

Complications Associated with Preoperative Chemotherapy and Radiation Therapy in Patients Undergoing Intracranial Tumor Resection

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Introduction

Most standard treatment options for primary CNS tumors include surgical resection, and neoadjuvant chemotherapy and radiotherapy are often used to improve outcomes (Institute, 2016). Chemotherapy has long been known to have a variety of adverse effects on various organ systems. Patients receiving chemotherapy are at a high risk of infection, largely because most chemotherapy agents can cause severe myelosuppression (Othieno-Abinya NA, 2007). Importantly, the effects of myelosuppression have been shown to persist long after the cessation of treatment (Zandvoort, Lodewijk, Klok, & Timens, 2003), indicating a prolonged susceptibility to infection. Several sequelae from radiation therapy of the brain have been described. While the mechanism of brain injury has not been elucidated, a loss of glial and vascular endothelial cells, demyelination, gliosis and white-matter necrosis have been described following radiation (Dhermain & Barani, 2016). There has also been recent interest in long-term neurocognitive effects of radiation therapy. While there are acute encephalopathic changes that can be seen, many of the effects of radiation therapy occur months or years after treatment, indicating permanent structural alterations in the brain (Dhermain & Barani, 2016). Until now, no studies have investigated acute complications after surgical resection of intracranial tumors in patients recently treated with radiotherapy.

Introduction (Continued)

The purpose of this study is to use a large surgical database to analyze intra-operative and post-operative complications that may arise when patients are treated with neoadjuvant chemotherapy and/or radiation therapy prior to intracranial tumor resection.

Patient Demographics

	No chemo Group	Chemotherapy group	No XRT group	XRT group
Average age (yrs)	56.02	54.5	56	55.8
Sex (% female)	52.4%	51%	52.4%	51%
ASA Score > 3	71.2%	81%	71.3%	85.1%
Average length of hospital stay (days)	6.8	6.2	6.77	7.42
Rate of return to OR within 30 days	5.3%	4.3%	5.3%	4.4%
30 day mortality rate	2.4%	5.7%	2.4%	4.4%

Methods

The ACS-NSQIP database was used to identify patients who underwent intracranial tumor resection between 2006 and 2014 based on CPT codes. Intraoperative or postoperative complications associated with patients treated with chemotherapy or radiation therapy prior to surgery were identified using chi square and multivariate logistic regression.

CPT Codes for Intracranial Tumor Resections

CPT	Description	Frequency	% of total
61510	Cranectomy, trephination, bone flap craniotomy; for excision of brain tumor, supratentorial, except meningioma	10438	59.2%
61512	Cranectomy, trephination, bone flap craniotomy; for excision of meningioma, supratentorial	3494	19.8%
61518	Cranectomy for excision of brain tumor, infratentorial or posterior fossa; except meningioma, cerebellopontine angle tumor, or midline tumor at base of skull	1649	9.4%
61519	Cranectomy for excision of brain tumor, infratentorial or posterior fossa; meningioma	630	3.6%
61520	Cranectomy for excision of brain tumor, infratentorial or posterior fossa; cerebellopontine angle tumor	720	4.1%
61521	Cranectomy for excision of brain tumor, infratentorial or posterior fossa; midline tumor at base of skull	208	1.2%
61526	Cranectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor	237	1.3%
61545	Craniotomy with elevation of bone flap; for excision of craniopharyngioma	102	0.6%
61546	Craniotomy for hypophysectomy or excision of pituitary tumor; intracranial approach	136	0.8%
61575	Transoral approach to skull base, brainstem, or upper spinal cord for biopsy, decompression, or excision of lesion	20	0.1%

Results

A total of 17,634 patients who underwent intracranial tumor resections were identified. 722 patients (4.28%) received chemotherapy within 30 days and/or radiation therapy within 90 days prior to surgery. Three surgical complications were found to be associated with neoadjuvant chemotherapy.

Factors Associated with Preoperative Chemotherapy in Univariate Analysis

Factor	Odds Ratio (95% CI)
Anesthesia Time > 3 hours	37.46 (24.05 - 58.36)
Occurrence of organ space SSI	3.91 (1.90 - 8.04)
Occurrence of CVA with neurological deficits	2.42 (1.13 - 5.19)

Factors Associated with Preoperative Radiotherapy in Univariate Analysis

Factor	Odds Ratio (95% CI)
Anesthesia time > 3 hours	20.13 (12.41, 32.66)

Conclusions

Neoadjuvant chemotherapy and radiation therapy were both associated with increased time under anesthesia, which may be associated with further morbidity. Additionally, chemotherapy was associated with stroke and organ space SSI. In the future, surgeons may decide to take steps to prevent such postoperative complications when operating on patients who have recently been treated with chemotherapy.

References & Acknowledgments

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Dhermain, F., & Barani, I. J. (2016). Complications from radiotherapy. *Handb Clin Neurol*, 134, 219-234. doi:10.1016/B978-0-12-802997-8.00013-X

Institute, N. C. (2016). Treatment of Primary Central Nervous System Tumors by Tumor Type. Adult Central Nervous System Tumors Treatment --Health Professional Version. Retrieved from https://www.cancer.gov/types/brain/hp/adult-brain-treatment-pdq-section/_792

Othieno-Abinya NA, W. A., Nyabla LO. (2007). Chemotherapy induced myelosuppression. *East Afr Med J*, 84(1), 8-15.

Zandvoort, A., Lodewijk, M. E., Klok, P. A., & Timens, W. (2003). Effect of multidose combination chemotherapy on humoral immune system. *Clinical Immunology*, 107(1). doi:10.1016/s1521-6616(03)00005-6