A GROSS AND HISTOLOGICAL STUDY OF HUMAN FOETAL OVARY AT DIFFERENT WEEKS OF GESTATION

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ABSTRACT

Background: The fetal life is a critical period in female fertility in which the germ cells complete proliferation, initiate meiosis and eventually form the life time reserve of primordial follicles. The age associated alteration in the ovaries being development, differentiation, follicular growth and stroma are indicators of reproductive capability. The present study was planned to study the gross and histological structure of human fetal ovary at different weeks of gestation.

Materials and Methods: A total of twenty six human female fetuses of different age from 18th to 36th gestational week were used for the present study. The fetuses were dissected and the ovaries were removed along with the uterus. The ovaries separated from uterus, weighed, the length and breadth of the ovaries were measured with graph paper. The ovaries were processed for histological studies by fixing, embedding, section cutting, staining by standard methods. The ovarian sections were observed for lining epithelium, ovaginous cords, cortico-medullary differentiation and different stages of follicles by observing their structural architecture.

Results: At the 18th week of gestation the microscopic structure of fetal ovary showed capsule, numerous ovigerous cords and oogonia. At the 20th week of gestation presence of primordial follicles were observed. At the 24th week of gestation cortico-medullary differentiation was started. At the 26th week of gestation primary follicles were clearly seen and the cortico-medullary differentiation was visible. At the 28th week of gestation many primordial and primary follicles were seen near cortico-medullary junction. At the 30th week of gestation cortico-medullary differentiation was clearly visible. At the 32nd week of gestation the multilayered (secondary) follicles started appearing. At the 34th week of gestation the antral follicles started appearing. At the 36th week of gestation few pre-antral and 1 to 2 antral follicles were found at cortico-medullary junction.

Conclusion: The present study concludes the presence of capsule at 18th week, primordial follicles at 20th week, at 26th week primary follicles, at 32nd week secondary follicles and at 34th week antral follicles.

KEY WORDS: Fetal ovary, histology, ovarian follicles.

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Access this Article online

Quick Response code

DOI: 10.16965/ijar.2017.241

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 27 Apr 2017
Peer Review: 28 Apr 2017
Revised: None

Accepted: 18 May 2017
Published (O): 30 Jun 2017
Published (P): 30 Jun 2017

INTRODUCTION

In female fertility, the fetal life is a critical

period in which the germ cells complete proliferation, initiate meiosis and eventually form the

life time reserve of primordial follicles [1]. The development of ovarian follicles in humans, especially primordial follicle throughout embryonic development has immediate association for improving reproductive efficiency, understanding the infertility in female and predicts the women reproductive lifespan [2]. The age associated alteration in the ovaries being development, differentiation and follicular growth and stroma are indicators of reproductive capability [3]. Various research works on histogenesis of ovaries in fetal periods of development were described in the scientific literature. Throughout the definitive histogenesis the parenchyma of ovary divides into an outer primitive cortex and inner medulla. The ovigerous cords are established from the solid cell mass in the cortex of the primitive gonad. The ovigerous cords break into groups of germinal and somatic cells, which will develop into primordial follicles by enclosing primordial germ cells. The primordial follicles mature into primary follicles. Further, progressively the primordial follicles mature into secondary and antral follicles [4].

The ovarian follicles were classified as the follicles which were lined by squamous granulosa cells primordial follicles and those with cuboidal granulosa cells primary follicle and those follicles lined by two to eight layers of granulosa cells were called preantral follicles [5]. The present study was planned to study the gross and histological structure of human fetal ovary at different weeks of gestation. Gross structure includes individual length, breadth, thickness and weight of ovaries. The histological study includes identification of capsule, cortico-medullary differentiation and different types of follicles i.e., primordial, primary, secondary or pre antral and antral follicles.

MATERIALS AND METHODS

A total of twenty six human female fetuses of different age groups from 18th to 36th gestational were used for the present study. These fetuses were the products of terminated pregnancies under the Medical Termination of Pregnancy Act of India, 1971 and spontaneous miscarriages. The collected foetuses were fresh and without any gross abnormalities. The collection was

carried out with prior permission from the Institution. After collection the fetuses were categorised in to three groups (Table 1). The body weight of fetuses were noted and perfused with 10% formalin for fixation. The fetuses were dissected through the anterior abdominal wall and the ovaries were removed along with the uterus. The ovaries separated from uterus were cleaned for connective tissue and fat, weighed with the aid of digital weighing machine. Then the length and breadth of the ovaries were measured with graph paper. The ovaries were processed for histological studies by fixing, embedding, section cutting, staining by standard methods. After embedding the paraffin blocks of ovary were sectioned with the Rotary Microtome. The sections of ovary were fixed to the slide by heat technique followed by staining with the Harris's Haematoxylin and Eosin yellow stain solution- 2% W/V, Nice Chemical Pvt. Ltd [6, 7]. The stained ovarian sections were analysed light binocular research microscope with a low power objective lens 4X, 10X and a high power 40X. The ovarian sections were observed for lining epithelium, ovaginous cords, cortico-medullary differentiation and different stages of follicles by observing their structural architecture.

Table1: Categorization of fetal groups.

Groups	Age of fetuses in weeks	Number of fetuses
Group-A	18 th to 22 nd week.	3
Group-B	24 th to 28 th week.	15
Group-C	30 th to 36 th week.	8

RESULTS

The results of the present study showed various changes in gross and histological structure of fetal ovary at the different weeks of gestation. The weight and length of the ovaries was increased as the gestational age progressed. But there was no change in the breadth and thickness of ovary (Table 2).

Various changes were observed in the microscopic structure of fetal ovary at different weeks of gestation. At the 18th week of gestation the microscopic structure of fetal ovary showed capsule lined by mesothelium which was made by cuboidal epithelium and numerous ovigerous cords and oogonia were observed. The vascularisation was less and cortico-medullary

Table 2: Showing various parameters of fetal ovary at different weeks of gestation.

S.No	Age (weeks)	Ovary			
		Weight (gm)	Length (mm)	Breadth (mm)	Thickness (mm)
1	18	0.03	10	4	2
2	20	0.04	11	4	2
3	22	0.05	11	4	3
4	24	0.05	11	4	1
5	24	0.05	11	4	2
6	24	0.06	12	4	2
7	24	0.06	12	3	1
8	26	0.07	12	4	2
9	26	0.07	12	2	1
10	26	0.07	12	4	2
11	26	0.07	11	4	1
12	26	0.07	12	4	2
13	26	0.07	12	3	2
14	28	0.07	11	4	1
15	28	0.07	12	4	2
16	28	0.08	12	3	2
17	30	0.08	12	4	2
18	30	0.08	13	4	2
19	32	0.08	13	4	2
20	32	0.08	13	4	2
21	32	0.08	14	3	1
22	34	0.08	14	4	2
23	34	0.09	14	4	2
24	36	0.09	15	6	2
25	36	0.09	15	4	2
26	36	0.09	15	4	2

differentiation was not found (fig. 1 and fig. 2). At the 20th week of gestation primordial follicles were present and the vascularisation was found to be increased, the cortico-medullary differentiations were not yet present (fig. 3). At the 22nd week of gestation appearance of the primordial follicles increased and cortico-medullary differentiation was not found while vascularisation was increased (fig. 3). At the 24th week of gestation primary follicles were appearing and cortico-medullary differentiation was started (fig. 4). At the 26th week of gestation primary follicles were clearly seen and the cortico-medullary differentiation was visible. The medulla was highly vascularized (fig. 4). At the 28th week of gestation many primordial and primary follicles were seen near cortico-medullary junction (fig. 5). The cortico-medullary differentiation was visible. The medulla was highly vascularized (fig. 4).

At the 30th week of gestation cortico-medullary differentiation was clearly visible. The size of ovum increased, primordial and primary follicles were well developed. The blood vessels were clearly visible in medulla (fig. 6). At the 32nd week of gestation, ova were increased in size and many primary follicles seen. The multilayered (secondary) follicles started appearing. The interstitial cells and blood vessels were clearly seen (fig. 6). At the 34th week of gestation oogonia found near the cortex were smaller whereas those near cortico-medullary junction were larger. The primary follicular number was increased and few secondary follicles were found near cortico-medullary junction. The antral follicles started appearing at this stage (fig. 7 and fig. 8). At the 36th week of gestation, the size of primordial and primary follicles was increased. Few pre-antral and 1 to 2 antral follicles were found at cortico-medullary junction, the blood vessels were appearing clearly (fig. 7 and fig. 8).

Fig. 1: Ovary at 18th week of gestation showing capsule (C) and Oogonia (OG). (10X H & E).

Fig. 2: Ovary at 18th Week of gestation showing ovigerous cords (OC). (10X H & E).

Fig. 3: Ovary at 20th Week of gestation showing Primordial follicles (PDF). (10X H & E).

Fig. 6: Ovary at 30th Week of gestation showing clear blood vessels (BV) in medulla. (10X H & E).

Fig. 4: Ovary at 24th Week of gestation showing cortex (CR), Medulla (M). (Cortico-medullary differences) and Primary follicles (PMF). (10X H & E).

Fig. 7: Ovary at 34th Week of gestation showing Antral follicles (AF) in low magnification (10X H & E).

Fig. 5: Ovary at 28th Week of gestation showing Primordial follicles (PDF) and Primary follicles (PMF). (10X H & E).

Fig. 8: Ovary at 34th Week of gestation showing Antral follicles (AF) in low magnification (40X H & E).

DISCUSSION

This study provides details about the gross features and appearance of capsule, ovigerous cords, development, differentiation and follicular growth and stroma of human fetal ovary at different weeks of gestation. In the present study appearance of the ovary was greyish in colour and situated horizontally at 18th week of gestation, more vertically from 24th week onwards. The weight and size of the ovary steadily increased from 18th week of gestation to 36th week of gestation. The ovarian width vary from 2 to 4 mm, length from 10 to 15 mm, and thickness from 1 to 2 mm, these results are in line with the previous study which mentioned that the ovarian width vary from 3.5 to 7 mm, length from 9 to 17mm, thickness from 2.5 to 5mm [8].

In the present study we observed the surface epithelium clearly and it was cuboidal epithelium at 18th week of gestation. However, earlier report has mentioned that the clearly recognizable germinal epithelium only at 24 weeks gestation [9]. The ovigerous cords were present at the 18th week of gestation, these results were in concur with previous study, which mentioned that the ovigerous cords were recognised at 15th week and their number were increased at 18th week of gestation [10]. In the present study we have used the fetuses from 18th week of gestation.

The cortico-medullary differentiation was started from 24th week of gestation, the same was well recognized by 30th week gestation. In previous study it is reported that the cortico-medullary differentiation was started at 20th week and at 24 weeks of gestation the clear cortico-medullary differentiation was found [3]. Another study stated that at 12th week of gestation the central fibro vascular medulla and hyper cellular cortex with germinal cells at periphery with clear cortico-medullary differentiation was found [10].

The result of the present study with respect to primordial follicles which were noticed at 20th week of gestation correlates with the earlier studies [3, 11]. But there are reports which do mention the appearance of primordial follicles between 16th - 29th weeks of gestation, at 19th week of gestation [5].

The primary follicles were observed in the present study at 24th week of gestation. In the previous study it is mentioned that by the end of second trimester (14th to 26th weeks) primordial and primary follicles were more in number [5]. The secondary or antral follicles were observed at 32nd week of gestation these results are concurring with the previous studies that reported the presence of growing or antral follicles at 32nd week [12-15].

CONCLUSION

The findings of this study concur with few earlier studies and differ with some of the studies. However, the present study revealed that there is a constant increase in the length and weight of the ovary. The position of the ovary did not reached the ovarian fossa even at 36th week of gestation. Histological study showed a well developed capsule at 18th week of gestation. Oogonia were small in size but with well developed euchromatic nucleus spreading throughout the ovary. Few interstitial cells were present in between the oogonium with the visibility of sexcords, cortico medullary junction was visible by 24th week and steadily there is an increase in its vascularity. Primordial follicles were visible deeply in the cortex from 20th week onwards. The differentiation of primary follicles with increase in its size at cortico-medullary junction was observed from the 24th week of gestation. Antral follicles were observed from 32nd-36th week at cortico-medullary junction.

Conflicts of Interests: None

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How to cite this article:

Mergu Prasad, Satya Prasad Venugopal, Rameswarapu Suman Babu. A GROSS AND HISTOLOGICAL STUDY OF HUMAN FOETAL OVARY AT DIFFERENT WEEKS OF GESTATION. Int J Anat Res 2017;5(2.3):4006-4011. DOI: 10.16965/ijar.2017.241