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JOURNAL ARTICLE

Cytoplasmic extrusion and the switch from creatine kinase B to M isoform are completed by the commencement of epididymal transport in human and stallion spermatozoa

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Although in several species there is a relationship between epididymal sperm transport and fertility, in human in vitro fertilization (IVF), spermatozoa recovered from the caput epididymidis or even the rete testis are fertile. We studied two objective markers of sperm maturity in the sperm of men and stallions: creatine kinase (CK) concentrations, which are a measure of cytoplasmic retention in immature spermatozoa, and the ratio of CK-M and CK-B isoforms (% CK-M/[CK-M + CK-B]), which is proportional to the incidence of mature sperm. The CK markers and the fertilizing function are closely related: Immature sperm with cytoplasmic retention do not bind to the zona, because during cytoplasmic extrusion, the sperm plasma membrane is also remodeled. We examined whether changes in sperm CK values are still ongoing during epididymal transport, or if cellular maturation is completed prior to the arrival of sperm in the caput epididymidis. The incidences of mature sperm in human caput and corpus epididymidis (studied in six men with obstructive azoospermia of various pathogeneses) were (mean+/-SEM) 55.7+/-2.2 and 49.3+/-7.6%, respectively; and the sperm CK-M ratios in the caput epididymidis of three men were 72, 75, and 70%, values that are similar to those of ejaculated sperm. In four segments of the proximal and distal epididymis of three stallions (the origin of sperm was also verified by the position of the cytoplasmic droplet) and in ejaculate of five stallions, the incidences of mature sperm were 88.2+/-6.2, 89.0+/-6.7, 90.3+/-7.8, 87.6+/-5.9, and 86.7+/-0.8%, and the respective CK-M ratios were 75.0+/-8.7, 84.2+/-2.9, 87.9+/-1.2, 92.5+/-1.5, and 69.3+/-3.5%. There were no differences in the incidences of mature and immature spermatozoa or in CK-M ratios among sperm arising from the various epididymal regions or from the ejaculate in men or stallions. Thus, the cellular maturation events in sperm, as detected by the CK markers, are completed by the time the sperm commences epididymal transport. These findings are in agreement with the IVF fertility of sperm aspirated from the male reproductive tract. The data may also suggest that the primary role of sperm epididymal transport in men is to remodel the plasma membrane to enhance sperm functional integrity in the diverse environments of the male and female reproductive tracts prior to fertilization.

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