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"Study of 'Mullerian duct' in Human Anatomy and its importance -A Literature Review."

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Abstract:

Mullerian duct: The Müllerian duct (MD) is the embryonic structure that develops into the female reproductive tract (FRT), including the oviduct, uterus, cervix and upper vagina. The FRT has essential functions in mammals, providing the site of fertilization, embryo implantation and fetal development. Defects in human FRT formation, thought to arise from abnormal embryonic development, are estimated to occur in up to 3% of births and often result in fertility problems. Diseases of the FRT are also prevalent in adult women and include uterine and cervical cancers, and endometriosis.

The Müllerian ducts develop from the anterior mesonephric coelomic epithelium and elongate along the anteroposterior axis between the Wolffian duct and the coelomic epithelium. The Müllerian ducts are paired tubes that grow into female reproductive organs early in fetal development. The ducts form the uterus, cervix, fallopian tubes and upper vagina. Developmental abnormalities in the ducts can lead to infertility or other health issues. So this article is focusing on anatomical details of Mullerian duct and its applied anatomy and clinical importance.

Key words: Mullerian duct, SRPT, Rachana Sharir.

Introduction:

Duct: Definition: A tube or vessel of the body through which fluids pass.

Mullerian duct - The Müllerian ducts are paired tubes that develop into the female reproductive organs. This happens while a fetus is growing in the womb.

Both males and females have Müllerian ducts at first. But during sexual differentiation (development of female or male sex organs), that changes. If a male hormone called anti-Müllerian hormone (AMH) is present, it prevents the ducts from developing into female sex organs. The Müllerian ducts are also called the paramesonephric ducts.[1]

The **paramesonephric ducts** (or **Müllerian ducts**) are paired ducts of the embryo that run down the lateral sides of the genital ridge and terminate at the sinus tubercle in the primitive urogenital sinus. In the female, they will develop to form the fallopian tubes, uterus, cervix, and the upper one-third of the vagina.[2]

The Müllerian ducts start developing on top of an embryo's kidneys (mesonephric kidneys) about 3–4 weeks into gestation (fetal development)[3]

Paramesonephric ducts are present on the embryo of both sexes. Only in females do they develop into reproductive organs. They degenerate in males of certain species, but the adjoining mesonephric ducts develop into male reproductive organs.

Objectives:

To study the anatomy of Mullerian duct or Paramesonephric ducts and its applied anatomy (Clinical Significance).

Methods:

Manual searching and collection.

Mullerian ducts **or** Paramesonephric ducts.

Structure & Function:[4]

Structure: The Mullerian duct is comprised of three cell types: the epithelial cells, which form the inner tube (Mullerian duct epithelium), the mesenchymal cells, which surround the tube (Mullerian duct mesenchyme) and the coelomic epithelial cells, which define the external borders of the duct (Mullerian coelomic epithelium)

Cells: Müllerian ducts contain epithelial and mesenchymal cells. Epithelial cells line a lot of organs. They help protect organs and also absorb and release important substances. Mesenchymal cells are stem cells, so they can grow into different types of cells.

Function:

The function of the Müllerian ducts is to develop into the female reproductive system organs. These organs are necessary for a person to carry a pregnancy. The organs include:

- Upper section of the vagina.
- Cervix (lower portion of the uterus).
- Uterus (organ that houses a developing fetus).
- Fallopian tubes (carry eggs from the ovaries to the uterus).[5]

In females, the paramesonephric ducts give rise to the uterine tubes, uterus, and upper portion of the vagina, while the mesonephric ducts degenerate due to the absence of male androgens. In contrast, the paramesonephric ducts begin to proliferate and differentiate in a cranial-caudal progression to form the aforementioned structures. During this time, the single-layered paramesonephric duct epithelium differentiates into other structures, ranging from the ciliated columnar epithelium in the uterine tube to stratified squamous epithelium in the vagina. The paramesonephric ducts and the mesonephric ducts share a majority of the same mesenchyme due to Hox gene expression. The genes expressed play a critical role in mediating the regional characterization of structures found along the cranial-caudal axis of the female reproductive tract.[6]

Discussion:

Clinical significance:

Anomalies in the female reproductive tract are estimated to be present in 0.1 to 3.0% of live births. Because the Müllerian ducts originate from the same intermediate mesoderm as the mesonephros, any female reproductive tract anomaly should warrant investigation of renal anomalies.

Uterine agenesis and hypoplasia are due to early developmental dysfunction of the Müllerian ducts around five weeks of gestation.

Unicornuate Uterus: This condition is due to the arrest of the development of one of the Müllerian ducts. This anomaly accounts for 20% of all uterine anomalies.

Didelphys uterus is due to failure of fusion of the Müllerian ducts to form the uterus and accounts for 5% of uterine anomalies.

A bicornuate uterus is due to the incomplete fusion of the Müllerian ducts. It is present in 10% of all uterine anomalies.

Septate uterus is the most common uterine anomaly, comprising 55% of anomalies.

An arcuate uterus is due to the indention of the endometrium into the uterine fundus.

Diethylstilbestrol (DES) Exposure: DES is a nonsteroidal estrogen analog that causes altered Hox gene expression in the Müllerian Ducts.

The Gartner duct is a remnant of the Wolffian duct; this can become a cystic structure in the lower wall of the vagina and is known as the Gartner's cyst.

Applied anatomy:

Mutation in AMH: Individuals that are 46, XY and have been tested positive for mutations in their AMH or AMH receptor genes have been known to exhibit features typical of that which are exhibited in persistent müllerian duct syndrome due to the fact that the paramesonephric ducts fail to regress.[7]

Paramesonephric duct anomalies: Anomalies that develop within the paramesonephric duct system continue to puzzle and fascinate obstetricians and gynecologists. The paramesonephric ducts play a critical role in the female reproductive tract and differentiate to form the uterine tubes, uterus, superior vagina as well as the uterine cervix. Many types of disorders can occur when this system is disrupted ranging from uterine and vaginal agenesis to the duplication of unwanted cells of the uterus and vagina. Paramesonephric malformations are usually related to abnormalities of the renal and axial skeletal system. [8]

The interaction between the epithelium and the mesenchyme regulates transcription factors and signaling molecules necessary for developing the Müllerian ducts.[9]

Conclusions:

1. The function of the Müllerian ducts is to develop into the female reproductive system organs.
2. The Müllerian duct (MD) is the embryonic structure that develops into the female reproductive tract (FRT), including the oviduct, uterus, cervix and upper vagina. The FRT has essential functions in mammals, providing the site of fertilization, embryo implantation and fetal development.
3. Müllerian duct anomalies (MDA) are uncommon but can be a treatable form of infertility.
4. Because of the wide variation in clinical presentations, müllerian duct anomalies important to diagnose & treat.

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