (FSH) trigger the start of the ovarian cycle. Each month thereafter, some of the primary oocytes will be stimulated to undergo further development. Not all primary oocytes produced in development survive until puberty. There are roughly 2 million primordial follicles in the ovaries at birth, each containing a primary oocyte. By the time of puberty, that number has dropped to about 400,000. The rest of the primordial follicles degenerate in a process called atresia.

The Ovarian Cycle: Ovarian follicles are specialized structures in which oocyte growth and meiosis I occur. The ovarian follicles are located in the cortex of the ovaries. Primary oocytes are located in the outer portion of the ovarian cortex near the tunica albuginea, in clusters called egg nests. Each primary oocyte within an egg nest is surrounded by a single squamous layer of follicular cells. The primary oocyte and its follicular cells form a primordial follicle. After sexual maturation, a different group of primordial follicles is activated each month. This monthly process is known as the ovarian cycle. The ovarian cycle can be divided into a follicular phase and a luteal phase. Important steps in the ovarian cycle can be summarized as follows:

1. Occurs about every 28 days in the ovaries of adolescent and adult women. It is marked by 2 distinct phases the follicular phase and the luteal phase, which are separated by ovulation = release of an egg from the ovary.

2. Days 1 - 14 are the follicular phase, which is initiated by the release of follicle stimulating hormone (FSH) from the anterior pituitary gland. During this phase, a primary follicle begins to enlarge and a primary oocyte continues the meiotic process. While it is growing, the follicle secretes estrogen and smaller quantities of progesterone into the blood.
3. By day 14, the developing ova in the primary follicle develops into a Graafian follicle, which is pushed up against the ovary surface like a blister.
4. The luteal phase begins around day 14, when a surge of lutenizing hormone (LH) released by the anterior pituitary causes a rupture of the Graafian follicle and subsequent ovulation. The ovum is then captured by fimbriae of the oviducts (fallopian tube). Indomethacine has a role in blocking ovulation.⁵
5. After the follicle ruptures, it collapses and is transformed into a corpus luteum.
 - The corpus luteum slowly increases in size, and its cells release a large quantity of the hormone progesterone and smaller amounts of estrogen in the blood.
 - The progesterone acts on the endometrium of the uterus, preparing it to receive a fertilized ovum.
6. If there is no fertilization, the corpus luteum degenerates and is reabsorbed by the ovary, marking the end of the luteal phase by day 28.
 - The decline in progesterone initiates the shedding of the endometrium in a process called menses or menstruation.

However, if fertilization does occur, the corpus luteum persists and secretes progesterone for about 6 months, until another stru although only about 500 will have been ovulated during the interim.

The Uterine Cycle: The uterine cycle is a repeating series of changes in the structure of the endometrium, the lining of the uterus. The uterine cycle averages 28 days in length, but it can range from 21 to 35 days in healthy women of reproductive age. We can divide the cycle into three phases: (1) menses or menstruation, (2) the proliferative phase, and (3) the secretory phase. The phases occur in response to hormones associated with the regulation of the ovarian cycle. Menses and the proliferative phase occur during the follicular phase of the ovarian cycle. The secretory phase corresponds to the luteal phase of the ovarian cycle.

Infertility: The medical textbook definition of infertility being the inability to conceive even after trying for a year. Couples who have never had a child are said to have "primary infertility"; those who have become pregnant at least once but are unable to conceive again are said to have "secondary infertility."

Aims and objectives:

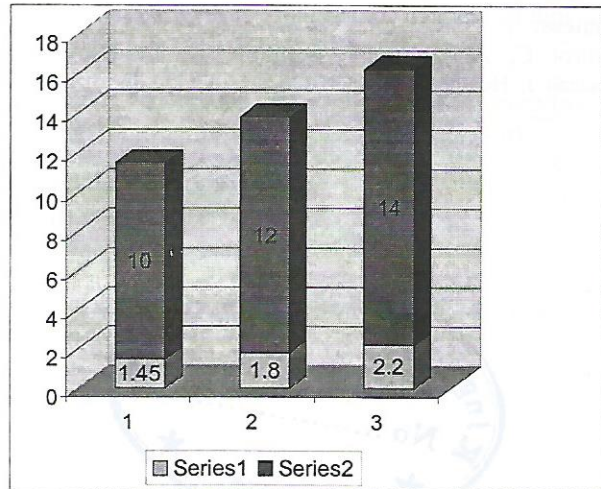
This study was designed to see the rate of growth of follicle till its rupture, so that the patients of primary and secondary infertility can be guided.

Subjects and procedure:

60 females of reproductive age with regular menstrual cycles were selected. The length range of their cycles was 26-30 days. They were advised to come on 10th, 12th, and 14th days of cycle. The ovaries were examined for the presence of follicles. The biggest maturing follicle was measured. The females having non-ovulatory cycles were excluded prior to selection. After 14th day all the subjects were examined daily till the rupture of follicle, under ultrasound examination. The results were presented as means and standard deviations.

Results:

Mean diameter of follicle on 10th day is 1.45cm(± 0 SD).
 Mean diameter of follicle on 12th day is 1.8cm(± 0.09 SD).
 Mean diameter of follicle on 14th day is 2.22cm (±0.13 SD).
 Mean diameter of follicle before rupture is 2.45cm(± 0.11 SD).



Series 1: Denotes follicular size; Series 2 Denotes days of cycle

Discussion:

Ultrasound can be used to monitor the growth and rupture of the dominant follicle⁶. In a single menstrual cycle, the chance of a perfectly normal couple achieving a successful pregnancy is only about 25%, even if they have sex every single day. This is called their fecundity, which describes their fertility potential. Humans are not very efficient at producing babies. There are many reasons for this, including the fact that some eggs don't fertilize and some of the fertilized eggs don't grow well in the early developmental stage^{7,8}. Over a period of a year, the chance

of a successful pregnancy is between 80% and 90%; so that 7 out of 8 couples will be pregnant within a year. These are the normal "fertile" couples - and the rest are "labeled" infertile^{9,10}. The chances of a couple getting pregnant in a given month will depend upon many things, and the most important of these are:

1. The age of the woman as with increasing age, number and quality of eggs start decreasing.
2. Frequency of intercourse
3. Trying time, is important as, if the couple is trying before or after 48 hours of ovulation, their chances of conceiving becomes less. Mostly ovum is fertilizable till 48 hours of ovulation.

So one of very important factor is the knowledge about the time of ovulation. When couple knows that what is the proper time at which, if they try to become pregnant there are more chances of conceiving it can solve their problem of infertility.

Conclusion:

If we know the rate of growth of follicle and the size before rupture, we can guide the females of primary and secondary infertility in best of their opportunity to conceive.

References:

1. Poirot C, Abriached F, Vauthier D, Lefebvre G, Raccach J, Hugues JN. 2003, Oocyte in vitro fertilization: results and future in humans. *Gynecol obstet fertile* 31(10): 803-12.
2. Alain M, Guy D, Nadine G. In vivo effect of epidermal growth factor, interleukin-1B, and interleukin-1RA on equine preovulatory follicles. 2003, *biology of reproduction* 68, 1748-1754.
3. Steven F, Palter AB, Ariel H, Johannes D, Veldhuis EY. 2001, Are estrogens of import to primate/human ovarian folliculogenesis? *Endocrine reviews* 22(3): 389-424.
4. Steven F, Palter AB, Ariel H, Johannes D, Veldhuis EY. 2001, Are estrogens of import to primate/human ovarian folliculogenesis? *Endocrine reviews* 22(3): 389-424.
5. LuYI, MaoZC. Effect of Indomethacine on ovarian follicle rupture. 1990 23(3): 319-31.
6. Daly DC, Soto AC, Walters C, Ying YK, Riddick DH. Ultrasonographic assessment of luteinized unruptured follicle syndrome in unexplained infertility 1985. *Fertil steril* 43(1): 62-5.
7. Mendelson EB, Friedman H, Neiman HL, Calenoff L, Vogelzang RL, Cohen MR. The role of imaging in infertility management 1985. *AJR Am J Roentgenol*, 144(2): 415-20.
8. Coulam CB, Hill LM, Breckle R. Ultrasonic evidence for luteinization of unruptured preovulatory follicles. 1982, 37(4): 524-9.
9. Coulam CB, Hill LM, Breckle R. Ultrasonic assessment of subsequent unexplained infertility after ovulation induction. 1983, *Br J Obstet Gynaecol*, 90(5): 460-7.
10. Admes JM, Taylor Ae, Crowley WF, Hall JE. Poly cystic ovarian morphology with regular ovulatory cycles: insights in to the pathophysiology of polycystic ovarian syndrome. 2004, 89(9): 4343-50

