Jurnal ARSI : Administrasi Rumah Sakit Indonesia

Volume 11
Number 2 *June*

Article 1

6-26-2025

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Recommended Citation

Perkasa, Sayyid Abdil Hakam; Rahmah, Habibah Nurul; and Arham, Abrar (2025) "Retrospective Study of Elective Intracranial Tumor Surgery Waiting Time at a National Referral Hospital in Indonesia," *Jurnal ARSI : Administrasi Rumah Sakit Indonesia*: Vol. 11: No. 2, Article 1.
DOI: 10.7454/arsi.v11i2.1199
Available at: https://scholarhub.ui.ac.id/arsi/vol11/iss2/1

Jurnal ARSI : Administrasi Rumah Sakit Indonesia
DOI: 10.7454/arsi.v11i2.1199
Juni 2025, Vol. 11, No. 2, Hal. 70-77

Retrospective Study of Elective Intracranial Tumor Surgery Waiting Time at a National Referral Hospital in Indonesia

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Article history:
Received: December 17, 2024; Revised: January 23, 2025; Accepted: March 12, 2025

Abstract. Elective surgery waiting times are a key measure of healthcare system performance and service quality. Long wait times can lower patients' quality of life, worsen symptoms, reduce treatment effectiveness, and increase financial stress. We aimed to provide a descriptive analysis of elective surgery waiting time for Intracranial Tumors at Mahar Mardjono National Brain Center Hospital in 2023. This study is a descriptive retrospective cross-sectional study using data from Electronic Health Records (EHR). The study sample included all elective intracranial tumor surgeries performed in 2023. A total of 371 elective intracranial tumor surgeries were analyzed. The median age of patients was 45 years, with the majority being female (64.42%). Most surgeries (44.47%) had a duration of surgery between 3–5 hours with meningioma making up the majority of cases operated (46.63%). The median waiting time for elective intracranial tumor surgery was 44 days, with most patients (72.78%) waiting between 0–3 months. These findings highlight the need for strategies to reduce elective intracranial tumor surgery waiting times. Both short-term and long-term interventions should be implemented, focusing on optimizing resources and expanding surgical capacity. Future studies should examine how these strategies impact patient outcomes and hospital efficiency while identifying potential barriers to their implementation.

Keywords: Waiting Time; Elective Surgery; Intracranial Tumor; Health System

Abstrak. *Waktu tunggu operasi elektif merupakan ukuran penting kinerja sistem perawatan kesehatan dan kualitas layanan. Waktu tunggu yang lama dapat menurunkan kualitas hidup pasien, memperburuk gejala, mengurangi efektivitas pengobatan, dan meningkatkan tekanan finansial. Penelitian ini bertujuan untuk memberikan analisis deskriptif waktu tunggu operasi elektif untuk Tumor Intrakranial di Rumah Sakit Pusat Otak Nasional Mahar Mardjono pada tahun 2023. Studi ini merupakan studi deskriptif retrospektif cross-sectional menggunakan data Electronic Health Records (EHR). Sampel studi mencakup semua operasi tumor intrakranial elektif yang dikerjakan pada tahun 2023. Sebanyak 371 operasi tumor intrakranial elektif dianalisis. Median usia pasien adalah 45 tahun, dengan mayoritas adalah perempuan (64,42%). Sebagian besar operasi (44,47%) memiliki durasi operasi antara 3–5 jam dengan meningioma sebagai mayoritas kasus yang dioperasi (46,63%). Median waktu tunggu untuk operasi tumor intrakranial elektif adalah 44 hari, dengan sebagian besar pasien (72,78%) menunggu antara 0–3 bulan. Temuan ini menyoroti perlunya strategi untuk mengurangi waktu tunggu operasi tumor intrakranial elektif. Intervensi jangka pendek dan jangka panjang harus dilaksanakan, dengan fokus pada pengoptimalan sumber daya dan perluasan kapasitas bedah. Penelitian di masa mendatang harus meneliti bagaimana strategi ini memengaruhi hasil pasien dan efisiensi rumah sakit sekaligus mengidentifikasi potensi hambatan terhadap pelaksanaannya.*

Kata kunci: *Waktu Tunggu; Operasi Elektif; Tumor Intrakranial; Sistem Kesehatan*

INTRODUCTION

Elective surgery is a surgical procedure performed to correct a non-life-threatening (non-emergency) medical problem and can be scheduled in advance (Prin *et al.*, 2018). Elective surgery waiting time is defined as the period between the date the surgery is proposed and the date the surgical procedure is performed (Ada *et al.*, 2023). Waiting times for elective surgery are often used as a primary indicator of health services as a parameter in measuring the performance of the health care system

and its quality of service (McIntyre and Chow, 2020; Rathnayake, Clarke and Jayasinghe, 2021; Ada *et al.*, 2023).

The demand for elective surgery has surged in recent years, driven by an aging population, growing patient confidence in surgical outcomes, increased awareness of surgical conditions, and technological advancements (McIntyre and Chow, 2020; De Guzman and Sia Su, 2022). However, this rising demand has led to long waiting lists, which occur when surgical needs exceed available resources (Ballini *et al.*, 2015; Immanuel and Dhamanti, 2024). Prolonged waiting times not only delay necessary medical interventions but also significantly impact patient well-being. Delays in elective surgery can worsen symptoms, reduce therapeutic effectiveness, lower quality of life, heighten financial stress, and decrease patient satisfaction with healthcare services (Oudhoff *et al.*, 2007; Salci *et al.*, 2016; Sutherland *et al.*, 2016; OECD, 2019, 2020; De Guzman and Sia Su, 2022; Ada *et al.*, 2023). Moreover, extended wait times reflect inefficiencies in healthcare planning and service delivery, highlighting the need for improved resource allocation and scheduling strategies (Rathnayake and Clarke, 2021; De Guzman and Sia Su, 2022; Ada *et al.*, 2023).

Elective surgery waiting times for intracranial tumors are particularly critical as it has been found to influence patient outcomes and may affect treatment efficacy. For instance, patients with glioblastoma who underwent surgery soon after MRI or neurosurgical consultation were found to have an improved KPS score, suggesting earlier surgery might help preserve neurological function and quality of life (De Swart *et al.*, 2022). Furthermore, intracranial tumors can grow quickly where delays in surgery may allow tumors to infiltrate surrounding brain tissue, complicating surgical resection and potentially impeding functional outcome and survival (Müller *et al.*, 2021; De Swart *et al.*, 2022).

Studies on general elective surgery waiting times in Indonesia exist, but research specifically focused on intracranial tumors remains scarce. In particular, there is limited evidence of variations in waiting times across different intracranial tumor subtypes. This study helps address this gap by exploring elective surgery waiting times for intracranial tumors using data from a national referral hospital, providing a more comprehensive understanding of overall waiting times and subtype-specific differences in Indonesia.

Given the challenges and significance of timely intervention, ensuring prompt access to elective surgery for intracranial tumors is crucial for optimizing patient outcomes and improving healthcare system efficiency. Therefore, this study aims to analyze the waiting times for elective intracranial tumor surgery. The research was conducted at Prof. Dr. dr. Mahar Mardjono National Brain Center Hospital, Jakarta.

METHOD

This is a descriptive retrospective cross-sectional study. We used a retrospective cross-sectional study design because it allows immediate insights into the current status of waiting times for elective surgeries in a hospital. A retrospective approach was used to calculate the waiting time for elective surgeries. Data including age, gender, histopathological diagnosis, duration of surgery, date of final surgical tolerance, and date of elective surgery were obtained through EHR. The elective surgery waiting time in this study was the time interval between the date of final surgical tolerance and the date of elective surgery.

The population of this study was all intracranial tumor elective surgeries carried out at the Prof. Dr. dr. Mahar Mardjono National Brain Center Hospital. The sample in this study was all intracranial tumor elective surgeries performed at the hospital in 2023 (January 1, 2023 - December 31, 2023). The study included patients with complete EHR who had elective intracranial tumor surgery in 2023. Patients who had emergency surgery while awaiting elective surgery and patients with incomplete EHR data were excluded. Collected data were analyzed using descriptive statistics in IBM SPSS and presented descriptively.

RESULT

A total of 371 elective intracranial tumor surgeries were analyzed in this study. The median age of patients undergoing elective intracranial tumor surgery was 45 years (range, 2 years to 77 years). Most of the patients in this study were female (n = 239, 64.42%), with a 1.81 female-to-male ratio. The elective intracranial tumor surgery duration in this study was mostly around 3–5 hours (n = 165, 44.47%). The most common histopathological diagnosis in elective intracranial tumor surgery was meningioma (n = 173, 46.63%), followed by Glioma (n = 77, 20.75%) and Pituitary Adenoma (n = 38, 10.24%) (Table 1).

Table 1. Demographic Characteristics of Elective Surgical Procedures for Intracranial Tumors

Variables	N	%
Gender		
Female	239	64.42
Male	132	35.58
Age by age group (min-max)	45 (2—77)	
<5 years old	6	1.62
5-9 years old	12	3.23
10-18 years old	23	6.20
19-59 years old	268	72.24
≥60 years old	62	16.71
Duration of Surgery in hour		
1-3	84	22.64
3-5	165	44.47
5-7	71	19.14
>7	51	13.75
Waiting time in month(s)		
0-1	152	40.97
1-2	67	18.06
2-3	51	13.75
3-4	43	11.59
4-5	22	5.93
5-6	19	5.12
>6	17	4.58
Histopathology		
Meningioma	173	46.63
Glioma	77	20.75
Pituitary Adenoma	38	10.24
Schwannoma	29	7.82
Lymphoma	9	2.43
Germ Cell Tumor	8	2.16
Craniopharyngioma	8	2.16
Metastasis	11	2.96
Other	18	4.85

To understand the waiting time for elective surgery, we calculated the time interval between the date of final surgical tolerance and the actual date of elective surgery. In this study, the median waiting time for elective intracranial tumor surgery was 44 days, with a range of 1 to 552 days. The mean waiting time was 62.87 days (Table 2).

Table 2. Mean and Median Waiting Time for Elective Intracranial Tumor Surgery in Days

Waiting Time Period	Median (days) [range]	Mean (days) [SD]
Overall Waiting Time (N = 371)	44 (1—552)	62.87 (±65.73)

The present study found that the majority of elective intracranial tumor surgeries had a waiting time of 0-1 month, which equals 40.97% (152 cases) of all elective intracranial tumor surgeries. Overall, the majority of elective intracranial tumor surgeries had a waiting time of 0-3 months (72.78%). These findings are illustrated in Figure 1.

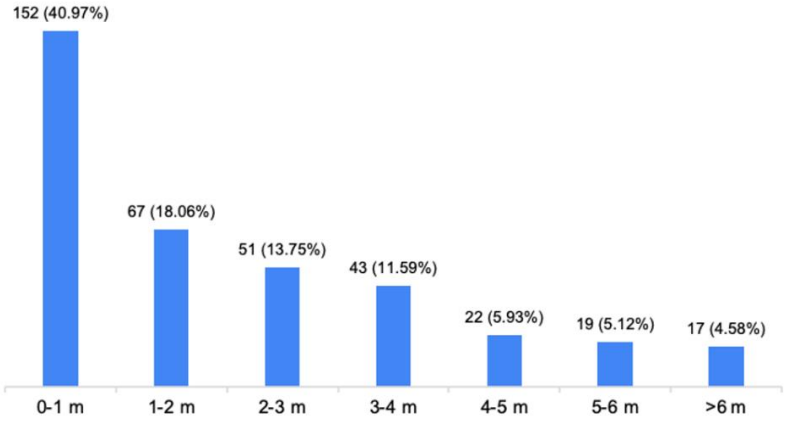

Figure 1. Waiting Time Distribution in Months

Different histopathologies had different waiting times (Table 3). As presented in the table, the majority of intracranial tumor elective surgery was performed less than 3 months after the date of final surgical tolerance. Histopathologically, meningioma accounts for the most cases with the shortest (<3 months) and longest (>6 months) waiting time for elective surgery, at 108 and 14 cases, respectively. Higher grade-tumors such as glioma, lymphoma, and metastasis have higher rates of surgeries within three months (above 80%) compared to lower-grade tumors such as pituitary adenoma, meningioma, and schwannoma (Table 3).

Table 3. Waiting Time by Histopathology

Histopathology	N	Waiting Time		
		<3 months N (%)	3–6 months N (%)	>6 months N (%)
Pituitary Adenoma	38	28 (73.68)	9 (23.68)	1 (2.63)
Meningioma	173	108 (62.42)	51 (29.48)	14 (8.1)
Glioma	77	63 (81.81)	14 (18.19)	0 (0)
Schwannoma	29	19 (65.52)	9 (31.03)	1 (3.45)
Lymphoma	9	9 (100)	0 (0)	0 (0)
Germ Cell Tumor	8	6 (75)	1 (12.5)	1 (12.5)
Craniopharyngioma	8	8 (100)	0 (0)	0 (0)
Metastasis	11	10 (90.9)	1 (9.1)	0 (0)
Other	18	16 (88.9)	2 (11.1)	0 (0)

DISCUSSION

The median age of elective intracranial tumor surgery patients in this study was 45 years. Brain tumors and central nervous system (CNS) tumors are known to be the 8th most common cancers in adults above 40 years old (Ostrom, Francis and Barnholtz-Sloan, 2021). One of the CNS tumor registry studies in Indonesia found that the highest incidence of primary CNS tumors was in the productive age group of 36-45 years (Wahyuhadi *et al.*, 2021). Majority of elective intracranial tumor surgery patients in this study were female, with a ratio of 1.81 (female-to-male).

This finding is in line with previous studies on brain tumors in several Asian countries, which reported brain tumors and CNS tumors were more commonly found in females than in males (Nakamura *et al.*, 2011; Jung *et al.*, 2013; Ardhini and Tugasworo, 2019; Nugroho *et al.*, 2020; Aninditha *et al.*, 2021; Wahyuhadi *et al.*, 2021). However, a study in South Africa found a higher ratio of male patients compared to female patients in elective brain tumor surgery (Kelly, Lekgwara and Mda, 2020). This difference in gender proportion may be due to differences in the study population.

The duration of intracranial tumor surgery in this study was mostly around 3–5 hours (44.47%). This finding is in line with the duration of elective surgery for intracranial tumors in adult patients in Norway, which is known to be a median of 200 minutes or around 3.34 hours (Viken *et al.*, 2018). Meanwhile, a study in Africa found that the average duration of elective surgery for brain tumor patients was 278 minutes or 4.6 hours (range, 2–4 hours) (Kelly, Lekgwara and Mda, 2020). Based on histopathology, the average duration of surgery for meningioma was 9.6 hours (range, 3.9–21.1 hours) (Hsu and Huang, 2016).

Meningioma constitutes the majority of histopathological diagnoses of intracranial tumors in this study (46.63%). Several studies of intracranial tumors in Indonesia found meningioma as the most common type of intracranial tumor (Ardhini and Tugasworo, 2019; Nugroho *et al.*, 2020; Aninditha *et al.*, 2021). Meningioma is known to be the most common intracranial tumor, with a global incidence of 10.82/100,000 per year (Izzuddeen, 2021). Glioma, meningioma, and pituitary tumors are known to be the most common tumor histologies in adults (Jaiswal *et al.*, 2016; Ostrom, Francis and Barnholtz-Sloan, 2021).

The median waiting time for elective intracranial tumor surgery in our study was 44 days, with a mean of 62.87 days. This median waiting time was longer than the study conducted in Cipto Mangunkusumo General Hospital (RSCM) by Nugroho *et al.* (2020), which found a median waiting time for elective intracranial tumor surgery of 35 days. However, the median waiting time for elective intracranial tumor surgery in our study is shorter compared to a study by Sardana *et al.* (2017), which found a median of 110.5 days in waiting time for elective neurosurgery. The median waiting time for surgery in brain tumor patients in low- and middle-income countries (LMICs) was found to be 4.6 days and 50 days (Haizel-Cobbina *et al.*, 2023).

Our study did not identify factors that contributed to the waiting time for elective intracranial tumor surgery. However, our study found that higher-grade tumors such as glioma, metastasis, and lymphoma have higher rates of surgeries within three months compared to lower-grade tumors such as pituitary adenoma, meningioma, and schwannoma. None of the patients with higher-grade tumors had to wait more than six months for surgery. We believe neurosurgeons tend to prioritize higher-grade tumors over lower-grade tumors for treatment. Several other factors could cause differences in waiting time. Patient factors such as age, tumor location, and comorbidities, as well as other factors such as the number of patient queues, operating unit capacity, number of inpatient rooms, and availability of neurosurgeons, can affect the waiting time for elective surgery (Haizel-Cobbina *et al.*, 2023; Immanuel and Dhamanti, 2024; Shakir *et al.*, 2024).

The Prof. Dr. dr. Mahar Mardjono National Brain Center Hospital is one of the vertical hospitals owned by the Ministry of Health Republic Indonesia that handles cases of neurological diseases. In all surgical cases, brain tumors are the majority of cases operated on throughout 2023, which is 561 out of 1910 (29.4%). Currently, there are four operating rooms at the hospital that serve elective surgeries from Monday to Friday. These rooms are divided into three shifts each day, with four elective surgeries in the morning shift, three in the afternoon shift, and one at night. Given the growing demand for neurosurgical procedures, strategies to reduce elective surgery waiting times are essential.

Short-term efficiency improvements can be implemented by optimizing existing resources. Studies have shown that referral management and surgery cancellation prevention significantly reduce wait times by minimizing unnecessary referrals and maximizing surgical capacity (Rathnayake, Clarke and Jayasinghe, 2024). Additionally, perioperative time management, including enhanced scheduling, standardized operating procedures, and better staff coordination, improves operating room (OR) efficiency and patient throughput without requiring additional resources (Stafinski *et al.*, 2022; Rathnayake, Clarke and Jayasinghe, 2024).

However, to achieve a substantial and sustainable reduction in waiting times, long-term measures such as expanding surgical capacity may be necessary. This includes increasing the number of surgeries per day and utilizing weekends (Saturday and Sunday) for elective procedures. This expansion requires additional health workers, surgical instruments, medical supplies, and operating room capacity (Blythe and Ross, 2022; Ginneken *et al.*, 2022; Australian Medical Association, 2023; Oliveira *et al.*, 2023; Getting It Right First Time (GIRFT), 2024). Careful hospital management planning and in-depth analysis are crucial to ensure the feasibility of these infrastructure and workforce enhancements. By combining short-term optimization strategies with long-term capacity expansion, the hospital can effectively reduce elective surgery waiting times and improve access to timely neurosurgical care.

Finally, our study found that the majority of patients undergoing elective intracranial tumor surgery had a waiting time of 0–3 months. This group represents 72.78% of all elective intracranial tumor surgeries. There is no international consensus on the length of waiting time for elective surgery, which is ‘excessive’, but several countries have set a maximum waiting time target of 3–6 months (Hurst and Siciliani, 2003).

CONCLUSION

We analyzed a total of 371 elective intracranial tumor surgeries. The median waiting time for elective intracranial tumor surgery at Prof. Dr. dr. Mahar Mardjono National Brain Center Hospital was 44 days with a mean of 62.87 days. The majority of intracranial tumor cases underwent surgeries less than 3 months after the date of final surgical

tolerance. Meningioma accounts for the most cases operated and accounts for the most cases with the shortest (<3 months) and longest (>6 months) waiting time for elective surgery.

RECOMMENDATION

Based on the research findings, several recommendations are proposed to reduce waiting times for elective intracranial tumor surgery. To facilitate dan ensure shorter waiting times for patients, hospital management should integrate short-term optimization strategies–such as referral management, surgery cancellation prevention, and perioperative management–with long-term capacity expansion. This approach ensures the optimization of existing resources while significantly and sustainably reducing waiting times in the future. Achieving this goal requires careful planning and in-depth analysis. Further research should explore the impact of these strategies on patient outcomes and hospital efficiency, especially in the context of intracranial tumors elective surgery. Potential barriers to implementing these strategies in different healthcare settings should also be further studied.

ETHICAL CLEARANCE

This research obtained ethical approval from the Health Ethics Research Committee of the Prof. Dr. dr. Mahar Mardjono National Brain Center Hospital No. DP.04.03/D.XXIII.9/219/2024.

CONFLICT OF INTEREST

The authors declare that there is no competing financial, professional, or personal interests that might have affected the findings.

AUTHORS' CONTRIBUTION

SAHP: Conceptualization, Methodology, Writing Review and Editing. HNR: Methodology, Writing Review and Editing, Writing Original Draft. AA: Writing Review and Editing. All authors have read and agreed to the published version of the manuscript.

ACKNOWLEDGMENT

Not applicable.

REFERENCES

Ada, M.O.A. *et al.* (2023) 'Waiting times for elective surgery in an African paediatric surgery department', *Annals of Pediatric Surgery*, 19(1), p. 24. Available at: https://doi.org/10.1186/s43159-023-00257-9.

Aninditha, T. *et al.* (2021) 'Adults brain tumor in Cipto Mangunkusumo General Hospital: A descriptive epidemiology', *Romanian Journal of Neurology*, 20(4), pp. 480–484. Available at: https://doi.org/10.37897/RJN.2021.4.13.

Ardhini, R. and Tugasworo, D. (2019) 'Epidemiology of primary brain tumors in dr. Kariadi Hospital Semarang in 2015-2018', *E3S Web of Conferences*. Edited by Hadiyanto, Budi Warsito, and Maryono, 125, p. 16004. Available at: https://doi.org/10.1051/e3sconf/201912516004.

Australian Medical Association (2023) *Addressing the elective surgery backlog*. Available at: https://www.ama.com.au/articles/addressing-elective-surgery-backlog.

Ballini, L. *et al.* (2015) 'Interventions to reduce waiting times for elective procedures', *Cochrane Database of Systematic Reviews*, 2015(2). Available at: https://doi.org/10.1002/14651858.CD005610.pub2.

Blythe, N. and Ross, S. (2022) *Strategies to reduce waiting times for elective care*. Available at: https://www.kingsfund.org.uk/insight-and-analysis/reports/strategies-reduce-waiting-times-elective-care.

De Guzman, G.S. and Sia Su, M.L.L. (2022) 'Patient waiting time analysis for elective gynecologic surgeries in a tertiary training hospital in the Philippines: A retrospective cross-sectional study', *Annals of Medicine & Surgery*, 81. Available at: https://doi.org/10.1016/j.amsu.2022.104403.

De Swart, M.E. *et al.* (2022) 'Between-hospital variation in time to glioblastoma surgery: a report from the Quality Registry Neuro Surgery in the Netherlands', *Journal of Neurosurgery*, 137(5), pp. 1358–1367. Available at: https://doi.org/10.3171/2022.1.JNS212566.

Getting It Right First Time (GIRFT) (2024) *Closing the gap: Actions to reduce waiting times for children and young people*. Available at: https://gettingitrightfirsttime.co.uk/wp-content/uploads/2024/08/UPDATE-Closing-the-gap-CYP-elective-recovery-August-2024.pdf.

Ginneken, E. van *et al.* (2022) *Addressing backlogs and managing waiting lists during and beyond the COVID-19 pandemic*. Copenhagen

(Denmark). Available at: https://www.ncbi.nlm.nih.gov/books/NBK589255/.

Haizel-Cobbina, J. *et al.* (2023) 'A Comparison of Surgery Wait Times and Postoperative Length of Hospital Stay Among Patients with Brain Tumors by Country-Level Income and Healthcare System: A Systematic Review and Meta-analysis', *World Neurosurgery*, 177, pp. 152-164.e13. Available at: https://doi.org/10.1016/j.wneu.2023.06.030.

Hsu, S.-Y. and Huang, Y.-H. (2016) 'Characterization and prognostic implications of significant blood loss during intracranial meningioma surgery', *Translational Cancer Research*, 5(6), pp. 797–804. Available at: https://doi.org/10.21037/tcr.2016.11.72.

Hurst, J. and Siciliani, L. (2003) *Tackling Excessive Waiting Times for Elective Surgery: A Comparison of Policies in Twelve OECD Countries*. Available at: https://doi.org/10.1787/108471127058.

Immanuel, T. and Dhamanti, I. (2024) 'Faktor yang Mempengaruhi Waktu Tunggu Operasi Elektif di Rumah Sakit', *Jurnal Kesehatan Tambusai*, 5(1), pp. 2159–2166. Available at: https://doi.org/doi.org/10.31004/jkt.v5i1.26405.

Izzuddeen, Y. (2021) 'Meningioma', in *Evidence based practice in Neuro-oncology*. Singapore: Springer Singapore, pp. 321–329. Available at: https://doi.org/10.1007/978-981-16-2659-3_30.

Jaiswal, J. *et al.* (2016) 'Spectrum of primary intracranial tumors at a tertiary care neurological institute: A hospital-based brain tumor registry', *Neurology India*, 64(3), p. 494. Available at: https://doi.org/10.4103/0028-3886.181535.

Jung, K.-W. *et al.* (2013) 'An Updated Nationwide Epidemiology of Primary Brain Tumors in Republic of Korea', *Brain Tumor Research and Treatment*, 1(1), p. 16. Available at: https://doi.org/10.14791/btrt.2013.1.1.16.

Kelly, A., Lekgwara, P. and Mda, S. (2020) 'The epidemiology and outcome of patients admitted for elective brain tumour surgery at a single neurosurgical centre in South Africa', *Interdisciplinary Neurosurgery*, 21, p. 100750. Available at: https://doi.org/10.1016/j.inat.2020.100750.

McIntyre, D. and Chow, C.K. (2020) 'Waiting Time as an Indicator for Health Services Under Strain: A Narrative Review', *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 57. Available at: https://doi.org/10.1177/0046958020910305.

Müller, D.M.J. *et al.* (2021) 'Timing of glioblastoma surgery and patient outcomes: a multicenter cohort study', *Neuro-Oncology Advances*, 3(1). Available at: https://doi.org/10.1093/noajnl/vdab053.

Nakamura, H. *et al.* (2011) 'Epidemiological study of primary intracranial tumors: a regional survey in Kumamoto prefecture in southern Japan—20-year study', *International Journal of Clinical Oncology*, 16(4), pp. 314–321. Available at: https://doi.org/10.1007/s10147-010-0178-y.

Nugroho, S.W. *et al.* (2020) 'Hubungan Waktu Tunggu Menuju Operasi Pengangkatan Tumor Intrakranial dengan Skala Performa Karnofsky Pascaoperasi', *Majalah Kedokteran Neurosains Perhimpunan Dokter Spesialis Saraf Indonesia*, 37(4). Available at: https://doi.org/10.52386/neurona.v37i4.175.

OECD. (2019) *Health at a Glance 2019: OECD Indicators*. OECD Publishing. Available at: https://doi.org/10.1787/4dd50c09-en.

OECD. (2020) *Waiting Times for Health Services: Next in Line*. OECD. Available at: https://doi.org/10.1787/242e3c8c-en.

Oliveira, M. *et al.* (2023) 'A systematic literature review on the utilization of extended operating room hours to reduce surgical backlogs', *Frontiers in Public Health*, 11. Available at: https://doi.org/10.3389/fpubh.2023.1118072.

Ostrom, Q.T., Francis, S.S. and Barnholtz-Sloan, J.S. (2021) 'Epidemiology of Brain and Other CNS Tumors', *Current Neurology and Neuroscience Reports*, 21(12), p. 68. Available at: https://doi.org/10.1007/s11910-021-01152-9.

Oudhoff, J.P. *et al.* (2007) 'Waiting for elective surgery: Effect on physical problems and postoperative recovery', *ANZ Journal of Surgery*, 77(10), pp. 892–898. Available at: https://doi.org/10.1111/j.1445-2197.2007.04268.x.

Prin, M. *et al.* (2018) 'Emergency-to-Elective Surgery Ratio: A Global Indicator of Access to Surgical Care', *World Journal of Surgery*, 42(7), pp. 1971–1980. Available at: https://doi.org/10.1007/s00268-017-4415-7.

Rathnayake, D. and Clarke, M. (2021) 'The effectiveness of different patient referral systems

to shorten waiting times for elective surgeries: systematic review', *BMC Health Services Research*, 21(1), p. 155. Available at: https://doi.org/10.1186/s12913-021-06140-w.

Rathnayake, D., Clarke, M. and Jayasinghe, V. (2021) 'Patient prioritisation methods to shorten waiting times for elective surgery: A systematic review of how to improve access to surgery', *PLOS ONE*. Edited by E. Hasanpoor, 16(8), p. e0256578. Available at: https://doi.org/10.1371/journal.pone.0256578.

Rathnayake, D., Clarke, M. and Jayasinghe, V. (2024) 'Global strategies to reduce elective surgery waiting times for sustainable health outcomes: a systematic review', *Hospital Practice*, 53(1). Available at: https://doi.org/10.1080/21548331.2024.2435802.

Salci, L. *et al.* (2016) 'Impact of Surgical Waitlist on Quality of Life', *Journal of Knee Surgery*, 29(04), pp. 346–354. Available at: https://doi.org/10.1055/s-0035-1564596.

Sardana, S.R. *et al.* (2017) 'Analysis of waiting time for elective surgical procedures in neurosurgery department at a tertiary care teaching hospital in NCT, India', *International Journal of Research in Medical Sciences*, 5(10), p. 4538. Available at: https://doi.org/10.18203/2320-6012.ijrms20174592.

Shakir, M. *et al.* (2024) 'Barriers to Neurosurgical Care of Brain Tumors in Low- and Middle-Income Countries: A Systematic Review of the Service Delivery Challenges', *World Neurosurgery*, 187, pp. 211-222.e3. Available at: https://doi.org/10.1016/j.wneu.2024.05.044.

Stafinski, T. *et al.* (2022) 'Reducing wait times to surgery—an international review', *Journal of Hospital Management and Health Policy*, 6, pp. 29–29. Available at: https://doi.org/10.21037/jhmhp-21-96.

Sutherland, J.M. *et al.* (2016) 'Health of patients on the waiting list: Opportunity to improve health in Canada?', *Health Policy*, 120(7), pp. 749–757. Available at: https://doi.org/10.1016/j.healthpol.2016.04.017.

Viken, H.H. *et al.* (2018) 'When Are Complications After Brain Tumor Surgery Detected?', *World Neurosurgery*, 112, pp. e702–e710. Available at: https://doi.org/10.1016/j.wneu.2018.01.137.

Wahyuhadi, J. *et al.* (2021) 'The Indonesian Central Nervous System Tumors Registry (Ina-CTR) : 7 years result from single institution of primary brain tumor epidemiology', *Indonesian Journal of Neurosurgery*, 4(1). Available at: https://doi.org/10.15562/ijn.v4i1.142.