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Radiodiagnosis

THE SIGNIFICANCE OF COMPUTED TOMOGRAPHY IN EVALUATING HYDROCEPHALUS

Dr. T Suresh — Associate Professor Department of Radiodiagosis Alluri Sitarama Raju Academy of Medical Sciences Eluru - 534005 West Godavari District, Andhra Pradesh, India

Dr. S Priyanka Rao* — Postgraduate Department of Radiodiagosis Alluri Sitarama Raju Academy of Medical Sciences Eluru - 534005 West Godavari District, Andhra Pradesh, India
*Corresponding Author

ABSTRACT

Aim ; Detection of Hydrocephalus and determining the cause of Hydrocephalus. CT helps in differentiating the communicating from non-communicating (Obstructive) Hydrocephalus along with grading of Hydrocephalus.

Materials and methods : In the present study, total 50 patients who were clinically diagnosed or suspected and undiagnosed cases of hydrocephalus were subjected to CT scan.

Results : In our study of CT evaluation of Hydrocephalus, the most common age group was >12 years. Tubercular meningitis is the major cause of hydrocephalus, observed in 30% of cases. Incidence of obstructive hydrocephalus significantly out numbered communicating type of hydrocephalus. Moderate and severe degree of hydrocephalus constituted majority of cases in our study accounting to 82%.

Conclusion: CT scan revealed the type of hydrocephalus, whether communicating or obstructive type along with the severity of hydrocephalus. Pathological causes of hydrocephalus was correlated.

KEYWORDS : CT, Hydrocephalus, Communicating, Non Communicating, Obstructive.

INTRODUCTION

The ability to image the human central nervous system non-invasively has completely changed the diagnostic approach to the pathology of brain. During the past three decades technical advancements have yielded a variety of examinations that produce detailed anatomic or physiologic information. Neurosonography has carved its own niche and has rapidly become the initial imaging procedure of choice for many CNS abnormalities in infants particularly in the diagnosis of hydrocephalus and its causes. But in few cases the exact cause cannot be determined by neurosonography Noninvasive imaging modalities like CT and now recently MRI have dominated the field of noninvasive neuroimaging in the diagnosis of hydrocephalus and its causes.

Hydrocephalus refers to the morphological and histological alteration in the brain parenchyma as a consequence of an increase in CSF spaces(particularly the ventricles) or pulsatile pressure within ventricles when there is an obstruction to flow of CSF or imbalance between its site of production and absorption.[1]

The accuracy of CT in assessing the ventricular size and ventricular abnormalities is almost equal to that of MRI. Because of its accuracy, speed, availability and non invasive capability it has become the imaging modality of choice for the diagnosis and management of hydrocephalus. CT also provides a tool for evaluating the pathophysiology of hydrocephalus and multiple changes attendant upon shunt therapy of hydrocephalus. [2]

MATERIALS AND METHODS

The Study Setting : This study was carried out from the cases collected from the Department Of Radiodiagnosis, Alluri Sitarama Raju Academy of Medical Sciences. Eluru

The Study Duration : The study was carried out for 24 months between November 2011 to November 2013.

The Study Design : A 24 months prospective study was carried out in the Department of Radiodiagnosis ,Alluri SitaramaRaju Academy of Medical Sciences, Eluru.

Source of Data : The patients were referred to our department from the General Medicine, Pediatrics, Neurosurgery and Neurology Departments on the basis of their clinical presentation. A detailed history along with complete clinical examination and laboratory investigations was done before the CT examination.

Study Population : 50 cases were sent for CT scan of head with signs and symptoms suspicious and suggestive of hydrocephalus between November 2011 to November 2013.

Selection of Patients :

The patients who were subjected for the study include (Inclusion criteria):

1. Clinically diagnosed cases of hydrocephalus
2. Patients of all ages and any sex who were undergoing CT for further indications (Eg.. Suspected tumor) and in whom hydrocephalus was detected incidentally.
3. Infants with congenital malformations who were suspected to have hydrocephalus and which was confirmed after CT imaging.
4. Suspected cases of Tubercular meningitis

Exclusion criteria:

Patients with ventricular dilatation due to cerebral atrophy (Hydrocep halus ex vacuo).

The Computed Tomography (CT) Machine :

All the cases were studied on a Siemens Somatom 40 ARC Computed Tomography system which is a modified Third generation machine. Factors of 130 KV and 70mA were constant for all cases and factors of 110KV and50mA were used for infants.

RESULTS

In our study of CT evaluation of Hydrocephalus, the most common age group was > 12 years, they accounted for a total of 15 cases (30%). The next common age group was between 0 to ≤1year and they accounted for a total of 11 cases (22%).

The next common group in descending order was between >1to≤ 3 years and they accounted for a total of 9cases(18%). Next comes >3to ≤ 6years and >6to≤ 12years and each accounted for a total of 8cases (16%) and 7cases(14%) respectively.

This study showed tubercular meningitis as the major cause of hydrocephalus and it accounted for 15cases(30%). The next important cause is tumors and it constituted 12cases (24%).

The other causes included aqueduct stenosis 9cases (18%),intrapar enchymal hemorrhage 4 cases(8%), congenital communicating hydrocephalus 5cases (10%), Dandy walker malformation 2 cases (4%) and other conditions like Normal pressure hydrocephalus, SAH, Vein of Galen malformation(VOGM) together accounted for the remaining 6% of the cases.

The study showed that incidence of obstructive hydrocephalus significantly more than communicating type of hydrocephalus.

In obstructive hydrocephalus which accounted for 32cases(64%), obstruction at the level of IV ventricle constituted the majority of

11cases(34.4%). The other sites of obstruction in descending order were as follows – at the level of aqueduct, which accounted for 9 cases (28.1%), obstruction at anterior III ventricle 6 cases(18.8%) obstruction at posterior III ventricle 3 cases(9.3%), Dandy Walker malformation and obstruction at outlet foramina of IV ventricle 2cases(6.3%) and others like Oligodendroglioma (obstruction at the level of lateralventricles) accounted for 1case(3.1%).

In communicating hydrocephalus which accounted for 18cases(36%), tubercular meningitis is the leading cause constituting 10cases (55.6%). The other causes included – congenital defective absorption at the level of arachnoid villi (27.7%) 5cases, functional hydrocephalus due to choroid plexus papilloma 1case(5.6%) and others like Normal pressure hydrocephalus and SAH accounted for 2cases (11.1%). Moderate and severe degree of hydrocephalus constituted majority of cases in our study accounting for 41cases (82%).

In our study of 50 cases it was noticed that 14 cases(28%) who did not have any signs and symptoms of hydrocephalus, were found to have hydrocephalus on CT imaging. Of the remaining (72%), clinically suspected cases of having hydrocephalus and which was confirmed by CT imaging constituted 28 cases(56%) and clinically diagnosed cases constituted 8 cases(16%). Moderate and severe degree of hydrocephalus constituted majority of cases in our study accounting for 41 cases(82%).

DISCUSSION

Hydrocephalus is a common disease complex with a diverse etiology, particularly in the pediatric population, with variable morbidity and mortality. It results from impaired circulation and absorption of CSF or in the rare circumstance from increased production of CSF.

Since most hydrocephalus is obstructive other than a minority due to overproduction, it would be more accurate to classify hydrocephalus as obstructive (IVOH) and of communicating type (EVOH). The common cause of obstructive hydrocephalus is obstruction by tumors, Aqueduct stenosis and congenital deformities like Dandy walker malformation.

Nonobstructive hydrocephalus commonly follows posthemorrhagic and postinfectious fibrosis at basal cisterns, incisura convexity cisterns and parasagittal region. Congenital causes such as Arnold Chiari malformation II and agenesis of arachnoid granulation are second common cause.

The major CT criteria for determining the site of obstruction in hydrocephalus is the point of transition from dilated to non-dilated CSF containing spaces.This approach is not without major pitfalls, however as pointed out by Naidich et al, who found that 25-35 percent of patients with communicating hydrocephalus had little or no dilatation of IV ventricle [2].

In our study done on 50 cases we found that obstructive hydrocephalus (64%) significantly out numbered communicating hydrocephalus (36%) which is similar to Pomschar et al study.[4] The major CT criteria used in our study was the point of transition from dilated to non dilated CSF spaces.

The other criteria used in our study in diagnosing, grading and determining the type of hydrocephalus included :

1. Ventricular size index.
2. Ventricular angle of frontal horn.
3. Temporal horn dilatation.
4. Sulci and Cisterns –whether prominent or obliterated.
5. Changes in the adjacent periventricular white matter-transependymal spread with periventricular edema.
6. CECT : To look for enhancing basal exudates (as in TBM), and look for characteristics of a tumor causing hydrocephalus.

In our study hydrocephalus was more below the age group of 3 years (40%),in contrast to the study done by Younger et al[5] and Shprecher et al[6]where hydrocephalus was commoner in elderly than young patients

In our study hydrocephalus showed male predominance 27(54%), when compared toYounger et al[5] and Shprecher et al[6] where males and females were equally affected. Most of the patients had neurological deficits, particularly in those patients in whom hydrocephalus was secondary to tubercular meningitis (or) tumor.

Our study showed tubercular meningitis as the major cause of hydrocephalus (38%), followed by tumors (24%) and aqueduct stenosis (18%). The other causes included congenital communicating hydrocephalus (10%) Dandy walker malformation (4%) and others (6%).

In a study done by Kingsely and Kendall et al on a series of 109 cases of hydrocephalus, tumors were the commonest cause of hydrocephalus 56 cases (51%) followed by communicating hydrocephalus 20 cases(18%), aqueduct stenosis 17 cases(16%) and posterior fossa cysts 16 cases(15%).[7]Pomschar et al (2012) in his study on 80 children and adolescents(75 obstructive and 5 communicating)[4],had post hemorrhagic aqueductal stenosis, 16 intracranial tumors, 9 Chiari II malformations, 5 other congenital malformations including malformations of the Dandy Walker spectrum, 9 idiopathic aqueductal stenosis, 7 arachnoid cysts and 10 other disorders, such as post-infections, mesencephalic arteriovenous malformation (AVM)[4]

In a study done by Djientcheu (2011) in 46 toddlers,the identified etiologies of hydrocephalus were aqueduct stenosis(28.7%), hemorrhage(18%), Dandy-Walker's syndrome (14.3%), meningitis (10.8%), myelomeningocele (10.8%), agenesis of Monro foramen (3.6%), brain abscess (3.2%) and posterior fossa tumor (3.6%). No specific cause was found in 7% of cases.[3]

CONCLUSION

In the present study, patients who were clinically diagnosed, clinically suspected and undiagnosed cases of hydrocephalus were subjected to CT scan.

1. CT scan revealed whether the hydrocephalus was of commun icating or obstructive type.
2. Pathological causes of hydrocephalus - Tubercular meningitis was the commonest cause of hydrocephalus, with tumors as second and aqueduct stenosis as the third important cause of hydrocephalus.
3. The severity of hydrocephalus was also identified. It was noted that most of the cases were of moderate and severe degrees of hydrocephalus, indicating that most of the patients presented late clinically.
4. All patients with ventricular dilatation should have atleast one thorough contrast enhanced CT scan to help rule out tumor or meningitis as cause of hydrocephalus
5. Therefore CT is a valuable tool with a very high diagnostic sensitivity and helps in early detection of hydrocephalus and aids in its management.

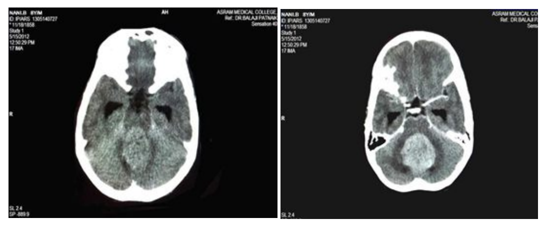

Figure 1 NECT Axial CECT Axial Brain shows well defined heterogenously enhancing hyperdense (40-50HU) lesion in the midline posterior fossa, compressing and displacing IV ventricle causing obstructive hydrocephalus – Medulloblastoma

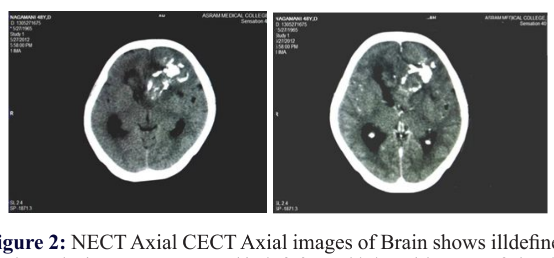

Figure 2: NECT Axial CECT Axial images of Brain shows illdefined isodense lesion to cortex noted in left frontal lobe with areas of chunky (400-500HU) calcifications. There is heterogenous enhancement following contrast administration with dilatation of adjacent lateral ventricle - Oligodendroglioma with Obstructive Hydrocephalus.

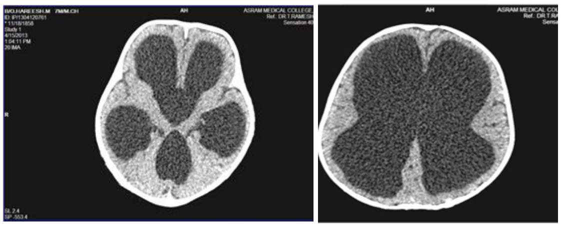

Figure 3: NECT Axial CECT Axial images showing grossly dilated lateral, III and IV ventricles with thinning of cerebral parenchyma - Congenital communicating hydrocephalus

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