

# Histoarchitectural Study of Corpus Luteum in Pregnant and Non-Pregnant State

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## Abstract

**Introduction:** The fate and the life span of the corpus luteum depends upon whether fertilization occurs or not. In the present study we have compared the histology of corpus luteum of early pregnancy with a non-pregnant state. **Subjects and Methods:** Tissue was collected during a pan hysterectomy for uncontrolled bleeding in a ruptured ectopic pregnancy and prepared for histology. The slides were compared with slides from ovary of a non-pregnant female present in the department of anatomy at JNMC, Aligarh. **Results:** The pregnant state had the fibroblast layer which was wider and granulosa luteal layer was more cellular in comparison to the non-pregnant state. **Conclusion:** In depth knowledge of the changes taking place in corpus luteum will increase our understanding of luteal dysfunction. More studies with advanced techniques are needed to further increase our knowledge.

**Keywords:** Corpus luteum, pregnancy.

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## Introduction

Corpus luteum is an important structure seen during the second half of ovarian cycle, formed by the remaining cells of the mature graffian follicle once the ovum is shed at ovulation. Corpus luteum is a temporary endocrine structure, the main function of which is the production of progesterone. The fate and the life span of the corpus luteum depends upon whether fertilization occurs or not. If fertilization occurs it is the main source of production of the hormone up to seventh to eight weeks of pregnancy,<sup>[1]</sup> after which the placenta starts producing the hormone and the luteal placental shift occurs.<sup>[2]</sup> If fertilization doesn't occur the corpus luteum starts degenerating and is called as the corpus luteum of menstruation which gets converted to corpus albicans.

Along with its fate the size of corpus luteum also varies during menstruation and in the early and late pregnancy.<sup>[3]</sup> In the present study we have compared the histology of corpus luteum of early pregnancy with a non-pregnant state i.e. corpus luteum of menstruation and we have done a detailed study about the changes in the size, vascularity and the changes taking place in the cells during pregnancy.

## Subjects and Methods

The tissue for the present study was collected during a pan hysterectomy for uncontrolled bleeding in a ruptured ectopic pregnancy. The length of the pregnancy as estimated by the

last menstrual period was around 16 weeks. The ovary showed a large corpus luteum measuring about 3-4 cm which occupied about one third of the ovary. Ovary with the corpus luteum was taken and fixed in formalin and the tissue was prepared for histology. The slides were compared with slides from ovary of a non-pregnant female present in the department of anatomy at JNMC, Aligarh, and the histological changes and the histological differences between the corpus luteum were noted.

## Results

The histological sections of ovary of non – pregnant state showed stroma consisting of multiple follicles in different stages of maturation. The corpus luteum was identified as a crumpled mass of cells surrounding a central cavity. The cavity was filled with eosinophilic substance which was a mixture of RBCs and fibrin clot formed by the degeneration of the granulosa cells. The boundary of the cavity was lightly staining and consisted of fibroblasts, outside which was layer of cells derived from granulosa cells called the granulosa lutein cells. The cells were round eosinophilic with a centrally located nucleus. Surrounding the granulosa lutein cells a layer of smaller cells was noted these are the cells derived from theca interna and are known as the theca luteal cells. [Figure 1] Outside the theca luteal cells a layer of fibroblast constituting theca externa was seen. The periphery of the corpus luteum showed few blood vessels with narrow lumen. The size of the corpus luteum was small suggesting its transformation into corpus albicans.

The histological section of the ovary of the case showed a large corpus luteum which was occupying a large portion of the ovary. The central cavity was large and was surrounded by fibroblast layer which was wider than that seen in the non-pregnant state. Surrounding this fibrous layer was a wide layer of cells which were large and showed features of steroid producing cell. [Figure 2,3] These cells formed the granulosa luteal layer, this layer was more cellular as compared to the non-pregnant state. The cells of the granulosa lutein cell layer were large polygonal, lightly staining, with a centrally placed nucleus and a prominent nucleoli. These cells also show large vacuoles in the cytoplasm Few cells having darkly staining cytoplasm were also seen. The same type of cells were reported by Visfeldt J et.al,<sup>[4]</sup> and were called as the K cells or the dark cells.

The layer towards the periphery of the granulosa lutein cells was composed of cells of smaller size known as the theca luteal cells. These cells were small rounded and darkly staining as compared to the granulosa lutein cells. The cells also showed vacuoles but the size of vacuoles was smaller as compared to the granulosa lutein cells. Stroma surrounding the corpus luteum showed increased vascularity which was evident by the large number of dilated vessels. The vessels invaginated into the theca luteal cells along with the surrounding theca externa and formed septa. These septa formed by the vessels and the surrounding theca luteal cells and the connective tissue also invaginated inside the granulosa luteal cells as is evident by the lumen of the vessels along with the theca luteal cells.

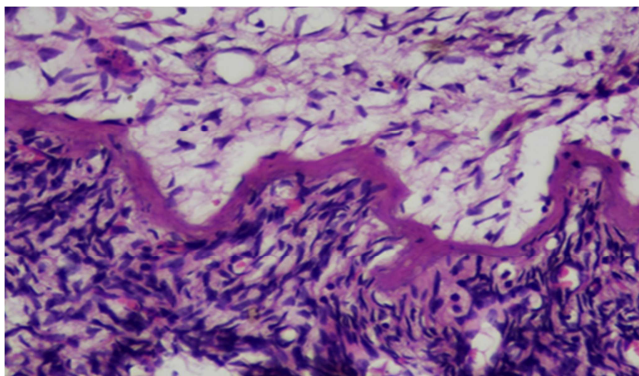


Figure 1: Photomicrograph of the ovary of non-pregnant state showing corpus luteum. H&E, 400X

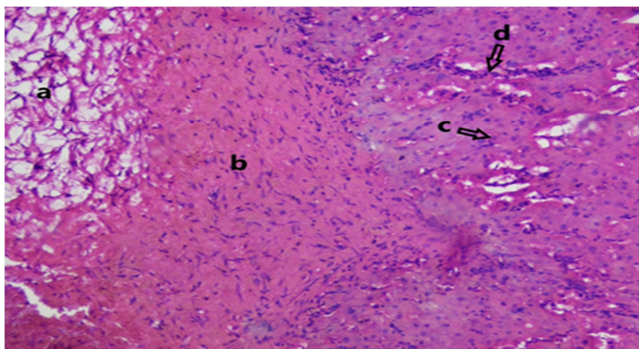


Figure 2: photomicrograph of the ovary of pregnant state showing corpus luteum with cavity (a), fibrous layer (b), granulosa luteal cell (c) and septa having theca luteal cells along with blood vessels (d). H&E, 100X

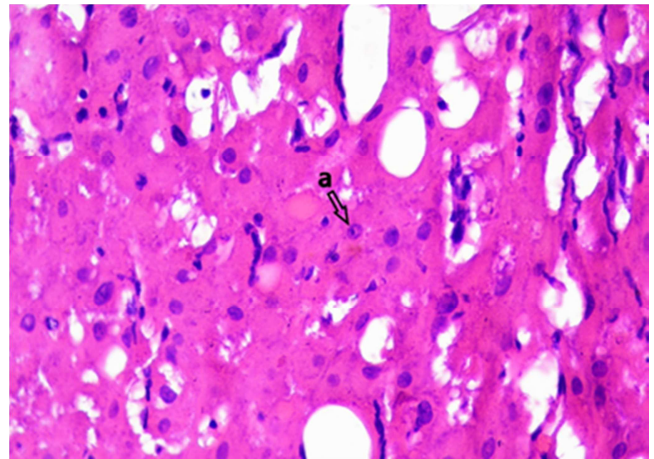


Figure 3: Photomicrograph of the ovary of pregnant state showing corpus luteum having granulosa luteal cell with nucleolus (a) and blood vessels. H&E, 400X

## Discussion

At ovulation the contents of the mature graffian follicle i.e. the ovum and the follicular fluid escapes and the remaining cells of the follicle collapse and becomes folded upon itself. Within few hours the cells increase in size and become polyhedral, develop a yellow pigment and becomes highly vascularised, the structure is now called as the corpus luteum.

The fate of the corpus luteum depends on whether or not pregnancy follows ovulation. In the absence of pregnancy the corpus luteum become a corpus luteum of menstruation while it becomes a corpus luteum of pregnancy in the event of pregnancy. In both the situations the main function of this endocrine structure is production of progesterone for the growth of endometrium. In case of corpus luteum of menstruation it has a functional life of approximately fourteen days, after which it disintegrates and forms corpus albicans. Whereas the corpus luteum of pregnancy increases in size till the leuto-placental shift occurs and placenta takes over the function of production of progesterone

The stages of development of corpus luteum has been divided into five phases.<sup>[5]</sup>

**1. Stage of the Ruptured Follicle.** Immediately after ovulation the diameter of the follicle is considerably decreased, since most of the liquor has been expelled and the wall has collapsed. Usually there is slight haemorrhage into the cavity due, and the vessels of the now withered thecal gland are congested. The folds of granulosa cells may appear slightly yellowish.

**2. Stage of Vascularization.** Starts around the second day of ovulation and during this phase the vascularisation reaches its peak. Initially the blood vessels are present immediately adjacent the granulosa cells, but within few days there is ingrowth of blood vessels and lymphatics accompanied by fibroblast. As these vessels are delicate, some bleeding in the lumen of corpus luteum is a common finding. As the vascularity increases the cells increase in size become polyhedral, and possess secretory function.

**3. Stage of Maturity.** In this stage the corpus luteum reaches its maximum size and maximum secretory activity.

A definite connective tissue layer lies the cavity and the blood vessels are numerous and become sinusoidal.<sup>[6,7]</sup> At this stage it can be seen as a yellowish projection from the surface of the ovary occupying about half the volume of ovary. The mature stage of the corpus luteum coincides with the pre-menstrual or luteal phase of the endometrium.

**4. Stage of Retrogression.** This phase is seen in case fertilization does not occur. The vascularity decreases as is evident by the lesser number of vessels and narrow lumen of vessels. The size of the corpus luteum decreases rapidly, the cells show degenerative changes like fatty cell shrinkage, vacuolation and pyknotic degeneration of the nuclei. Its secretion of progesterone diminishes sharply, and this decrease is a major factor in the precipitation of menstruation.

However in case of pregnancy such changes are not seen, instead the size of corpus luteum increases till the end of third month, the cells increase to thrice the original size, and are polyhedral with a centrally placed nuclei and a prominent nucleoli as is present in the present case. These cells can encroach into the follicular lumen and obliterate it. The vascularity of the surrounding vessels also increases thus stating that the secretion of progesterone is still at a higher rate. The secretion of progesterone lasts till the end of the fourth month, when placenta takes over the function. Then retrogression begins but proceed, very slowly, so that the corpus luteum is still readily recognizable at term .

**5. Stage of the Corpus Albicans.** All corpora lutea eventually degenerate to form these gradually shrinking functionless masses of amorphous scar tissue.<sup>[8]</sup> Exactly similar, but smaller, corpora albicantia are also formed by degeneration of the interstitial glands arising from atretic follicles. Thus, an adult ovary contains numerous, and variably sized, corpora albicantia.

## Conclusion

Corpus luteum is a very imp structure as it produces progesterone to help maintain the normal pregnancy. Many couples suffer from infertility or recurrent abortions. In depth knowledge of the changes taking place in corpus luteum will increase our understanding of luteal dysfunction. More studies with advanced techniques are needed to further increase our knowledge regarding in depth changes and functioning of corpus luteum so as to better understand every problem arising because of its dysfunction.

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