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Paratubal and tubal abnormalities

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The fallopian tubes are the essential genital ducts that convey the female sex cells for fertilization. They are differentiated and detectable early in fetal life. There are numerous paratubal and tubal abnormalities that can occur at any point in the female life. Some of these are rare but may initiate significant morbidity and/or manifest as life-threatening clinical problems. A comprehensive understanding of symptoms, diagnosis, optimal imaging modalities, and medical and surgical management is vital to identify the best treatment option. The clinical entities described in this article include torsion, hydatids of Morgagni, paraovarian cysts, infections including tuboovarian abscess/pyosalpinx and salpingitis isthmic nodosa, ectopic pregnancy, tumors, and genetic disorders.

The genital ducts are the essential component of the internal genitalia that convey the gametes (ova and spermatozoa) to a location where fertilization can take place. In all vertebrates, there are paired genital ducts: the mesonephric (Wolffian) and the paramesonephric (Mullerian) ducts. In females, the approximated portions of the paramesonephric ducts fuse and develop into the uterus and the vagina, while the upper parts of the paramesonephric ducts become the fallopian tubes. The mesonephric ducts degenerate[1] (Figure 1). Ductal differentiation is under the control of the secretion of sex hormones.

Barberini and coworkers[2] analyzed the ultrastructure of oviducts from necroscopy specimens of human fetuses obtained from spontaneous abortions at the 14th, 18th, 20th and 22nd weeks of pregnancy and from intrauterine fetal death (IUFD) due to hydrocephalus at the 24th and 31st weeks. Table 1 summarizes the main microtopographical features of the human fallopian tube. Figure 2 diagrams the microtopography of the cell differentiation in each portion of the fallopian tube as defined by these authors. This study supports the assumption, based on previous mammalian studies, that both the differentiation pattern of the mucosa and the epithelial cell distribution in the various tubal segments are detectable in early fetal life.

The normal fallopian tube extends from its corresponding ovary anteriorly and medially to its terminus in the posterosuperior aspect of the uterine fundus. During the adult reproductive years, its length is between 9 and 11 cm. The tube at the ovarian end opens to the peritoneal cavity, comprising about 25 irregular finger-like extensions of the tube—the fimbriae. The fimbriae attach to the expanded end of the tube, the infundibulum, which is about 1 cm long and 1 cm in diameter distally. The infundibulum lies within a few millimeters of the superolateral or tubal end of the ovary. It narrows gradually to about 4 mm in diameter and merges medially with the ampullary portion of the tube, which extends about 6 cm, passing anteriorly as it loops around the ovary. At a point characterized by relative thickening of the muscular wall, the isthmic portion begins and extends some 2 cm to the uterus. Within the myometrium, the tube extends as a 1-cm-long intramural segment until it

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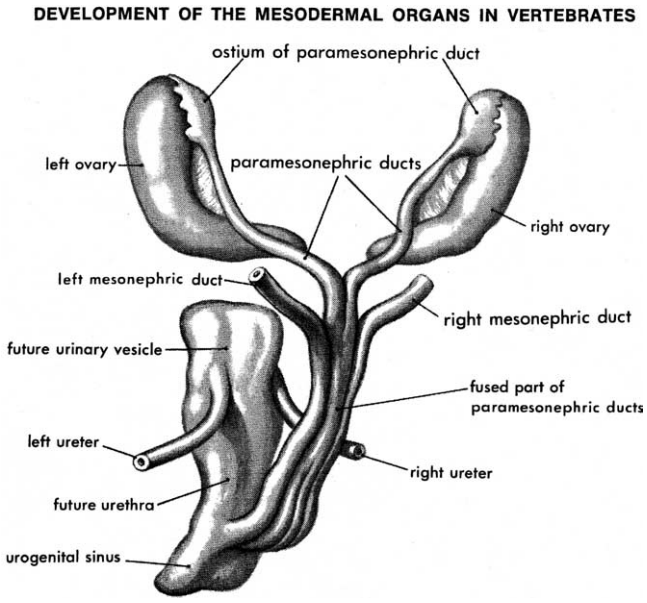

Figure 1 Connections of the genital and urinary ducts in a female human embryo of 29 mm (beginning of third month) in which the genital ducts are still in the indifferent stage. (Reprinted with permission.[1])

joins the extension of the endometrial cavity at the uterotubal junction (Figure 3).

Throughout its extrauterine course, the tube lies in a peritoneal fold along the superior margin of the broad ligament—the mesosalpinx. The arterial blood supply has a dual origin. A tubal branch of the uterine artery passes in the mesosalpinx laterally from the cornu of the uterus to anastomose with tubal branches of the ovarian artery. Venous drainage parallels the arterial supply. Tubal lymphatics pass laterally, accompanying the ovarian vessels. On the right side, lymph drains into nodes in the area of the right renal vein and the inferior vena cava, and on the left, lymph drains into nodes between the left ovarian vein and the left renal vein. Lymphatics also drain into presacral and common iliac nodes, and this has been implicated in dissemination of malignancies due to extrapelvic spread.

The nerve supply of the fallopian tube is both sympathetic and parasympathetic. The sympathetic fibers originate from T10–L2. Parasympathetic fibers originate from the vagus nerve supply as well as S2 to S4.[3]

The human ovum is released from the ovary in an environment of sticky cumulus cells. The fimbriae of the fallopian tube are lined with cilia that oscillate in the direction of the tubal ostium and provide direction for the ovum encapsulated mass. The ovum is ushered into the lumen where, probably due to estrogen, the ciliary movement continues and the cumulus mass of ovum is transported within the ampulla. This is also enhanced by the tubal environment that contains multiple substrates such as hyaluronidase and carbonic anhydrase that help remove the cumulus covering of ovum in preparation for fertilization. Some of these same substrates, particularly bicarbonate, enhance the storage of spermatozoa in the isthmic area in preparation for fertilization.[4]

Torsion of the fallopian tube

Torsion of the fallopian tube is an uncommon cause of abdominal pain in premenarchal girls and postmenarchal teenagers. The reported incidence rate is approximately 1 in 1.5 million women.[5] It can be related to intrinsic or extrinsic causes. Intrinsic factors predisposing to torsion include: (1) an abnormally long tube and mesosalpinx, (2) adnexal venous congestion related to premenarchal hormonal activity or when the veins of the mesosalpinx are longer than the arteries, and (3) abnormal peristalsis of the tube. Extrinsic

Table 1 Summary of the main microtopographical features of the human fetal tube according to developmental stage

Week		
14th	fimbriae	not developed
	cells	microvillus
		ciliated (also invaginated apically)
		ciliogenic
18th	fimbriae	developing and fan-shaped with many round holes at the surface
	cells	ciliated cells more numerous at the fimbriae, less numerous at the uterotubal junction
20th	cells	ciliated cells less numerous at the infundibulo-ampullary zone
		only microvillous cells with solitary cilia in large areas of the ampulla
22nd	fimbriae	round holes at the surface more numerous
	cells	ciliated cells more numerous at the fimbriae
		only microvillous cells with solitary cilia in large areas of the ampulla
24th	fimbriae	festooned
	cells	many ciliated cells and round holes on the fimbriae
		ciliogenic cells and round holes at the isthmus
31st	fimbriae	indented with hypertrophic mucosa
	cells	many microvillous-secreting cells

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