





Original Research

Epidemiological trends and factors associated with survival in patients with medulloblastoma: A 45-year population-based retrospective study

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Highlights

- In this population-based study that patients with MB, age-adjusted incidence rates remained relatively stable between 1975 and 2019.
- Female incidence was stabilizing over time, while male incidence was increasing, with an APC of 0.35. This study evaluated independent prognostic factors associated with survival in patients with MB.
- Patients with MB in the high-risk group may benefit from chemotherapy.

Abstract

Medulloblastoma (MB) is a primary brain malignancy. However, updated epidemiological data and long-term

outcomes are lacking. The clinical and epidemiological datasets of patients with MB in the current study were obtained from the Surveillance, Epidemiology, and End Results (SEER) databases. Joinpoint regression models were used to assess the rate of changes in the incidence, prevalence, and treatment trends in patients with MB. Cox hazard and competition risk model analyses were used to assess overall survival (OS) and cancer-specific survival (CSS). The age-adjusted incidence of MB remained relatively stable at 0.15 per 100,000 individuals in 2019. The annual percentage change (APC) of females remained stable, whereas that of males increased over time. The 20-year limited-duration prevalence of patients with MB increased significantly from 0.00016% in 1999 to 0.00203% in 2018. Patients aged 5–19 years accounted for 46.7% of all age groups, and the trend for the three treatments was increased. Average annual percentage change (AAPC) for the chemotherapy group was increased in patients aged 20+ years MB [AAPC=2.66 (95% CI 0.93–6.31)]. Multivariate analysis revealed that OS and CSS varied significantly according to age, year of diagnosis, histology, stage, surgery, and radiotherapy. Subgroup analysis showed that chemotherapy was associated with a favorable prognosis in high-risk groups. The incidence of MB remained relatively stable, and its prevalence increased significantly. This current population-based study further identified the prognostic factors in patients with MB. Moreover, the use of chemotherapy was associated with better survival in high-risk groups.

Introduction

Medulloblastomas (MBs) are the most common embryonal tumors located in the cerebellum, accounting for less than 2.6% of primary brain and other central nervous system (CNS) tumors [1]. The incidence of MB in childhood is approximately 0.6 per 100,000 per year [2], and it is rare in adults. Despite the addition of multiple therapies, there is still relatively poor long-term survival and high lethality for some subtypes, even with the addition of multiple therapies [3]. Medulloblastomas have been classified into four molecular subtypes: Wnt, SHH, Group 3, and Group 4, among which Wnt has the best prognosis and Group 3 the worst [4]. Additionally, the high cost treatment poses a significant challenge for families with children. The implementation of monitoring and treatment strategies that consider the population has always been a crucial objective of global health policies.

Embryonal tumors include medulloblastomas, atypical teratoid/rhabdoid tumors (ATRT), and CNS embryonal tumors (NOS), according to the 2016 CNS World Health Organization (WHO) classifications [5], with MB accounting for the largest proportion. Previous studies have reported that the incidence of MB has remained unchanged over the last few decades [2], [6], [7]. However, the current epidemiology of MB after pathological updates is lacking. The management of MB involves postoperative treatment consisting of a combination of irradiation and chemotherapy. The diagnosis and treatment of MB continues to progress and update [3], [8], yet previous epidemiological studies have focused more on the reported incidence of MB and less on the reported prevalence and changes in treatment modalities.

Randomized trials comparing treatments with or without chemotherapy for adult MB are lacking, primarily due to the low incidence of the disease in adults. Consequently, most treatment protocols for adult patients with MB are based on studies conducted on children [9]. While some evidence does not support the role of chemotherapy in improving the outcomes of adult patients with MB [10], [11], [12], recent retrospective studies also have supported the benefit of chemotherapy in adults with MB [13], [14], [15], [16], [17], [18], [19]. However, there is no consensus regarding chemotherapy protocols. In this present study, chemotherapy was investigated in adult patients with MB.

To the best of our knowledge, there have been studies related to some aspects of MB [6], [20]. However, no recent studies have investigated the changes in incidence, prevalence, and treatment. Therefore, this study aims to analyze epidemiological trends and prognostic factors in patients with MB. Furthermore, it aims to analyze the benefits of chemotherapy in adult patients with MB, with the intention of aiding clinical decision-

making.

Section snippets

Data source

Description of the current study design, including demographic and inclusion criteria, is provided in eFig. 1. To ensure the efficient use of the tumor case database, we precisely calculated the incidence rates by combining SEER8 (1975–1991), SEER12 (1992–1999), and SEER17 (2000–2019) [20]. A 10- and 20-year analysis of the SEER12 registry (1992–2020) provided limited and persistent incidence rates. The incidence and prevalence rates were based on the standard population of the United States in ...

Annual incidence overall time

The overall age-adjusted incidence of MB was 0.12 per 100,000 persons in 1975, which remained relatively stable at 0.15 per 100,000 persons in 2019, with minor fluctuations from 1975 to 1988 [APC=-2.54, 95% CI -17.62, 0.33] and 1988–2019 (APC=0.62, 95% CI 0.09, 2.99), as shown in Fig. 1A and eFig.2. Across over 45 years, the overall incidence of all embryonal tumors increased significantly from 1975 to 1999 [APC=1.26 (95% CI 0.55, 6.72); eFig. 2] and then remained stable from 1999 to...

Discussion

This study provides an overview of the epidemiology and prognostic factors of MB, as well as outcomes based on chemotherapy in adult patients. First, the age-adjusted annual incidence of MB did not change, while the prevalence increased significantly. Second, the trends of the three treatments for MB increased in patients aged 5–19 years, and the AAPC of the chemotherapy group increased in adult patients. Third, OS and CSS were associated with age, histology, stage, and treatment modality....

Conclusions

Our population-based analysis revealed that the incidence of MB remained relatively stable, and the prevalence of MB increased significantly from 1975 to 2019. Furthermore, chemotherapy was associated with improved outcomes in the high-risk groups....

Ethics approval and consent to participate

The data analyzed and used in this study was obtained from Surveillance, Epidemiology, and End Results (SEER) database in accordance with the SEER data use agreement. Therefore, this study did not require approval of ethical board....

Availability of data and materials

Publicly available datasets were analyzed in this study. These data are available at www.seer.cancer.gov/....

Author contributions

Concept and design of the study were conducted by DH, YY, and ZY. Data collection, analysis, and

interpretation of the study were performed by DH, PW, and SZ. DH, HC, and CZ were responsible for creating figures and tables. DH and PW drafted the manuscript, while QS, CZ, and ZY contributed to the manuscript revision. The final manuscript was reviewed, checked, and approved by all authors....

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CRedit authorship contribution statement

Dongjie He: Writing – original draft, Data curation, Conceptualization. **Yahui Yang:** Conceptualization. **Peiwen Wu:** Writing – original draft, Data curation. **Siying Zhu:** Methodology, Data curation. **Hao Chang:** Software, Methodology, Data curation. **Chao Zhang:** Software, Methodology, Data curation. **Qiuju Shao:** Writing – review & editing. **Zongyan Yu:** Writing – review & editing, Conceptualization....

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper....

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