



Introduction

- The surgical resection of Low Grade Gliomas (LGG) remains challenging.
- The need for Gross Total Resection (GTR) has become more accepted within the Neurosurgical community worldwide.
- The most definitive indication for the use of intraoperative MRI is for the resection of LGG.
- The authors will report their experience with Australia’s first iMRI operating suite, which has been functional since 2007 at Sydney’s Royal Prince Alfred Hospital. This high field (1.5T) closed bore unit “BrainSuite” is a Siemens and BrainLab collaboration.
- This is the first Australian study of iMRI guided surgery and is one of the largest studies in the world, on this topic.

Aim

- To investigate the degree of resection achieved, and post-operative neurological deficit rate, amongst LGG patients who undergo high field iMRI guided surgery.

Methods

- A retrospective audit of the medical records was undertaken on all patients who were operated on with iMRI guidance and were histologically identified to have a Low Grade Glioma.
- The Primary Endpoints were: Histological Type, Extent of Resection, Incidence of New or Worsened Neurological Deficits and other Post-operative Complications.
- The Secondary Endpoints were: Operation Duration, Sequences used, Number of Scans per patient and Change in Seizures 6 months Post-Operatively.
- Patients with Pilocytic Astrocytomas, Pleomorphic Xanthoastrocytomas, Tancytic Ependymomas and Gemistocytic Astrocytomas were excluded, as they followed a different natural history.

Results

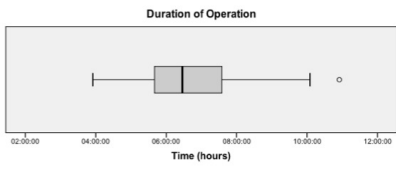
- Between September 2007 and March 2013, a total of 292 adult patients underwent surgery in the BrainSuite at our institution.

- Of these, 45 patients were retrospectively identified to have a histologically diagnosed WHO Grade I or II glioma. After excluding those with tumours of a different natural history, 30 patients were included in this study.
- After the T1 weighted registration scan, the most commonly performed preoperative and intraoperative sequences were both FLAIR. Only 1 neurosurgeon employed additional sequences, with DTI sequences used on 2 patients and DWI used on 1 patient.
- All tumours were WHO Grade II with 16 astrocytomas, 9 oligodendrogliomas and 5 mixed oligoastrocytomas. Of these, 10 were recurrent gliomas (as seen in Figure 1).

Figure 1. Table of Pre-operative Data

Population (n)	30	Location	
Age			
Median	43	L&F Frontal	5 (16.7%)
Range	21-63	L&F Temporal	6 (20%)
		L&F Insular	2 (6.7%)
		L&F Parietal	0 (0%)
		L&F Occipital	2 (6.7%)
		Right Frontal	13 (43.3%)
		Right Temporal	4 (13.3%)
		Right Insular	2 (6.7%)
		Right Parietal	2 (6.7%)
		Right Occipital	2 (6.7%)
Gender			
M	12 (40%)		
F	18 (60%)		
ECOG Status		Presentation	
0	20 (66.7%)	Asymptomatic (n)	3 (10%)
1	10 (33.3%)	Incidental	2 (6.7%)
		Recurrent on MRI	1 (3.3%)
WHO Grade			
II		Symptomatic (n)	27 (90%)
Type		Seizures	21 (77%)
Astrocytoma	16 (5 Recurrent)	Headache	11 (38.7%)
Oligodendroglioma	9 (2 Recurrent)	Cognition and Memory	4 (13.3%)
Oligoastrocytoma	5 (3 Recurrent)	Sensori Deficit	4 (13.3%)
		Incidental/Recurrent	3 (10%)
		Visual Deficit	3 (10%)
		Vertigo/Dizziness/Nausea	5 (16.7%)

Figure 2. Graph of Operation Duration



- Of the 19 GTR's, 17 patients had residual tumour on the first intraoperative scan and 1 patient still had residual tumour on the second intraoperative scan.
- The duration of each operation ranged between 3:55 and 10:55 hours, with a median of 6:28 hours (seen in Figure 2).
- Of the 30 patients, a GTR was achieved in 63.3% of patients and Sub-Total Resections (STR) were acheived in 33.3% of patients (as seen in Figure 3).

Figure 3. Table of Extent of Resection

Histology	n	%
Astrocytoma	16 (5 Recurrent)	
GTR	8 (1 Recurrent)	50% (20%)
STR	7 (4 Recurrent)	43.75% (80%)
Biopsy	1	6.25%
Oligodendroglioma	9 (2 Recurrent)	
GTR	8 (2 Recurrent)	88.9% (100%)
STR	1	11.1%
Biopsy	0	0%
Oligoastrocytoma	5 (3 Recurrent)	
GTR	3 (1 Recurrent)	60% (33.33%)
STR	2 (2 Recurrent)	40% (66.66%)
Biopsy	0	0%
Total	30 (10)	
GTR	19 (4)	63.3% (40%)
STR	10 (6)	33.3% (60%)
Biopsy	1	3.3%

- 73.3% of patients experienced new or worsened neurological deficits immediately post operation, but were largely asymptomatic at 6 months follow up (seen in Figure 4).

Figure 4. Table of New or Worsened Neurological Deficits

Neurological Deficit	Patients with New or Worsened Neurological Deficits	
	Immediately Post Operation	6 Months Post Operation
Total	22 (73.3%)	5 (16.7%)
Motor	9 (30%)	0
Sensory	2 (6.7%)	0
Speech	7 (23.3%)	1 (3.3%)
Visual	7 (23.3%)	1 (3.3%)
Cognition and Memory	6 (20%)	3 (10%)
Balance and Coordination	4 (13.3%)	0

- Of the 20 patients who presented with seizures, 100% reported symptom improvement. 17 were seizure free at 6 month follow-up and of the 4 who continued to have seizures postoperatively, all reported improved seizure frequency or intensity.
- A significant difference was found between the seizure rates preoperatively and postoperatively (p<0.001).

Conclusions

- iMRI guided surgery for LGG provides a safe and effective way to achieve maximal resection.