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QUESTION:

Discuss the factors facilitating the movement of sperm in the female reproductive tract

Transport of sperm from site of deposition in the female to site of fertilization represents a critical phase of the reproductive process of farm animals. Sperm transport failures, which result in fertilization failure, account for a significant proportion of the loss of potential offspring in each major class of animal. Improving sperm transport and reducing fertilization failure could reduce intercalving intervals of cattle and increase lambing rate of sheep and average litter size of swine. The term "sperm transport" properly means the movement of sperm by the female reproductive tract from the site of deposition of semen to the ampulla of the oviducts. However, the term often is used in a broader sense to define movement of sperm in the female regardless of whether the movement resulted from action of the female tract or from action of sperm. In fact, most studies on movement of live sperm through the female tract are not designed to separate the role of the female from that of the sperm. Therefore, "sperm transport" in this paper will encompass consequences of all physiological processes involved in movement of sperm in the female tract. Sperm transport can be measured directly or indirectly in several ways. Fertility can be a crude measure of sperm transport if other factors that influence fertility are constant. The fertilization rate of ova and the number of accessory sperm embedded in or attached to the zona pellucida represent more quantitative measures of sperm transport, and the number of sperm in the various segments of the reproductive tract, preferably at more than one interval after insemination, is the most direct measure. Sperm numbers, usually calculated from microscopic counts of sperm in a portion of the washings or flushing of segments of the reproductive tract, are reliable only if the flushing procedures remove nearly all sperm from the tract. Sperm numbers in the reproductive tract, particularly in the oviducts, vary greatly among animals. This variability often necessitates assignment of large numbers of animals to experimental groups.

Sperm may begin to undergo the process of rapid sperm transport within seconds after ejaculation. This type of sperm movement is thought to be predominantly passive, resulting from coordinated vaginal, cervical, and uterine contractions. Although these contractions are of short duration, they are believed to be the primary force responsible for the rapid progression of sperm to the upper female reproductive tract the oviduct. Settlege and coworkers in 1973 reported results of a study in which fertile ovulatory females were intravaginally inseminated with donor sperm at the time of bilateral salpingectomy for sterilization. Within 5 minutes after

insemination, sperm were present within the Fallopian tubes, and the number of sperm found there was proportional to the number inseminated. Similar results demonstrating this rapid transport process have also been documented in numerous animal studies.

The transport of sperm depends on several factors:

- The sperm must be capable of propelling themselves through the environment of the female vagina and cervix.
- This environment, which is under cyclic hormonal control, must be favorable to admit the sperm without destroying them.
- The sperm must possess the capability of converting to a form that can penetrate the cell membrane of the egg (capacitation).
- The time between recovery of the sperm and the precise timing of that ovulation;
- The techniques used to recover the sperm, which have often been inadequate, for example Settlege et al. (1973) using a cytocentrifuge had a recovery rate of only 1%;
- The results have usually been qualitative, and even when quantitative data are presented it is only possible to determine sperm migration at one time-point - the sequence of sperm transport cannot be determined;
- Some of the patients studied have had tubal or uterine pathology making comparison to the normal situation difficult. Nevertheless, a succinct summary of the previous data provides a starting point from which to develop an hypothesis.