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A comparative study between Medulloblastoma And Cerebellar astrocytoma In children

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Abstract

A prospective study was conducted between 2000 & 2002, on 50 children with histopathologyically verified medulloblastoma and cerebellar astrocytoma in neurosurgical department of Surgical Specialties Hospital. Their ages ranged from 2-19 years, with peak incidence between 5-10 years. No significant gender differences found.

Clinical findings of raised intracranial pressure & cerebellar dysfunction were prevalent in most of children.

CT scan confirmed the classical features of medulloblastoma as midline location, well defined margin & hyperdensity of lesion with homogenous enhancement after I.V. contrast infusion. In cerebellar astrocytoma, 60% were midline tumor, most of which were solid & 40% were hemispheric lesion, most of which were cystic. Calcification on CT scans seen more in medulloblastoma.

Shunt operation was the main procedure conducted for treatment of hydrocephalus associated with these tumors, but other CSF diversion procedures, especially safety burrhole at time of tumor resection was carried on in cystic lesion located off the midline.

The traditional suboccipital craniectomy, in sitting position, was performed in almost all patients. Total removal was achieved in 46.7% of children with medulloblastomas & 50% of children with cerebellar astrocytomas. Brain stem violation was evident more in medulloblastoma & was the main factor behind the incomplete tumor removal in significant number of cases that adversely affected the outcome.

Generally postoperative complications (pseudomeningocele, cerebellar mutism, meningitis, CSF leak, cranial nerve palsy…etc.) encountered more in children with medulloblastoma.

Mortality rate was 6.7% in medulloblastomas & 10% in cerebellar astrocytoma. The cause of death in patients with medulloblastoma was meningitis & patients with cerebellar astrocytomas was brain stem injury.

It was obviously concluded that early diagnosis & total removal of tumor with proper postoperative care would essentially decrease the postoperative morbidity & mortality.

Key words: Medulloblastoma, Cerebellar astrocytoma, children

Introduction

Primary tumors of the CNS form 20% of the neoplasias seen in children. They are the second commonest type of cancer seen in childhood, after leukemia. [1]

In order of frequency the most common brain tumors in children were astrocytoma (35%) & medulloblastoma (20%). [2]

The commonest site of the CNS neoplasias in children was the cerebellum (58.9%). [1]

Majority of posterior cranial fossa tumors in children were intra-axial tumors. The commonest type was medulloblastoma (40%) followed by astrocytoma (23%). [3]

Medulloblastoma is a malignant embryonal tumor, predominantly of childhood, arising from undifferentiated neuroepithelial cell in the cerebellum, the etiology of which remain unknown. It occur principally in the midline cerebellar region, but it prone to invade the meninges & CSF spaces. [4]

Medulloblastoma can occur at any age, from neonate to elderly, but is primarily a pediatric tumor. [5]

The incidence most commonly is in the first decade, with 70% of tumor occurring in patients less than 8 years of age. [6]

The peak of incidence was between 3 – 8 years. There is a well known male predominance ranging from 1.33: 1 to 2:1. [4]

Cerebellar astrocytoma is a benign tumor of childhood known to be associated with excellent long-term survival in-patients in who complete surgical resection is possible. [7]

About 4 – 10% of cerebellar astrocytomas are malignant, either anaplastic variants or, to lesser extent, glioblastomas. [8, 9])

Cerebellar astrocytomas appear to occur most frequently during the middle to latter half of the first decade of life. They are rare in the first year of life & are rare in adult life. [5]

They occur equally frequently in males & females, with no obvious racial predilection. [6]

Fig. (1): ***Cerebellar astrocytoma. CT scan of a 2 years old child shows cystic lesion with mural nodule enhancement.***

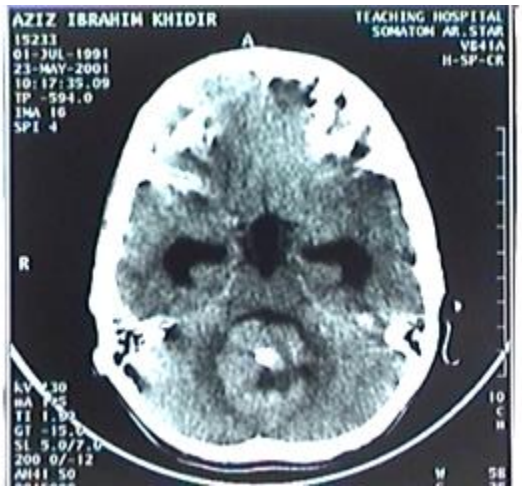
Fig. (2): Medullablastoma in an 10 years old child. A: preoperative CT scan shows midline isodense lesion with small hyperdense area (calcification). B :postoperative CT scan of the same patient confirm the total removal of the tumor.

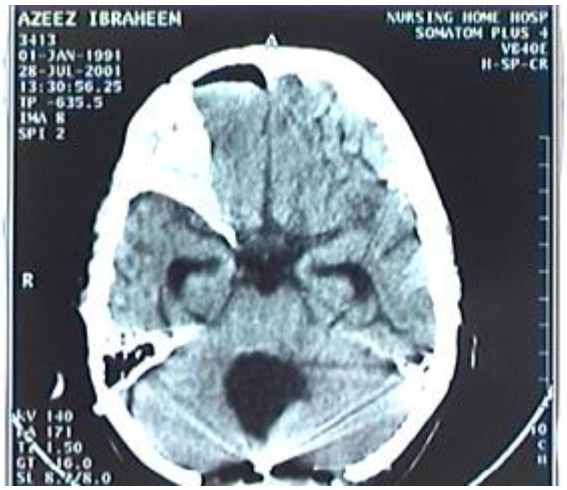
Patients & Methods

A prospective study, was achieved on 50 patients admitted to neurosurgical department of Surgical Specialties Hospital during 2000 & 2001 with histopathologically proven medulloblastoma & cerebellar astrocytoma. Patients below age of 20 years (ranged from 2-19years) from different geographical regions in Iraq were included in this study.

CT scans were done for all patients, it was the main imaging tool for diagnosis of posterior fossa tumors in children.

For treatment of the associated hydrocephalus patients were divided into 5 groups: elective shunt (1), emergency shunt (II), direct attack with safety bun-hole (III), direct attack with external drain (IV) & direct attack only (V).





Type of tumor, texture, color, demarcation, vascularity & its extension had been documented during the operation. The extent of tumor resection as estimated by the surgeon was considered either partial or subtotal or total. Brain stem injury was indicated by bradycardia & / or arrhythmia encountered during the operation & air embolism was detected by resistant hypotension as Doppler U/S was not available.

Operative specimens of the lesion had been examined at histopathological Lab. in Surgical Specialties Hospital & depending on the report of histopathologist the result was documented.

Outcome was estimated for only 33 patients after 6 months follow up (missed cases & dead patients have been excluded). Patients' outcomes were divided into good, fair &poor. Good outcome included patients free of major neurological deficit & able to return to previous level of activity. Fair outcome included patients life independently but not able to return to full activity because of new or preoperative neurological deficit that did not fully recover. Poor outcome included
dependent patients with major neurological deficit.

Results

Of the 50 patients included in this study, there was 30 (60%) patients having medulloblastoma &20(40%) patients having cerebellar astrocytoma

Patient's age in this study ranged from 2-19 years. The peak incidence for both medulloblastoma & cerebellar astrocytoma was between 5-10 years

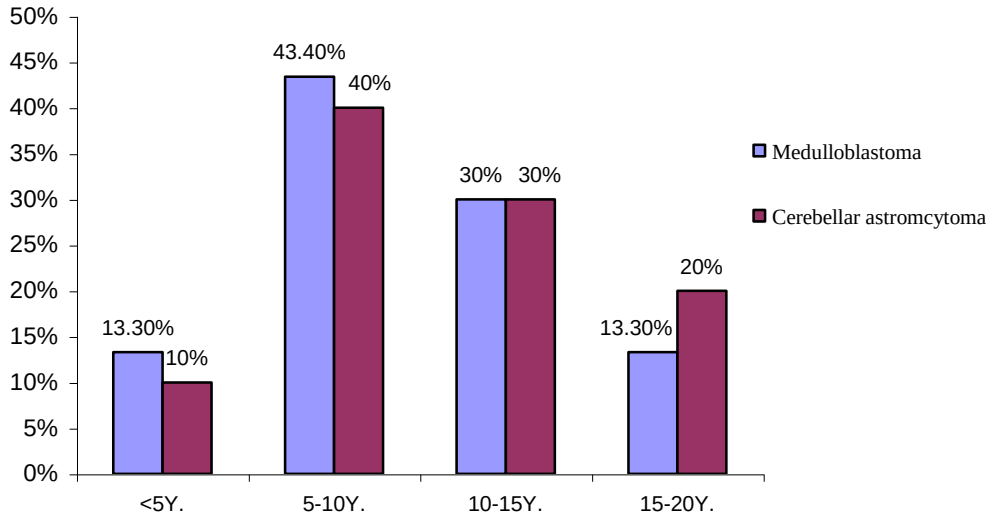


Fig (3): *Age distribution.*

Medulloblastoma was equally distributed between male & female, while cerebellar astrocytoma was showed slightly female predominance (male -female ratio1: 1.2).

The frequency of the common symptoms in children with both medulloblastoma and cerebellar astrocytomanb was headache , vomiting & unsteadiness of gait .
The frequency of the common signs in children with both medulloblastoma and cerebellar astrocytoma were papillodema, ataxia & nystagmus.

The findings in CT scan were as follow:

- Medulloblastoma was vermian in 28 (93.3%) patients & hemispheric in only 2(6.7%) patients, while cerebellar astrocytoma was vermian in 12 (60%) patients & hemispheric in 8 (40%) patients.
- Medulloblastoma was solid in 25 (83.3%) patients, mixed in 4 (13.4%) patients & cystic in only 1 (3.3%) patients, while cerebellar astrocytoma was solid in 8 (40%) patients, cystic in 7 (35%) patients & mixed in 5 (25%)

patients. In cerebellar astrocytoma cystic lesion was more frequent in hemispheric tumor.

- Calcification was found in 7(23.3%) patients with medulloblastoma &in only 1(5%) patient with cerebellar astrocytoma (Fig. 14).

Shunt operation was conducted before tumor resection in 28 (93.3%) patients with medulloblastoma & 15 (75%) patients with cerebellar astrocytoma. (Table 1).

CSF diversion procedures		Medulloblastoma	Astrocytoma
Shunt	Elective	25 (83.3 %)	15 (75 %)
	Emergency	3 (10 %)	----
Non-Shunt	Attack + safety burrhole	2 (6.7 %)	1 (5 %)
	Attack + external drain	----	3 (15 %)
	Attack only	----	1 (5 %)

Table (1): *Modes of CSF diversion.*

Peroperative, the texture of tumor was soft in 24 (80%) patients with medulloblastoma & 16 (80%) patients with cerebellar astrocytoma. Tumor colour was purpule – reddish in the majority of patients with medulloblastoma, 20 (66.7%) patients, while it was white in the majority of patients with cerebellar astrocytoma, 13 (65%) patients. The colour of fluid in all cystic tumors was golden yellow.

The majority of tumors in medulloblastoma were well demarcated, 19 (63.3%) patients, while the majority of tumors in cerebellar astrocytoma were ill demarcated, 12 (60%) patients.

In general the vascularity of tumor in medulloblastoma was higher than cerebellar astrocytoma.

Intraventricular extension were reported in 26 (86.7%) patients with medulloblastoma, compared to 9 (45%) patients with cerebellar astrocytoma Brain stem was violated in 15(50%) patients with medulloblastoma &7(35%) patients with cerebellar astrocytoma. Aqueduct invasion was reported in 4(13.3%) patients with medulloblastoma while no aqueduct invasion was reported in cerebellar astrocytoma.

Total removal of tumor was achieved in 14 (46.7%) patients with medulloblastoma & 10 (50%) patients with cerebellar astrocytoma (Fig.4).

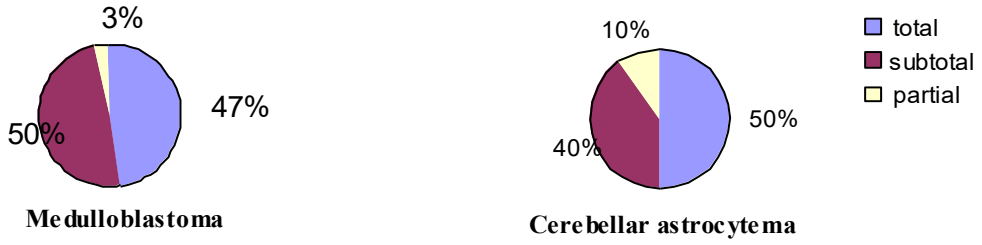


Fig. (4): ***Extent of tumor removal.***

In general the incidence of complications as shown in table(2) were higher in patients with medulloblastoma.

	Complications	Medulloblastoma	Astrocytoma
Propoerative	Bradycardia	5 (16.7%)	2 (10%)
	Arrhythmia	1 (3.3%)	2 (10%)
Postoperative	Cerebellar dysfunction	6 (20%)	7 (35%)
	Pseudomeningocele	3 (10%)	----
	Cerebellar mustim	4 (13.3%)	----
	Meningitis	2 (6.7%)	----
	Absence gag reflex	2 (6.7%)	2 (10%)
	Hemiparesis	3 (10%)	1 (5%)
	Cranial nerve palsy	1 (3.3%)	----
	CSF Leak	1 (3.3%)	----
	Seizure	1 (3.3%)	----
	Local skin infection	1 (3.3%)	----

Table (2): ***Incidence of complications.***

Mortality was documented in 2 (6.7 %) patients with medulloblastoma & 2 (10 %) patients with cerebellar astrocytoma.

Depending on the report of the histopathologist, medulloblastoma was classical in 27 (90 %) & dysmoblastic variant in 3 (10 %), while cerebellar astrocytoma was pilocytic in 11 (55 %) & fibrillary in 9 (45 %) (Fig. 5).

Fig. (5): ***Histopathological classification.***

Medulloblastoma was showed good outcome in 12 (63.2 %) patients, fair in 5 (26.3 %) patients & poor in 2 (10.5 %) patients, while in cerebellar astrocytoma, the outcome was good in 10 (71.4 %) patients, fair in 3 (21.4 %) patients & poor in 1 (7.2 %) patient (Fig.19).

Discussion

Medulloblastoma & cerebellar astrocytoma represents the main bulk of posterior fossa tumor in children.

As agreed in the literature, both medulloblastoma & astrocytoma exhibited a peak of incidence between 5 -10 years.[5,4]

In this study, medulloblastoma seen equally distributed between male & female, while cerebellar astrocytoma was showed slightly female predilection. This result not compatible with the literature Farewell et.al.[10] showed male predominance in medulloblastoma. Wilkins & Rengechary[6] confirmed equal sex distribution in cerebellar astrocytoma. This is, probably, due to the small number of cases in this study.

As strongly agreed in the literature, headache was the commonest symptom. It was reported in 90% of patients with medulloblastoma &95% of patients with cerebellar astrocytoma. The second prevalent symptom was vomiting, explained by endocraninal hypertension or direct pressure on medullary emetic center or both.

Papillodema was the most significant sign detected in 86.7% of patients with medulloblastoma &80% of patients with cerebellar astrocytoma. Approximately the same result was documented by Delia et al.[11]

Because of its availability & easier application in children, CT scan was the main diagnostic tool used in this study. It confirmed the universally accepted midline location of medulloblastoma in 93.3% of cases. A cerebellar strocytoma also have

high tendency of midline location (60%) but with significant incidence of hemispheric location (40%).

It was evident radiological that medulloblastoma was a solid lesion; while cerebellar astrocytoma was cystic in majority of hemispheric lesion, & could be either cystic or solid in vermin lesions [6, 12, 13]. In this study, CT scan showed solid tumor in majority of both medulloblastoma & cerebellar astrocytoma, while the incidence of cystic tumor was higher in cerebellar astrocytoma, especially if the tumor was hemispheric.

The incidence of calcification detected on CT scan of patients with medulloblastoma (23.3%) was significantly higher than patient with cerebellar astrocytoma (5%). This results showed agreement with the study of Colosime et al.[14], but he showed higher calcification incidence of astrocytoma (17%).

Still there is controversy about the management of hydrocephalus associated with posterior fossa tumor in children.. Most of the neurosugeon indicated shunt operation for these patients with midline solid tumors (majority of medulloblastoma) claming that it will improve the clinical features of raised I.C.P., provide lax brain during tumor resection & facilitate smooth postoperative course, as reported by Griwan et.al[15] & Goel[16]. Furthermore, Lee et al. concluded that patients with extensive tumor that present in late stage of disease, especially in developing countries, are most likely to benefit from precraniotomy shunting.[17]

Total removal was achieved in 50% of patients with cerebellar astrocytoma & 46.7% of patients with medulloblastoma. The most important parameter that affect the extent of tumor removal was brain stem violation, indicated by the peroperative development of bradycardia & / or arrhythmia during the surgeon's attempt to remove the tumor from the fourth ventricle floor. These peroperative worning signs occurred in 20% of cases. Furthermore, the high vascularity of tumor in medulloblastoma & the poorly defined tumor margin in cerebellar astrocytoma were also adversely affecting the extent of tumor resection. It was strongly evident that gross total removal of tumor in medulloblastoma will improve prognosis intimately[18], while even subtotal removal of tumor in cerebellar astrocytoma will exhibits long term survival of children. [11, 19] .

Mortality rate of children treated for medulloblastoma was 6.7 % & of children treated for cerebellar astrocytoma was 10 %. Helseth et al.[20] showed higher mortality rate of children with medulloblastoma (13%) & Pancalete et al.[7] showed lesser mortality rate of children with cerebellar astrocytoma (4.2%). Lack of antibiotics & inappropriate management of external drain rendered meningitis, the main cause of death in medulloblastoma. In cerebellar astrocytoma brain stem injury was considered to be the cause of death. This iatrogenic problem can be avoided by the use of new advanced neurosurgical technology, as CUSA, laser, operative microscope & good illumination.

Inspite of the short period of follow up in this study (6 months), patients with cerebellar astrocytoma were showed better outcome than patients with medulloblastoma, but to confirm the higher rate of survivals reported in the literature for children having cerebellar astrocytoma, longer time of follow up is needed.

Conclusions:

1- The peak incidence of both medulloblastoma & cerebellar astrocytoma is between 5-10 years without significant gender difference.
2- Most of them presented with headache & vomiting secondary to raised I.C.P., were misdiagnosed as gastrointestinal disorders by most of physician.
3- On CT scan, majority of medulloblastoma was midline tumor, solid, hyperdense & diffusely enhanced with contrast; while cerebellar astrocytoma was solid, isodense & partially enhanced in most of midline tumors & cystic with mural nodule enhancement in most of hemispheric lesion.
4- The incidence of tumor calcification was significantly higher in patients with medulloblastoma.
5- Shunt operation was indicated for midline & solid tumors, while non-shunt CSF diversion procedures could be an alternative in cystic tumor located away from the midline.
6- Gross total removal of tumor should be the goal standard of neurosurgeon, but every effort should be given to avoid brain stem injury.
7- Postoperative morbidity & mortality was significantly decreased by the use of advanced neurosurgical techniques.
8- Postoperative morbidity & mortality was higher in children with medulloblastoma, as compared to cerebellar astrocytoma.
9- Brain stem violation was the main factor that affect outcome adversely & signified the delayed presentation of cases in this study.

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