Meetings International SciTechnol

J Vet Sci Med Diagn 2018, Volume:7
DOI: 10.4172/2325-9590-C1-015

International Meeting on

VETERINARY AND ANIMAL SCIENCE

August 06 - 07, 2018 | Dubai, UAE

Arenavirus infections can cause severe illnesses including several haemorrhagic fevers

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The Arenaviredae are a family of viruses whose members are generally associated with rodent transmitted disease in humans which currently comprises 24 viral species. Arenavirus infections are relatively common in humans in some areas of the world and can cause severe illnesses including several haemorrhagic fevers. The virus particles vary in diameter from 60 to more than 300 nm. They are spherical and have a reported average diameter of 92 nanometres. All are enveloped in a lipid bilayer and have a bisegmented ambisense RNA genome, but relatively little is known about how virions are assembled and how virion structure relates to transmissibility. To investigate the role of each viral structural protein in forming and maintaining the structure of the virion, we have imaged particles of arenaviruses LCMV, PICV and TCRV, and compared their shape and structural characteristics to similar sized phospholipid vesicles. A very strong association between particle size and shape was found for all arenavirus particles: small virions were significantly rounder than vesicles of similar size, while large particles tended to be more elliptical in appearance. The natural variation in surface glycoprotein decoration and ribonucleoprotein incorporation was then measured. From this data it was concluded that there is no strong evidence relating particles size to decoration for arenaviruses as a group, but we did detect significant correlations between internal density and virion shape. Overall, we are able to conclude that small virions are round and relatively rigid compared to vesicles of the same size, while large virions are not. By comparing relative density of the membrane- proximal region it was discovered that arenavirus shape is controlled by complexes containing GPC, Z and NP at the surface of the virion, and that an unbroken inner shell of NP is essential for maintaining a rigid spherical shape. Furthermore, it was revealed that the inner leaflet of intact arenaviruses has a lower density than the inner leaflet of vesicles consistent with the interpretation that viral proteins are displaying lipid molecules from the inner leaflet of the viral membrane. These data provide a new way of assessing the function of viral protein interactions on virion structure and may be of use in designing antiviral drugs that act at the level of virion structure.

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