RESEARCH COMMUNICATION

Trends in the Brain Cancer Incidence in India

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Abstract

Trends in cancers of the central nervous system in both sexes in five Indian population based cancer registries (Mumbai, Chennai, Bangalore, Delhi & Bhopal) were evaluated over a period of the last two decades. For this purpose we applied a model that fits the data is the logarithm of Y=ABx which represents a Linear Regression model. This approach revealed an increasing trend in cancers of nervous system in both sexes throughout the entire period of observation in almost all registries. As CNS cancers are increasing, analytic epidemiological studies should be planned in a near future on a priority basis to understand the etiology of these cancers in depth.

Key Words: Trends - brain - nervous system - incidence

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Introduction

Although not very frequent, brain tumors contribute significantly to morbidity, often affect children and overall have a poor prognosis. Due to marked resistance to radiation and chemotherapy, the prognosis for patients with glioblastomas is very poor. The majority of patients die within 9-12 months and less than 3% survive more than 3 years. Many genetic alterations involve in the development of nervous tissue tumors have been identified and may lead to novel therapeutic approaches, including gene therapy.

In this paper an attempt have been made to study the trends in cancers of central nervous system in both the sexes in five population based cancer registries (Mumbai, Chennai, Bangalore, Delhi and Bhopal) over a period of last two decades. All these registries are under the network of National Cancer Registry Programme (NCRP) of Indian Council of Medical Research (ICMR), New Delhi. The clean data is available for 22 years of period (1982-2003) for Mumbai, Chennai and Bangalore registries, and for 16 years of period (1988-2003) for Delhi & Bhopal registries. The data used for trend analysis from these 5 registries has been coded in one format i.e. for topography ICD-10 (WHO, 1992) and for morphology ICD-O-3 (Cancer Incidence in Five Continents, 1982) has been used. For calculating various rates, population by age, sex and year has been estimated by using "Distribution method". (National Cancer Registry Programme, 2006) based on 1981, 1991, 2001 census figures for all these registries. For calculating age adjusted incidence rates, world standard population (WHO, 2000) has been used.

Materials and Methods

In India first population based cancer registry was established in Mumbai (Bombay) by Indian Cancer Society in 1964 covering the urban population of Greater Mumbai. NCRP was launched by ICMR in 1981, establishing another two population based cancer registries at Chennai and Bangalore. Subsequently new population based cancer registries were commissioned by ICMR under the network of NCRP at Bhopal and New Delhi in 1986.

Various analytic approaches and measures of trends including geographical display and the overall mean annual percentage rate of change in age adjusted incidence rates or age specific rates as well as modeling by age, period and cohort have been used to study the trends in cancer incidence.

For studying trends we use a model that fits this data is the logarithm of Y=ABx which represents a Linear Regression Model Where 'Y' is the estimated incidence rates per 100,000 population and 'x' is the calendar year minus initial year for the current date. Capital 'A' therefore represents the estimated rate of initial year and (B-1)*100 gives the Average annual percentages change in the incidence rates during the period (Cancer Incidence and Mortality in Greater Mumbai, 2005). The observed and estimated (based on model fitting) age adjusted incidence rates for each site for all registries are shown diagrammatically. The estimates of the average annual percentage rates in incidence rates of various cancers by sex are given in tabular form. Age-period cohort models were not considered because the data required for carrying

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Table 1. Age Adjusted Incidence Rates for Cancers of Brain - Nervous System for Various Registries by Year and Sex

Year	Males					Females				
	Mumbai	Bangalore	Chennai	Delhi	Bhopal	Mumbai	Bangalore	Chennai	Delhi	Bhopal
1982	1.8	1.6	1.2			1.3	1.1	0.8		
1983	1.7	2.4	2.3			1.2	0.9	1.0		
1984	2.6	1.0	2.9			1.4	1.1	1.6		
1985	2.6	1.5	1.5			1.7	1.5	0.9		
1986	1.9	2.7	2.0			1.5	1.2	0.7		
1987	2.5	2.0	2.3			2.2	1.7	1.7		
1988	2.7	2.9	2.5	3.8	0.9	1.6	1.2	0.8	2.0	0.5
1989	2.8	3.7	1.7	3.4	3.0	2.1	1.8	0.7	2.6	1.6
1990	3.0	3.2	1.9	4.2	1.9	2.6	1.1	1.4	3.1	1.9
1991	3.8	2.3	2.3	3.7	2.9	1.9	1.7	1.2	2.8	3.0
1992	3.4	2.9	2.0	4.9	3.3	2.2	2.0	1.1	3.0	0.9
1993	3.3	3.0	2.5	4.8	4.2	2.1	1.5	1.5	3.4	1.6
1994	2.9	2.3	2.7	4.8	2.8	2.2	2.1	1.2	2.7	2.6
1995	3.2	2.3	2.9	4.2	3.1	2.2	1.5	1.6	3.1	1.0
1996	3.6	2.8	3.3	4.2	3.1	2.6	1.3	2.1	3.1	1.0
1997	3.6	2.5	3.3	4.2	1.4	2.1	1.8	2.1	2.5	1.2
1998	3.2	3.4	2.5	4.7	2.5	2.6	1.7	2.3	2.8	1.8
1999	3.7	2.7	2.9	3.5	2.5	3.3	2.1	2.3	2.2	1.7
2000	4.0	3.0	3.7	4.5	2.6	3.0	2.3	1.9	2.4	1.0
2001	3.8	3.3	2.3	3.7	3.5	2.6	2.5	1.8	2.1	1.1
2002	3.9	3.9	3.9	3.9	2.5	2.6	2.2	2.0	2.0	1.3
2003	3.8	3.8	3.0	3.8	2.4	2.7	2.7	2.0	2.7	1.1

out analysis are not available for longer period except in the Mumbai registry.

Results

Age adjusted incidence rates for cancers of nervous system by sex and year for various registries are presented in Table 1. The average age adjusted incidence rates along with its annual percentage change for CNS cancers by sex for various registries are presented in Table 2.

For studying predominance of CNS cancers it's ranking at starting period (1982-83) and at the end of period (2002-03) in both the sexes are compared for each registry. For Mumbai registry cancers of CNS are ranked 9th in both the sexes in both the periods. For Bangalore and Chennai registries it ranked 9th in males and 8th in females in both the periods. At Delhi registry it's ranking is 9th in males and 7th in females in both the periods. For Bhopal registry it also ranked 9th in males in both the periods and could not occupy any place in ten leading sites in any of the periods.

Table 2. Average Age Adjusted Incidence Rate and Annual Percentage Change in Age Adjusted Rates for Cancers of Brain- Nervous System by Sex for Various Registries

Registry	Average Adjusted Incidence rate		Annual Percentage Change	
	Male	Female	Male	Female
Mumbai	3.08	2.17	3.46**	3.66**
Bangalore	2.69	1.68	3.29**	3.12**
Chennai	2.53	1.49	3.09**	4.69**
Delhi	4.14	2.66	-0.10ns	-1.16ns
Bhopal	2.66	1.46	1.75ns	-2.21ns

ns Not Significant, ** p< 0.01

The average age adjusted incidence rates for CNS cancers are ranged in males from 2.53 (Chennai registry) to 4.14 (Delhi registry) while in females it ranged from 1.46 (Bhopal registry) to 2.66 (Delhi registry).

The observed and expected values of age adjusted incidence rates over a period of time for cancer of CNS by sex are presented by line graphs in fig. 1. There has been increasing trend in incidence rates in both the sexes of CNS cancers were observed in all the registries except Delhi. The increase in incidence for Bhopal registry and decrease in incidence for Delhi registry was not statistically significant. More than 3%, statistically significant increase in age adjusted incidence rates of CNS cancers were noted in both the sexes in Mumbai, Chennai and Bangalore registries.

Discussion

Data utilized in this study from various registries have maintained the strict definition for inclusion or exclusion of cancer cases throughout entire period of study. This data has been coded using ICD-10 for topography and CD-O-3 for morphology. There has been no change in coverage of areas of each registry during the entire study period.

Before attempting an interpretation of trends it is of the importance to evaluate the reliability of the incidence data. Various indices of reliability have been proposed for e.g., proportion with microscopic verification (MV), proportion registered by death certification alone (DCO), and percentage of deaths in relation to incidence. The percentage of MV between these registries is ranged 77 to 87% in males and 75 to 89% in female; the percentage of DCO is ranged from 3 to 8% while incidence mortality ratio ranged in between 25 to 50% (National Cancer

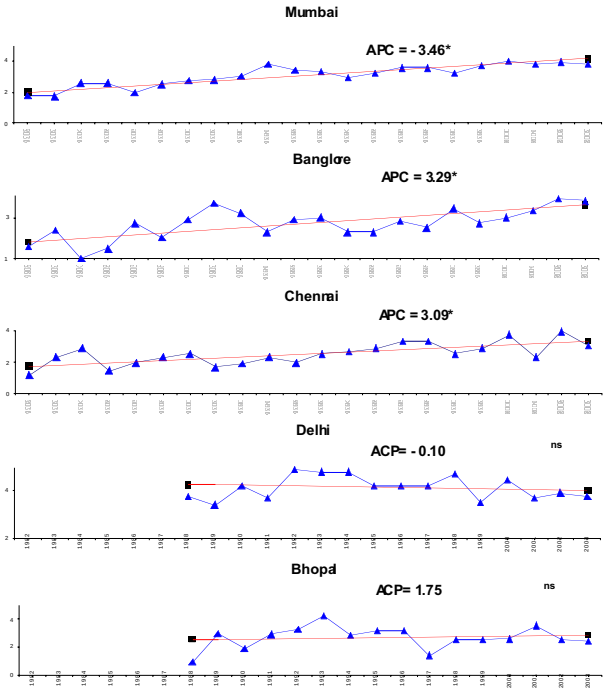

Figure 1. Trends in Brain NS Incidence Rates - Males

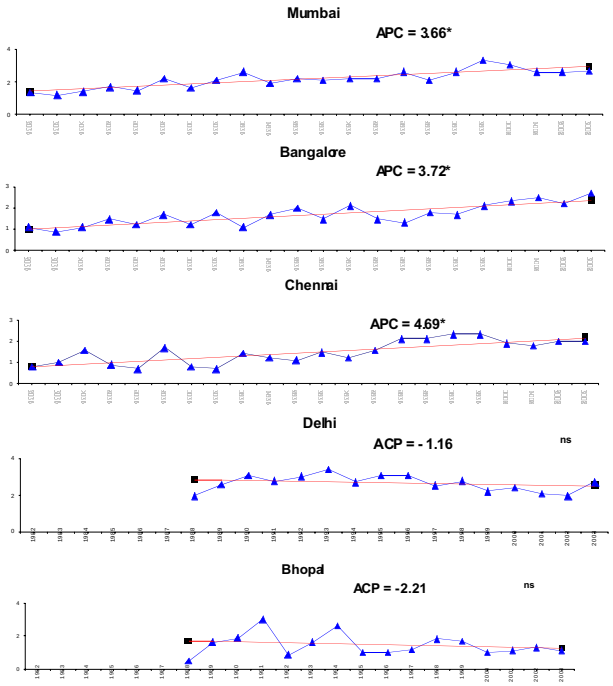

Figure 2. Trends in Brain NS Incidence Rates - Females

Registry Programme, 2006). The data from these five registries have been accepted for publications in the VI, VII, VIII Volumes of cancer incidence in Five Continents published by International Agency for Research on Cancer, Lyon, France (Cancer Incidence in Five Continents, 1992; Cancer Incidence in Five Continents, 1997; Cancer Incidence in Five Continents, 2002). It appears that cancer registration within these registries is of acceptable standard and interpretation of the observed trends can be attempted.

The majority of tumors of the central nervous system (CNS) are derived from glial cells (gliomas), the most malignant and frequent being glioblastoma. Tumors of the CNS account for less than 2% above all malignancies (About 175,000 cases per year world wide); the incidence does not vary markedly between regions or populations (Stewart and Kleihues, 2003). Several factors frustrate systematic study of epidemiology of tumors of the central nervous system. Firstly several distinct clinicopathological entities are grouped under this general heading and since their atiological factors are probably different, a coherent pattern for the whole group is unlikely to emerge. Secondly accurate diagnosis of intra- cerebral and intraspinal lessons is problematic, and it is difficult to distinguish primary from metastatic tumors and to differentiate the many different kinds of primaries. Thirdly, because even benign lessons may have dramatic consequences for the patients (Stewart and Kleihues, 2003). Generally, incidence rates area higher for men, in particular, malignant brain tumors occur more frequently in males while the benign meningiomas occur predominantly in females. During the past decade the incidence of glioblastoma's in the elderly has increased by 1-2% per year but to some extent this may be due to the introduction of high-resolution neuroimaging.

Some studies have suggested an increased incidence of CNS neoplasm associated with certain occupations, including farming, fire-fighting, metal working and the rubber & petro-chemical industries and those who worked has anatomists, pathologists and embalmers, but most of these reports have not been confirmed and causative agents have not been identified.

Suggestions that radio-frequency radiation generated by mobile phones and microwave telecommunication may play a role in the etiology of malignant gliomas remain to be substantiated. Similarly, the role of diet in brain tumor etiology, and specifically involvement of N-nitroso compounds (which are potent neuro-carcinogens in rodents) formed in nitrate - preserved to food, is unclear. (Tomatis et al., 1990) As CNS cancers are increasing, to understand an etiology of these cancers, in depth, analytic epidemiological studies should be planned in a near future on priority bases.

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