Monitoring intracranial pressure (ICP) is important for patients with increased intracranial pressure. Invasive methods of ICP monitoring include lumbar puncture manometry, which requires high precision, is costly, and can lead to complications. Non-invasive monitoring of ICP using tympanic membrane pulse (TMP) measurement can provide an alternative monitoring method that avoids such complications. In the current study, a piezo based sensor was designed, constructed and used to acquire TMP signals. The results showed that tympanic membrane waveform changed in morphology and amplitude with increased ICP, which was induced by changing subject position using a tilt table. In addition, the results suggest that TMP are affected by breathing, which has small effects on ICP. The newly developed piezo based brain stethoscope may be a way to monitor patients with increased intracranial pressure thus avoiding invasive ICP monitoring and facilitating reduced cost and man-hour.