The incidence of brain tumours in Iran: A systematic review and meta-analysis

Article · January 2019
DOI: 10.4103/AIHB.AIHB_60_18

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Abstract

Background: Brain tumours (BTs) constitute approximately 88% of all central nervous system tumours. The present study aimed to determine the age-standardised rate (ASR) of BTs in Iran. Methods: A comprehensive search was conducted on all studies of BTs incidence using Medline/PubMed, Scopus, Embase, Google Scholar and Web of Sciences as international databases and Scientific Information Database, MagIr, IranMedex and IranDoc as Iranian databases until April 2018. This systematic review was done based on the preferred reporting items for systematic reviews and meta-analyses. Results: The primary search yielded 312 relevant studies. A total of 17 studies were included after more detailed retrieval. The results of the random-effect model were demonstrated the ASR of BTs was 4.16 (95% confidence interval [CI], 3.20–5.12) for males and 3.40 (95% CI, 2.67–4.13) for females. Conclusion: The incidence of BTs is lower in Iran compared to other parts of the world. The incidence of nervous system cancers is increasing base on region, geographical, and economic conditions in Iran. Hence, training programmes can be considered to reduce the risk factors, complications of nervous system cancers and early diagnosis of nervous tumors.

Keywords: Brain tumours, incidence, Iran, systematic review

Introduction

Brain tumours (BTs) constitute approximately 88% of all central nervous system (CNS) tumours.1 However, the International Classification of Disease for Oncology defines meningeal, pituitary gland, pineal gland and nervous tumours (NTs) as CNS tumours.2

The malignant and benign BTs consist of a group of diverse and uncommon diseases with various presentations according to location, morphology, molecular biology and clinical behaviour.3 Due to the different location of these tumours, the clinical outcome of malignant or benign tumours is different and often life-threatening.3 The current prevalence of BTs is not critical; however, their incidence is rapidly rising worldwide.4 These tumours may present with mental changes and neurological deficits, and the social burden of these types of tumours is as high as other tumours. Thus, it is essential to improve the knowledge of the BTs epidemiology to facilitate the diagnosis, prevention and even initial treatment of the diseases.3

Previous reports demonstrated that the incidence of BTs is different among countries worldwide. In general, the incidence of BTs is higher in the West than the East and higher in developed countries than developing countries.5 In 2012, the CNS tumours accounted for approximately 255,000 new cases, <30% of all new cancers worldwide.6 The age-adjusted...
distribution of these diseases is also different worldwide, with the highest incidence in Australia, North America and North Europe and the lowest incidence in Africa. The incidence is far more among the Caucasians than African Americans.\[8\]

Epidemiologic studies in different regions of the world indicate that men are more likely at higher risk for BTs than women.\[9\] In addition, an age distribution model also indicates that the highest incidence of these cancers occurs in adults over 60 years old, adolescents and also children aged 0–4 years.\[10,11\]

In Iran, there are a few epidemiological studies about the CNS tumors\[12,13\] and there is no report of estimate about the incidence of these cancers. Since prevention, diagnosis and treatment planning need to know about the incidence and trend of BTs. No systematic review of the epidemiology of CNS cancers carried out in Iran and the present study aimed to determine the age-standardised rate (ASR) of brain and CNS cancers in Iran.

**Methods**

The systematic review and meta-analysis were designed and conducted based on the preferred reporting items for systematic reviews and meta-analyses checklist in 2018.\[14\]

**Search strategy of systematic reviews**

A comprehensive search was conducted on all published studies of BTs incidence using Medline/PubMed, Scopus, Embase, Google Scholar and Web of Sciences as international databases and Scientific Information Database (www.sid.ir), MagIran (www.magiran.com), IranMedex (www.barakatkns.com) and IranDoc (www.irandoc.ac.ir), as Iranian national databases until April 2018.

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Q. 1: Samples were representative?, Q. 2: Participants were appropriately recruited?, Q. 3: Sample size was adequate?, Q. 4: Study subjects and the setting were described?, Q. 5: Data analysis was conducted?, Q. 6: Objective, standard criteria and reliably were used?, Q. 7: Appropriate statistical analyses were used?, Q. 8: Confounding factors, subgroups and differences were identified and accounted?, Q. 9: Subpopulations were identified using objective criteria?
**RESULTS**

**Description of literature search**

The primary searches of databases and also references searching of obtained studies yielded 312 potentially eligible studies. In total, 95 studies were selected to evaluate more accurately, and the review finally included 17 unique studies. Duplicate (n = 7) and irrelevant studies (n = 182), studies with incorrect study population (n = 11) and inadequate data (n = 8) were excluded from the study. The flowchart of the studies retrieval and selection in this review has been shown in Figure 1.

**Description of the included studies**

The included studies were published from 2003 to 2016. Based on geographical locations, four studies were conducted in all states of Iran,\(^{[18-21]}\) three in Fars province,\(^{[22-24]}\) two in Ardabil province,\(^{[25,26]}\) two in East Azerbaijan province,\(^{[27,28]}\) one in Kerman province,\(^{[29]}\) one in Kurdistan province,\(^{[30]}\) one in Golestan province,\(^{[31]}\) one in Semnan province,\(^{[32]}\) one in Tehran metropolis\(^{[33]}\) and one in Shahroud city.\(^{[34]}\) All the studies have reported ASR of BTs. The main characteristics of the selected studies have been represented in Table 2.

**The results of individual studies**

The highest ASR was reported from East Azerbaijan province between 2006 and 2007 (9.39 for men and 8.06 for women/100,000).\(^{[28]}\) On the other hand, the lowest ASR was reported from Kurdistan Province in 2003 (0.5 for men and 0.8 for women/100,000).\(^{[30]}\)

**The results of meta-analysis**

The results of the random-effect model were demonstrated the ASR of BTs was 4.16 (95% confidence interval [CI], 3.20–5.12) among men and 3.40 (95% CI, 2.67–4.13) among women. Furthermore, the heterogeneity of the studies was confirmed by the results of Cochran’s Q-test (Q = 2879.8, df = 18, \(F^2 = 98.4\%\), \(P < 0.001\)) for men and (Q = 1864.2, df = 18, \(F^2 = 99\%\), \(P < 0.001\)) for women. The forest plots of the random-effect meta-analysis for ASR of BTs among Iranian population have been represented in Figures 2 and 3 for men and women, respectively.

### Table 2: Basic characteristics of included studies in the systematic review

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<th>Order</th>
<th>Author, years</th>
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<th>Location</th>
<th>Sample size</th>
<th>ASR (males)</th>
<th>ASR (females)</th>
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ASR: Age-standardised rate
Hassanipour, et al.: Incidence of brain tumours in Iran

Figure 2: Forest plot of the random-effect meta-analysis for age-standardised rates of brain tumours among Iranian men.

Publication bias
Egger’s test\[^{[35]}\] used to evaluated publication bias. Results of Egger’s test showed lack of publication bias ($P = 0.185$ for men and $P = 0.227$ for women).

Discussion
Cancer is the third leading cause of death in Iran.\[^{[36]}\] There are a few studies on the epidemiology of cancer among population of developing countries including Iran.\[^{[37-42]}\]

Results of the present study indicated that the ASR of BTs was lower in Iranian men and women than those of other countries (4.16 and 3.4/100,000 men and women, respectively). Based on the previous reports, the incidence of these cancers is higher in developed countries such as the United States, Canada, England and Australia, than in developing countries.\[^{[43]}\]

Jazayeri et al. have demonstrated in a similar study that the standardised incidence of primary CNS tumours in Iran is $5.69/100,000$. This study was limited to obtained data from the cancer registry during 2001–2008 and did not cover other newer studies.\[^{[12]}\] The possible causes of BTs among the Iranian population may be associated with the socioeconomic level, present risk factors and absence of advanced diagnostic methods for BTs in Iran.

There is a huge difference in the incidence of BTs worldwide.\[^{[44]}\] European countries and Eastern European region including Albania, Macedonia, Serbia and Croatia had a high incidence, while other countries such as Cyprus, Belarus, Russia and Moldova had a low incidence of BTs.\[^{[45]}\]

According to the results of conducted studies on refugees, the incidence of BTs among migrants to more advanced areas was higher than that of native people, indicating the effects of environmental factors on CNS malignancy.\[^{[46]}\] Global studies show an increasing trend for these cancers probably due to the aging of those communities.\[^{[47,48]}\] The reasons of this increasing trend have not been completely determined yet, but one of the possible assumptions is the advancement of technology and more modern diagnostic methods and tools of these types of cancer.

The present study showed that the highest ASR of BTs among people belonged to East Azerbaijan Province and Tabriz city (9.39/100,000 for men and 8.68/100,000 for women). The high incidence of BTs in this region may be attributed to the specific cultural and economic factors, occupational, nutritional and environmental exposure, genetic factors and access to better diagnostic facilities such as the computed tomography scan, magnetic resonance imaging and neurosurgical technologies.\[^{[49]}\]

In other global studies, the ASR was also slightly higher in men than women. Regarding race, the incidence of nervous system cancers is the highest among American white men and the lowest among American black women.\[^{[50,51]}\]

Results of the present study indicated that the lowest ASR of BTs among Iranian people belonged to Kurdistan province (0.5/100,000 for men and 0.8/100,000 for women). It is probably due to the incidence of other diseases, cultural issues, low levels of risk factors and the lack of advanced diagnostic systems in Kurdistan compared to other regions of Iran.\[^{[10]}\]

Environmental factors, including exposure to radiation, special dietary factors such as consumption of fruits...
Hassanipour, et al.: Incidence of brain tumours in Iran

Figure 3: Forest plot of the random-effect meta-analysis for age-standardised rates of brain tumours among Iranian women.

and vegetables and occupational exposure, play important roles in the incidence of these types of cancer.[52,53] According to studies in the region, stomach, skin, oesophagus and bladder cancers among men and skin, oesophagus, stomach and breast cancers among women are more prevalent than CNS cancers.[30]

CONCLUSION

In comparison to other geographical locations, the incidence of BTs is lower in Iran. The incidence of nervous system cancers is increasing based on region, geographical and economic conditions in Iran. Changes in the public lifestyle and increasing risk factors are the main causes of increasing incidence of BTs in Iran. Hence, training programmes can be considered to reduce the risk factors, complications of nervous system cancers and early diagnosis of NTs.

Acknowledgement

The authors gratefully acknowledge the Gastrointestinal and Liver Diseases Research Center (GLDRC) of Guilan University of Medical Sciences for the invaluable coordination and cooperation.

Financial support and sponsorship

The current study was financially supported by Guilan University of Medical Sciences, Rasht, Iran.

Conflicts of interest

There are no conflicts of interest.

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Hassanipour, et al.: Incidence of brain tumours in Iran


