FREQUENCY OF VARIOUS PRIMARIES IN BRAIN METASTASES

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ABSTRACT

Introduction: Brain metastases are the most common intracranial tumors in adults, affecting upto 20% to 40% of all cancer patients. . In order of decreasing frequency, lung, breast, melanoma, renal and colon cancers are the most common primary tumors to metastasize to the brain. Early diagnosis and treatment may result in remission of brain symptoms and may enhance the quality of patients life and prolong survival.

Methods: The study is descriptive case series. The study was carried out at Radiology Department PGMI / HMC Peshawar. Study of one year duration (December 2006- December 2007) was done on patients referred to the radiology department . Sample size was 50 patients of all ages selected by non probability convenience sampling with the exclusion of diagnosed cases and Patients with a history of co-existent infective or inflammatory disease process.

Results: Gender distribution of the study showed that 62% patients were male , while the remaining 38% were female . The age range was 3–85 years, with a mean value of 50 years. Regarding the number of metastatic brain deposits, 74% of the patients had multiple brain deposits , while 26% of patients had a single brain deposit . Bronchogenic carcinoma was the most common tumor giving metastatic brain deposits present in 34% of patients. Area distribution of the patients showed that bronchogenic carcinoma was most common in patients belonging to Peshawar District. Carcinoma breast was mostly seen in the patients coming from Mardan District. Patients with gastrointestinal malignancy were mostly from Charsadda District.

Conclusion: Early diagnosis and treatment is important as it may reverse symptoms completely, often returning the patient to a useful life at least for sometime. The study also strongly supported the importance of CT scan in the early and correct diagnosis of brain metastases, as this is more readily available and affordable in our setup compared to magnetic resonance imaging and is more frequently advised to patients.

KEY WORDS: Brain Metastases, Bronchogenic Carcinoma, Carcinoma breast, Cerebral Cortex, Leptomeninges.

INTRODUCTION

Metastases of the brain are the most feared complication of systemic cancer and are the common intra-cranial tumors in adults[1]. Majority of brain metastases occur in adult patients aged 35 -70 years [2]. However, they may also occur in less than 5% of children with systemic cancer[3]. Brain metastases occur in 20 -40% of patients with cancer and their frequency has increased over time due to improved survival[4]. Approximately 80% of brain metastases are supra-tentorial, 15% are infra-tentorial and 5% occur in the brain stem [5]. When brain metastases occur, they lead to a considerable decrease in both survival and the quality of life, in patients who otherwise might be functional[6]. Further more the location, size and number of such lesions play a decisive role in management and diagnosis. Early diagnosis therefore, is important and early treatment may reverse symptoms completely, often returning the patient to a useful life at least for some time[5].

Systemic malignancy can metastasize to any location in the brain but most commonly (80%) affects the cerebral hemispheres[7,8].The vascular pattern of the brain accounts for the tendency of metastases to be located at the grey-white junction. Thus metastatic disease should be strongly suspected in patients with multiple cranial lesions, which appear as round, well demarcated lesions located at the junction of grey and white matter[9, 10].

Multiple intra cranial masses are metastases until proven otherwise, unless the history clearly indicates another etiology, such as multiple abscesses in a patient with a known endocarditis or defective immunity. A history of prior malignant disease is highly suggestive and is very useful[11,12].

Different primary tumors would take different time interval in spreading to the brain. Multiple, large autopsy series suggest that, in order of decreasing frequency, lung, breast, melanoma, renal and colon cancers are the most common primary tumors to metastasize to the brain [13].

Radiological diagnosis of brain metastases in a patient with known systemic cancer is easy[1]. The radiological examinations established in the diagnosis of this condition included computed tomography (CT) scan or magnetic resonance imaging (MRI)[8]. Until recently, CT

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scan was the primary imaging method of evaluation of patients with intracranial metastases[14]. Intra venous administration of contrast material (30-40mg of iodine) increases the diagnostic accuracy of CT. Most metastases enhance after a standard dose of intra venous contrast[15]. Although MRI is more sensitive in detecting brain metastases but as CT is more readily available and affordable in our setup and is advised more frequently in patients with suspected brain metastases, so CT scan will be used as the imaging modality.

The aim of this study is to determine the frequency of various primaries in brain metastases and also to know the characteristics of the different types of metastatic brain deposits. The results of this study will guide us to investigate a patient with clinical and radiological evidence of brain metastases for various primaries cost effectively using CT as the diagnostic tool.

MATERIALS AND METHODS

Sampling:

About 50 patients were included in this Descriptive case series. The study was carried out at Radiology Department PGMI / HMC Peshawar. Study duration was one year . Patients of both gender and of all ages having metastatic deposits in the brain on CT scan are included in this study. Patients with a diagnosis of a primary tumor in the brain and with a history of co-existent infective or inflammatory disease process are excluded from the study.

Diagnosis

After taking a history and evaluating the records, CT scan was preformed with X-vision Toshiba Helical CT scanner available in Hayatabad Medical Complex Peshawar. Using a lateral scout image for planning axial contiguous slices were taken parallel to the orbito-meatal line. Slice thickness was 5mm from the Foramen magnum to the petrous ridge and 8 to 10 mm to the vertex. Films were viewed under optimal viewing conditions and looked for the presence, number, site, characteristics and pattern of enhancement of metastatic brain deposits. The site of the primary tumor elsewhere in the body was also noted. A detailed profoma was designed for data collection, history and record of subject patients.

Data Analysis Procedure

The data collected was analyzed using statistical package SPSS version 10. The results were presented in the form of tables and graphs. For continuous variables i.e age, mean and standard deviation was calculated and for categorical variables i.e gender, locality, primary tumor, grade of tumor and pattern of enhancement of brain deposits, frequency was calculated in the form of proportions. For comparing proportions (categorical variables) student t-test was applied for calculation of p-value which is significant to ≤ 0.05.

RESULTS

My study consisted of 50 patients with known primary cancer elsewhere in the body. Gender distribution of the study showed that 62% patients were male (n = 31), while the remaining 38% were female (n = 19), with a male to female ratio of 6:4.

The age range was 3–85 years, with a mean value of 50 years and Standard Deviation as ±17.89. Maximum number of patients presented between the ages of 46 to 65 years (n =29, 58%), followed by the 26 to 45 years age group (n =10, 20%). i.e. 78% of the patient population presented between the ages of 26 to 65 years (n =39). The rest of the data for age distribution is given in Table 1.

Table: 1 Age Group in Years

S.No	Age group in years	No of patients	% age
1.	0 –25	3	6
2.	26 –45	10	20
3.	46 –65	29	58
4.	66 –85	8	16

Regarding the frequency with which primary tumors elsewhere in the body metastasize to the brain it was seen that bronchogenic carcinoma was the most common tumor giving metastatic brain deposits present in 34% of patients (n =17). The second common primary tumor with metastatic brain deposits was carcinoma breast, occurring in 24% of patients (n =12). The third common primary tumor metastasizing to the brain was carcinoma of the gastro-intestinal tract seen in 10% of patients (n =5). Melanoma with brain deposits was seen in 8% of patients (n =4), thyroid carcinoma was observed in 6% patients (n =3), renal cell carcinoma was seen in 4% patients (n =2), neuroblastoma in 4% patients (n =2), choriocarcinoma in 4% patients (n =2), leukemia in 2% patients (n =1) wilms tumor in 2% (n =1) and osteosarcoma also in 2% of patients (n =1) shown in Table 2.

Table:2 Frequency of Primary Tumours Metastatizing to Brain

Site of the Tumor	Frequency	Percent	Valid Percent	Cumulative Percent
Bronchogenic Carcinoma	17	34.0	34.0	34.0
Breast Carcinoma	12	24.0	24.0	62.0
Gastrointestinal Tract Carcinoma	5	10.0	10.0	72.0
Melanoma	4	8.0	8.0	80.0
Thyroid Carcinoma	3	6.0	6.0	86.0
Renal Cell Carcinoma	2	4.0	4.0	90.0
Neuroblastoma	2	4.0	4.0	94.0
Choriocarcinoma	2	4.0	4.0	98.0
Leukemia	1	2.0	2.0	100.0
Wilm'sTumor	1	2.0	2.0	36.0
Osteosarcoma	1	2.0	2.0	38.0
Total	50	100.0	100.0	

DISCUSSION

Brain metastases are the most common intra cranial tumours in adults, affecting upto 20% to 40% of all cancer patients, and representing one of the most frequent neurological complications of systemic cancer as a major cause of morbidity and mortality [16,17].

This study includes 50 patients with an age ranging from 3 –85 years. The mean age of presentation is 50 years. Maximum number of patients were in the 41 –65 years group, with 90% of patients being adults and 10% being children. This is comparable to a study done by Munir and worker [1] .

In my study I placed emphasis on the frequency of various primary tumors, that gave rise to metastatic brain deposits. The most common primary tumor metastasizing to the brain was bronchogenic carcinoma, seen in 34% of patients. The next most common primary was carcinoma breast seen in 24% of patients. Metastatic brain deposits from gastrointestinal tract malignancies were seen in 10% of patients. The other primary tumors giving rise to metastatic brain deposits were melanoma 8%, thyroid carcinoma 6%, renal cell carcinoma 4%, neuroblastoma 4%, chorio-carcinoma 4%, Wilm's tumor 2%, leukemia 2% and osteosarcoma 2%. My results were comparable to the results of Munir and workers who found metastatic brain deposits in 40% of patients with bronchogenic carcinoma, 18% in carcinoma breast, renal cell carcinoma in 10% of patients, Gastrointestinal tract tumors in 8% carcinoma thyroid in 4% melanoma 6% neuroblastoma 4% chorio-carcinoma, lymphoma, leukemia and sarcoma in 2% cases each [1] .

Wolfgang Danhert concluded that six tumors account for 95% of all brain metastases in which bronchogenic carcinoma accounts for 47% carcinoma breast 17%, gastrointestinal tract tumors 15%, hypernephroma 10%, melanoma 8% and choriocarcinoma 2% [18] .

Srikanth SG and Co-workers claim that 33% of lung cancers, 25% gastrointestinal tract, 10%, ovarian 3%, from breast, cervix and esophagus each and 2% from the kidney, thyroid and larynx each are responsible for sending metastases to the brain [7] .

It was observed that most of the patients with metastatic brain deposits due to bronchogenic carcinoma belonged to Peshawar District. Breast cancer patients with brain deposits came mainly from Mardan District. Patients with gastrointestinal tract malignances came largely from Charsadda District. Melanoma was common in Kohat District, thyroid malignancy was common in the region of Dir District, renal cell carcinoma patients were from Swabi District, patients with neuroblastoma belong to Swat District. Choriocarcinoma was seen in the patients from Karak District, Leukemia was common in Dir District, Wilm's tumour in Charsadda, while Osteosarcoma occurred commonly in D.I Khan.

CONCLUSION

The frequency of primary tumors giving rise to brain metastases is quite variable, but the most common primary tumor with metastatic brain deposits is bronchogenic carcinoma. The second common tumor metastasizing to the brain is carcinoma breast, followed by gastrointestinal tract malignancy and then melanoma. Early diagnosis and treatment is important as it may reverse symptoms completely, often returning the patient to a useful life at least for sometime. The study also strongly supported the importance of CT scan in the early and correct diagnosis of brain metastases, as this is more readily available and affordable in our setup compared to magnetic resonance imaging and is more frequently advised to patients.

REFERENCES

1. Ahmad M, Ayub Z, Khan Y. Sites of Primary Malignancies in Patients with brain metastases. J Postgrad Med Inst 2005; 19: 266-9.
2. Khosla A, Creasy JL, Coombs BD, De La Paz RL. Brain Metastases WWW. E Medicine. Com / Radiology/Brain. August 2004.
3. MC Cutcheon IE. In Metastatic brain tumors. Rengachary SS, Ellenbogen RG's Principles of Neuro-surgery. 2nd ed. Edinburgh: Elsevier Mosby 2005; 478 -86.
4. Soffietti R, Ruda R, Mutani R. Management of brain metastases. J Neural 2002; 249: 1357 -69.
5. Christians MH, Kelder JC, Arnoldus EPJ, Tijssen CC. Prediction of Intracranial Metastases in Cancer Patients with Headache 2002; 94 (7): 2063 -68.
6. Mystakidou K, Boviatsis EJ, Kouyialis AT, Voulmvourakis K, Kouloulias V, Kouvaries J etal. Silent Radiological imaging time in patients with brain metastases. Clin Neurol Neuro surg 2004; 106: 300-4.
7. Srikanth SG, Jayakumar PN, Chandrashekar HS. CT features of intra cranial metastases of unknown primaries. Neurol India 2002; 50: 282 -5.
8. Ganju A, Rock JP, Rogers LR, Rosenldum, ML. In Intracranial Central Nervous system Manifestation of systemic cancer. Robert and Christopher's Principles of Neuro-surgery. 2nd ed. New York; Lippin Coltt –Raven. 1999; 521 -31.
9. Sawaya R, Bindal RK. Metastatic brain tumours. Edinburh: Churchill Livingstone 1995: 923 -46.
10. Voorhies RM, Surdaresan N, Thalar HT. The single supratentorial lesion. An evaluation of pre-operative diagnostic tests. J Neurosurg 1980; 53:364 -8.
11. Lane B, Moseley IF, Stevens JM. Cranial and intra cranial pathology (1) Intra cranial tumors. Grainger and Allison's Diagnostic Radiology. 3rd ed. New York: Churchil Livingstone 1997; 2067 -91.
12. Magilligan DJ, Duvefnoy C, Malik G, Yagnik PM. Surgical approach to lung cancer with solitary cerebral metastases. Twenty years experience. Ann thoracic surg 1986; 42: 360-4.
13. Hardy J, Smith I, Cherryman G, Johnson CE. The value of computed tomography (CT) scan surveillance in the detection and management of brain metastases in patients with small cell lung cancer. Br J Cancer 1990; 62: 684 -6.
14. Sze G, Shin J, Knol G, Kinkel WR, Vicent RG. Intra parenchymal brain metastases; MRI versus contrast enhanced CT. Radiology 1988; 168: 187 -94.
15. Haymen LA, Evans RA, Hink VC. Delayed high iodine dose contrast computed tomography in cranial neoplasms. Radiology 1980; 136: 677-84.
16. Posner JB, Chernic NL. Intra cranial metastases from systemic cancer Adv. Neurol 1978; 19: 579 -92.
17. Van Den Bent MJ. The diagnosis and management of brain metastasis. Curr Opin Neurol 2001; 14: 717 -23.
18. Danhert W. Radiology Review Manual. 5th ed. Philadelphia: Lippincott Williams and Wilkins 2003; 302 -3.