The Value of Computed Tomography in The Diagnosis of Intracerebral Meningioma

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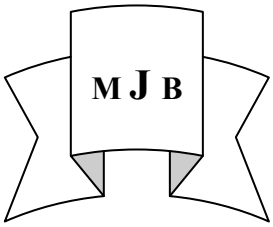

Abstract

To assess the value of computed tomography(CT) scanning in evaluation and diagnosis of intracranial meningioma

Seventy patients suffering from headache, vomiting ,fits and papilloedma were employed in this study.

The examination was conducted from January 1995 to January 2000, in computed tomography unit ,department of radiology in Ibin Sena teaching hospital in Mosul city, Iraq

The study included 70 cases of intracranial meningiomas, the average age incidence was 42 years with female predominance ratio of (3:1).The study also showed that Arabs were more affected with intracranial meningiomas (51.4%) than Kurd (34.3%), and the other minorities (14.4%) . Moreover, this study showed that 14.3% of the cases were related to old trauma, and it was found that meningioma occurs on right side of the head more than the left side and rarely reported Intraventricular. Finally this study showed that intracranial meningioma was found in children who were even 4 years old male and 7 years old female .

Post contrast examination by CT scanning revealed an accuracy of 95.7%
for intracranial meningiomas of typical and characteristic appearance of homogeneous enhancement in rather common locations.

The false positive cases constitute only 4.3% which latter proved to be gliomas All patients diagnosed with intracranial meningioma underwent surgical resection and biopsy.

الخلاصة

لبيان أهمية فحص المفراس C.T في تقييم وتشخيص أورام ألأ غشيه ألسحا ئية الدماغية. تم فحص سبعون مريضا يعانون من ألصداع والتقيؤ ونوبات صرعٍ ٍ مع وذمة قرص العصب البصري.

أجريت الدراسة في الفترة من كانون الثاني ١٩٩٥ إلى كانون الثاني سنة ٢٠٠٠ في وحدة المفراس قسم الأشعة في مستشفى ابن سينا التعليمي في الموصل.

من بين سببعين حالة من الأورام السحائية الدماغية ظهر إن معدل العمر هو (٤٢) ة وكانت الإناث أكثر إصابة من الذكور بنسبة ١:٣ وكذلك أوضحت الدراسة أن المواطنين العرب يصابون بهذا الورم بنسبة (٤و ٥١ %) و المواطنين الأكراد بنسبة (٣و ٣٤ %) إما باقي الأقليات فكانت (٤ و١٤%) وكذلك أظهرت الدراسة إن (٣و١٤%)من الأورام السحائية الدماغية حدثت بعد حوادث سابقة للدماغ.

كما إن نتائج هذه الأورام تحدث في الجهة اليمنى من الدماغ أكثر من الجهة اليسرى وقلما تنمو في بطينات الدماغ كما اضهرت الدراسة وجود حالات عند الأطفال دون ألعشر سنوات .

إن الفحص بعد اعطاع صبغة ألأيودين أ ظهر إن الأورام السحائية تعطي زيادة كبيرة ومتجانسة وذات خصوصية في زيادة كثافة الورم السحائي وفي المظهر وفي أمكنة خاصة ومعروفة في الدماغ مما يجعل دقة تشخيص الورم السحائي تصل إلى نسبة ٧و٩٥% بعد الصبغة، عدا ثلاث حالات (٣و٤%) ثبتت أنها أورام خبيثه .

Introduction

Meningioma is the most common benign tumor of meninges that represents 10-15 % of primary intracranial neoplasms[1]. It is originated from meningiocytes in the region of the arachnoid villii in relation to the dura matter [2]. The common sites of such tumor are Para sagittal, lateral convexities, sphenoid ridges, suprasellar, posterior fossa and rare cases in the acoustic intrameatal and intrasellar regions, [3 ,4 , 5] .

According to the most workers ,meningiomas are considered to be tumors of adult female with a peak age incidence at around 45 years, and 90% of meningiomas are benign [6 , 7] .

The initial experience and literatures reports indicate that non invasive method of CT scanning is undoubtedly a specific diagnostic and most accurate single radiological method for detecting intracranial meningiomas. The accuracy of such method is approximately 84.4% in pre contrast and 96 .4% in postcontrast examination. [6 ,7 , 8] .

The typical and reliable CT features are well defined, sharply delineated, rounded ,ovoid or lobulated tumor in the characteristic sites [1]moreover a uniform intrinsic high density seen on non contrast examination and marked homogeneous enhancement after intravenous contrast injection of conray (iodine containing compound).

The CT scan is highly sensitive to detect early calcified meningioma and performed quite well in detecting bony lesion, and the diagnosis of meningioma should be considered in any patient with contrast enhancing mass abutting the inner table of the skull [8, 9] .

Mass effect resulting from bulk of the tumor or due to peritumoral edema [10] especially in secretory meningiomas which appears as low density area not enhanced after contrast examination . Infact 60% of meningiomas are associated with perifocal brain edema [5,11,12] .

The aim of this study is to assess the value and accuracy of CT scanning in the diagnosis of meningioma and to compare the findings with the post operative biopsy.

Patients and Methods

A prospective CT scan study of 70 patients with intracranial meningioma was conducted, the patients were investigated in CT unit in Ibin Sena teaching hospital in Mosul city, Iraq from January 1995 to January 2000. All patients had proper standard pre and post-contrast CT-scan examination in transverse sections of 8 mm thickness using 60 ml. of water soluble contrast conray 280 melamine iothalamate 60 % through direct intravenous route. The machine used is a fourth generation high resolution CT scanner Pfizer 0450 USA made , and Spiral CT scanner 3D Phlips co. Holland.

Diazepam in a dose of 0.2-0.3 mg/kg was used as a sedative intravenously in adults and children ,and Intramuscular or intra rectal in infant .

Analysis of the data was considered using the followings :

1-Age and gender incidence .

2-Anatomical site of the tumor .

3-The maximum surface area of the tumor: by measuring the products of maximum length of the tumor multiplied by its maximum width at right angle on cross section of CT scan image to obtain average surface area.

4-Findings obtained from CT images .

5-The study results were confirmed by post operative findings and biopsy .

Results

The current study included 70 patients, 52 patients of them (74.3%) were female and 18 patients (25.7)were males with a ratio of 3:1. Arab patients were 36 (51.4%) while Kurd patients were 24 (34.3%) and other minority were 10 patients (14.3%) .

Table1 and histogram Figure 1, demonstrate the average age and sex distribution showing that the 53 patients (75.7%) were in the age group 30-59 years . The incidence of meningioma declined above and below the above age level.

In this series table 2 shows the age and sex distribution in relation to the site of the tumor, 24 patients (34.2 %) were located on the convexities of the skull , and 2 patients (2.9%) in the lateral ventricles.

Table 3 demonstrates the features of the meningioma which showed characteristic
pre contrast hyper density in 52 patients(74.3%)and the mass effect were shown in 5 patients (82.9%)and 59 patients (84.3%) in which they were enhanced homogeneously after contrastcontrast. Figure 2 .

Regarding the shape of the tumor, in 58 patients (82.9%) it was delineated rounded or Ovoid ,while in only 2 patients (2.6%) it had lobulated out line.

The diameter of the tumor ranged between 1-8 cm . and the average surface area was (16.25) cm^2 .

Post traumatic meningiomas were found in 10 patients (14.3%) the period varied from 4 months to 4 years after the incidence of head trauma. More further ,regarding the site of the tumor in (44.28%) of cases the tumor was found to be in right side of the skull,(37.1%) in the left side,13 patients 18.6% in the mid region of the skull

In this Study different patterns of meningiomas are shown in (Figure 2 A,B,C,D) .

Table 1 Age and gender distribution in patients with intracranial meningiomas in Nineveh province from 1995 to 2000 .

AGE IN YEARS	PATIENTS		MALE		FEMALE	
	No.	%	No.	%	No.	%
0-9	2	2.9	1	1.4	1	1.4
10-19	3	4.3	0	0	3	4.3
20-29	6	8.6	3	4.3	3	4.3
30-39	17	24.3	3	4.3	14	20
40-49	21	30.0	3	4.3	18	25.7
50-59	15	21.4	5	7.1	10	14.3
60-69	5	7.1	3	4.3	2	2.9
70-79	1	1.4	0	0	1	1.4
TOTAL	70	100%	18	30	52	74.3

Table 2 Average age distribution, gender and site of tumor in patients with intracranial meningioma in Nineveh province from 1995-2000 .

LOCATION	**NUMBER OF CASES**	**%**	**MALE**	**FEMALE**	**AVERAGE AGE ON ADMISSION IN YEARS**	**PVALUE**
Convexity	**24**	**34.2**	**7**	**17**	**47.8**	**NS**
Parasagittal	**17**	**24.3**	**6**	**11**	**42**	**NS**
Sub frontal	**10**	**14.3**	**1**	**9**	**43**	**NS**
Cerebello-pontine angle	**8**	**11.4**	**3**	**5**	**45.8**	**NS**
Sphenoid ridge	**4**	**5.7**	**0**	**4**	**39.7**	**NS**
Post. fossa	**3**	**4.3**	**1**	**2**	**38.3**	**NS**
Parasellar	**2**	**2.9**	**0**	**2**	**45.0**	**NS**
Intraventricular	**2**	**2.9**	**0**	**2**	**35.0**	**NS**
Total	**70**	**100%**	**18**	**52**	**42**	**NS**

All results were NS (using X test).
NS means no significant differences between the male and female regarding the location of the tumor.

Table 3 CT scan features of tumor in patients with intracranial meningiomas in Nineveh province from 1995-2000.

C.T features	Number	%
Tumoral density/ plain		
-hyper dense	52	74. 3
-isodense	18	25.7
-hypo dense	0	0
Hyperstosis	14	20
Calcification	18	5.7
Bony erosion	9	2.8
Peritumoral edema.	63	90
-mild	35	50
-moderate	11	15.7
-gross	17	24.58
-non	7	10
Mass effect	85	82.85
Shift of midline	24	34.28
Homogeneous-enhancement	65	92.85
Faint enhancement	5	7.14
Cystic changes	14	20
-central	7	10
-eccentric	7	10

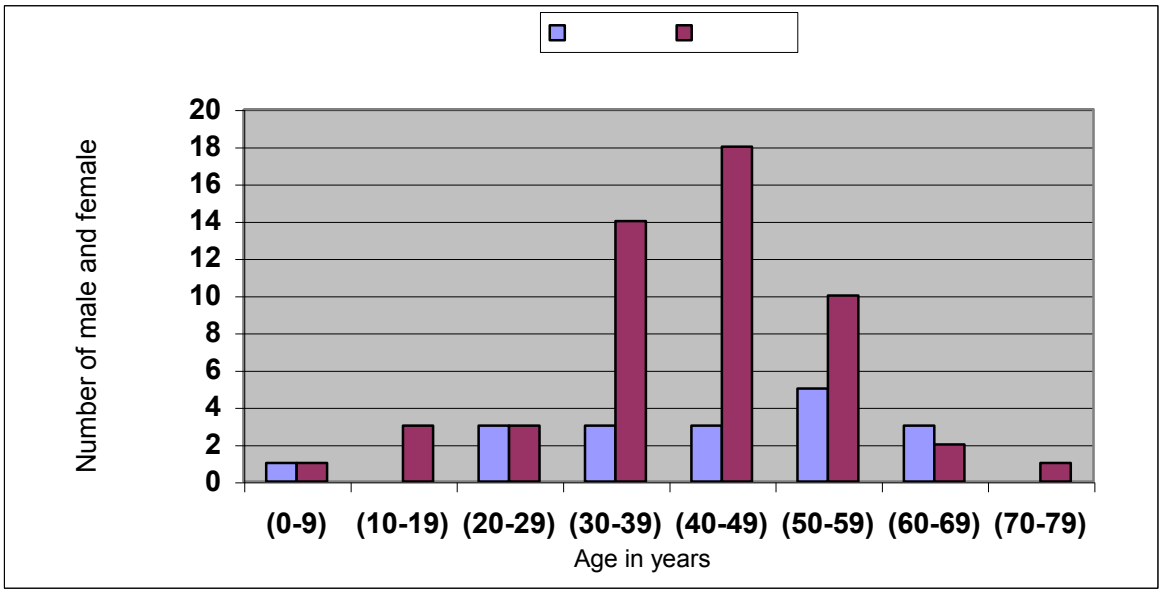

Fig: 1.Age and gender distribution in patients with intra cranial meningiomas in Nineveh Province from 1995 to 2000.

Series 1:male
series 2: female.

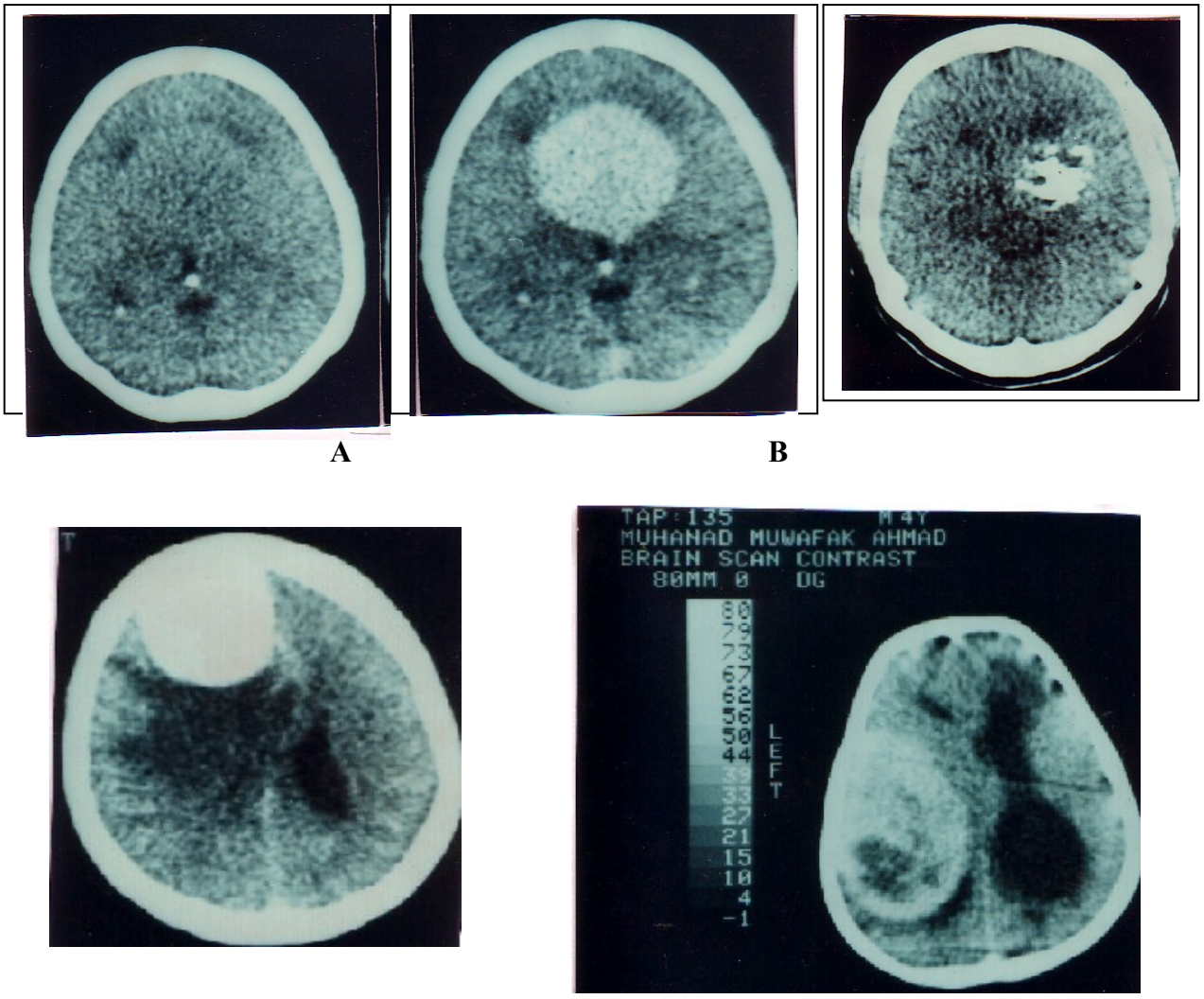

Figure 2
A: pre isodense and post homogeneous enhancement.
B: With irregular calcification.
C: With moderate perifocal edema and dense homogeneous enhancement.
D: Meningioma in four years old boy showing heterogeneous enhancement and eccentric cystic changes.

Discussion

The study included 70 patients over 5 years. They were diagnosed and analyzed on the basis of CT features and post operative biopsy .

Computed Tomography is a sensitive and non invasive exploration which should be performed first when intracranial tumor is suspected [8] .

The peak age incidence in this study was 42 years which is comparable with other studies and it is explained in Table 4 , in later studies [6,13,29] . No case was reported in patients less than 10 years old .In contrast the study of Amano K , et al (14) reported a case of cystic meningioma in 10 months old infant and Im SH Wang K, et al [15] study reported 11 cases range between10 months to 19.5 years . In Ferrante study [16] 19 patients (1.3%)out of 1397 of meningiomas were diagnosed before the age of 16 years. The study of Turgt M, [17] diagnosed meningiomas in 2% of all intracranial tumors infancy and childhood. Also in a study of Amir Jamshidi A, [18] the meningiomas

accounted about 1.1% of all intracranial pediatric tumors. But in this study 2 patients (2.9%) less than 10 years, a boy of 4 years old Figure 2 D, and a girl of 7 years old were reported .

In this series the females were predominant (74.3%) with a ratio of 3:1,the later finding was nearly similar to that reported by New,[19] with a ratio of 3:2, and Zain Alabdeen et al, [12] with a ratio of 1.9 : 1 .

In the current study there were 10 patients (14.3%) had a positive history of skull trauma,the same was mentioned by Traub SB [20] who found that 14.4% of patients gave a positive history of trauma to the skull .Other workers also correlate the occurrence of some meningiomas with prior trauma to the skull and meninges [21,22,23] .

In this study hyperostosis associated with the tumor was shown in 14 patients (20%)

In contrast, other studies done by Weggli U, [24] and Claveria LE, [11] showed hyperostosis in 18% and 16 % of cases respectively.Table: 5.

However, Connor et al, [25] mentioned that calcification was detected in (15-20%) , also study of kizana E et al, [26] showed tumor calcification in (62%) of CT scan and (8%) of MRI modalities.

In this series CT scan of 18 patients (25 .7%) showed tumoral calcifications which indicates that CT is very sensitive to detect tumor calcification and even more sensitive than other modalities.fig.2 B.

According to previous experience of other workers, [2, 24, 27] it had been reported that the tumor pattern of meningioma is typical and uniform, and often characteristic in its appearance and location which can be diagnosed with confidence. in this study meningioma was located more on the right side in (44.1%) in comparison with wiggli et al, [24] who found

(40%) of cases to be located on the right side of the skull.

The diminished density surround the tumor is due to brain edema. Calveria [11] foundthat the edema tends to be minimal in (56%) of cases while Sutton [10] stated that most meningiomas are surrounded by moderate oedema , and recently Pistils, et al, [12] stated that 60% of meningiomas are surrounded by moderate edema . Infact in this series 63 patients (90%) of the meningiomas showed peritumoral edema, minimal in 50%, moderate in 15.8% figure2C, and gross edema in 24.3%,the other 10% showed no edema,the high percentage in this series is due to high resolution CT equipment used.

Necrotic changes within the tumor have been to be uncommon in untreated cases,but Russell's, et al , [28] ,found necrosis in (14%) of their cases, while this study demonstrates intra tumoral necrosis in 21% of the cases fig. 2D. Hyper density lesions were found in this series in about 74.3% and isodense in 25.7% of them.The latter tumors showed enhancement in 65 patients (93%) ,This result was slightly higher than Weggli report [24] , who found enhancement in 89% of his cases, the latter was close to the result of New ,et al [19] who showed enhancement in 94.4% of cases and Kizana E ,et al study [26] who showed enhancement in 98 % of the reported cases.

In this study the results confirmed by post operative biopsy were positive in 67 patients making the accuracy (95.7%), the remaining 3 cases (4.3 %) were malignant gliomas, similarly changes reported by chamberlain, [7] ,showed 90% of the cases to be benign meningiomas, (6%) atypical meningiomas and (2%) malignant gliomas.

Table 4 .Peak age incidence of the patients with intracranial meningioma in Ninevah province compared with others studies

STUDY	NO. OF CASES	PEAK AGE IN YEARS	P-VALUE
current study	70	42.0	
Traub	170	45.8	NS
Zain Alabdeen	53	47.7	NS
Challis AH	261	40.0	NS

Z-test of proportion showing :
1-No significant difference was detected between this study and Traub study : P=NS using Z-test.
2-No significant difference was detected between this study and Zain Alabdeen : P=NS using Z-test.
3-Khalil AH :P=NS using Z-test

Table5 Comparison of CT scan features of intracranial meningioma in this current with other studies the data are presented in percent.

FEATURES	WEGGLI %	CLAVERIA SUTTON %	CURRENT %
Hyperstosis	18	16.9	20
Calcifications	23	19.7	25.7
Bone erosion	non	4.2	12.9
Peritumoral oedema	60	67.6	90
Mass effect	75	77.5	82.9
Cystic component		8.5	20
Total	40	71	70

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