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Trend of incidence and mortality of brain and central nervous system cancer in Iran from 1990 to 2017: A global burden of disease-based study

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Hedayat Abbastabar

Advanced Diagnostic and Interventional Radiology Research Center, Tehran University of Medical Sciences, Tehran, Iran

Keywords
Incidence; Mortality; Neoplasms; Brain; Central Nervous System; Global Burden of Disease

Abstract

Background: Brain and central nervous system (CNS) cancers make up about 3% of all cancers around the world and are more common among men than women. Present study aimed to evaluate the occurrence trend of brain and CNS cancers in Iran from 1990 to 2017.

Methods: This study using global burden of disease (GBD) 1990 to 2017 data demonstrated the trend of incidence and mortality of brain and nervous system cancer in Iran. All-age, sex-based, age-standardized, age-specific (from 1990 to 2017), and age distribution of incidence and mortality rates of brain and nervous system cancer were estimated in Iran during 2017.

Results: Both incidence and mortality rates of brain and nervous system cancer increased from 1990 to 2005 in Iran, Eastern Mediterranean Region, and global level. During 1990, incidence and mortality rates of brain and nervous system cancer were higher in women than men, but gradually both rates increased in men and exceeded women in Iran. From 1990 to 2017, the value of age-adjusted rate was higher than all-age rate of brain and nervous system cancer. The most incidence and mortality of brain and nervous system cancer from 1990 to 2017 occurred in age group of > 70 and the least values were seen in 15-49-year-old group in Iran.

Conclusion: The brain tumor occurrence and mortality in Iran was higher than other Eastern Mediterranean Region countries. Incidence and mortality of this cancer has an increasing trend in Iran and this trend somewhat was independent from population aging.

Introduction

Brain tumor is an abnormal mass in the brain that can be benign or malignant by the nature of its constituent cells.[1]

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Corresponding Author: Hedayat Abbastabar
Email: epid_86@yahoo.com

The origin of the tumor may be from the brain tissue or spreads from other organs that so-called metastasis. Studies, especially in developed countries, show an increasing occurrence of brain and CNS cancers, most of which are seen in the elderly.[2,3] Application of computerized tomography (CT) and magnetic resonance imaging (MRI) in the 1980s is a major cause of overall advances in diagnosis and prevalence increase. Little is known about the etiological factors of brain cancers. In addition to genetic risk factors, exposure to ionizing radiation expands the risk, while allergic factors appear to reduce the risk.[4,5] The prognosis of brain and central nervous system (CNS) cancers changes according to age and histological type. Overall, 5-year survival is poor, with prognosis particularly poor for glioblastoma and older age. The increase observed for survival in higher-income countries is largely attributable to improvements in medical care and the availability of new therapies.[6,7]

Brain and CNS cancers make up about 3% of all cancers around the world and are more common among men than women.[8] In 2016, there were 330000 [95% confidence interval (CI): 299000-349000] new cases of CNS cancer and 227000 (95% CI: 205000-241000) dead cases globally, and age-standardised incidence rates of CNS cancer increased globally by 17.3% (95% CI: 11.4%-26.9%) between 1990 and 2016.[9,10] Approximately, 0.6% of population will have brain and other nervous system cancer at some point of their lives.[11]

Following the number of new cases, deaths, and survival over time can help scientists determine if progress has been made and where further research is needed to address challenges, including improved screening or better treatments. Therefore, the present study aimed to evaluate the occurrence trend of brain and CNS cancers in Iran from 1990 to 2017.

Materials and Methods

Study type: This study using global burden of disease (GBD) 1990 to 2017 data demonstrated the trend of incidence and mortality of brain and nervous system cancer in Iran. The 2017 GBD project was an integrated systematic effort to estimate the global and regional comparative risk of morbidity, mortality, and disability-adjusted life years (DALYs) occurred by various risk factors and diseases based on data collections and calculations of 354 types of diseases and injuries and 282 causes of death in 195 countries.[12]

Data source: The process for evaluation of information began with combining data sources from various possible origins, so as to consist of 21 possible Global Health Data Exchange (GHDx) data types ranging from verbal autopsy, vital records registration, disease registries, scientific literature to epidemiological surveillance data. GBD collaborator network prepared 2842 data sources for GBD 2017. They analyzed 21100 sources of epidemiological surveillance data (country-years of disease reporting) for GBD 2017 and 4734 sources of disease registry data. For non-fatal estimation, they did systematic data and literature searches for 82 non-fatal causes and one impairment, which were updated at February 11, 2017.[12]

Brain and nervous system cancer disease incidence and mortality data were included in the study. Moreover, through a comprehensive systematic review of published and unpublished data, a Bayesian meta-regression method was performed to ensure consistency between incidence rate and cause of death for each condition.[13] Firstly, all-age incidence and mortality rate of brain and nervous system cancer was shown in Iran, Eastern Mediterranean Region, and global level from 1990 to 2017. Afterwards, incidence and mortality rates of brain and nervous system cancer were displayed according to gender in Iran during the same period. And then, all-age and age-standardized incidence and mortality rates of brain and nervous system cancer were presented in Iran from 1990 to 2017. In the following, age-specific incidence and mortality rates of brain and nervous system cancer were depicted per 100000 individuals in Iran. Finally, age distribution of incidence and mortality rates of brain and nervous system cancer was exhibited in Iran during 2017. All calculations and statistical analyses were performed by GBD Results Tool software.

Results

All-age incidence and mortality trend: The results of all-age incidence and mortality rates of brain and nervous system cancer according to location showed a similar trend; so that, from 1990 to 2005, the incidence and death rates were higher at global level but after this time, both of these rates in Iran overtook the Eastern Mediterranean Regional Office (EMRO) and global level. Moreover, during this period, both incidence and mortality rates had an ascending slope in all of these places, but the rates of increase in Iran were much higher than other locations (Figure 1).

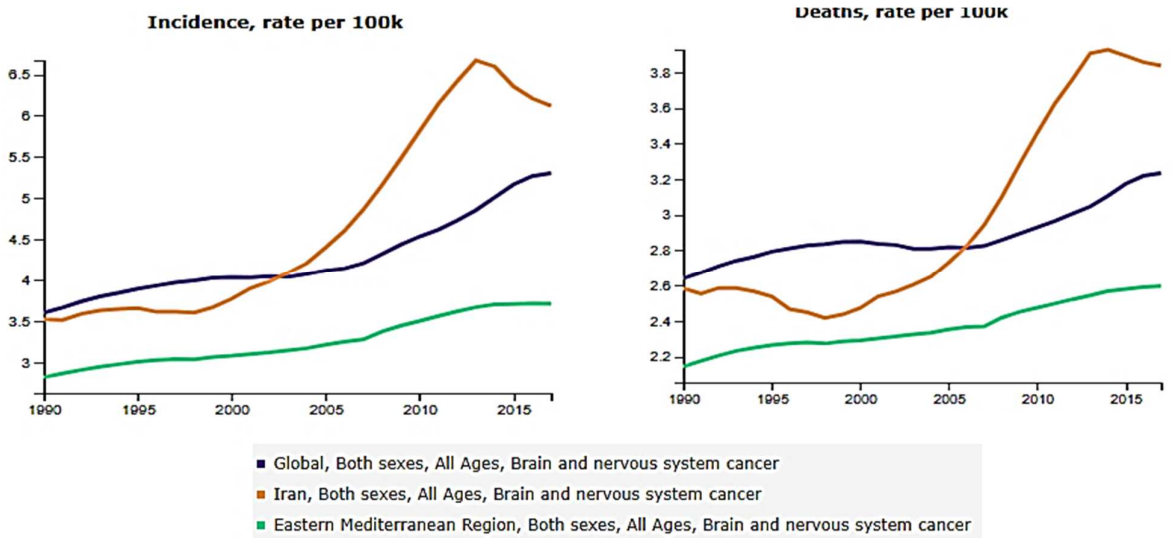

Figure 1. All-age incidence and mortality rate of brain and nervous system cancer per 100000 individuals in Iran, Eastern Mediterranean Region, and global level from 1990 to 2017

Gender-based incidence and mortality trend: According to gender incidence and mortality rates of brain and nervous system cancer in Iran, during 1990 both rates were higher in women but gradually, their numbers in women began to decline and this trend continued until 2000; after that these values slowly rose and fell again in 2013. On the contrary, both rates increased in men with steep slopes; they exceeded women quickly. The gap between two sexes has grown; eventually, their trend has declined in men during 2013, but their values were much higher in men (Figure 2).

All-age and age-standardized incidence and mortality trend: Based on all-age and age-standardized incidence of brain and nervous system cancer from 1990 to 2017 in Iran, a high-speed increasing trend was observed until year 2013 and then followed a downward trend; besides, during all these times, there was a difference between all-age and age-standardized incidence rate and the value of age-adjusted rate was higher. Moreover, trends of all and standardized mortality rate during these times were similar, but they had a slower growth trend; moreover, the difference between two rates was more than incidence rates of them (Figure 3).

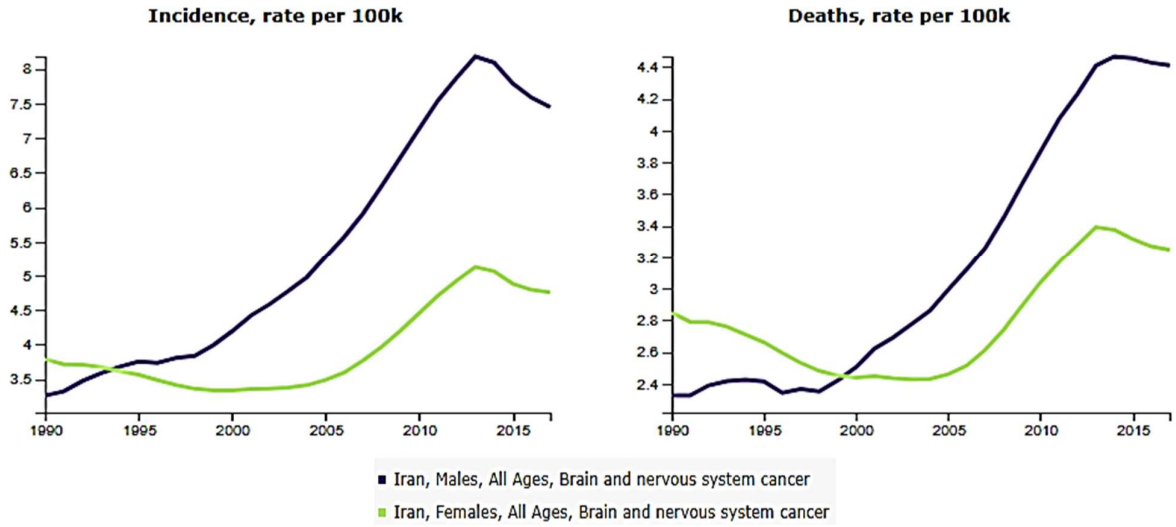

Figure 2. Incidence and mortality rate of brain and nervous system cancer per 100000 individuals in Iran according to gender from 1990 to 2017

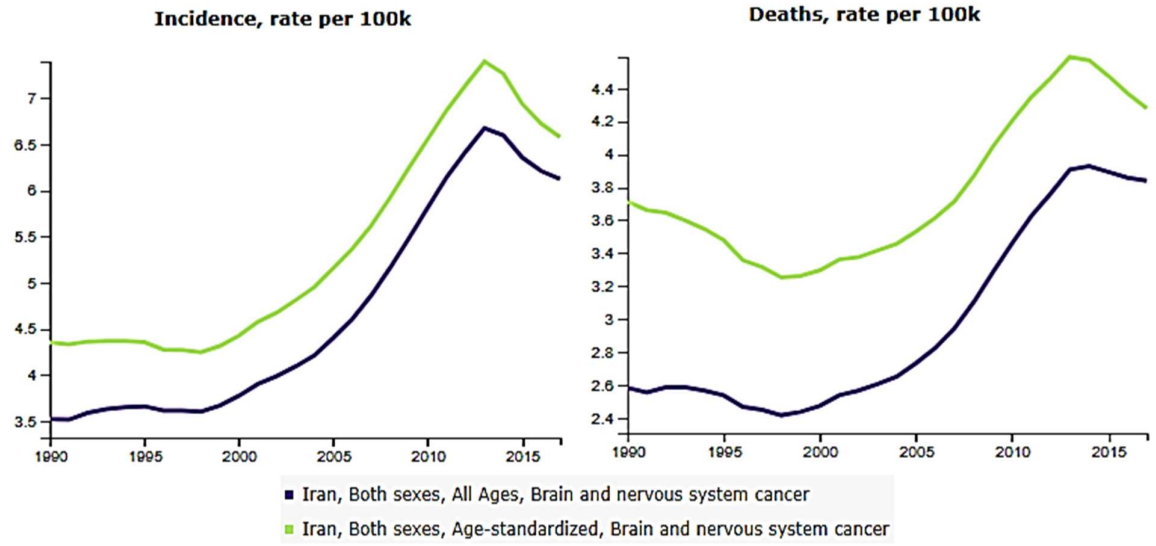

Figure 3. All-age and age-standardized incidence and mortality rate of brain and nervous system cancer per 100000 individuals in Iran from 1990 to 2017

Age-specific incidence and mortality trend: The age-specific incidence and mortality rates of brain and nervous system cancer in Iran from 1990 to 2017 showed a relatively resembling trend. The most incidence and mortality during all these years occurred in age group of > 70 and the least values were seen in 15-49-year-old group. Incidence rate of brain and nervous system cancer approximately rose in all age groups from 1990 to 2017, but increasing value in age groups of fewer than 5 and more than 70 years had steeper slope. However, mortality rate of brain and nervous system cancer had a relatively stable trend during these times and only the last age group (+ 70) had an increasing trend (Figure 4).

Incidence and mortality values in 2017 according to age: Distribution of incidence rate of brain and nervous system cancer in Iran during 2017 showed that the most new cases occurred in early neonatal period (age: 0-6 days); afterwards, its rate decreased until 45 years and then slowly increased in old ages. Besides, according to death rate in Iran during 2017, the risk of brain and nervous system cancer mortality was high in early neonatal period; afterwards, it declined and stabled until 45 years and then increased more quickly (Figure 5).

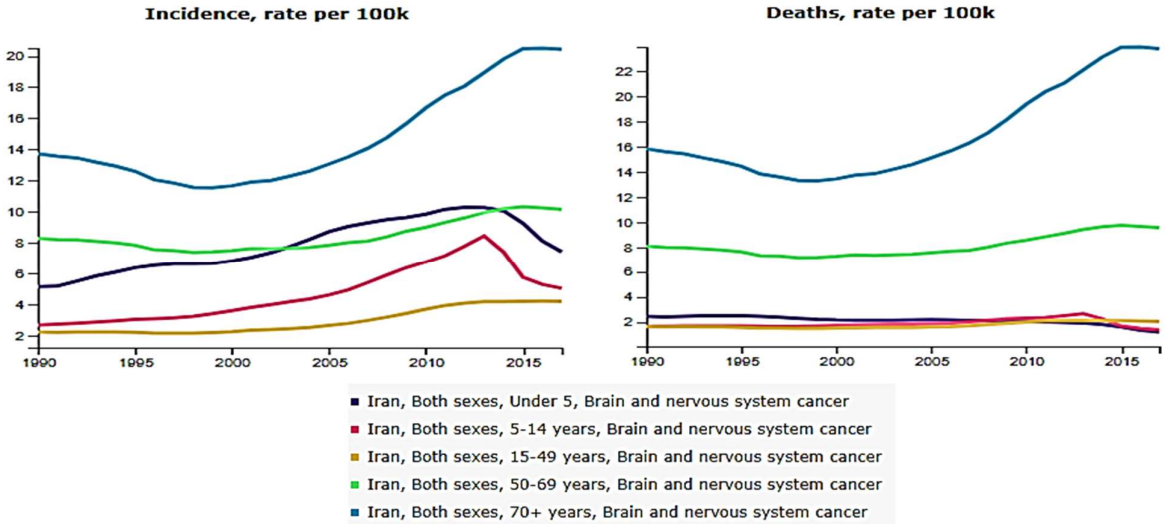

Figure 4. Age-specific incidence and mortality rates of brain and nervous system cancer per 100000 individuals in Iran from 1990 to 2017

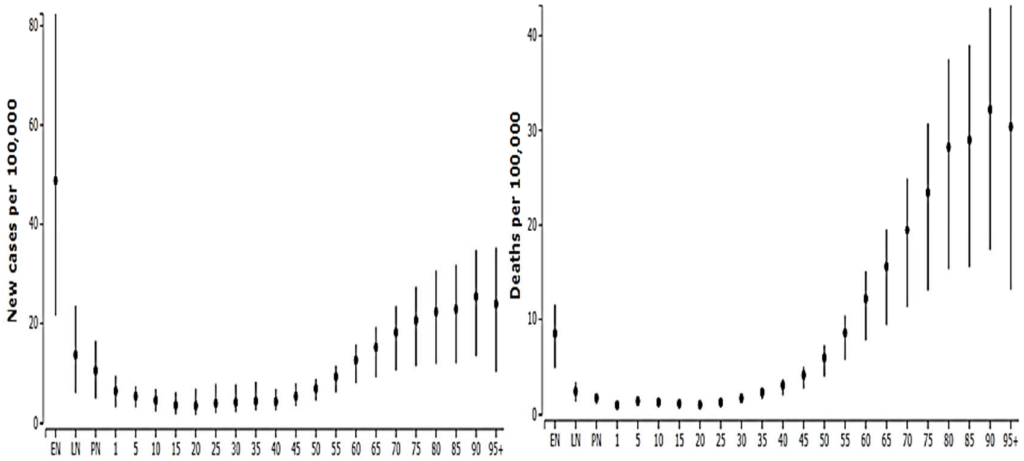

Figure 5. Age distribution of incidence and mortality rates of brain and nervous system cancer per 100000 individuals in Iran during 2017 (EN: Early neonatal; LN: Late neonatal; PN: Post neonatal)

Discussion

Both incidence and mortality rates of brain and nervous system cancer increased from 1990 to 2005 in Iran, Eastern Mediterranean Region, and global level. During 1990, incidence and mortality rates of brain and nervous system cancer were higher in women than men, but gradually both rates increased in men and exceeded women in Iran. From 1990 to 2017, the value of age-adjusted rate was higher than all-age (unadjusted) rate of brain and nervous system cancer. The most incidence and mortality rate of brain and nervous system cancer occurred in age group of > 70 and the least values were seen in 15-49-year-old group in Iran from 1990 to 2017.

Both incidence and mortality rates of brain and nervous system cancer had an ascending slope in Iran, Eastern Mediterranean Region, and global level, but the rates of increase in Iran were much higher. In a study conducted in Central and South America, incidence and mortality were more prevalent in Brazil, Colombia, Cuba, and Uruguay than in the other countries of the region. The most incidence rates, seen in Brazil, were similar to the rates in the United States (US) and other regions of the world,[14] but they were less than the incidence rates observed in Goiania, Brazil, among men (10.5), which - along with Serbia (10.5), Sweden (9.5), and Croatia (9.5) - are the highest in the world.[15] According to the study entitled "Global, regional, and national burden of brain and other CNS cancer, 1990-2016: A systematic analysis for the Global Burden of Disease Study 2016", East Asia was the region that had the highest incidence of CNS cancer for both sexes in 2016 [108000 (95% CI: 98000-122000)] and then Western Europe [49000 (95% CI: 37000-54000)] and South Asia [31000 (95% CI: 29000-37000)]. The top three countries with the highest number of new cases were China, US, and India. CNS cancer was responsible for 7.7 million (95% CI: 6.9-8.3) DALYs worldwide.[9] Geographical variation in incidence among countries can indicate a real increase in risk due to some factors including diet, race, ethnicity, infectious factors, etc. Although it can indicate differences in diagnostic practices, case ascertainment and access to health care cannot be ruled out.[1,11,16-19]

Incidence and mortality rates of brain and nervous system cancer in Iran were higher in women during 1990, but gradually, their numbers decreased in women and increased in men. Tangible differences were observed between men and women in terms of brain cancer incidence, mortality, and progression.[20,21] Usually, men are more probable than women to develop a brain tumor, but some specific types of brain tumors, such as meningioma, are more prevalent in women.[21] According to the study that was accomplished in England on data from 1995 to 2003, age- and sex-specific incidence rates of primary CNS tumors of men and women were equal to each other until 50 years, but at elderly ages, differences between them gradually increased and they were higher in men than women.[22] In a study on primary brain and CNS tumors diagnosed in the Korean, tumors occurred in women more often than in men (female to male ratio: 1.59:1).[23] The results of GBD project on brain and CNS cancer during 2016 showed that the age-standardized incidence rate per 100000 population totally was higher in men and sex gap

was more in the old ages.[9] For effecting of gender on disease phenotype, it should be influenced on underlying risks and progression mechanisms. Gender applies its role by making differences in sex chromosome components, sex hormone epigenetic (organizational) and acute (activation) effects, and maintenance or re-programming gender-specific maternal and paternal genes replication.[21,24,25]

There was a difference between all-age and age-standardized incidence and mortality rates of brain and nervous system cancer from 1990 to 2017 and age-adjusted rate was higher during all the times in Iran. The interpretation of this finding is that aging of population does not have a major role in this increasing trend and thus, other factors such as ionizing radiation, mobile phones, occupational exposures, trauma, diets high in N-nitroso compounds, viral infections, and tobacco smoking can be responsible for this ascending slope.[6,11,16,18,19,26] According to a registry-based study conducted on patients with CNS tumor in Gironde, France, totally, 3515 cases were identified during 2002 to 2012. In France study, all age-adjusted CNS tumors increased by 2.7% per year; moreover, effects of age groups (including 0-24, 25-49, 50-64, 65-79, 80 and more) were assessed on increasing trend and it was specified that increasing trend occurred in all age groups, but the value of growth was different and it was in line with age.[3] In another study that was accomplished in Iran, the total number of registered cases of brain cancer was 282 cases in 2000 that reached to 1257 cases in 2005; the age-standardized incidence rate from 0.47 cases in 2000 increased to 1.99 cases in 2005 per 100000 people, but there was not statistically significant differences between them (P = 0.180).[26]

According to age-specific rates of brain and nervous system cancer in Iran, the most incidence and mortality occurred in age group of > 70 years and the least values were seen in 15-49-year-old group from 1990 to 2017. Based on the study done in England using data of 1995-2003, the age-adjusted incidence rate of CNS tumors was 9.21 in 100000 person-years, but these values in age groups of 0-14, 15-24, and 25-84 years were 3.56, 3.26, and 14.54 per 100000 person-years.[16,26]

Conclusion

The brain tumor occurrence and mortality in Iran was higher than other Eastern Mediterranean Region countries. Incidence and mortality of this cancer has an increasing trend in Iran and this trend somewhat was independent from population aging.

Conflict of Interests

The authors declare no conflict of interest in this study.

Acknowledgments

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