



Emergency Versus Elective Brain Tumor Excisions: A 3-Year Propensity Score Matched Outcome Analysis



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Introduction

Emergency neurosurgical operations for brain tumours entail less time in radiological investigations and planning, less available intraoperative monitoring (IOM) and subspecialized neurosurgeons and neuro-anesthetists.

However, the disparity between emergency versus elective surgeries has not been evaluated in Hong Kong. This investigation aims to delineate differences in: (1) intra-operative; (2) clinical; and (3) oncological outcomes between these 2 surgical settings.

Materials and Methods

Study Design

A consecutive series of 262 craniotomy/craniectomies for brain tumors were performed between January 2018 and December 2020 at Queen Mary Hospital. They were stratified into emergency (n=86) and elective (n=176) cases. Independent variables including preoperative Karnofsky Performance Score (pre-KPS), American Society of Anesthesiologists' (ASA) score, tumor location and volume were collected.

Statistical Analysis

Statistical analysis was performed with SPSS software (v.27.0; IBM Corp, Chicago, IL, USA). We generated matched cohorts to correct for the heterogenous baseline co-variables. Propensity score matching (PSM) was performed using baseline demographics, ASA and pre-operative KPS scores, tumour pathology and location. Then 1:1 nearest neighbor (greedy) matching without replacement was used to match the elective to the emergency cases according to their respective propensity scores. The caliper value was set at 0.2. This yielded 60 patients in each group. Their outcomes were compared for any significant disparities.

Results

In total, there were 262 patients who underwent brain tumour excisions from 2018 to 2020. Of these 176 cases (67.2%) were elective and 86 (32.8%) were emergency.

Table 1: Summary of clinical and demographic data before matching

	Elective (n=176)	Emergency (n=86)	p value
Baseline demographics			
Age (mean ± SD)	54.1 ± 16.3	50.9 ± 22.1	0.180
Men, n (%)	70 (39.8%)	44 (51.2%)	0.086
Smoker/drinker, n (%)	24 (13.6%)	22 (25.7%)	0.024
Comorbidities, n (%)			0.152
Ischemic heart disease	4 (2.3%)	6 (6.98%)	
Chronic kidney disease	0 (0%)	2 (2.33%)	
Diabetes mellitus	22 (12.5%)	7 (8.14%)	
Hypertension	44 (25%)	15 (17.4%)	
ASA, median (IQR)	3 (1)	3 (0)	<0.001
Pre-KPS, median (IQR)	80 (10)	75 (20)	<0.001
IOM use, n (%)	82 (46.6%)	4 (4.7%)	<0.001
Tumour characteristics			<0.001
Pathology, n (%)			
Meningioma	86 (48.9%)	14 (16.3%)	
Metastasis	25 (14.2%)	41 (47.7%)	
Glioma	49 (27.8%)	21 (24.4%)	
Others	16 (9.09%)	10 (11.6%)	
Size (cm ³) (mean ± SD)	27.6 ± 29.5	29.0 ± 28.6	0.720
Location, n (%)			0.029
Infratentorial	22 (12.5%)	23 (26.7%)	
Temporal	37 (21.0%)	12 (14.0%)	
Occipital	8 (4.5%)	3 (3.5%)	
Frontal	68 (38.6%)	33 (38.4%)	
Parietal	30 (17.0%)	11 (12.8%)	
Intraventricular	3 (1.7%)	1 (1.2%)	
Suprasellar	7 (4.0%)	0 (0%)	
Others	4 (2.3%)	2 (2.3%)	
FU time (months) (mean ± SD)	52.0 ± 46.4	43.2 ± 27.5	0.107

Table 2: Summary of clinical and demographic data after matching

	Elective (n=60)	Emergency (n=60)	p value
Baseline demographics			
Age (mean ± SD)	53.8 ± 16.8	53.2 ± 19.5	0.853
Men, n (%)	26 (43.3%)	28 (46.7%)	0.855
Smoker/drinker, n (%)	10 (16.7%)	11 (18.3%)	1.000
Comorbidities, n (%)			0.603
Ischemic heart disease	1 (1.7%)	4 (6.7%)	
Chronic kidney disease	0 (0%)	2 (3.3%)	
Diabetes mellitus	5 (8.3%)	3 (5.0%)	
Hypertension	7 (11.7%)	10 (16.7%)	
ASA, median (IQR)	2 (1)	3 (1)	0.309
Pre-op KPS score, median (IQR)	80 (20)	80 (20)	0.794
IOM use, n (%)	33 (55%)	3 (5%)	<0.001
Tumour characteristics			<0.001
Pathology, n (%)			
Meningioma	24 (40%)	11 (18.3%)	
Metastasis	6 (10%)	33 (55%)	
Glioma	23 (38.3%)	12 (20%)	
Others	7 (11.7%)	4 (6.7%)	
Size (cm ³) (mean ± SD)	25.2 ± 27.0	28.3 ± 31.2	0.562
Location, n (%)			0.804
Infratentorial	12 (20%)	14 (23.3%)	
Temporal	12 (20%)	9 (15%)	
Occipital	3 (5%)	2 (3.3%)	
Frontal	20 (33.3%)	23 (38.3%)	
Parietal	11 (18.3%)	23 (38.3%)	
Intraventricular	1 (1.7%)	1 (1.7%)	
Suprasellar	1 (1.7%)	1 (1.7%)	
Others	1 (1.7%)	0 (0%)	
FU time (months) (mean ± SD)	45.8 ± 25.5	42.9 ± 27.8	0.550

Before matching, there were more brain metastases (48.9% vs 16.3%, p<0.001) in the emergency group patients, with a lower ASA and pre-KPS (p<0.001). There were also significant disparities in the distribution of tumour location (p=0.029).

After matching, all baseline covariates were comparable except for tumour pathology (18.3% vs 40%, p<0.001). As expected, there was significantly less IOM use both before and after matching (4.7% vs 46.6% and 5% vs 55%, p<0.001).

Table 3: Summary of major outcomes of the propensity-score-matched cohorts

	Elective (n=60)	Emergency (n=60)	p value
Intra-operative outcomes			
Operative time (min) (mean ± SD)	200 ± 80	174 ± 83	0.084
Blood loss (ml) (mean ± SD)	514 ± 377	426 ± 272	0.263
Clinical outcomes			
Any 30-day complications	17 (28.3%)	20 (33.3%)	0.346
30-day complications (local), n (%)			
New deficit	5 (8.3%)	9 (15%)	0.197
Significant edema	3 (5%)	6 (10%)	0.245
New seizure	3 (5%)	2 (3.3%)	1.000
Hydrocephalus	2 (3.3%)	2 (3.3%)	1.000
Significant bleeding	1 (1.7%)	3 (5%)	0.619
30-day complications (systemic), n (%)			
Stroke	1 (1.7%)	0 (0%)	1.000
PE/DVT	0 (0%)	3 (5%)	0.244
Sepsis	4 (6.7%)	3 (5%)	1.000
Reoperation, n (%)	0 (0%)	5 (8.3%)	0.029
Readmission, n (%)	3 (5%)	8 (13.3%)	0.102
Functional outcome, median (IQR)			
KFS-discharge	80 (20)	80 (20)	0.596
KFS-follow-up	90 (30)	90 (18)	0.909
Length of stay (days) (mean ± SD)	8.4 ± 5.8	8.1 ± 7.1	0.847
30-day mortality, n (%)	0 (0%)	1 (1.7%)	1.000
Discharge disposition, n (%)			0.660
Home	35 (58.3%)	37 (61.7%)	
Institution	3 (5%)	4 (6.7%)	
Rehabilitation	22 (36.7%)	18 (30%)	
Oncological outcomes			
Simpson grading, median (IQR)	2 (2)	2 (1)	0.825
Gross total resection rate (non-meningioma), No./total (%)	22/41 (53.7%)	39/50 (78%)	0.024

As shown in table 3, there were no statistically significant differences in the intra-operative outcomes. For clinical outcomes, they had comparable rates of readmission and 30-day complications/mortality, similar functional outcomes, length of stay (LOS) and discharge disposition.

However, the emergency subset had higher reoperation rate (8.3% vs 0%, p=0.029). For oncological outcomes, Simpson grading was similar (p=0.825), but for non-meningioma pathologies, emergency surgeries more often achieved gross total resections (78% vs 53.7%, p=0.024).

Discussion

We demonstrated that emergency brain tumour excisions did not compromise patient safety and major outcome measures. After PSM, the only inferior outcome was the re-operation rate. Oncologically, the gross total resection rate for non-meningioma pathologies was higher.

This investigation is limited by significant disparities in the tumour pathology persisting despite PSM (p<0.001). This is explained by the diverse baseline tumour pathology, such that a lower caliper value would significantly sacrifice the post-PSM sample size. This illustrates the inherent limitation of a retrospective trial. Feasibility of extrapolation of these results to other centers remains to be proven.

Nonetheless, this is the first study in Hong Kong to compare outcomes of elective versus emergency brain tumour excisions with matched cohorts. We showed that with proper selection, emergency surgeries had reasonable outcomes despite less frequent IOM use, and less neuroanaesthetic support. Future investigations may focus on cost-effectiveness analyses on elective and non-elective operations to optimize operation theatre resource utilization.

Conclusion

After matching for baseline covariates, except for a higher re-operation rate, emergency brain tumour excisions had comparable intra-operative, clinical and oncological outcomes compared to elective surgeries.

Reference

Chan AY, Choi EH, Oh MY, Vadera S, Chen JW, Golshani K, Wilson WC, Hsu FPK. Elective versus nonelective brain tumor resections: a 5-year propensity score matching cost comparison analysis. J Neurosurg. 2021 Jul 9:1-5. doi: 10.3171/2020.12.JNS203401.