Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

A Cross-Sectional Comparative Correlation Study of Computed Tomography and Magnetic Resonance Imaging in the Evaluation of Pediatric Hydrocephalus .

Dr. Kamal Nayan Gangey[1], Dr. Prashant Kumar Sinha[2]
[1] Associate Professor, Department of Radiodiagnosis, SRMSIMS, Bareilly.
[2]Associate professor, Department of Radiodiagnosis, Varun Arjun Medical college and Rohilkhand hospital, Banthra, shahjahanpur
,

Abstract

Background:
Hydrocephalus is a common pediatric neurosurgical disorder characterized by abnormal cerebrospinal fluid (CSF) accumulation, leading to ventricular dilatation and raised intracranial pressure. CT is the preferred emergency imaging modality because of its rapid acquisition, whereas MRI provides superior soft tissue characterization without ionizing radiation. This study compared the diagnostic performance and correlation of CT and MRI in pediatric hydrocephalus.

Aim:
To compare the diagnostic performance of CT and MRI and determine the correlation between their imaging findings in pediatric hydrocephalus.

Materials and Methods:
A hospital-based prospective observational comparative study was conducted over 18 months in 80 children (0–18 years) with suspected hydrocephalus who underwent both CT and MRI. Imaging findings were compared using sensitivity, specificity, diagnostic accuracy, Cohen's kappa, and Pearson's correlation coefficient.

Results:
The mean age was **4.9 ± 3.8 years**, and **58.8%** were males. Both CT and MRI detected ventricular dilatation in **100%** of cases. MRI identified significantly more aqueductal stenosis (27.5% vs. 20.0%, p=0.028), congenital anomalies (31.2% vs. 22.5%, p=0.019), posterior fossa lesions (15.0% vs. 10.0%, p=0.041), and periventricular edema **(**70.0% vs. 48.8%, p=0.006) than CT. CT demonstrated 91.3% sensitivity**,** 95.0% specificity**,** and 92.5% diagnostic accuracy**.** Agreement between CT and MRI was excellent (**κ=0.88**), with a strong correlation for ventricular size assessment **(**r=0.93, p<0.001**).**

Conclusion:
CT is an effective first-line imaging modality for rapid diagnosis, whereas MRI is superior for etiological evaluation, treatment planning, and follow-up in pediatric hydrocephalus.

Recommendation:
CT should be used for initial evaluation, particularly in emergencies, while MRI should be preferred for comprehensive assessment. Larger multicenter studies are recommended to validate these findings.

Keywords: *Pediatric hydrocephalus, Computed tomography, Magnetic resonance imaging, Ventriculomegaly, Neuroimaging, Correlation study*
Submitted: *July 13, 2026* ***Accepted:*** *July 29, 2026* ***Published:*** *September 01, 2026*

Corresponding Author: *Dr. Kamal Nayan Gangey[1]*
Email: ***kamalnayanrai@yahoo.co.in***
Associate Professor, Department of Radiodiagnosis, SRMSIMS, Bareilly.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

Introduction

Hydrocephalus is a neurological disorder characterized by abnormal accumulation of cerebrospinal fluid (CSF) within the cerebral ventricular system resulting from impaired CSF circulation, absorption, or, rarely, excessive production. Progressive ventricular dilatation leads to increased intracranial pressure, compression of adjacent brain parenchyma, impaired cerebral perfusion, and, if untreated, permanent neurological deficits. Hydrocephalus affects approximately 0.5–1 per 1,000 live births worldwide and remains one of the most frequent indications for pediatric neurosurgical intervention. Congenital causes include aqueductal stenosis, neural tube defects, Dandy-Walker malformation, Chiari malformation, arachnoid cysts, and genetic disorders, whereas acquired causes include intraventricular hemorrhage, meningitis, tumors, trauma, and postoperative complications.[1]

Neuroimaging plays a central role in the diagnosis, classification, etiological assessment, treatment planning, and postoperative surveillance of pediatric hydrocephalus. Imaging not only confirms ventricular enlargement but also identifies the level and mechanism of CSF obstruction, associated brain abnormalities, complications, and suitability for procedures such as ventriculoperitoneal shunting or endoscopic third ventriculostomy. Current diagnostic modalities include cranial ultrasonography, computed tomography (CT), and magnetic resonance imaging (MRI), each having specific clinical applications. Cranial ultrasonography is valuable in neonates with an open anterior fontanelle; however, CT and MRI remain the principal imaging techniques in older infants and children.[2]

Computed tomography is widely available, rapid, relatively inexpensive, and highly effective in detecting ventriculomegaly, intracranial hemorrhage, and acute hydrocephalus, making it the preferred investigation in emergencies. Nevertheless, CT exposes children to ionizing radiation, an important concern because pediatric patients are more radiosensitive and frequently require repeated follow-up examinations. Magnetic resonance imaging overcomes this limitation by providing excellent soft tissue contrast, multiplanar capability, superior visualization of the ventricular system, posterior fossa structures, aqueduct, brainstem, and associated congenital anomalies without radiation exposure. Advanced MRI techniques, including three-dimensional T2-weighted imaging, phase-contrast cine MRI, and constructive interference in steady state (CISS) sequences, further improve evaluation of CSF dynamics and obstructive lesions.[3]

Although both CT and MRI are routinely employed in pediatric hydrocephalus, the relative diagnostic contribution of each modality in identifying ventricular enlargement, etiology, associated abnormalities, and level of obstruction continues to influence clinical decision-making. Comparative evaluation of these imaging modalities is therefore important for establishing optimal diagnostic strategies while minimizing unnecessary radiation exposure. The present study was undertaken to compare CT and MRI findings in pediatric hydrocephalus and determine the degree of correlation between these two imaging modalities.[4]

Aim

To compare Computed Tomography and Magnetic Resonance Imaging in the evaluation of pediatric hydrocephalus and determine the diagnostic correlation between the two imaging modalities.

Objectives

1. To evaluate CT findings in pediatric patients with hydrocephalus.
2. To evaluate MRI findings in pediatric hydrocephalus.
3. To compare the diagnostic performance of CT and MRI in identifying the cause and type of hydrocephalus.
4. To assess the correlation between CT and MRI in detecting ventricular enlargement and associated intracranial abnormalities.
5. To determine the role of MRI as a complementary imaging modality in patients initially evaluated with CT.

Materials and Methods

Study Design

A hospital-based prospective cross-sectional observational comparative study

Study Setting

The study was conducted in the Department of Radiodiagnosis, in collaboration with the Departments of Pediatrics and Neurosurgery, at a tertiary care teaching hospital in Bareilly, Uttar Pradesh, India. The hospital serves as a regional referral center for pediatric neurosurgical cases and is equipped with multidetector CT and MRI facilities.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

Study Duration
The study was conducted over 18 months, from January 2024 to June 2025.

Study Population
Children aged 0–18 years clinically suspected of hydrocephalus and referred for neuroimaging.

Sample Size
The sample size was calculated using the single population proportion formula, $n = Z^2P(1-P)/d^2$, assuming a 95% confidence level ($Z = 1.96$), an expected prevalence of pediatric hydrocephalus of **22%** based on the facility-based study by Blein Mulugeta et al., and an absolute precision of **10%**. The minimum calculated sample size was **82**. Considering feasibility and the availability of eligible participants during the study period, **80 pediatric patients** were enrolled.

.

Inclusion Criteria
- Age ≤18 years.
- Clinical suspicion of hydrocephalus.
- Patients undergoing both CT and MRI examinations.
- Informed consent obtained from parents or legal guardians.

Exclusion Criteria
- Contraindications to MRI (e.g., incompatible implanted devices).
- Previous neurosurgical intervention before imaging.
- Severe motion artifacts affecting image quality.
- Incomplete imaging records.

Methodology
All enrolled patients underwent both Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) of the brain according to a standardized institutional imaging protocol. CT examination was performed initially in patients presenting with suspected hydrocephalus, particularly in emergency settings, using a multidetector computed tomography (MDCT) scanner. Non-contrast CT (NCCT) of the brain was performed in all patients with thin-section axial image acquisition extending from the foramen magnum to the vertex. Multiplanar reconstructions in the coronal and sagittal planes were generated whenever necessary to improve anatomical localization and assessment of ventricular morphology. Contrast-enhanced CT (CECT) was performed selectively in patients with suspected intracranial neoplasms, infectious lesions, inflammatory pathology, vascular malformations, or when additional characterization of intracranial abnormalities was clinically indicated. CT images were evaluated using both brain and bone window settings to assess ventricular size, associated cranial abnormalities, intracranial hemorrhage, calcifications, and mass lesions.

Subsequently, all patients underwent MRI of the brain using a standardized pediatric neuroimaging protocol. MRI examinations included axial T1-weighted images, axial and coronal T2-weighted images, Fluid Attenuated Inversion Recovery (FLAIR) sequences, Diffusion-Weighted Imaging (DWI) with corresponding Apparent Diffusion Coefficient (ADC) maps, Susceptibility-Weighted Imaging (SWI), sagittal T2-weighted images, and high-resolution three-dimensional Constructive Interference in Steady State (3D-CISS) or Fast Imaging Employing Steady-state Acquisition (FIESTA) sequences for detailed visualization of the ventricular system and cerebrospinal fluid (CSF) pathways. Post-contrast T1-weighted images were obtained whenever clinically indicated, particularly in cases with suspected intracranial tumors, infectious diseases, inflammatory lesions, or postoperative evaluation. Younger children who were unable to cooperate during MRI underwent imaging under appropriate sedation administered according to institutional pediatric anesthesia protocols, with continuous monitoring of vital parameters throughout the examination.

All CT and MRI examinations were independently reviewed by two experienced consultant radiologists who were blinded to each other's imaging interpretations and the final diagnosis. In cases of disagreement, a consensus interpretation was reached through joint review. Imaging analysis focused on both qualitative and quantitative parameters relevant to hydrocephalus. Ventricular enlargement was assessed by evaluating the lateral, third, and fourth ventricles, and ventricular size was quantified using the Evans Index, calculated as the ratio of the maximum frontal horn width of the lateral ventricles to the maximum internal diameter of the skull at the same level. The diameter of the third ventricle was measured in the axial plane at its widest point. The presence, location, and type of CSF pathway obstruction were documented, including aqueductal stenosis, obstruction at the foramina of Monro,

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

fourth ventricular outlet obstruction, and communicating hydrocephalus.

Associated intracranial abnormalities were systematically evaluated on both imaging modalities. Particular attention was paid to congenital malformations such as Chiari malformation, Dandy–Walker malformation, myelomeningocele, agenesis of the corpus callosum, arachnoid cysts, and other developmental anomalies. Intracranial neoplasms, posterior fossa lesions, intraventricular hemorrhage, post-infectious sequelae, cortical thinning, cerebral atrophy, and periventricular edema (transependymal CSF seepage) were also assessed. MRI was additionally evaluated for visualization of the cerebral aqueduct, posterior fossa structures, brainstem, cerebellum, and associated white matter abnormalities, which are often inadequately characterized on CT.

The imaging findings obtained from CT were subsequently compared with those obtained from MRI for each patient. The diagnostic performance of CT in identifying ventricular enlargement, determining the site and cause of hydrocephalus, and detecting associated intracranial abnormalities was assessed using MRI findings as the reference standard. Agreement between CT and MRI was evaluated for individual imaging parameters, and the strengths and limitations of each imaging modality were analyzed to determine their respective roles in the comprehensive evaluation of pediatric hydrocephalus.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Agreement between CT and MRI findings was assessed using Cohen's kappa coefficient. Pearson correlation coefficient was used to evaluate ventricular measurements obtained by CT and MRI. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of CT were calculated considering MRI as the reference standard. A **p-value <0.05** was considered statistically significant.

Bias

To minimize selection bias, consecutive sampling was used, and all eligible pediatric patients meeting the inclusion criteria during the study period were enrolled. Measurement bias was reduced by using standardized CT and MRI imaging protocols. Two experienced consultant radiologists independently interpreted the images while being blinded to each other's findings, and discrepancies were resolved by consensus. Uniform inclusion and exclusion criteria were applied to all participants to minimize information and observer bias.

Ethical Considerations

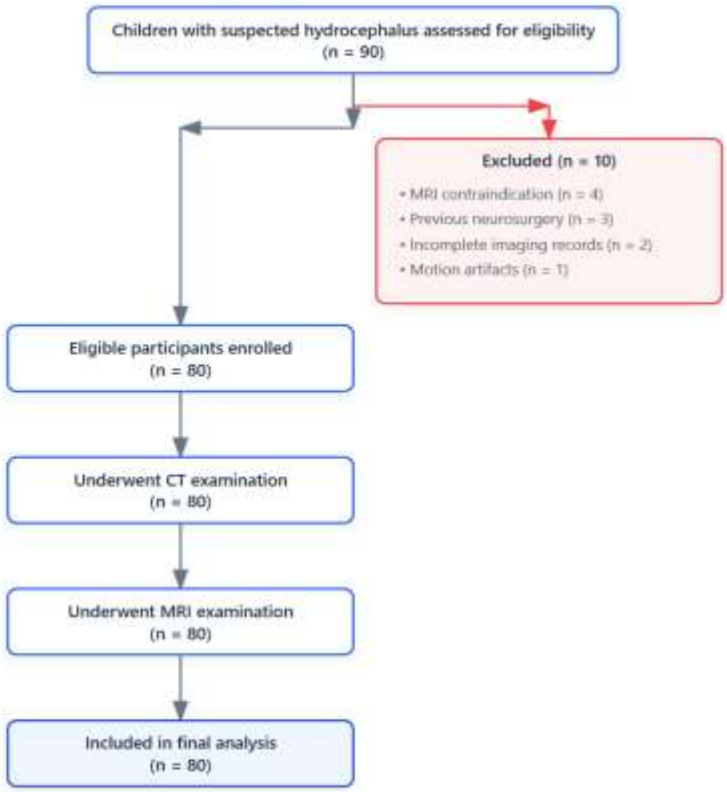
The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Ethics Committee (IEC) of the participating tertiary care teaching hospital before commencement of the study.

Informed Consent

Written informed consent was obtained from the parents or legal guardians of all participants before enrollment. Assent was obtained from children, where appropriate, according to their age and understanding. Participation was voluntary, and confidentiality of patient information was maintained throughout the study.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

Results



A total of **80 pediatric patients** with clinically suspected hydrocephalus were included in the study. Every patient underwent both Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) of the brain. The age of the patients ranged from **1 month to 18 years**, with a mean age of **4.9 ± 3.8 years**. Males constituted **47 (58.8%)** of the study population, while **33 (41.2%)** were females (male: female ratio = 1.42:1).

MRI confirmed hydrocephalus in all patients and demonstrated superior visualization of the site of obstruction, congenital malformations, posterior fossa abnormalities, and periventricular changes. CT accurately identified ventricular enlargement in most patients but was less sensitive in detecting the underlying etiology and associated intracranial abnormalities.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

Table 1: Demographic Characteristics of the Study Population (n = 80)

Characteristic	n	%
Age group (years)		
<1	18	22.5
1–5	30	37.5
6–10	16	20.0
11–18	16	20.0
Gender		
Male	47	58.8
Female	33	41.2

***Mean age:** 4.9 ± 3.8 years*

Table 1 shows the demographic distribution of the 80 pediatric patients included in the study. The mean age of the study population was 4.9 ± 3.8 years, indicating that hydrocephalus predominantly affected younger children. The largest proportion of patients (37.5%) belonged to the 1–5 years age group, followed by infants aged <1 year (22.5%), while children aged 6–10 years and 11–18 years each constituted 20.0% of the study population. There was a male predominance, with 47 (58.8%) males and 33 (41.2%) females, resulting in a male-to-female ratio of approximately 1.4:1.

Table 2: Etiology of Pediatric Hydrocephalus Detected by MRI (n = 80)

Etiology	n	%
Congenital aqueductal stenosis	22	27.5
Neural tube defects (myelomeningocele)	16	20.0
Posterior fossa tumors	12	15.0
Post-meningitic hydrocephalus	11	13.8
Intraventricular hemorrhage	8	10.0
Dandy–Walker malformation	5	6.2
Chiari malformation	3	3.8
Arachnoid cyst	3	3.8

Table 2 depicts the etiological distribution of pediatric hydrocephalus as determined by MRI. Congenital aqueductal stenosis was the most common cause, accounting for 22 (27.5%) cases, followed by neural tube defects (myelomeningocele) in 16 (20.0%) patients and posterior fossa tumors in 12 (15.0%) patients. Post-meningitic hydrocephalus was observed in 11 (13.8%) cases, while intraventricular hemorrhage accounted for 8 (10.0%) cases. Less frequent etiologies included Dandy–Walker malformation in 5 (6.2%) patients and both Chiari malformation and arachnoid cysts in 3 (3.8%) patients each. These findings indicate that congenital abnormalities were the predominant causes of pediatric hydrocephalus in the study population, with MRI effectively identifying both obstructive and developmental etiologies.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

Table 3: Comparison of CT and MRI Findings

Imaging Finding	CT n (%)	MRI n (%)	p-value
Ventricular dilatation	80 (100)	80 (100)	1.000
Aqueductal stenosis	16 (20.0)	22 (27.5)	0.028
Posterior fossa lesion	8 (10.0)	12 (15.0)	0.041
Congenital brain anomalies	18 (22.5)	25 (31.2)	0.019
Periventricular edema	39 (48.8)	56 (70.0)	0.006
Intraventricular hemorrhage	8 (10.0)	8 (10.0)	1.000
Brain tumors	11 (13.8)	12 (15.0)	0.812

Table 3 compares the diagnostic findings of CT and MRI in the evaluation of pediatric hydrocephalus. Both imaging modalities detected ventricular dilatation in all patients (100%), demonstrating complete agreement ($p = 1.000$). However, MRI identified significantly more cases of aqueductal stenosis (27.5% vs. 20.0%; $p = 0.028$), posterior fossa lesions (15.0% vs. 10.0%; $p = 0.041$), congenital brain anomalies (31.2% vs. 22.5%; $p = 0.019$), and periventricular edema (70.0% vs. 48.8%; $p = 0.006$) compared with CT, indicating its superior sensitivity for detecting underlying etiological and associated intracranial abnormalities. In contrast, both CT and MRI showed identical detection rates for intraventricular hemorrhage (10.0%; $p = 1.000$), while the detection of brain tumors was comparable between the two modalities (13.8% vs. 15.0%; $p = 0.812$), with no statistically significant difference. Overall, MRI demonstrated a significant diagnostic advantage over CT in identifying the cause and associated abnormalities of pediatric hydrocephalus, whereas both modalities were equally effective in confirming ventricular enlargement and detecting intracranial hemorrhage.

Table 4: Diagnostic Performance of CT (MRI Taken as Reference Standard)

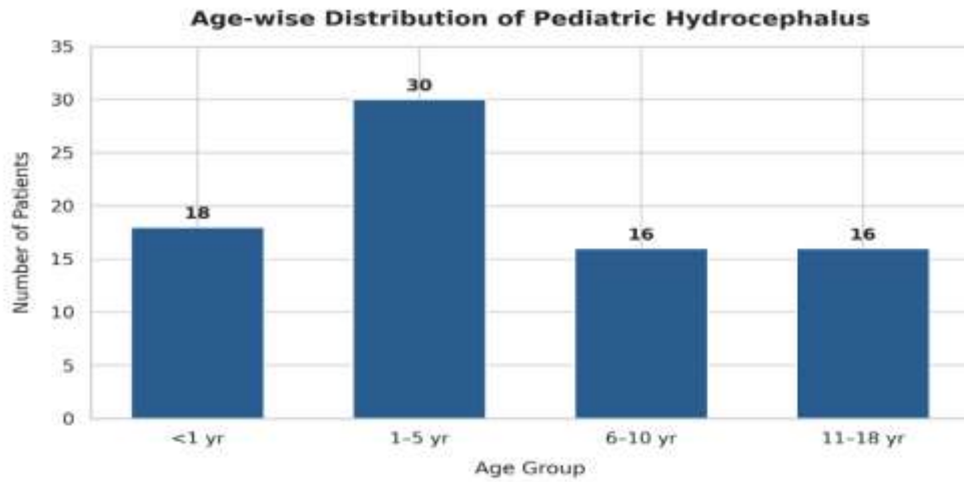
Parameter	Value
Sensitivity (%)	91.3
Specificity (%)	95.0
Positive predictive value (%)	97.1
Negative predictive value (%)	82.6
Diagnostic accuracy (%)	92.5
Cohen's kappa (κ)	0.88
Pearson's correlation coefficient (r)	0.93
p value	< .001

Table 4 summarizes the diagnostic performance of CT in the evaluation of pediatric hydrocephalus, with MRI considered the reference standard. CT demonstrated a high sensitivity of 91.3% and specificity of 95.0%**,** indicating excellent ability to correctly identify both positive and negative cases of hydrocephalus-related findings. The positive predictive value (97.1%) and negative predictive value (82.6%) further reflect the reliability of CT in clinical practice. The overall diagnostic accuracy was 92.5%**,** confirming CT as an effective imaging modality for the initial assessment of pediatric hydrocephalus. A Cohen's kappa coefficient of 0.88 indicated excellent agreement between CT and MRI in the evaluation of imaging findings, while a strong positive Pearson correlation ($r = 0.93$, $p < 0.001$) for ventricular size

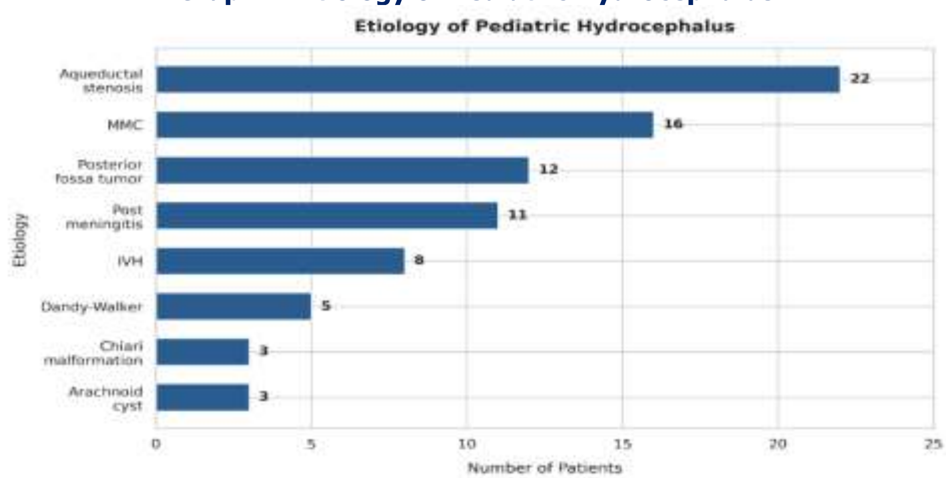
Student’s Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

measurements demonstrated a high degree of concordance between the two modalities. These findings suggest that although CT provides a highly accurate assessment of ventricular dilatation, MRI remains superior for comprehensive evaluation of the underlying etiology and associated intracranial abnormalities.

Graph 1. Age-wise Distribution of Pediatric Hydrocephalus

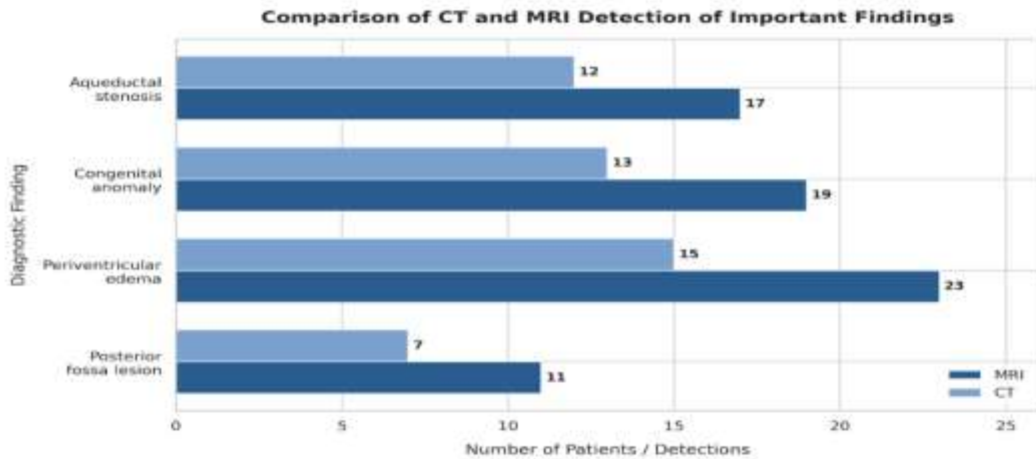


Graph 2. Etiology of Pediatric Hydrocephalus



Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

Graph 3. Comparison of CT and MRI Detection of Important Findings



Discussion

Hydrocephalus remains one of the most common neurosurgical disorders encountered during infancy and childhood. Early diagnosis and precise identification of the underlying etiology are essential for appropriate surgical planning and prevention of long-term neurological sequelae. Neuroimaging has become indispensable in the evaluation of pediatric hydrocephalus, with Computed Tomography (CT) serving as the primary emergency imaging modality and Magnetic Resonance Imaging (MRI) providing comprehensive anatomical and etiological assessment. The present study compared CT and MRI findings in 80 pediatric patients with hydrocephalus and demonstrated that although CT reliably identified ventricular enlargement, MRI was significantly superior in determining the cause, level of obstruction, associated congenital malformations, and periventricular changes.

In the present study, the mean age of the patients was **4.9 ± 3.8 years**, with the highest proportion (37.5%) belonging to the **1–5-year age group**. A male predominance (58.8%) was observed, with a male-to-female ratio of approximately 1.4:1. Similar demographic findings have been reported in several pediatric hydrocephalus studies. Pankaj Krishnan and colleagues5 reported that congenital hydrocephalus commonly presents during infancy and early childhood, with aqueductal stenosis and neural tube defects representing the predominant etiologies in developing countries. Their review also highlighted the importance of MRI in defining the mechanism of hydrocephalus and associated developmental abnormalities.

Aqueductal stenosis was identified as the most common cause of hydrocephalus in the present study (27.5%), followed by myelomeningocele (20%), posterior fossa tumors (15%), post-meningitic hydrocephalus (13.8%), and intraventricular hemorrhage (10%). These findings are consistent with those reported by David Panagopoulos et al. (2024)6, who observed that congenital aqueductal stenosis remains the leading cause of obstructive hydrocephalus in children, whereas infections, intraventricular hemorrhage, and neoplasms account for most acquired cases. They further emphasized that MRI accurately demonstrates the site of obstruction and facilitates selection of patients for endoscopic third ventriculostomy.

One of the major findings of the present study was that CT detected ventricular dilatation in **100%** of patients, demonstrating excellent performance for confirming hydrocephalus. However, MRI detected significantly more cases of aqueductal stenosis, congenital anomalies, posterior fossa lesions, and periventricular edema. These findings are supported by Mekouar Y et al. 7 and the widely accepted view that CT is highly sensitive for identifying ventriculomegaly but has limitations in characterizing the underlying pathology because of inferior soft tissue contrast. MRI detected **22 cases of aqueductal stenosis**, whereas CT identified only **16 cases**, a statistically significant difference. Likewise, MRI identified congenital brain anomalies in **31.2%** of patients compared with **22.5%** by CT. Similar observations were described by William N. Gibbs8, who reported that MRI provides superior delineation of the aqueduct, fourth ventricle, posterior fossa structures,

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

arachnoid membranes, and transependymal CSF flow, enabling accurate differentiation between obstructive and communicating hydrocephalus.

Periventricular edema, an important indicator of raised intraventricular pressure and active CSF seepage, was detected in **70%** of patients by MRI but only **48.8%** by CT. MRI is inherently more sensitive for demonstrating transependymal CSF permeation because T2-weighted and FLAIR sequences provide excellent visualization of white matter signal abnormalities. This observation agrees with educational reviews from the European Society of Radiology, which state that MRI is the preferred technique for identifying transependymal edema and subtle parenchymal injury in pediatric hydrocephalus.

The present study demonstrated a **sensitivity of 91.3%**, **specificity of 95%**, and an overall **diagnostic accuracy of 92.5%** for CT using MRI as the reference standard. Although CT showed excellent agreement with MRI in diagnosing ventricular enlargement (**κ = 0.88**), MRI remained superior for etiological diagnosis and preoperative planning. Similar conclusions were reported by Charles D. Robson9, who observed that rapid MRI protocols provide diagnostic information comparable to CT for ventricular size while eliminating radiation exposure and improving evaluation of associated intracranial abnormalities.

The strong positive correlation between CT and MRI ventricular measurements observed in the present study (**r = 0.93**) indicates that both modalities reliably quantify ventricular enlargement. However, MRI supplied substantially greater anatomical detail regarding CSF pathways, posterior fossa abnormalities, associated cortical malformations, and brainstem anatomy. These findings agree with contemporary recommendations that ventricular measurements alone should not determine patient management; rather, imaging should establish the underlying cause and mechanism of hydrocephalus before intervention.

An important advantage of MRI demonstrated in this study is the absence of ionizing radiation. Children with hydrocephalus frequently undergo repeated imaging during diagnosis, postoperative surveillance, and assessment of shunt function. Repeated CT examinations substantially increase cumulative radiation exposure. Recent pediatric imaging recommendations therefore advocate rapid-sequence MRI whenever feasible because it provides equivalent assessment of ventricular size while avoiding radiation.

The present findings also have practical implications for clinical management. CT remains indispensable in emergencies because of its rapid image acquisition, widespread availability, and excellent detection of acute hemorrhage and ventricular enlargement. Conversely, MRI should be considered the imaging modality of choice for comprehensive etiological evaluation, preoperative planning, postoperative follow-up, and assessment of complications such as aqueductal stenosis, posterior fossa tumors, Chiari malformation, Dandy–Walker malformation, and transependymal edema. Advanced MRI techniques—including three-dimensional heavily T2-weighted sequences and phase-contrast CSF flow imaging- provide additional information regarding CSF dynamics that cannot be obtained with conventional CT

Overall, the findings of the present study reinforce current evidence that CT and MRI are complementary rather than competing imaging modalities. CT offers rapid initial diagnosis in acute settings, whereas MRI provides superior anatomical characterization, etiological diagnosis, radiation-free follow-up, and guidance for definitive neurosurgical management. The high diagnostic agreement between CT and MRI for ventricular enlargement, combined with MRI's superior ability to identify associated abnormalities, supports the use of MRI as the preferred comprehensive imaging modality in pediatric hydrocephalus whenever available.

Generalizability

The findings are generalizable to pediatric patients with suspected hydrocephalus managed in tertiary care hospitals with CT and MRI facilities. However, the single-center design and relatively small sample size may limit wider applicability.

Conclusion

Both CT and MRI are valuable imaging modalities in the evaluation of pediatric hydrocephalus, with complementary roles in clinical practice. CT is an excellent first-line investigation because of its rapid availability and high diagnostic accuracy in detecting ventricular dilatation and acute intracranial pathology, making it particularly useful in emergency settings. MRI, however, is superior in identifying the underlying etiology, site of CSF obstruction, congenital anomalies, posterior fossa lesions, and periventricular edema owing to its excellent soft tissue contrast and multiplanar imaging capability without radiation exposure. The present study demonstrated

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.7 No. 3 (2026): September 2026 Issue
https://doi.org/10.51168/xvftw583
Original Article

excellent agreement between CT and MRI for the assessment of ventricular enlargement, while MRI provided more comprehensive diagnostic information essential for treatment planning. Therefore, CT should be used for initial evaluation in emergencies, whereas MRI should be considered the imaging modality of choice for definitive diagnosis, preoperative assessment, and follow-up of pediatric hydrocephalus.

Study Limitations

- The study was conducted at a single tertiary care center with a relatively small sample size.
- Long-term postoperative imaging follow-up was not included.
- Advanced MRI techniques such as diffusion tensor imaging, volumetric analysis, and cine phase-contrast CSF flow studies were not performed in all patients.
- Surgical findings were not available in every patient for direct imaging correlation.
- Cost-effectiveness and imaging turnaround time were not analyzed.

Recommendation

CT should be used as the initial imaging modality for suspected pediatric hydrocephalus, particularly in emergency settings, while MRI should be preferred for comprehensive etiological evaluation, preoperative planning, and follow-up because of its superior diagnostic capability and lack of ionizing radiation. Further multicenter studies with larger sample sizes are recommended.

Acknowledgment

The authors sincerely thank the Department of Radiodiagnosis, the Departments of Pediatrics and Neurosurgery, and all the patients and their parents/guardians for their cooperation and participation in this study. The authors also acknowledge the support of the hospital staff who assisted in data collection and imaging procedures.

List of Abbreviations

ADC Apparent Diffusion Coefficient
CECT Contrast-Enhanced Computed Tomography
CISS Constructive Interference in Steady State
CSF Cerebrospinal Fluid
CT Computed Tomography
DWI Diffusion-Weighted Imaging
FIESTA Fast Imaging Employing Steady-state Acquisition
FLAIR Fluid-Attenuated Inversion Recovery
IEC Institutional Ethics Committee
MDCT Multidetector Computed Tomography
MMC Myelomeningocele
MRI Magnetic Resonance Imaging
NCCT Non-Contrast Computed Tomography
PPV Positive Predictive Value
NPV Negative Predictive Value
SWI Susceptibility-Weighted Imaging

Source of Funding

The authors received no external funding for this study.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Dr. Kamal Nayan Gangey: Conceptualization, study design, data acquisition, image interpretation, manuscript drafting, and final approval.
Dr. Prashant Kumar Sinha: Data analysis, image interpretation, manuscript review and editing, and final approval of the manuscript.

Author Biographies

Dr. Kamal Nayan Gangey, MD (Radiodiagnosis), is an Associate Professor, Department of Radiodiagnosis, SRMS Institute of Medical Sciences, Bareilly, Uttar Pradesh, India. His research interests include pediatric neuroradiology, neuroimaging, and diagnostic radiology.
Dr. Prashant Kumar Sinha, MD (Radiodiagnosis), is an Associate Professor, Department of Radiodiagnosis, Varun Arjun Medical College and Rohilkhand Hospital, Banthra, Shahjahanpur, Uttar Pradesh, India. His areas of interest include neuroradiology, cross-sectional imaging, and pediatric imaging.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available because they contain information that could compromise participant confidentiality.

References

1. Rekate HL. The definition and classification of hydrocephalus: a personal recommendation to stimulate debate. Cerebrospinal Fluid Res. 2008;5:2. https://doi.org/10.1186/1743-8454-5-2
2. Tekes A, et al. Ultrafast brain MRI can be used for indications beyond shunted hydrocephalus in pediatric patients. AJNR Am J Neuroradiol. 2018;39(8):1515-1518. (AJNR) https://doi.org/10.3174/ajnr.A5724
3. Patel DM, Tubbs RS, Pate G, et al. Fast-sequence MRI studies for surveillance imaging in pediatric hydrocephalus. J Neurosurg Pediatr. 2014;13(4):440-447. (jns) https://doi.org/10.3171/2014.1.PEDS13447
4. Niederhauser BD, et al. Retrospective review of rapid pediatric brain MR imaging at an academic institution including practice trends and factors affecting scan success. Pediatr Radiol. 2013;43:1338-1348. (PMC)
5. Krishnan P, Raybaud C, Palasamudram S, Shroff M. Neuroimaging in pediatric hydrocephalus. Indian J Pediatr. 2019;86(10):952-60. https://doi.org/10.1007/s12098-019-02962-z
6. Mekouar Y, Orgi A, Jadid A, et al. Hydrocephalus in children: Imaging features and differential diagnosis. European Congress of Radiology Educational Exhibit. 2022.
7. Panagopoulos D, Koutsarnakis C, Tsermoulas G, Brotis AG. Pediatric hydrocephalus: Current concepts in pathophysiology, diagnosis and management. Brain Sci. 2024;14(11):1110.
8. Gibbs WN. Imaging of hydrocephalus. Appl Radiol. 2021;50(5):16-24.
9. Robson CD. Neuroimaging of children with surgically treated hydrocephalus. AJR Am J Roentgenol. 2017;209(6):1308-18.

PUBLISHER DETAILS:

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa