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Commentary

The Role of Sperm Anatomy in Male Infertility

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DESCRIPTION

Sperm is the male reproductive cell, or gamete, in anisogamous sexual reproduction (forms in which there is a larger, female reproductive cell and a smaller, male one).Sperm cells are formed during spermatogenesis, which occurs in the seminiferous tubules of the testes in amniotes (reptiles and mammals). Starting with spermatogonia, this process produces a series of sperm cell precursors that eventually develop into spermatocytes. The spermatocytes next go through meiosis, which reduces the number of chromosomes in half and creates spermatids. The major purpose of sperm is to reach the ovum and fuse with it, resulting in the delivery of two subcellular structures:

The male pronucleus, which contains the genetic material.

The centrioles, which assist arrange the microtubule cytoskeleton.

Anatomy

The sperm cell of a mammalian can be split into two parts:

Head: The nucleus, which has densely coiled chromatin fibers, is encircled anteriorly by the acrosome, a narrow, flattened sac that carries enzymes for piercing the female egg. It also has vacuoles in it.

Tail: The longest portion, also known as the flagellum, is capable of a wave-like action that pushes sperm for swimming and assists in egg entry. Previously, it was assumed that the tail moved in a helical pattern.

One typical centriole and one atypical centriole, such as the proximal centriole-like, are found in the neck or connecting component. The midpiece has a central filamentous core with numerous mitochondria spiraled around it, which is utilized to produce ATP along the trip via the female cervix, uterus, and uterine tubes. The sperm contributes three critical components to the oocyte during fertilization: a signaling or activation agent that induces the metabolically inactive oocyte to awaken; the haploid paternal genome; and the centriole, which forms the centrosome and microtubule system.

Origin

Animal spermatozoa are generated by meiotic division within the male gonads (testicles) during spermatogenesis. It takes around 70 days for the first spermatozoon process to finish. The creation of spermatogonia from germ cell precursors is the first step in the process. These divide and develop into spermatocytes, which then proceed through the meiosis process to create spermatids. The sperm grows the recognizable tail in the spermatid stage. It is termed a spermatozoan once it has reached complete maturity, which takes around 60 days. Semen is the fluid that carries sperm cells out of the male body.

SPERM QUALITY

The main characteristics of semen quality, which is a measure of the capacity of semen to fertilize, are sperm quantity and quality. As a result, in humans, it is a measure of a man's fertility. Sperm genetic quality, volume, and motility all tend to decline as people become older. Damaged DNA found in sperm cells after meiosis but before fertilisation can be repaired in the fertilised egg, but if not, it can have significant consequences for fertility and the growing foetus. The production of oxidative DNA damage in human sperm cells is particularly susceptible to free radical assault.

Because male spermatozoa lose their ability to repair DNA damage as they grow into mature sperm, the post meiotic phase of mouse spermatogenesis is extremely susceptible to environmental genotoxic chemicals. Irradiating male mice during late spermatogenesis causes damage in fertilizing sperm cells that lasts for at least 7 days, and disrupting maternal DNA double-strand break repair pathways enhances sperm cell-derived chromosomal abnormalities. Melphalan, a bifunctional alkylating drug often used in chemotherapy, causes DNA lesions in male mice during meiosis, which may remain in an unrepaired condition as germ cells advance through DNA repair-competent phases of spermatogenic development. After conception, such unrepaired DNA lesions in sperm cells might result in children with a variety of defects.

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SPERM SIZE

Sperm size, at least in certain species, is linked to sperm quality. For example, the sperm of some fruit fly species (Drosophila) may be up to 5.8 cm long, which is around 20 times longer than the insect itself. Longer sperm cells are better at displacing rivals from the female's seminal receptacle than their shorter counterparts. Females gain because only healthy men have 'excellent' genes that allow them to generate enough long sperm to outcompete their competitors.