Cavitation Inception and Dynamics in Micro/Nano Scale Confinements

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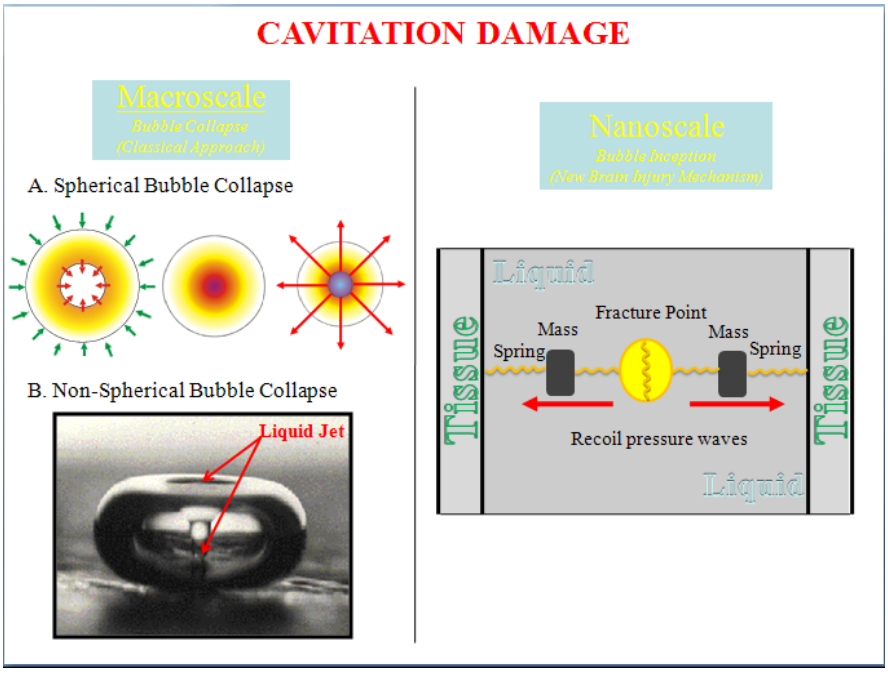
Due to the different nature of the blast environment (excessive pressure followed by head acceleration) it is reasonable to expect a unique brain injury pattern involving a new brain injury mechanism. The classical cavitation theory which is based on bubble collapse is not a complete representation of the cavitation phenomena.

If the impact is severe enough, it may produce cavitation in the brain, which provides mechanisms for brain injury. The complexity of this problem is mainly due to the fact that liquid in the brain is confined at very different scales from 1 cm to 0.1 µm. We develop a theoretical approach to estimate liquid cavitation in the brain.



The goal of this study is to demonstrate, and quantify, the potential danger hidden in the liquid in the brain exposed to an intense tension. The following important questions are addressed: Why cavitation may occur in the brain? Where cavitation may occur in the brain? Why cavitation may cause brain damage? The solution to this problem is crucial for early diagnosis interpretation of MTBI. Our preliminary work indicated that, at the cellular level, the nanoscale cavitation inception might be responsible for the brain injury. This concept has to be further investigated and correlated to neuro-imaging studies.