Complications and Risk Factor Analysis of Ommaya Reservoir Placement in 835 Patients

Rory R Mayer BS; John Matthew Debnam MD; Dima Suki PhD; Ryan Seiji Kitagawa MD; Ian E. McCutcheon MD; Morris Groves MD; Raymond Sawaya MD; Jeffrey S. Weinberg MD

[Department of Neurosurgery, The University of Texas M.D. Anderson Cancer Center and Baylor College of Medicine, Houston, Texas]

CONGRESS OF NEUROLOGICAL SURGEONS 2011 ANNUAL MEETING WASHINGTON, DC OCTOBER 1-6, 2011

Introduction

The surgical complication rate associated with the placement of Ommaya reservoirs has been previously described; however, an appropriate analysis and risk factor assessment has been limited by sample size. Further, no analysis has identified what risk factors, such as coagulopathies in cancer patients, are involved in the placement of these devices that may generate complications. Additionally, numerous surgical adjuncts including stereotactic navigation are now employed with the aim of improved device placement, but no study has demonstrated their effectiveness at reducing surgical complications in this setting.

Our objective was to assess the incidence of complications associated with the various techniques involved in Ommaya catheter placement and identify relevant risk factors. Further, we sought to determine whether the use of stereotactic neuronavigation or other surgical adjuncts resulted in an increased precision of targeting to the intended ventricular location or produced a decreased incidence of complications postoperatively.

Methods

We reviewed all Ommaya catheter operations taking place at our institution between 1993-2010 (n=835). Primary cancer diagnosis, the extent of intracranial disease, pre-operative white blood cell and platelet counts, antibiotic administration, and intraoperative transfusion requirements were documented. Operative modalities employed including stereotactic image-guided navigation, fluoroscopy, pre-assembled catheters, the use of a brain needle, or a free hand device placement were documented. Complications, defined as neurological and regional, or systemic, were assessed at 48 hours and at 30 days.

Results

Our analysis demonstrates a 10% incidence of complications (7% neurological/regional) at 48 hours. At 30 days, complications occurred in 36% (22% neurological/regional). Altered mental status was the most common complication at 48 hours and 30 days (2% and 5%).

Table 1: Indications for Ommaya reservoir placement

	Percent	n
Chemotherapy	85.4	713
Prophylactic chemotherapy	4.2	35
Antibiotic administration	1.2	10
Other*	9.2	77
Total	100	835

* Other = including chemotherapy ± analgesics, antibiotics

Table 2: Risk factors for complications following Ommaya reservoir placement

	48 hours (%) complications	30 days (%) complications	N^
White blood cell count (cells/μL)			
> 0.8	8.8	34.1	636
≤ 0.8	40.0	73.3	15
p value	0.001	0.055	
Hemoglobin count (gm/dl)			
Normal to mild anemia	8.1	34.4	227
Moderate to severe anemia	15	35.5	425
p value	< 0.05	0.417	
Platelet count (platelets/μL)			
High > 450,000	12.5	12.5	8
Normal 75,000 – 450,000	8.5	31.7	470
Low < 75,000	12.6	44.8	174
p value	0.151	0.001	
LMD*			
Yes	9.7	36.9	674
No	8.5	28.4	141
p value	0.393	0.032	
LMD diagnosis by CSF profile			
Yes	9.2	37.7	551
No	10.3	30.2	252
p value	0.352	0.022	

*LMD = leptomeningeal disease, diagnosis made by combination of clinical findings, cerebrospinal fluid cell count and cytology, and radiographic findings; ^30 day cohort

Intracranial hemorrhage occurred in less than 3% of patients at 48 hours and 4% at 30 days. Additional complications at 30 days were infections (respiratory and urinary tract; sepsis; and meningitis), and seizures. Preoperative symptoms, cancer pathology, KPS score, and number of CNS operations preceding the Ommaya placement were not associated with a higher incidence of complications. An increased risk of complications at 30 days occurred with a misplaced catheter; platelet counts below 75,000; a WBC count below or equal to 800 cells/μL; a diagnosis of LMD; or, a history of CNS radiation.

Table 3: Complication rate relative to intended location of catheter placement

Intended Location of Catheter	48 hours (%)	30 days (%)	n
Yes	7.7	33.7	646
No	19.1	42.0	162
p value	p <0.001	p = 0.032	

Table 4: Location of catheter tip by postoperative head CT

Location	Percent	n
Lateral ventricle	42.6	297.0
At or in proximity to FOM*	22.3	186.0
Ventricular system contralateral to insertion side	12.5	87.0
Other	7.9	55.0
Third ventricle	6.1	51.0
Brain parenchyma	3.0	21.0
Total	100.0	697.0

*FOM = foramen of Monro

The use of a brain needle for catheter guidance or pre-assembly of the Ommaya construct were not associated with a signficant increase in precision.

Table 5: Precision of catheter-targeting by operative modality

Operative Modality	Guided to Intended Target (%)	n	p-value^
Stereotactic Navigation	90.5	74	0.009
Use of surgical adjunct*	89.7	87	0.009
Intraoperative Fluoroscopy	86.1	165	0.017
Pre-assembled Catheter[1]	80.8	542	0.236
Brain Needle[1]	79.8	515	0.437
Free Hand	76.3	118	-------

*Use of stereotactic navigation, fluoroscopy, endoscopy or ultrasound-guidance

[1] employed technique ± additional surgical adjuncts

^relative to precision of operation without operative modality

Conclusions

- These findings involve the largest analysis to date of Ommaya reservoir placements.
- Successful targeting of the Ommaya reservior to avoid misplacement is significantly associated with a decreased incidence of complications.
- Stereotactic navigation significantly improves intraoperative catheter-targeting.
- Preoperative risk factors for complications include a platelet count below 75,000, a WBC count below or equal to 800 cells/μL, a history of CNS radiation, and the presence of LMD.

References

Please see author for reference list.