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Epidemiological, diagnostic and therapeutic profile of cerebral tumors in the radiotherapy department of Dalal Jamm hospital

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Abstract

Introduction: Brain tumors, whether benign or malignant, primary or secondary, raise public health concerns due to their relative rarity and high mortality and morbidity rates. They account for 1.6% of all cancer cases, with types predominating according to patient age and gender. Brain metastases are more frequent than primary malignant brain tumors. Advances in imaging have improved diagnosis and management, but the constraints of the African context limit access to care.

Materials and Methods: This retrospective study included 105 patients with brain tumors treated between June 2018 and October 2022 at the Dalal Jamm Hospital in Guediawaye. Sociodemographic, clinical, radiological, therapeutic and evolutionary data were analyzed. Statistical analysis was performed with SPSS.

Results: Of 1,740 patients treated with radiotherapy, 105 had brain tumors. Women were more numerous, with a mean age of 43.17 years. The most common symptoms were related to intracranial hypertension. The majority of patients were in good general condition on admission. The mean time from diagnosis of the primary lesion to the appearance of brain metastases was 48.37 weeks. Magnetic resonance imaging was underused. Secondary brain tumors were frequent, mainly of mammary origin. Radiotherapy was the main treatment, but limited access to radiotherapy centers led to delays. Radiotherapy doses varied according to tumor type. Concomitant chemotherapy was given for high-grade gliomas, but its use was limited due to cost and drug shortages. Palliative chemotherapy was rarely used. Median survival was 3 months.

Keywords: Brain tumors; Brain metastases; Radiotherapy; Imaging; Africa; Prognosis

1. Introduction

Brain tumors, whether benign or malignant, primary or secondary and developing from the brain parenchyma, are of major public health concern, given their relative rarity, due to the associated mortality and morbidity rates (1).

Central nervous system (CNS) tumors accounted for 1.6% of all cancer cases in 2020 (1). In adults, glioblastoma (48.6%) dominates among primary malignant tumors, while meningioma (53.9%) is predominant among benign tumors (2). For children, the most common tumors are pilocytic astrocytoma (17.5%) and embryonal tumors (15.7%) before the age of 14, while pituitary tumors (24.7%) prevail between the ages of 15 and 19 (3).

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It should be noted that brain metastases constitute the main brain tumour pathology in adults (4-6), being present in 20 to 40% of patients with malignant tumours, and are ten times more frequent than primary brain malignancies (7,8).

Significant advances in imaging techniques have considerably improved the diagnostic and therapeutic approach to brain tumors. The management of these tumors requires a multidisciplinary approach involving neurologists, neuroradiologists, neurosurgeons, neuroanesthetists, anatomopathologists, medical oncologists, radiation therapists and psychologists.

However, it is important to note that constraints specific to the African context, such as the lack of resources for investigations and disparities in patient care, constitute real obstacles to the management of brain tumors and the conduct of studies on them.

Thus, our retrospective study aims to evaluate the impact of radiotherapy in the management of brain tumors and to analyze the profile of patients followed for these tumors in the radiotherapy department of the Dalal Jamm Hospital in Guediawaye, by examining their medical evolution.

2. Materials and Methods

2.1. Patient characteristics

This study is retrospective, descriptive, and analytical in nature, covering a sample of 105 patients with brain tumors treated at the Radiotherapy Department of the Dalal Jamm National University Hospital (CHNDJ) in Guédiawaye, over the period extending from June 2018 to October 2022. Inclusion criteria were as follows:

- Patients registered at the Centre Hospitalier Dalal Jamm.
- Patients diagnosed with a brain tumor.
- Patients who had received radiotherapy treatment.

2.2. Data studied

Data were collected using an operating form including the following elements: socio-demographic characteristics, World Health Organization (WHO) general health classification, clinical examination findings (including neurological and extraneurological signs), histological type of tumor, radiological findings (CT, MRI), treatments administered (surgery, radiotherapy, chemotherapy), the time lapse between surgery and radiotherapy, the location of the primary lesion in the case of brain metastases, the sequence of appearance of brain metastases, the presence or absence of metastases outside the brain, and the clinical course.

2.3. Statistical analysis

Statistical analysis of the data was carried out using SPSS version 23 software. Categorical variables were presented as frequencies (n) and percentages (%).

3. Results

During the study period, the radiotherapy department treated a total of 1,740 patients, of whom 136 cases of brain tumors were identified, representing 7.8% of the total. Of these, 105 were included in our study. Female patients significantly outnumbered males, with 79 females (75.2%) and 26 males (24.8%), resulting in a sex ratio of 0.32 (Figure 1). The mean age of our patients was 43.17 years, ranging from 8 to 73 years. The most affected age group was 50-60 years. Pediatric patients accounted for 10.5% of the sample, while adults made up 89.5% (Figure 2).

At diagnosis, the most commonly observed symptoms included signs of intracranial hypertension, notably headache (72.4%), vomiting (30.5%) and decreased visual acuity (28.6%) (Figure 3). All patients had been assessed as to their general condition at their first consultation. Over half (52.4%) were classified as WHO stage 1, 29.6% as stage 2 and 13.3% as stage 3 (Table 1).

Table 1 Distribution of patients by WHO status

	Frequency	**Percentage**
WHO 0	5	4,8
WHO 1	55	52,4
WHO 2	31	29,6
WHO 3	14	13,3
Total	105	100,0

Table 2 Distribution of tumors by location

Nature of the tumor	**Location**		
	SupraT	**underT**	**underT-SupraT**
Primary	19	2	1
Secondary	48	4	7
Total	67	6	8

Table 3 Total prescribed dose and fractionation

Secondary Cancer (N = 79)	**Average**	**21,29**	**3,8**
	Median	**20**	**4**
Primary Cancer (N = 26)	Average	52.1	2
	Median	54	2

The mean time from diagnosis of the primary lesion to onset of brain metastasis was 48.37 weeks, ranging from 0 to 208 weeks. Synchronous brain metastases, occurring at the same time as the discovery of the primary lesion, were observed in 2.1% of patients. For patients with breast cancer, the mean delay was 47.1 weeks, while it was 2 weeks for primary pulmonary lesions.

Of the 105 patients, 96 (91.1%) had undergone brain CT, of whom 22 had also had complementary brain MRI, while 3 had only had MRI, representing 25.5%.

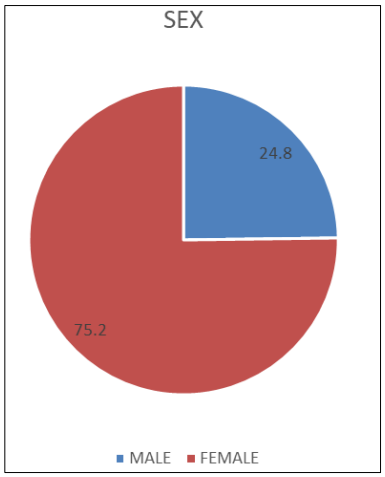

Figure 11 Distribution of patients by gender

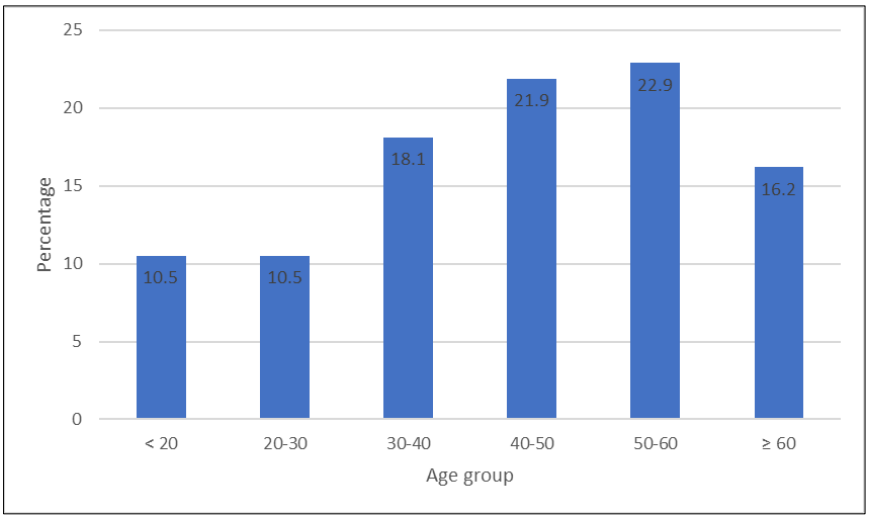

Figure 2 Patient distribution by age group

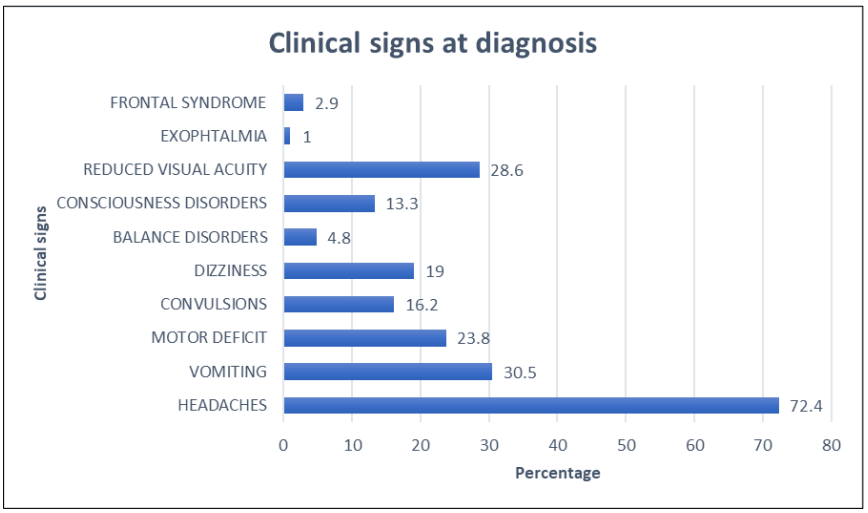

Figure 3 Distribution of clinical signs at diagnosis

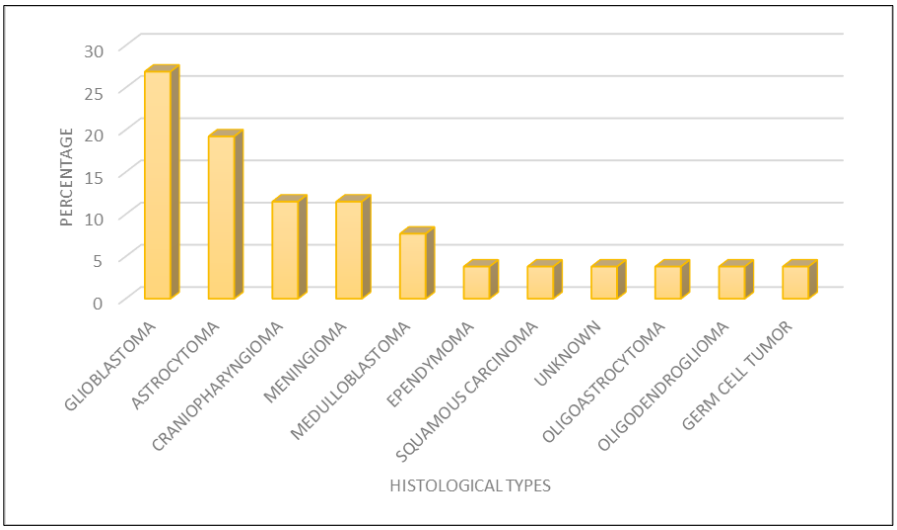

Figure 4 Histological type of primary brain tumors

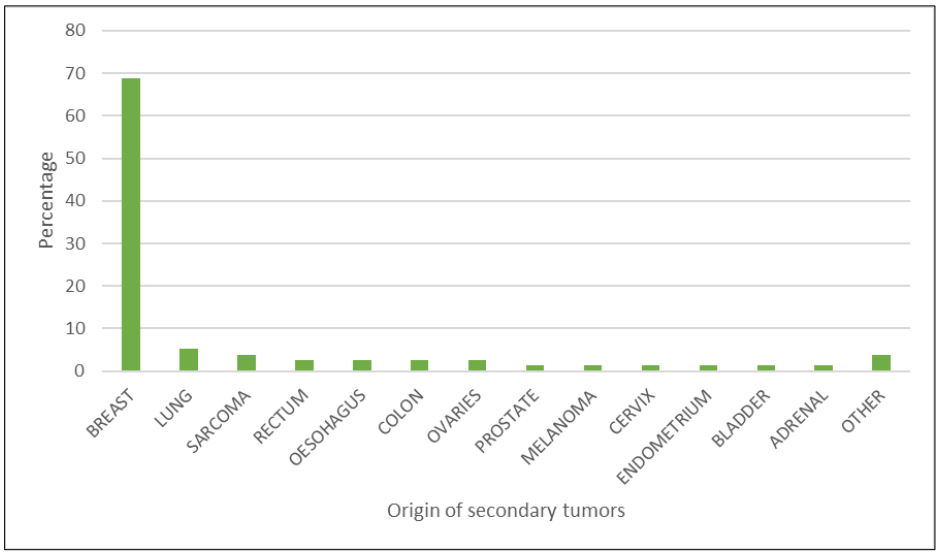

Figure 52 Distribution of secondary tumors by origin

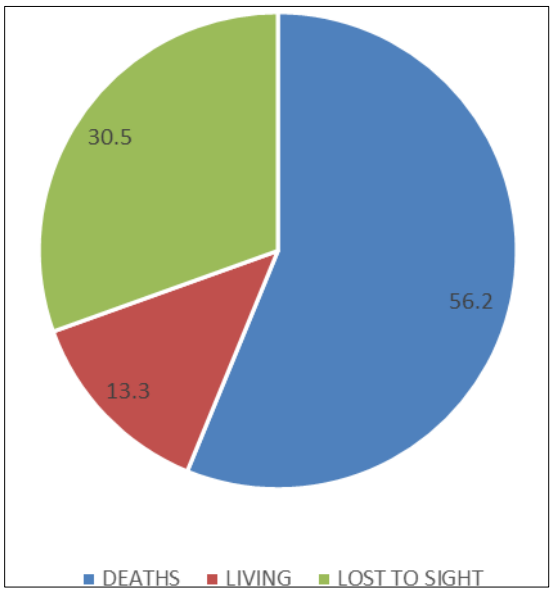

Figure 6 Distribution of patients according to evolution

We identified 41 patients (48.3%) with multiple brain lesions, mainly secondary tumors. The remaining 44 patients (51.8%) had a single brain lesion. In addition, 67 patients (63.8%) had brain tumors located above the tentorium, while 6 patients (5.7%) had tumors located below the tentorium. The remaining 8 patients (7.6%) had lesions both above and below the tentorium, and for 24 patients, the location was unspecified (Table 2).

Of the 71 patients with secondary brain tumors (after excluding missing data), 45 (63.4%) also had secondary lesions outside the brain, while 26 (36.6%) did not. Among patients with secondary tumors, other extra-cerebral metastatic sites were observed, notably in the lungs (37.2%), liver (19.8%) and bone (18.6%). Lymph node, mediastinal and splenic metastases were less frequent.

Regarding histological type, we found glioblastoma in 26.9% of cases, astrocytoma in 19.23%, craniopharyngioma and meningioma in 11.5% of cases each (Figure 4).

In our study, the vast majority of patients (75.2%) had secondary brain tumours, mainly from breast cancer (68.8%), followed by lung cancer (5.2%) and sarcomas (3.9%). Other types of cancer, such as esophageal, rectal and ovarian, were less frequent (2.6% each) (Figure 5).

All patients undergoing surgery had been referred from neurosurgical departments (25 cases of primary tumors and 2 cases of secondary tumors), i.e. 25.7%. MRI performed 48 hours after surgery was not systematic.

The time from surgery to the start of radiotherapy ranged from 7 to 60 weeks, with a mean of 21.2 weeks.

All patients had received radiotherapy, using the three-dimensional (3D) conformal technique with dosimetric CT simulation. Radiotherapy doses administered to secondary tumors ranged from 20 Gy to 40 Gy, in fractions of three to four Gy, five days a week, with a mean dose of 21.29 Gy and a median of 20 Gy (Table 3). This involved irradiation of the whole brain, sometimes with a higher dose within the tumor. The mean duration of radiotherapy for these patients was 8.47 days, with a median of 7 days.

Patients with primary tumors received radiotherapy doses ranging from 30 Gy to 60 Gy, in fractions of two to three Gy, five days a week, with a mean dose of 52.1 Gy and a median of 54 Gy (Table 3). The mean duration of radiotherapy for these patients was 39 days, with a median of 40 days.

We identified 6 cases of high-grade glial tumors, including 5 cases of glioblastoma and one case of anaplastic oligoastrocytoma. Of these patients, 66.7% also received concomitant Temozolomide-based chemotherapy.

Palliative chemotherapy was indicated for patients with secondary tumors, but only 39.24% received it after radiotherapy.

In terms of patient outcome, 56.2% died, with a median survival time of 3 months (ranging from 3 days to 27 months). Fourteen patients (13.3%) are still alive, while 32 (30.5%) have been lost to follow-up (Figure 6).

4. Discussion

4.1. Incidence and demographic characteristics

Tumors of the central nervous system (CNS) remain a rare entity, with 105 cases recorded during our study period, equivalent to an average of 26 cases per year. These results are in line with those of the study carried out by Motah et al. in Cameroon, which recorded 150 cases over a 9-year period, equivalent to an incidence of 15 cases per year (9). The rarity of brain tumours partly explains the low number of cases in our series. In addition, many patients requiring postoperative adjuvant treatment are not systematically referred for radiotherapy, and some are referred to other radiotherapy centers in Dakar.

With regard to gender distribution, our study also showed a predominance of females, in correlation with the results of the study carried out by Zouaoui et al. in France, where 53.3% of patients were female (10). This predominance may be explained in part by the high frequency of brain metastases, particularly from breast cancer, a disease that predominantly affects women (11).

4.2. Clinical presentation

At the time of diagnosis, the clinical presentation of our patients was mainly characterized by symptoms of intracranial hypertension, such as headache, decreased visual acuity and vomiting. These findings are consistent with data from Kirby's meta-analysis, where headache was present in 48-71% of patients (12). A Moroccan series by Kozmane also showed that 65.95% of patients had headaches (13).

Seizures were present in 16.2% of our patients, which is lower than the 40-60% reported by Vecht et al. (14). Tumor-induced seizures are multifactorial and less frequent in high-grade glioma and secondary tumors (15). This finding is in agreement with our series, where secondary tumors predominated, and glioblastoma was the most common primary tumor.

The majority of our patients (86.8%) had good general condition, with a WHO score ≤ 2, while only 13.3% presented with impaired general condition. These results are comparable to those of a German study, where more than half the

patients had a WHO score ≤ 2 (16). This observation suggests that diagnoses are becoming increasingly early, resulting in better general condition at presentation.

In our study, the vast majority of patients (97.8%) had brain metastases metachronous to their primary cancer, while only 2.1% had synchronous brain metastases. This is in line with the findings of Takakura, who noted that 20% of his 928 patients with brain metastases had brain metastases revealing the primary disease (17). Furthermore, he observed that 25% of lung cancer brain metastases were revelatory, in contrast to breast cancer. In our study, 50% of lung cancer brain metastases were revelatory. In general, brain metastases from lung cancer were more frequently revelatory of the primary disease than those from breast cancer.

The mean time between diagnosis of the primary tumor and brain metastasis was 48.37 weeks, ranging from 2 weeks for primary lung sites to 47.1 weeks for primary breast sites. A Swedish series by Smedby et al. showed similar delays, ranging from 12 weeks for lung cancer patients to 168 weeks for breast cancer patients (18). These results suggest that brain metastases develop later in breast cancer than in lung cancer, in part due to significant advances in breast cancer management.

4.3. Paraclinical data

Magnetic resonance imaging (MRI) remains the preferred imaging modality for the evaluation of brain tumors due to its high resolution, favorable safety profile and superior sensitivity compared with computed tomography (CT) (19,20). However, in our cohort, only 25% of patients benefited from this imaging modality, a percentage similar to the results of studies carried out in Madagascar (9%) and Senegal (15%) by Thiam et al. (21,22). Conversely, in the Moroccan study by Kozmane, all patients benefited from MRI (13). These variations may be explained in part by the difficulties of access to MRI in Senegal, where CT remains the most widely used imaging technique due to its high cost, which limits its accessibility to a large part of the population.

In our series, 36.6% of patients had brain metastases as their only metastatic manifestation. In 63.4% of cases, other metastatic sites were present, mainly in the lung (37.2%), liver (19.8%) and bone (18.6%). These results differ slightly from those of Mané's study, which found 56% of cases with exclusive brain metastases and 44% with other metastatic sites, mainly lung (22%) and bone (12%) (23).

4.4. Histological data

Secondary tumors were predominant in our series, in contrast to the results reported by Thiam et al. in their study conducted at Fann University Hospital in Dakar, where the frequency of secondary tumors was 2.9%. This difference is mainly due to the data collection criteria in the Thiam et al. study, which was limited to patients with histologically confirmed secondary brain tumors. In our study, only two patients underwent brain biopsy for definitive anatomopathological diagnosis. However, in current practice, in the presence of neurological symptoms in a patient with a known and progressive cancer, the diagnosis of brain metastasis is generally based on radiological features, due to the ease of access to imaging and the quality of the information it provides (4). Consequently, biopsy is the exception rather than the rule.

It should be noted that the incidence of primary tumors reported in our series could be underestimated for several reasons: the limitation of our series to data from one oncology department, the fact that patients with benign brain tumors that have been completely resected or have a low evolutionary potential are not systematically referred for radiotherapy, the death of patients after surgery and before the availability of anatomopathological reports, as well as financial constraints linked to the inaccessibility of radiotherapy for many patients. In other parts of the world, CNS tumours are more dominated by metastatic lesions (24,25), which may be linked to the greater availability of effective therapeutic means and improved CNS imaging techniques.

Among the primary tumors, gliomas, particularly astrocytomas, predominated, with a clear prevalence of glioblastoma (26.9%). These results are consistent with other studies.

As for benign tumors, meningioma and craniopharyngioma were the most common histological types, a finding similar to that of the US study by Miller et al. published in 2021, which revealed that the majority (56%) of patients presented with meningioma (27).

4.5. Therapeutic data

In Landoure's study, only 22.2% of patients underwent surgery (28). Our results are in agreement with this series, but differ from those of Zouaoui et al. who observed that 68.6% of patients underwent surgery, whether excision or biopsy (10). This disparity can be explained by the limitations in terms of the technical platform for the management of brain tumors in our country (23,29), the limited number of neurosurgeons (26) and neurosurgical departments (8) for a population of 17 million in Senegal.

Radiotherapy plays an essential role in the treatment of brain tumors, but in Senegal there are only two public and one private radiotherapy center for the whole country. This shortage of centers means long waiting lists, and unfortunately, some patients die before they can even consult for their treatment, while others die before their radiotherapy begins.

The radiation dose administered to patients with secondary tumors ranged from 20 Gy to 40 Gy in fractions of three to four Gy, in line with international recommendations. Most patients (77.2%) received a dose of 20 Gy in 5 fractions of 4 Gy. This approach consisted of a complete irradiation of the brain, with possible dose overimpression in the tumor.

It should be noted that in the Senegalese study by Mané and in the Algerian series by Chami et al. all patients underwent total brain irradiation (23,29). This technique is widely accepted in the treatment of brain metastases, particularly multiple brain metastases, due to its rapid and effective efficacy (30). However, in recent years, stereotactic irradiation has gained in importance for improving local tumor control. Unfortunately, stereotaxis is not yet available in Senegal.

For patients with primary tumors, the radiation dose varied from 30 Gy to 60 Gy in fractions of two to three Gy, five days a week, depending on tumor histology.

Concurrent and adjuvant chemotherapy based on temozolomide (TMZ) is indicated for high-grade gliomas, in accordance with the Stupp protocol (31). The addition of TMZ to radiotherapy early in the course of glioblastoma has shown a significant survival benefit (31). In our study, only 66.7% of patients benefited from this approach, due to the drug's high cost and limited availability. Moreover, TMZ stock shortages in pharmacies are frequent.

As for palliative chemotherapy, only 39.24% of patients in our series benefited from it. These results are similar to Mané's study, where only 21.5% of patients received palliative chemotherapy, but differ from the Algerian series reviewed by Chami et al. where palliative chemotherapy was administered in 81.6% of cases (23,29).

5. Conclusion

Brain tumors are rare conditions, accounting for 1.6% of all cancers, but they generate significant morbidity and mortality. The exact incidence of these tumors remains unknown in our region, in the absence of cancer registries. The majority of patients present with symptoms related to intracranial hypertension. Secondary tumors arise mainly from the breast, while glioblastomas dominate among primary tumors. Standard treatment includes surgery, possibly combined with radiotherapy and chemotherapy. Despite therapeutic advances, the prognosis for patients with brain tumors remains poor.

Compliance with ethical standards

Disclosure of conflict of interest

No conflicts of interest to report.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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