Vestibular Physiology

Orientation of our body in space is the primary function of the vestibular system. This is achieved by integration of signals from vestibular, visual and proprioceptive receptors at the level of brain stem. The information regarding the movement of head relative to the body is largely provided by the paired vestibular sensory endorgans (Fig. 1). Semicircular canals (SCC's) detect angular acceleration and the otolithic organs the linear acceleration (i.e. Gravity, deceleration in a car). Within the ampulated end of the three paired SCC's (superior, posterior and lateral SCC's) lie the endorgans of cristae. These contain specialized hair cells which transduce mechanical shearing forces into neural impulses. The hair cells have cilia which extends into a gelatinous matrix called cupula (Fig. 2).

The otolithic organs of utricle and the saccules are found in the vestibule. Their hair cells cilia projects into a gelatinous matrix which contains blanket of calcium carbonate crystals better known as otoliths (Fig. 3).

The impulses from the theses receptors relay in the superior and inferior vestibular nerve which in turn synapses with second order neurons in the central vestibular nuclei to form three tracts namely vestibulo-ocular reflex (VOR), vestibulospinal tracts (VST) and vestibulocerebellar tracts (VCT). From these the VOR is the fastest and the most important corrective reflex. VOR is required to keep a stable image on the retina with head movement. As the head moves in one direction there should be an equal and opposite conjugate eye movement (doll's eye maneuver). When the VOR is affected bilaterally (for example with systemic aminoglycoside toxicity) the patient will complain of blurring of vision with head movement better known as oscillopsia. If there is a defect in the VOR in an acute situation there is a retinal slip and central correction. This Nystagmus is the cardinal sign of central and peripheral vestibular disorders.