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## Original Article

# Evaluation of Hydrocephalus and its Types on Computed Tomography

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## ABSTRACT

Hydrocephalus is the buildup of cerebrospinal fluid in the ventricles of the brain. The extra fluid exerts pressure on the brain. It can be due to genetic issues, Head trauma, infection, stroke, tumors, and bleeding in the brain. **Objective:** To evaluate hydrocephalus and its type on Computed Tomography. **Methods:** The study was conducted in a Govt sector tertiary care hospital of tehsil Kharian, district Gujrat, Pakistan. The data was collected from December 2021 to March 2022 using convenient sampling technique. A sample size of 70 patients was considered as per convenience. The patients of hydrocephalus who undergo brain scan plain were included. The data was collected after informed consent. Data were entered and analyzed using SPSS version 20.0. **Results:** This study revealed that females 40(57.1%) were more likely to have hydrocephalus than males 30(42.9%). The common age group having hydrocephalus was 1-10years 23(32.9%). The most frequent finding evaluated was non-communicating hydrocephalus 36(51.4%). The most common effects in hydrocephalus was congenital dilatation of the third ventricle and two lateral ventricles 40(57.1%). **Conclusions:** CT is the best modality for diagnosing hydrocephalus in children as well as in elders. CT is a useful imaging method for visualizing congenital hydrocephalus.

## INTRODUCTION

Hydrocephalus is a disease in which a large amount of cerebrospinal fluid collects inside the hollow spaces in the brain, these hollow spaces are called ventricles [1]. There are four ventricles present in the human brain [2]. Excess fluid puts extra pressure on the brain so that the intracranial pressure increases [3]. Hydrocephalus can be congenital or acquired [4]. Congenital hydrocephalus occurs at birth, while the acquired form of hydrocephalus occurs at any age because of head injury, meningitis, hemorrhage, brain tumor and infection [5]. According to research which was conducted in the USA in 2018 every 3 out of 1000 newborn babies were born with hydrocephalus [6]. If it left untreated it can be fatal. In infants, the size of the head increases day by day and present with a huge head, seizures, vomiting, fever and problem in sucking the

milk. In adults, hydrocephalus causes severe headache, memory loss, thinking issues, poor bladder control, altered mental status, poor vision and difficulty in speech [7]. An imbalance between drainage and the production of cerebrospinal fluid (CSF) causes hydrocephalus [8]. There is approx. 500ml of CSF form regularly inside the brain. Epidermal cells which are collectively called choroid plexus are responsible for producing CSF and they lined the ventricles of the brain [9]. In adults the normal volume of CSF is 150ml [10]. The CSF production by choroid plexus is continuously absorbs by the arachnoid granulation [11]. The CSF production is not dependent on its absorption. If absorption is reduced then the accumulation of CSF occurs in the ventricles of the brain [12]. Hydrocephalus is of 4 different types communicating, non-communicating,

normal pressure hydrocephalus and ex-vacuo hydrocephalus [13,14]. In communicating type of hydrocephalus the flow of CSF is restricted after it exits the ventricles. A reduction in CSF flow and absorption in the arachnoid villi causes CSF to accumulate in the ventricles [15]. In non-communicating type of hydrocephalus the flow of CSF is blocked along the one or more narrow passages connecting the ventricles [16]. In normal-pressure hydrocephalus CSF collects in the ventricles and intracranial pressure increases which cause thinking and reasoning problems [17]. Adults are affected by hydrocephalus ex-vacuo, which happens when the brain is damaged by a degenerative condition such as Alzheimer's disease, trauma, stroke, infection, or head injury [18]. Some common risk factors of congenital hydrocephalus are the use of alcohol and smoking during pregnancy, diabetic pregnant female suffering with hypertension, lack of prenatal care and radiation therapy during pregnancy [19]. Some common complications of hydrocephalus are epilepsy, gait disturbance and vision problems including double vision. In rare cases, if hydrocephalus is left untreated it causes permanent blindness can be fatal [20,21]. The only treatment of hydrocephalus is to drain the excess fluid surgically [22]. This surgical drainage system is called a shunt [23]. A procedure known as endoscopic third ventriculostomy can be used to treat hydrocephalus [22]. In this process, an endoscope with fiber optics is used to see the ventricles and build a new conduit for CSF to flow through this procedure. The best modalities for diagnosing hydrocephalus are CT scans and MRI. Enlarged ventricles are seen in both the modalities. To differentiate between communicating and non-communicating hydrocephalus, the neurosurgeon can use CT and MRI images. A spinal tap can assist assess CSF pressure in people with normal pressure hydrocephalus [24,25]. CT scanning is quick and painless technique. It produces detailed axial images of brain ventricles. CT scans have been particularly useful in individuals with adequate stenosis and dilatation of the ventricles. This study shows the relevance of computed tomography in the diagnosis of hydrocephalus, as well as its relationship to age. In the case of hydrocephalus, a CT scan is used for emergency exams and early detection of hydrocephalus in infants lowers the mortality rate.

## METHODS

The study was conducted in a Govt sector tertiary care hospital of tehsil Kharian, district Gujrat, Pakistan. The data was collected from December 2021 to March 2022, a four-month cross-sectional study, using convenient sampling technique. A sample size of 70 patients was considered as per convenience. The patients of hydrocephalus, who undergo brain scan plain of age 1 to 50 years, were included. Demographic and clinical history was

noted. The data were collected after informed consent. Data were entered and analyzed using SPSS version 20.0.

## RESULTS

Gender	Frequency(%)
Female	40(57.1%)
Male	30(42.9%)
Total	70(100.0%)

**Table 1:** Gender of Patients

The current study was conducted in a Govt sector tertiary care hospital with a sample of 70 patients who visited the CT department for diagnosis and investigation of hydrocephalus. The total number of patients was 70 of which there were 40(57.1%) females and 30 (42.9%) males, as shown in Table 1.

Age of patients	Frequency(%)
1-10 years	23(32.9%)
11-20 years	17(24.3%)
21-30 years	12(17.1%)
31-40 years	10(14.3%)
41-50 years	8(11.4%)
Total	70(100.0%)

**Table 2:** Frequency distribution of age group

The current study enrolled patients with different age groups as group 1(1-10 years) have the highest frequency of 23(32.9%), group 2(11-20 years) have the frequency of 17(24.3%), group 3(21-30 years) have a frequency of 12(17.1%), group 4(31-40 years) have a frequency of 10(14.3%) and group 5(41-50 years) have the lowest frequency of 8(11.4%) as shown in Table 2.

Types of hydrocephalus	Frequency(%)
Communicating hydrocephalus	22(31.4%)
Non-communicating hydrocephalus	36(51.4%)
Normal pressure hydrocephalus	12(17.1%)
Total	70(100.0%)

**Table 3:** Frequency distribution of types of hydrocephalus

Non-communicating hydrocephalus has the highest frequency of 36(51.4%), normal pressure hydrocephalus has the lowest frequency of 12(17.1%) and communicating hydrocephalus has a frequency of 22(31.4%) as shown in Table 3.

Dilated ventricles	Frequency(%)
Two Lateral ventricles	21(30.0%)
Third ventricle and Two lateral ventricles	40(57.1%)
Fourth ventricle and Two lateral ventricles	9(12.9%)
Total	70(100.0%)

**Table 4:** Frequency distribution of dilated ventricles

Two lateral ventricles along with the third ventricle have the highest frequency of 40(57.1%) and fourth ventricle and two lateral ventricles have the lowest frequency of 9(12.9%) as shown in Table 4.

## DISCUSSION

Hydrocephalus is a condition in which a substantial amount

of cerebrospinal fluid accumulates inside the ventricles of the brain. Excess fluid places additional pressure on the brain, raising intracranial pressure. Hydrocephalus can be divided into two types. Congenital hydrocephalus is present at birth. The causes of congenital hydrocephalus include genetic and developmental issues. The most common symptom of congenital hydrocephalus is a swollen head. Hydrocephalus can develop at any age. The causes of acquired hydrocephalus include head injuries, strokes, infections, tumors, and brain bleeding. In the current study, 70 patients were included with 30(42.9%) males and 40(57.1%) females of varied ages. This showed that females are more affected by hydrocephalus. A previous study by Alhussain et.al published in 2018 carried out at Soba university hospital had similar results that the females affected with hydrocephalus are more common than males [1]. In the current study, non-communicating hydrocephalus has the highest frequency of 36(51.4%), normal pressure hydrocephalus has the lowest frequency of 12(17.1%), and communicating hydrocephalus has a frequency of 22(31.4%). A previous study by Alhussain et.al published in 2018 had similar results that non-communicating hydrocephalus has the highest frequency of 40(57.1%) [1]. The current study revealed that hydrocephalus is more common in children than in adults a similar study done by Davis A. et al issued in 2010 also had the same findings that clinical suspicion of hydrocephalus is more in children than adults [26].

## CONCLUSIONS

CT is the best modality for diagnosing hydrocephalus in children as well as in elders. CT is a useful imaging method for visualizing congenital hydrocephalus. Neonates and children under the age of ten are typically affected by hydrocephalus.

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