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Application of Two Novel Techniques of Minimally Invasive Image Guided Inter-Fascicular Evacuation (MIS) of Spontaneous Basal Ganglia Hemorrhages (SC-ICH)

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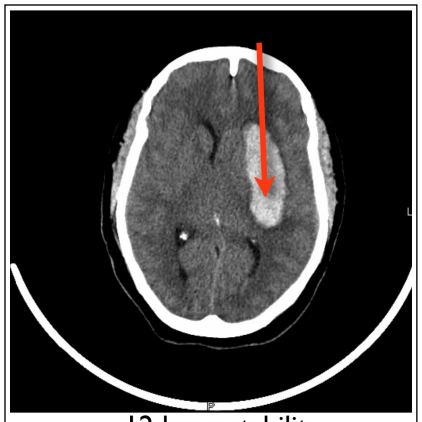
Introduction

We describe two innovative minimally invasive surgical techniques of intracerebral hemorrhage (ICH) evacuation combining fascicular anatomy and advanced imaging. We hypothesize that minimally invasive surgery results in decreased clot burden, restores fascicular anatomy and improves survival.

Methods

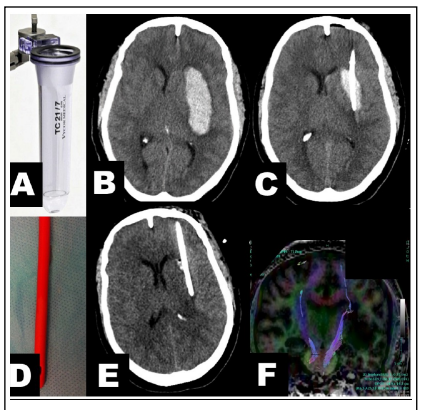
46 minimally invasive clot evacuations were completed in patients with an ICH 20cc-100cc, age <80, and admission GCS >5 from a population of 855 consecutive screened patients with sub-cortical intracerebral hemorrhages over 7 years. Both techniques were developed simultaneously to adress moderate and larger ICH and taylored to patient's neurorologial condition. Based on previously published data, two key principals were followed: ICH stability and plan to engage the clot along it's long axis. Putaminal ICH tend to present in an oblong shape with it's long axis ina antero-posterior plane. These clots are ideal for a frontal approach dissecting along the fiber tracts of teh superior longitudinal facsiculus, thus INTER-FASCICULAR.



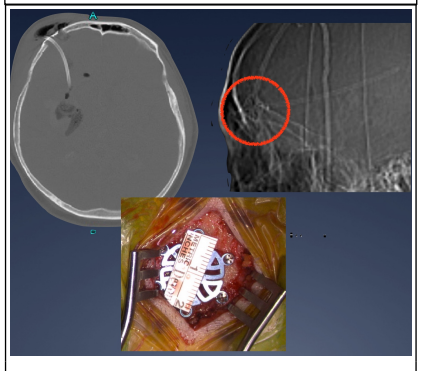
12 hour stability

Our first cohort of 28 patients with an average ICH volume of 47 +/- 17cc, a modified 14Fr urethral rubber catheter (Bard Inc.) was placed using image guidance (StealthStation® AxiEM™) along the long axis of the intracerebral hemorrhage and evacuated by manual aspiration followed rtPA lysis and drainage **(Image 1)**.

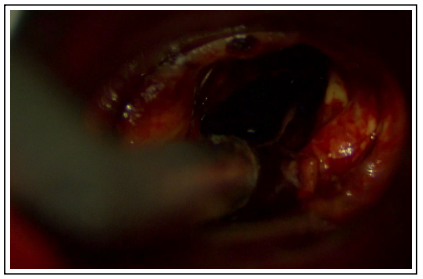
Our second cohort of 16 patients with an
average ICH volume of 84 +/- 21cc a 12mm port (VBAS™, Vycor Medical Inc.)
was placed under image guidance for direct bonicular microsurgical evacuation.



Panel A: The VBAS™ aperture port. Panel B: Pre-op image of typical basal ganglia hemorrhage. Panel C: Immediate post-op image with catheter in clot. Panel D: The 14f rubber, urethral catheter. Panel E: Late post-op image following rtPA thrombolysis. Panel F: Diffusion tensor image demonstrating a left basal ganglia hemorrhage displacing the corticospinal tracts.



Post-op tubular access evacuation

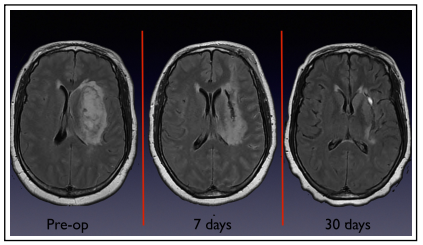


Results

First cohort: In this group of 28 patients a significant surgical reduction of 22cc or 46% ($p<0.05$) was achieved by catheter evacuation. An additional 12cc was removed following rtPA lysis in 17 patients, significantly reducing clot volume ($p<0.05$). 30-day mortality was 11.5% (44.9% by predicted admission ICH score). GCS significantly improved from 10.1 on admission to 12.5 at discharge in survivors ($p<0.05$). There were two re-bleeds in this group requiring re-operation.

Second cohort: 80% reduction (pre 82.6cc +/- 21.8, post 16.9cc +/- 12.9, $p<0.05$) in clot volume by minimally invasive access port evacuation in these 16 patients. 30-day mortality was 37.5 +/- 0.5% (expected 46.5 +/- 26.7%). There was a non-significant trend towards improvement in survivor discharge GCS (9.5 to 11.9, $p=0.059$).

T2-FLAIR imaging demonstrated minimal injury to longitudinal tracts. Effect on cortico-spinal tract anatomy was evaluated by diffusion tensor imaging before and after minimally invasive clot evacuation.



Learning Objective:

To apply novel surgical techniques using fascicular anatomy, imagine guidance, and lessons learned from previous clinical trials to the treatment of subcortical spontaneous hemorrhages.

References

1. Abdu E, Hanley DF, Newell DW. Minimally invasive treatment for intracerebral hemorrhage. Neurosurg Focus 2012; 32 (4): E3.
2. Mould WA, Carhaupoma JR, Muschelli J et al. Minimally invasive surgery plus recombinant tissue-type plasminogen activator for intracerebral hemorrhage evacuation decreases perihematomal edema. Stroke 2013; 44: 627-634.
3. Zhou X, Chen J, Li Q et al. Minimally invasive surgery for spontaneous supratentorial intracerebral hemorrhage: a meta-analysis of randomized controlled trials. Stroke 2012; 43:2923-2930.

Conclusions

Innovative MIS for SC-ICH is feasible, effective, without significant disruption of subcortical tracts. DTI demonstrates trend towards preservation of cortico-spinal tract.