BIRDS-EYE VIEW ANIMATION OF A MILD TRAUMATIC BRAIN INJURY IN A CAR CRASH

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Narrator

During a sudden deceleration as shown in the beginning of the animation sequences, the brain violently impacts against the inner surface of the skull at two times. First, when the head impacts with the air bag or otherwise stops its forward motion and begins it's immediate rapid, violent reversal of motion. And second, when the head impacts against the headrest and repeats the immediate, rapid and violent reversal of motion.

By observing the collision from a view that follows the motion of the head, one can appreciate the deformation of the brain as it violently impacts against the front and back of the skull. When the impacts of the brain against the skull are viewed in slow motion, the shockwaves that travel through the brain during the impacts can be observed.

Close inspection of an area of the outer surface of the brain and inner surface of the skull during the initial impact shows the soft fragile brain scraping against the hard, jagged inner surfaces of the skull to create shearing forces.

As the gray matter, comprised of cell bodies, and the white matter comprised of axons are of two different densities. The shearing forces create a plane of cleavage where many axonal injuries occur. The axons may be completely torn, partially torn, or separated from their connections with other cells. Thousands or even millions of scattered axons may be torn but unless some of the larger and more resilient arteries are also torn no bleeding occurs.

Traditional imaging studies such as CT or MRI are not nearly sensitive enough to detect individual axonal injuries or even relatively large groups of axonal injuries. CT and MRI are designed to detect areas of bleeding. Unless a blood vessel or multiple blood vessels are torn creating a relatively large bleed, these studies fail to demonstrate any findings that would indicate the presence of multiple, widespread and microscopic axonal injuries that can result in devastating neuropsychological deficits.

In situations where the forces involved are severe enough to result in an injury to the blood vessels, the injuries to the axons are even more severe. An injury to one or more blood vessels results in the release of one or more blood cells into the surrounding brain tissue.

CT and MRI are designed to detect blood, or after a period of time the remnants of blood called Hemosiderin. Large quantities of red blood cells must hemorrhage from a blood vessel or blood vessels to be detectable on CT or MRI. If even one small hemorrhage occurs that is detectable, it is an indicator that there are likely vast numbers of associated axonal injuries that are not depicted in the scans.