

The characterisation of sperm and seminal plasma glycoproteins: Their role within the tetraspanin network and male fertility

Mgr. Veronika Páleníková

Abstract

Sperm membranes are highly organized structures, in which tetraspanins are involved, forming tetraspanin networks that also include transmembrane glycoproteins called integrins. Tetraspanin networks have been described in mammalian oocytes where they participate in the communication and interaction of molecules present not only on the egg but also on the sperm. The presence of some integrins has also been detected in sperm, but their exact localization or interaction with other integrins and tetraspanins is questionable. Therefore, our aim was not only to describe the localization and heterodimerization of $\alpha 3$, $\alpha 6$, αV , $\beta 1$, and $\beta 4$ integrins in sperm, but also to determine their possible interaction with tetraspanins, especially with the CD151 molecule. The main delivery of this doctoral thesis is a detailed characterization of the above-mentioned integrins. Importantly, we detected the presence of integrin $\beta 4$ subunit in mouse sperm, and characterised that it forms functional heterodimer with $\alpha 6$ subunit. In addition, we described $\alpha 6\beta 1$ and $\alpha 3\beta 1$ integrin pairs, which contribute to the integrity and complexity of sperm membranes. Moreover, we found that $\alpha 6$ integrin subunit interacts with CD151 tetraspanin, which we detected in mammalian sperm for the first time. We have also proposed CD9 and CD81 as tetraspanin partners for αV integrin in tetraspanin web. Our goal was to define glycoproteins of tetraspanin networks and sialylated glycoproteins of seminal plasma, as both play complimentary role in the reproduction. Further, we aimed to discover possible differences between normozoospermic and pathological samples of seminal plasma sialoproteins. Although we did not detect significant difference between individual men samples, we revealed a relationship between seminal plasma sialoproteins and the presence of anti-sperm antibodies in ejaculate, apoptotic sperm, and ejaculate quality. Additionally, using mass spectrometry we have identified seminal plasma sialoproteins that are associated with sperm and participated in modulation of the immune response and apoptosis. The results of this complex study have not only contributed to a better understanding of protein interaction in both sperm and seminal plasma, but also suggested possible improvements in diagnostic approaches, and set a ground for further investigation.

Key words: integrins, tetraspanins, membrane, gamete fusion, ejaculate, sialic acid, anti-sperm antibody