

DBS Mediated Cerebral Edema – Revisiting Biocompatibility

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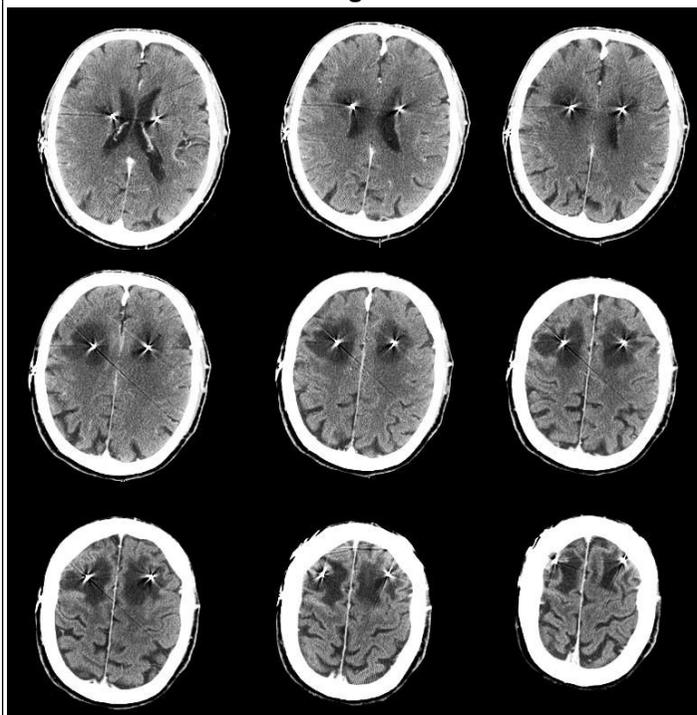
Introduction

Several publications highlight reactions around DBS electrodes which manifest as symptomatic or asymptomatic cerebral edema (Figure 1-3). We encountered a severe form of this phenomenon which started as edema around the leads progressing to cystic cavities. We present a detailed review of the literature involving immune response of the brain, pre-clinical and post-mortem studies and present a concise review of possible mechanisms.

Methods

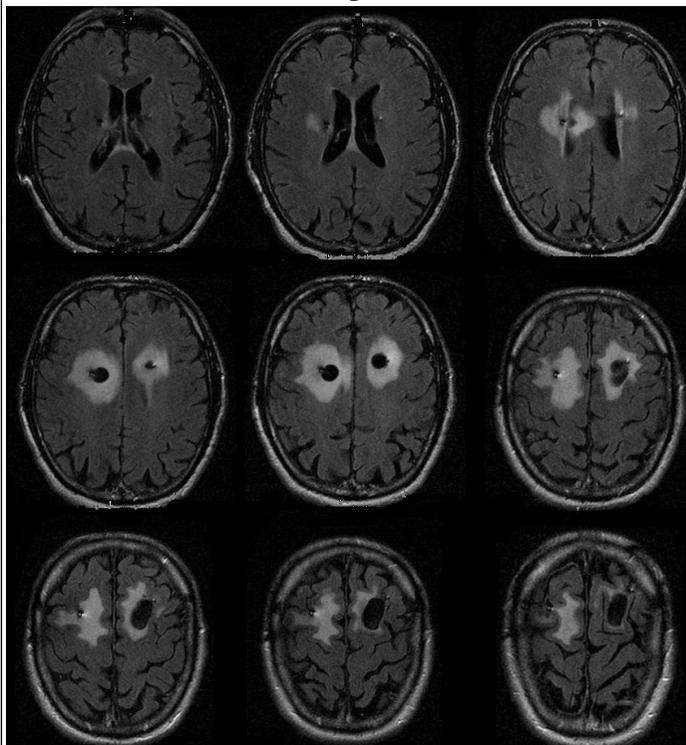
We conducted a review of all the publications from 1980 to the present. Search terms included DBS, silicone, brain implant, CNS immunological reaction, pre-clinical and post mortem DBS studies. About 36 manuscripts were reviewed.

Fig 1



4 month post op CT scan of the brain

Fig 2



9 month post op MRI

Conclusions

Although, several theories are proposed for this phenomenon, we think it is most likely a combination of brief breakdown of the

Results

There were five manuscripts with DBS mediated cerebral edema. Possible etiologies include immune reaction to the biomaterials of the DBS causing cerebritis, luxury perfusion due to breakdown of the blood-brain-barrier(BBB), micro-hemorrhage, mechanical trauma, and transependymal edema. Pre-clinical animal studies and post mortem human studies reveal similar changes with 5-25 microns of scar around the electrodes with the presence of activated astrocytes and a rim of GFAP positive gliosis up to 1 mm in thickness. Acute and chronic phases of foreign body response (FBR) of the brain to drug delivery implants, have shown the formation of a barrier created by astrocytes and macrophages trying to contain the foreign body leading to cyst formation around the implants.

BBB with insertion of the DBS lead followed by a foreign body response. In its severest form, this reaction manifests as a cystic encephalopathy.

Learning Objectives

1. Edema around the DBS leads have not been well explained
2. Highlights brain immune reactions to DBS
3. Severe cases of DBS leads forms cysts around the leads

References

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- Transient, symptomatic, post-operative, non-infectious hypodensity around the deep brain stimulation (DBS) electrode. Deogaonkar M, Nazzaro JM, Machado A, Rezai A. *J Clin Neurosci.* 2011 Jul;18(7):910-5. doi: 10.1016/j.jocn.2010.11.020. Epub 2011 May 14. PMID: 21571534

Fig 3

