ACCURACY OF COMPUTERISED TOMOGRAPHY IN DIAGNOSIS OF BRAIN TUMOURS IN CHILDREN

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Background: CT scan has replaced most of the invasive techniques in diagnosis of brain tumours because it can accurately demonstrate, localize and characterize the brain tumours. The objective of this study was to observe the accuracy of CT scan in the diagnosis of brain tumours in children by comparing it with histopathology. This descriptive case series was conducted at Department of Radiology, Ayub Teaching Hospital Abbottabad from 10th March 2005 to 9th March 2007. **Methods:** Both pre and post contrast CT scan was carried out on 120 patients referred to Radiology Department for CT scan suspected of having brain tumours. Data of CT findings/diagnosis of patients having brain tumours were collected on a proforma. Histopathology of specimen from operation or biopsy was carried out and compared with the CT scan diagnosis. **Results:** Glial tumours comprised the largest category 68 (56.67%). Medulloblastoma was 23 (19.16%) Craniopharyngioma 8 (6.63%) and Ependymoma were 6 (5.0%) each. Hemangioblastoma 2 (1.67%), Choroid plexus one (0.83%) adenoma and pineal tumours were 9 (3.33%) each. As regards comparison between CT and histopathology, an agreement between the two was found in 104 (86.67%) cases whereas in 16 (13.33%) of the cases, the histopathology reports were different. In case of Astrocytomas 63 (92.64%) were confirmed on histopathology and 5 (7.36%) was reported differently. In Medulloblastomas 19 (82.60%) were accurately diagnosed on CT scan. Sensitivity of CT scan in diagnosis of brain tumours in children was 93.33%. **Conclusion:** CT Scan is more accurate predictor of brain tumour yet it is not always 100% accurate.

Keywords: CT scan, Histopathology, Paediatric tumours, Astrocytomas, Medulloblastoma

INTRODUCTION

Primary brain tumours are commonly located in the posterior cranial fossa in children. Approximately 70% of all intracranial tumour in children are infratentorial whereas in adults majority of supratentorial.[1]

Brain tumours are 20 to 30% of all paediatrics tumors.[2] Incidence peaks in first year of life.[3] Eighty-eight percent of all tumours fall into one of the 4 categories, astrocytoma, medulloblastoma, ependymoma and craniophrangioma.[4] The remaining 12% consist of less frequently occurring tumours such as germ cell tumours, choroid plexus carcinoma and subependymal giant cells tumors.[5]

From a histological perspective, astrocytomas, oligondedrogliomas, and oligoastrocytomas may be benign or malignant (WHO grade I–II). Glioblastoma multiforme represents the most aggressive variety of malignant glioma (WHO grade III–IV). At the opposite end of the spectrum, there are so-called the pilocytic astrocytomas, a distinct variety of astrocytic tumours (WHO grade-I). Majority of them are located in the posterior cranial fossa, affect mainly children and young adults, and have a clinically favourable course and prognosis.[6]

In contrast to other types of cancer, primary brain tumours rarely metastasize, and in this rare event, the tumour cells spread within the skull and spinal canal through the cerebrospinal fluid, rather than via bloodstream to other organs.[7]

Clinical features are headache, nausea, vomiting, convulsions, focal neurological deficits, hemiplegia, visual field defects, diplopia, unstable gait and loss of consciousness. The clinical features depend on site, size, location and nature of the tumour and result from increased intracranial pressure secondary to hydrocephalus.[8]

CT has replaced most of invasive techniques used previously because it is non-invasive and can accurately demonstrate, localise and characterise brain tumours.

The objective of the study was to determine the accuracy of CT scan in the diagnosis of brain tumour in children below 16 years taking histopathology as gold standard.

MATERIALS AND METHODS

The study was carried out in Department of Radiology Ayub Teaching Hospital Abbottabad, from March 2005 to March 2007. Histopathology was carried out in Department of Pathology Ayub Medical College Abbottabad. A total of 120 consecutive patients were included in the study. All cases of age less than 16 years, in which both CT and biopsy reports were available, were included in the study whereas inadequate/non-conclusive biopsy reports and space occupying lesions other than brain

tumours, e.g., Tuberculoma, abscess etc. were excluded from the study.

All 120 consecutive cases underwent CT scan during the study period; CT image was obtained on X-Ray films with multi-format camera. A record of the positive cases was kept on floppies. All the cases diagnosed as brain tumours on CT scan were followed up in the neurosurgical and pathology departments and data about the operation notes and reports were collected and a comparison was made between the CT-scan diagnoses and histopathological diagnoses.

Data were entered into computer using SPSS version 10 for analysis. The test performance characteristics were calculated using the predictive value model of Galen and Gambino. Histopathology was taken as diagnostic reference 'Gold Standard'. 2×2 table was used to determine sensitivity, specificity, positive predictive value, negative predictive value and diagnostic efficacy by calculating true positive, True Negative, False Positive and False Negative.

RESULTS

There were 68 (56.67%) male and 52 (43.33%) female patients. Male to female ratio was 3:2.

Out of total 120 cases, glial tumours were 68 (56.67%), medulloblastoma were 23 (19.16%) followed by pineal tumours 9 (7.5%), craniophrangiomas 8 (6.67%), and ependymoma 6 (5%), pituitary adenoma 3 (3.33%), hemangioblastoma 2 (1.67%) and choroid plexus adenoma 1 (0.83%).

Out of these 120 tumours, 72 (60%) were infratentorial and 48 (40%) supratentorial in location. Infratentorial location was more common between the ages of 7 months to 5 years and supratentorial between 6 years to16 years.

Out of 68 cases of astrocytoma 63 (92.64%) were confirmed on histopathology, 5 cases (7.35%) were not confirmed. Four cases were diagnosed as infarcts and 1 as encephalitis on histopathology. Out of 23 cases of medulloblastoma, 19 (82.60%) were accurately diagnosed on CT and 4 (17.40%) were diagnosed as ependymoma on histopathology. Craniopharyngiomas 6 cases (75%), ependymoma 4 cases (80%) pituitary adenoma 2 cases (66.67%) hemangioblastoma 1 (50%), pineal tumours 7 (77.78%) and choroid plexus adenoma 1 case (100%) were correctly diagnosed when CT diagnosis was compared with histopathology diagnosis.

The overall accuracy of CT Scan was 86.6% taking histopathology as gold standard.

Table-1: CT scan versus Histopathological pattern of paediatrics intracranial tumours (n=120).

Disease	CT diagnosis Cases (%)	Histopathology diagnosis Cases (%)
Glioma	68 (56.67%)	63 (92.64%)
Medulloblastoma	23 (19.16%)	19 (82.60%)
Ependymoma	6 (5.0%)	4 (80%)
Craniopharyngioma	8 (6.63%)	6 (70%)
Pituitary adenoma	3 (3.33%)	2 (66.67%)
Hemangioblastoma	2 (1.67%)	1 (50%)
Pineal tumour	9 (7.5%)	7 (77.78%)
Choroid plexus adenoma	1 (0.83%)	1 (100%)

DISCUSSION

Paediatric solid tumours represent a distinct set of malignancies of embryonal origin and brain tumours are the most common solid malignancy in childhood.[2]

In developing countries the prevalence rate of paediatric tumours has been reported from 4.38% to 12.6% while in developed countries the prevalence rate of childhood tumours is 2%.[3] This could be an apparent increase as number of school going children in developing countries differ from that in developed countries. Secondly, this high frequency of paediatric tumours in developing countries could be attributed to the increased percentage of (39% of total population is children) in the over all population.[5]

The common clinical manifestation in our selected group of 30 cases were headache (60%), vomiting (33.3%) seizures (26.67%) and hemiplegia (16.25%). Visual defects and vertigo were 13.31% each. Unstable gait and unconsciousness were 3.33% each. A similar study was carried out at PNS Shifa Naval Hospital Karachi by Khalid MM in which the clinical features were headache (76%), vomiting (62%), seizures (84%) visual defects (44%), personality changes (36%) vertigo 26% and hemiparesis 22%.[6] A study conducted by National Survey of Care for Brain Tumours in USA revealed that the most common clinical presentations of brain tumours were a progressive neurological deficit (68%), headache (54%) and seizures (26%).[9] These clinical manifestations only slightly differed from our study, the reason being less number of patients and different purpose of our study and that our study was carried out on children and this study was carried out mainly on adults.

In our study infratentorial origin was the most frequent site. Infratentorial region was involved in 60% of the cases which is relatively lower than the figure of 70% reported in western literature.[4]

Glioma constituted the commonest neoplasms comprising 56.67% of all primary CNS neoplasms, followed by medullobastoma (19.16%), craniopharyngioma (6.67%) and ependymoma (5%). These findings were similar to published data by Hanif G *et al*.[10] In their study glioma comprised 44.8% of all

brain tumours followed by medullobastoma (15.5%) and ependymoma (10.3%). Similar data were published by Young *et al* in 2000 from the USA.[1] Hanif *et al*[10] reported a relatively high number of medullobastoma as compared to astrocytoma in children.[11] In their study total number of children with malignant disease was 338 and out of these CNS tumours were only 24 in number (7.1%); 13 (54.16%) were medulloblastoma, 4 (16.67%) astrocytoma, 4 (16.67%) glioblastoma, 1 (4.16%) craniopharyngioma and 2 (8.33%) of sympathetic nervous system. CT scan can determine the degree of malignancy on the bases of tumour size, necrosis, calcification, oedema, haemorrhage, and contrast enhancement. On the basis of CT features, 15 (62.5%) cases were placed in low grade (I-II) and 2 (8.33%) patients in high-grade malignancy.

Khalid MM quotes different figures. Out of 48 cases of glioma, 19 (39.58%) were placed in low grade (1&II) and 29 (60.42%) in high grade malignancy.[6] The reason for this difference is that our study was carried out on children in whom grade I–II are more common.

CT has become the primary imaging investigation in cases of suspected brain tumours, surpassing many other invasive imaging modalities. It has considerably high sensitivity it is non-invasive having no hazards except ionizing radiations.

CT can predict the pathological nature of a lesion with reasonable degree of accuracy. As regards comparison between the diagnosis made on CT scan with histopathology, out of 120 cases, 104 (86.67%) were found to have same diagnosis on histopathology as on CT scan and 16 cases (13.33%) were reported differently on histopathology.

CONCLUSION

CT Scan is more accurate indicator of brain tumour, yet it is not always 100% accurate.

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