

Introduction: Intracranial hemorrhage (ICH) is a highly prevalent disease associated with a high mortality (35-52%). Of the survivors, only 12 to 39 percent of patients will achieve independent function. The challenges associated with the surgical management of this entity fall into one of the following categories: mapping, access, visualization, and evacuation.

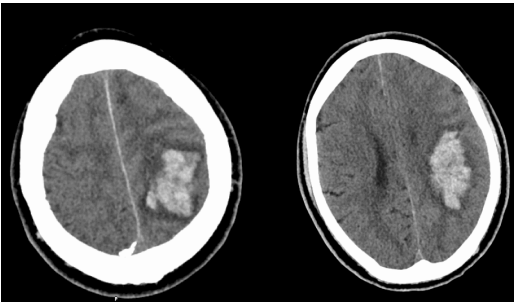
Methods: A systematic approach integrating 5 separate core competencies to provide safe and consistent minimally invasive corridors for evacuating ICH:

- 1) Imaging and mapping,
- 2) Dynamic navigation,
- 3) Radial transsulcular access,
- 4) Exoscopic high definition optics, and
- 5) Resection with automated atraumatic mechanical instrumentation.

The approach was used for the surgical management of ten consecutive primary ICH admitted at the Ottawa Hospital between September 2011 and March 2013. Patients with suspected secondary ICH or uncorrected coagulopathy were excluded. Radiological and clinical data were retrospectively collected and analyzed.

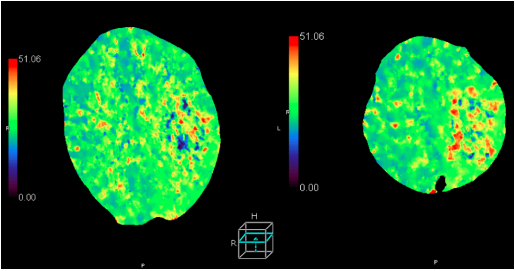
Case Illustration: A 47 year old previously healthy male was referred for sudden onset of right sided hemiparesis. At the time of admission, his systolic blood pressure was 250 mmHg. On examination, the patient had a power of 1/5 (MRC scale) in his right upper and lower extremities as well as right-sided neglect. A CT scan showed a left frontoparietal acute intraparenchymal hematoma. No definitive underlying vascular abnormality was demonstrated on CT Angiography. The patient was taken to the operating room for an emergency craniotomy.

Pre-op CT scan

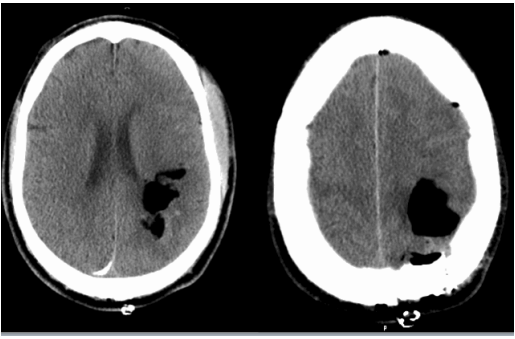


Left frontoparietal acute 2.8 x 5.7 cm ICH
with mild midline shift and surrounding
vasogenic edema.

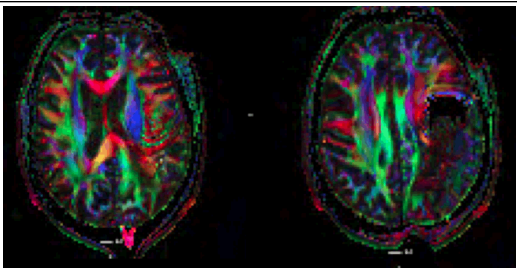
Pre-op time to peak - TTP



Postoperative CT showed no residual hemorrhage



Surgical Procedure: Surgery was performed through a small 3 cm craniotomy. After the preplanned trajectory was verified with the neuronavigation system, the sulcus overlying the lesion was opened under direct VITOM visualization. The BrainPath access system coupled with neuronavigation were used to attain a “deep” cannulation. Once the obturator was removed, the blood clot “herniated” into the BP sheath. In a systematic fashion, the clot was evacuated using the “two suction” technique while maintaining incremental hemostasis. At the end of the procedure, the BP was removed and the site of cannulation was covered with a piece of Duragen matrix. The boneflap was placed and secured. No mannitol was given at any point before or during the procedure. The patient improved significantly; his power at the time of discharge was 4/5 (MRC scale).



Post-op MRI confirmed effective surgical decompression.

Results: Complete evacuation of all ICH was confirmed radiologically. Diffusion tensor imaging (DTI) was used to confirm white matter tracts recovery. Significant recovery was observed in 78 % of the patients and no new deficits were encountered. There were no systemic complications or fatalities.

Conclusions: The “5 pillars” approach is safe and effective for the management of primary ICH. The effectiveness, and the potential economic value to the health system of early parafascicular surgical intervention for acute ICH will be evaluated in a Phase I Trial that is currently underway.

Patient	Age	Sex	Side	Elusquent area	Admission GSC	Tracts	Clinical Outcome	Complications
1	60	F	L	None	15	SLF, CR, Optic radiation	Improved	UTI
2	78	M	L	Sensory	8	CR, CC, Cingulum, SLF	Improved	DVT
3	65	M	R	Motor cortex	14	ILF, IFO, optic radiation	No new deficit	Rebleed
4	65	M	R	Broca	14	ILF, IFO, optic radiation	Improved	None
5	62	F	L	Broca	9	SLF, CR, IC, Optic tract	No new deficit	None
6	65	F	R	IC	8	SLF, CR, IC, CC, Cingulum, ILF, optic tracts	Improved	UTI
7	46	M	L	IC	13	SLF, CR, CC, Cing	Improved	None
8	44	F	L	sensorimotor	8	SLF, CR, IC, Cing, CC	Improved	None
9	44	F	L	sensorimotor	8	SLF, CR, IC, Cing, CC	No new deficit	None (2nd stage)
10	70	M	R	sensorimotor	14	CR, SLF, CC	Improved	None

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