Prediction of non Beningn Meningioma by CT scan

Rahman MM[1], Islam F[2], Harun K[3], Barua KK[4]

Abstract

Introduction:. *The term meningioma is the non-committal, all encompassing name coined by Harvey Cushing for the tumor of the meninges, which is usually benign. Meningiomas are particularly dear to Neurosurgeons because they can often be totally removed surgically . meningiomas are devided into three basic categories such as benign, Atypical meningioma & Malignant meningioma*

Objectives: *Objectives of this study was to asses whether cystic necrosis and margin characters of intracranial meningioma in CT scan provide any guideline to diagnose the histological subtypes & planning of the treatment. Specific objectives of this study was To find out the relationship of cystic necrosis and margin character of tumor with benign and non-benign histological subtypes of intracranial meningioma and to correlate cystic necrosis and margin character with histological subtypes of intracranial meningioma.*

Method: *The present study was conducted at Neurosurgery department with the help of pathology and Radiology department, BSMMU Dhaka on 48 cases of intracranial meningiomas to find out the relationship of cystic necrosis and margin character of tumors in CT scan with histologically benign and non-benign meningiomas. A total of 48 cases of intracranial meningiomas diagnosed by CT scan and confirmed by histological reports following surgery were taken as sample. Data were collected with the help of structured questionnaire addressing all variables of interest. Collected data were processed and analyzed using computer software SPSS version 12. The test statistics used to analyzed the data were descriptive statistics and $\div^2$ probability test and level of significance was set at 0.05*

Results: *The result obtained showed that 33.3% of patient with meningiomas were within 40-49 years age group. The mean age was 40±13.57 years, age range was 14-85 years and age range of non-benign meningioma was from 30-55 years. A female preponderance was observed and male to female ratio was 1: 1.18. In non-benign meningiomas male female ratio was 1; 0.67. Most of meningiomas were located in cerebral convexities (41.7%), next was in parasagital region (33.3%). In this study of meningiomas 89.6% were benign and 10.4% were non-benign (atypical or malignant).Cystic necrosis, a hypodense area within tumor was found in 20.8% cases and 80% of non-benign 14% of benign meningiomas. Tumor margins were regular in 70.8% of tumors with meningiomas. Irregular margin, fringes or mushrooming were observed in all of non-benign meningiomas and 20.9% of benign meningiomas. $\div^2$ analysis was done and significant association of cystic necrosis with benign and non benign meningiomas was observed (p=.001). Significant association of margin character of tumor with benign and non-benign meningiomas was also observed (p=<.001).*

Conclusion: *There is a significant association of cystic necrosis within tumor and margin characteristics of tumor in CT scan with histologicaly benign and non-benign meningioma. Proper evaluation of CT scan preoperatively may help in assessment of atypical and malignant meningioma as well as planning of treatment.*

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Introduction:

Meningiomas are common tumors that accounts for 14%-18% of intracranial neoplasm .[1] They are thought to originate from arachnoid cap cell, which from the outer lining of the arachnoid granulation, a theory supported by ultra structural similarities and a tendency to form whorls in both .[1] Meningioma most commonly occurs in middle decade of life, commonly encountered in women than men.[3,5, 21] Meningiomas occur twice as frequently in female as in males.The incidence of meningioma increases with age. A slight dip after the eight decade may be explained by several factors including a less aggressive surgical approach in the elderly. Another factor is a failure to realize that even though the total number in 9th decade is less than in earlier decades, the incidence of meningioma within this age group actually increased . [12] The peak incidence is around 45 years. The ratio of female to male patient is 2:1 and the incidence increased with age. Meningioma constitute 1 to 4 percent of all

1. Dr Md Moklasur Rahman, Assistant Professor, Department of Neurosurgery,National Institute of Neurosciences & Hospital Dhaka
2. Dr Farzana Islam, Junior Consultant(Gynae & Obs), General Hospital Munshigonj
3. Dr Kaisar Harun, Assistant Professor, Department of Neurosurgery, National Institute of Neurosciences & Hospital Dhaka
4. Professor Dr Kanak Kanti Barua, Chairman, Department of Neurosurgery, Bangobandhu Sheikh Mujib Medical University Dhaka

Address of Correspondence: Dr Md Moklasur Rahman, Assistant Professor, Department of Neurosurgery, National Institute of Neurosciences & Hospital Dhaka, phone 01819126262, E-mail: drmukulns@gmail.com

childhood (<11 years) brain tumors. The average age at presentation is 11.6 years. There is an equal incidence of male and female childhood meningiomas. [13,17, 27] The familial occurrence of meningiomas, usually multiple, is largely found in the context of Von-Rickling housen disease.[29]

The world health organization (WHO) divides meningioma into three basic categories, 1) Meningioma (i.e. the common or typical 'benign'meningioma) 2) atypical meningioma 3) malignant meningioma .[28] Atypical meningiomas are defined as there with histologic and cytologic features that fall short of frank anaplasia, accordingly these tumors demonstrate hypercellularity, patternless or sheet like growth, focal or geographic necrosis and certain cytologic findings including high nuclear-cytoplasmic ratios, coarse chromatin and prominent nucleoli. Brain invasion is, by definition a feature of malignant rather than atypical meningiomas although atypical meningiomas often have a broad attachment to pial surface.4The objective of surgery is total removal of meningioma including the dural attachment and bone that is involved by the tumor. The completeness of surgical removal is the single most prognostic factor . [29] The radiotherapy is beneficial; 1) as an adjunct to surgery in meningioma with malignant, atypical and papillary histological types.2) in recurrent meningiomas at difficult sites following reoperation.3) as a primary mode of therapy for medically unfit patients and 4) in vascular meningioma .[29]

Objectives:

Objectives of this study was to asses whether cystic necrosis and margin characters of intracranial meningioma in CT scan provide any guideline to diagnose the histological subtypes & planning of the treatment. Specific objectives of this study was To find out the relationship of cystic necrosis and margin character of tumor with benign and non-benign histological subtypes of intracranial meningioma & To correlate cystic necrosis and margin character with histological subtypes of intracranial meningioma.

CT scan features

Plain and contrast enhanced CT detect 85% and 95% of intracranial meningioma respectively (New et al, 1980)

NECT scan typically show a sharply circumscribed round or smoothly lobulated mass that abuts a dural surface usually at an obtuse angle. Approximately 7o% to 75% of all meningiomas are homogenously hyperdense relative to adjacent brain; 25% appear isodense, hypo dense tumors are seen in 1% to 5% of cases . [28]

Calcification is seen in 20% to 25% and can be diff use or focal, psamomatous, sand like, sunburst or globular even ring like pattern occurs. Occasionally meningiomas appear densely calcified.[8, 11, 18] Malignant tumors do not display calcification. [1,5 ,17] Hyperostosis can be striking or absent. Peritumoral edema is seen in 60% of cases and may be extensive involving the white mater tract of an entire hemisphere. 28Meningioma like many other central nervous system tumor posses the ability to induce peritumoral edema. With the advent of CT, a direct quantification of low density area of edema surrounding a meningioma is possible. Osborn in 1994 observed 60% edema in CT scan of meningioma.[28] This allows an accurate correlation between the amount of edema and factors such as age sex tumor size, location, histology, growth rate, secretory product and hormonal receptors.[15] More than 505 of malignant meningioma demonstrate "Mushrooming" a CT feature (Fig 1,2 3), described by New et a [l.25, 31] Other features thought to be typical of malignant meningioma include indistinct tumor margin, fringes of tumors extending deeply into the brain substances, marked bone destruction and prominent low density necrosis. [1] Mushrooming (Fig 1,2,3)refers to an exclusion of tumor pannus along surface of brain to a distance from the globular mass of the lesion . 1

Material And Method:

The present study was conducted at Neurosurgery department with the help of pathology and Radiology department, BSMMU Dhaka on 48 cases of intracranial meningiomas to find out the relationship of cystic necrosis and margin character of tumors in CT scan with histologically benign and non-benign meningiomas. A total of 48 cases of intracranial meningiomas diagnosed by CT scan and confirmed by histological reports following surgery were taken as sample. Data were collected with the help of structured questionnaire addressing all variables of interest. Collected data were processed and analyzed using computer software SPSS version 12. The test statistics used to analyzed the data were descriptive statistics and $\div^2$ probability test and level of significance was set at 0.05

Results:

The result obtained showed that 33.3% of patient with meningiomas were within 40-49 years age group. The mean age was 40±13.57 years, age range was 14-85 years and age range of non-benign meningioma was

from 30-55 years. A female preponderance was observed and male to female ratio was 1: 1.18. In non-benign meningiomas male female ratio was 1; 0.67. Most of meningiomas were located in cerebral convexities (41.7%), next was in parasagital region (33.3%). In this study of meningiomas 89.6% were benign and 10.4% were non-benign (atypical or malignant).Cystic necrosis, a hypodense area within tumorFig (1,2,3) was found in 20.8% cases and 80% of non-benign 14% of benign meningiomas. Tumor margins were regular in 70.8% of tumors with meningiomas. Irregular margin, fringes or mushrooming(Fig 1,2,3)were observed in all of non-benign meningiomas and 20.9% of benign meningiomas. $\div^2$ analysis was done and significant association of cystic necrosis with benign and non benign meningiomas was observed (p=.001). Significant association of margin character of tumor with benign and non-benign meningiomas was observed (p=<.001).

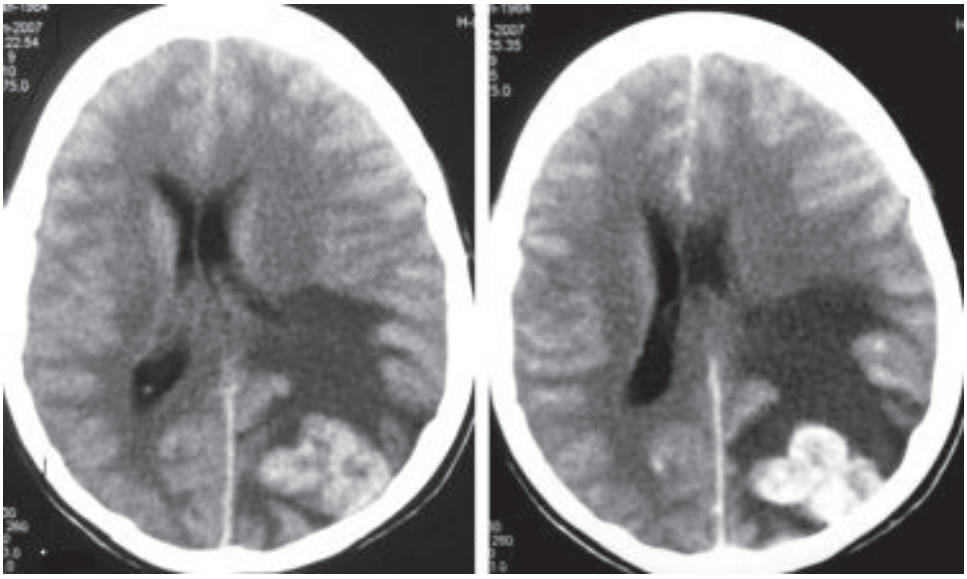

Fig.-1: *Photograph of CT scan (pre and post contrast) of brain showing left convexity meningioma with 1) huge peritumoral edema 2) cystic necrosis within tumor 3) Irregular border and 'mushrooming' like appearance of border 4) midline shifting.*

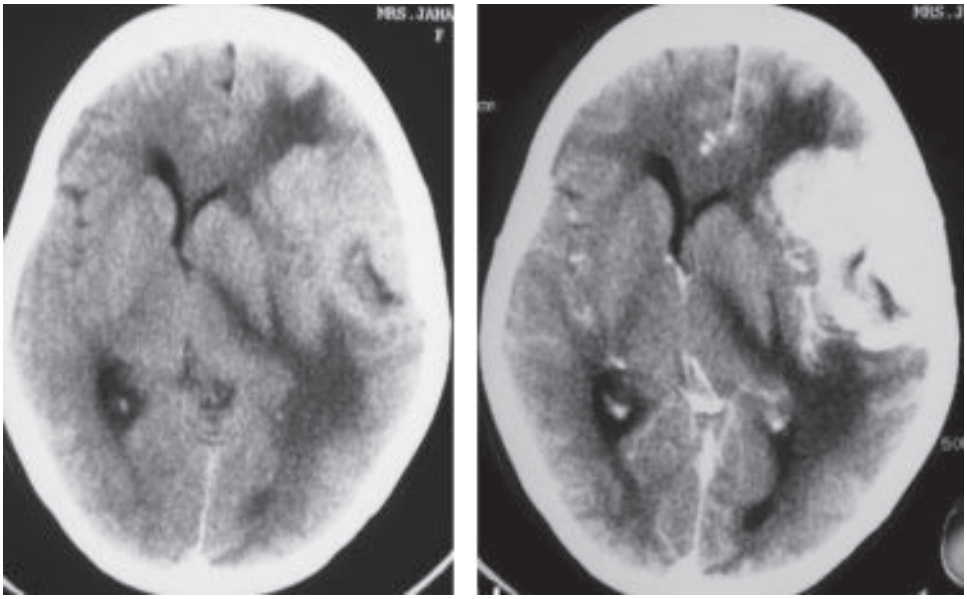

Fig.-2: *Photograph of CT scan (pre and post contrast) of brain showing left convexity meningioma with 1) Cystic necrosis within tumor 2) Irregular border 3) huge peritumoral edema 4) Midline shifting.*

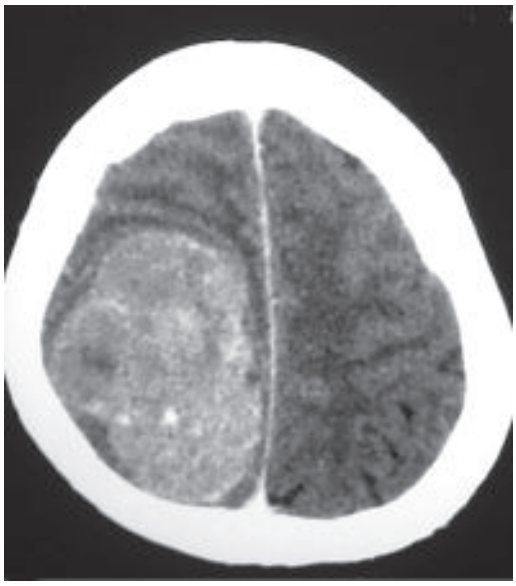

Fig.-3: *Photograph of CT scan (post contrast) of right parasagital meningioma showing irregular border, cystic necrosis and heterogenous contrast enhancement irregular border cystic necrosis within tumor.*

Table-I

Age distribution of patients with meningiomas

Age range(in years)	Frequency	Percentage
10-19	1	2.1
20-29	10	20.8
30-39	12	25.0
40-49	16	33.3
50-59	5	10.4
60-69	2	4.2
70-79	1	2.1
80-89	1	2.1
Total	48	100.0

Mean = 40.0 years SD = 13.6 Median= 40.0 years
Range =14- 85 year

Table-II

Location of tumors in patients with meningioma

Location	Frequency	Percentage
Convexity	20	41.7
Parasaggital	16	33.3
Sphenoid Wing	3	6.3
Falcine	2	4.2
CP Angle	5	10.4
Tentorial	1	2.1
Olfactory groove	1	2.1
Total	48	100.0

Table-III

Distribution of histological subtypes of intracranial meningioma

Histological subtypes	Frequency	Percentage
Meningothelial	20	41.7
Transitional	8	16.7
Fibroblastic	8	16.7
Psamomatus	4	8.3
Angioblastic	2	4.2
Microcystic	1	2.1
Atypical	4	8.3
Malignant	1	2.1
Total	48	100.0

Table-IV

Association of cystic necrosis with benign and non-benign subtypes of intracranial meningioma.

Benign or non-benign types	Cystic necrosis		Total
	Present	Absent	
Benign	6	37	43
Non-benign	4	1	5
Total	10	38	48

c2 =10.36
df =1
p = .001)

Table-V

Association of margin characteristics between benign and non-benign meningioma

Histological subtypes	Margin		Total
	Regular	Irregular or Mushrooming	
Benign	34	9	43
Non-Benign	0	5	5
Total	34	14	48

c2 = 12.54
df = 1
p = <.001)

Discussion:

The present study was conducted at the department of Neurosurgery with the help of pathology and Radiology department BSMMU. The purpose of this study was to find out the association of cystic necrosis and margin characteristics of intracranial meningiomas with histologically benign and non-

benign subtypes. In this study of 48 cases of intracranial meningiomas, mean age of the patients was 40±13.57; peak incidence of age was within 40-49 years age group. Age range of non-benign meningiomas was between 30-55 years, 2 were between 40-50, 2 were between 30- 39 and one was 55 years. Average age of defferent studieswas 55years,[5,6] 54.4years,23, an 56 years. [8] Regarding hispathological subtypes 89. 6% were benign and 10.4% were non-benign (atypical or malignant). Out of benign meningiomas 41% were meningothelial, 16.7% were transitional, 16.7% were fibroblastic, 8.3% were Psamomatus, 4.2% were angioblastic, and 2.1% were microcystic. Regarding benign and non-benign subtypes, Mahmood et al (1993) observed 92% benign and 8% non-benign, Alvarez (1987) observed 89.3% benign and 10.7% non-benign; Dimeco 2004 observed 79.6% benign and 18.5% malignant; Servo (1990) observed 89% benign and 11% non-benign. The present study is consistent with the above mentioned study. Cystic necrosis was observed in 20.8% cases of this study. Cystic necrosis was observed in 6(14%) benign cases and in 4 (80%) cases out 5 cases of non-benign meningiomas. Dietman (1992)observed 4 out of 5 cases of malignant meningiomas ,Servo observed 20%)of malignant and 4% of benign meningiomas, Alvarez (1987) observed 15 out of 58 cases of typical and 10 put of 12 atypical meningiomas. Comparing with these studies our study of 48 cases of intracranial meningiomas is consistent with these study..In present series 70.8% of tumor margin were regular. Irregular margin, fringes or mushrooming were present in 29.2% of meningiomas. Irregular margin, fringes, or Mushrooming were present in all of 5 non-benign meningiomas and 20.9% of benign meningiomas. Irregular margin was observed in 5 out of 5cases of malignant meningiomas by Dietman(1982), 55% of atypical and malignant meningiomas by Mahmood(1993),Yonis (1982) irregular margin 6 out of 17 malignant meningiomas and Mushrooming was observed in 11 out 23 malignant meningiomas .

In this study, there was significant association of cystic necrosis with benign and non-benign meningiomas. Servo (1990) observed significant relationship between cystic necrosis and malignancy in meningiomas, Alvarez (1987) found similar association of cystic changes or necrosis with benign and non-benign meningiomas. Similar relationship was also observed by vassilouthis and Ambrose in 1979. Dietman (1982) reported that heterogeneous contrast enhancement with or without cystic component may be considered as suspicion of malignancy.Significant association of margin character of irregular margin fringes or mushrooming with benign and non-benign was also observed in this series of 48 cases. Alvarez (1987) observed significant relationship of tumor fringes with benign and non-benign meningiomas,Yunis (1995) supported the usefulness of mushrooming in the diagnosis of aggressive meningiomas,7 Dietman (1982)reported that irregular outline of tumor with meningiomas may be considered as malignant meningiomas. [7] Vassilouthis and Ambrose (1979) in their study concluded that irregular margin, fringes, of tumor if exhibited then chances of possible malignancy is suspected. [30]

Study Limitation:

1) As incidence of non-benign meningioma is low, this sample size is not adequate to comment conclusively.
2) Ratio of male: female bed is 2: 1 and number of female bed is limited in our place of study.

Conclusion:

Cystic necrosis , margin irregularity, and mashrooming characters are more common in non-benign meningiomas. There is a significant association of cystic necrosis within tumor and margin characteristics of tumor in CT scan with histologicaly benign and non-benign meningioma. Proper evaluation of CT scan preoperatively may help in predict atypical and malignant meningioma as well as planning of treatment.

Recommendation:

From the light of this study of intracranial meningiomas, it is therefore recommended that when irregular margin fringes or 'mushrooming' is seen in CT scan of intracranial meningiomas, suspicion of non-benign meningioma should be born in mind. Large sample of non-benign cases should be studied for further conclusion.

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