Management of Pediatrics Hydrocephalus: A Systematic review and metanalysis; on Endoscopic third Ventriculostomy (ETV), vs. ventriculoperitoneal shunt (VPS), Treatments and Postoperative Outcomes

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Keywords: Pediatrics, Hydrocephalus, Endoscopic third ventriculostomy (ETV), Ventriculoperitoneal shunt (VPS), Fenestration, Treatments, Outcomes

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Abstract

Introduction: Inadequate passage of cerebrospinal fluid (CSF) through the points of production, such as the choroid plexus, absorption, and drainage into the dural venous sinus, causes hydrocephalus, which is characterized by a failure in CSF homeostasis and progressive active distension of the cerebral ventricles and the cerebral ventricular system.

Methods: Using the PRISMA standards, R software, and Excel, we searched a number of databases, including ScienceDirect and PubMed/MEDLINE. Pediatric hydrocephalus, particular surgical methods, survival and fatality rates, as well as its physiology, pathology, and development, were among the search phrases used. Only research that was released in English between March 2000 and September 2025

Results: We distributed the N=3,119 pediatric hydrocephalus patients that we identified in our systematic evaluation in Table 1. N = 1728 patients (55%) and N = 948 (30%) underwent endoscopic procedures. VP-shunt N = 765 (24%). In contrast, Table 2 shows N=1391 patients (44%). ETV/VP shunt; N = 474 (15%). ETV/CPC; N = 766 (24%). In conclusion:

Conclusion: Endoscopic third ventriculostomy (ETV) and choroid plexus cauterization (CPC) are combined operations used to treat hydrocephalus in children. These treatments range from straightforward Kocher point stenting to intricate shunt systems. The normal head circumference can be controlled to some extent by using a single decision to regulate the flow of cerebrospinal fluid (CSF).

INTRODUCTION

Hydrocephalus is defined as a failure in cerebrospinal fluid (CSF) homeostasis and the progressive active distension of the ventricles and the cerebral ventricular system

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resulting from inadequate passage of CSF through the points of production, such as the choroid plexus, absorption, and drainage into the dural venous sinus. Therefore, infants with hydrocephalus tend to have an increased head circumference and may present with signs and symptoms of intracranial pressure. [1]. A canine experiment conducted by Walter Dandy in the mid-19th and early 20th centuries on obstructive hydrocephalus using phenolsulfonphthalein led to a more up-to-date understanding of communicating and non-communicating hydrocephalus. Although Hippocrates reported the term "water" in macrocephalic children, hydrocephalus itself was first described in the writings of Celsus, between 25 BC and 50 AD. [2]. Epidemiologically, approximately 400,000 new cases of pediatric hydrocephalus develop worldwide each year, with over 80% of these cases occurring in low- to middle-income countries [3]. Hydrocephalus is caused by neural tube defects, and up to 85% of children may be born with myelomeningocele and/or spina bifida-like myelomeningocele [4]. Endoscopic third ventriculostomy (ETV) involves fenestrating the floor of the third ventricle and diverting cerebrospinal fluid to the basal cisterns. When combined with choroid plexus cauterization (CPC-ETV), it is indicated in children under 2 years of age, where ETV alone carries a poor prognosis [5]. Figure 1 shows a) ETV for pediatric patients with hydrocephalus and fenestration of the third ventricle. b) VP-shunt: detailed components by structure and function for hydrocephalus drainage and external program, (ICP) measure of a Codman-Hakim shunt device. The aim of this systematic review is to analyze ETV vs. ventriculoperitoneal shunt (VPS) treatments and postoperative outcomes

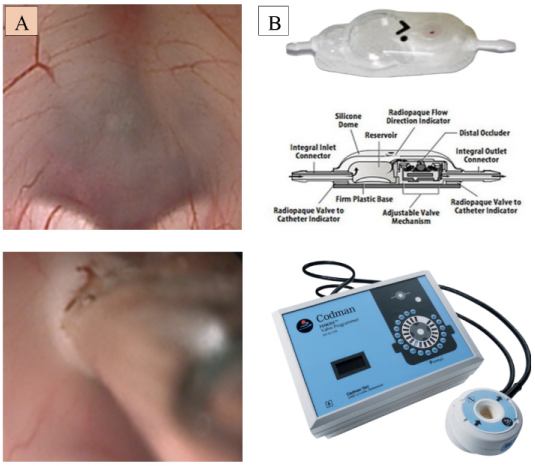

Figure 1: a) ETV for pediatric patients with hydrocephalus and fenestration of the third ventricle. b) VP-shunt: detailed components by structure and function for hydrocephalus drainage and external program, (ICP) measure of a Codman-Hakim shunt device.

Materials and Methods

Search Strategy

In our systematic review, we followed the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). We focused on the treatment of pediatric hydrocephalus, specifically endoscopic third-trimester ventriculostomy (ETV) versus ventriculoperitoneal shunt (VPS). We examined the results of postoperative studies with treatment modalities and effective management of hydrocephalus. A search was conducted in various databases, including ScienceDirect and PubMed/MEDLINE, using the PRISMA guidelines, R software, and Excel. Search terms included pediatric hydrocephalus, specific surgical techniques, survival and mortality rates, as well as its physiology, pathology, and development. Only studies published in English between March 2000 and September 2025 were included. The PICO framework (Population, Intervention, Comparison, and Outcomes) was used to define the study population, focusing on patients between 1 month and under 17 years of age with ventricular expansion and associated symptoms, diagnosed by imaging studies (Figure 2).

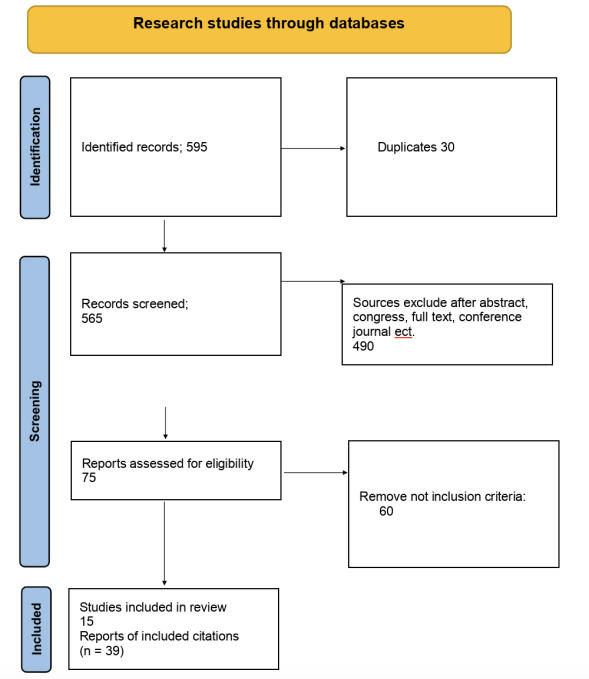

Figure 2: PRISMA on Pediatrics Hydrocephalus, ETV vs. VP-shunt

Search Strategy

The search strategy incorporated MeSH (Medical Subject Headings) terms related to pediatric hydrocephalus with myelomeningocele, third ventricle endoscopy, and VP-shunts. (”Hydrocephalus/blood”[Mesh] OR ”Hydrocephalus/cerebrospinal fluid”[Mesh] OR ”Hydrocephalus/classification”[Mesh] OR ”Hydrocephalus/complications”[Mesh] OR ”Hydrocephalus/congenital”[Mesh] OR ”Hydrocephalus/diagnosis”[Mesh] OR ”Hydrocephalus/diagnostic imaging”[Mesh] OR ”Hydrocephalus/diet therapy”[Mesh] OR ”Hydrocephalus/drug therapy”[Mesh] OR ”Hydrocephalus/embryology”[Mesh] OR ”Hydrocephalus/epidemiology”[Mesh] OR ”Hydrocephalus/etiology”[Mesh] OR ”Hydrocephalus/genetics”[Mesh] OR ”Hydrocephalus/history”[Mesh] OR ”Hydrocephalus/immunology”[Mesh] OR ”Hydrocephalus/metabolism”[Mesh] OR ”Hydrocephalus/microbiology”[Mesh] OR ”Hydrocephalus/mortality”[Mesh] OR ”Hydrocephalus/parasitology”[Mesh] OR ”Hydrocephalus/pathology”[Mesh] OR ”Hydrocephalus/physiopathology”[Mesh] OR ”Hydrocephalus/prevention and control”[Mesh] OR ”Hydrocephalus/psychology”[Mesh] OR ”Hydrocephalus/radiotherapy”[Mesh] OR ”Hydrocephalus/surgery”[Mesh] OR ”Hydrocephalus/therapy”[Mesh]) Keywords: Other keywords include ”hydrocephalus in children,” ”Endoscopic third ventriculostomy (ETV),” ”VP-shunt,” ”Fenestration,” ”Diagnosis,” ”Neuroimaging,” ”Morbidity,” and ”Mortality.”

Inclusion and exclusion criteria

Inclusion criteria: Age range: children under 1 month to under 17 years. Infant patients with congenital hydrocephalus associated with other pathologies such as myelomeningocele or Chiari malformation. Incidence, morbidity, and mortality of hydrocephalus in pediatric patients. Surgical and postoperative neurological outcomes of congenital and non-congenital hydrocephalus in the pediatric population, including obstructive hydrocephalus associated with posterior fossa tumors. Risk factors affecting children with hydrocephalus in terms of etiology, genetics, histology, and pathogenesis. Management of pediatric hydrocephalus, including diagnosis, neuroimaging (CT and MRI), and surgical procedures such as endoscopic third ventriculostomy (ETV) fenestration and ventriculoperitoneal shunt (VP shunt). Exclusion criteria: Studies of non-pediatric hydrocephalus or studies not in English were excluded, as were related publications that did not meet the inclusion criteria, those with abstract findings, and patients with myelomeningocele and without hydrocephalus.

Data and Analysis

We collected all data from the included studies related to various aspects of congenital obstructive hydrocephalus, including diagnosis, management, and treatment. We examined and evaluated factors influencing the presence of symptoms, hydrocephalus, and

intraventricular hemorrhages, which can affect the lateral ventricles (herniation, blockage, and cerebrospinal fluid accumulation), as well as head circumference. Surgical treatment and management are focused on fenestration. Surgical techniques were also thoroughly reviewed due to their high mortality and survival rates and the causes of postoperative infections and/or the presence of epilepsy in cases of tumor mass in patients with ventricular expansion of accumulated CSF, considering its location, size, and shape for its removal. We extracted data using several standardized systems and rigorously analyzed them with research manuscripts relevant to this review. Once the data were compiled from detailed information for studies, we included demographic characteristics, interventions, and control parameters in comparative studies, as well as authorship, year of publication, and study design. Our data analysis plan was redefined before the start of data collection. Also using the R and Excel programs, we began with all aspects related to congenital hydrocephalus, including pediatric statistical studies for hydrocephalus management. This review used and analyzed the necessary statistics, including a forest plot, funnel plot, and 95% confidence interval, to determine heterogeneity and p-values and the magnitude of hydrocephalus in children.

Risk of Bias Assessment

We sought to ensure the results of the methodological search and assessed the quality of all included studies through systematic reviews and meta-analyses. The risk of bias for each study was determined using standard tools, according to the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). R Software Manager 5.4. The risk of bias can be found due to the intervention design and blinding of outcomes, which is key to ensuring the validity of the outcome assessment. According to the assessment, non-randomized studies presented a relatively high risk of bias, mainly related to participant selection with appropriate tools for bias assessment (Supplementary material).

Statistical analysis:

Our statistical analysis relied on data generated using R Software Manager 5.4 and Microsoft Excel. Data presentation: Results are presented as mean ± standard deviation (SD). In a comparative analysis, we included the comparative studies "Management of hydrocephalus in pediatric patients with Endoscopic Third Ventriculostomy (ETV) and Ventriculoperitoneal Shunt (VPS), Treatments and Postoperative Outcomes," surgical approach, postoperative outcomes, and survival. Statistical significance: A p ¡ 0.05 was considered statistically significant. Effect measures: Mean differences and likelihood ratios were calculated for the observed outcomes. Model selection: We used random-effects models to estimate the measures of the outcomes of the individual studies and to bolster the calculations of the systematic review or meta-analysis.

Results

In our systematic review, we found a total of N=3,119 pediatric patients with hydrocephalus, which we distributed in Supplementary Table 1 [7,8,9,10,11,12,13,14,15,16,17,18]. N=1728 patients, (55%), with endoscopic procedure N=948, (30%). VP-shunt N=765. (24%). While in Supplementary Table 2 [19,20,21,22,23,24,25,26,27,28,29,30], N=1391 patients (44%). ETV/VP shunt; N=474, (15%). ETV/CPC; N=766 (24%). Heterogeneity was assessed as follows: Chi^2 = 17.96, df = 11, P ¡ 0.08 vs. I^2 = 39%, test for overall effect: Z = 1.24, P = 0.21; Tau^2 = 0.01; Chi^2 = 20.13, df = 11, P ¡ 0.04; I^2 = 45%, confidence interval test for overall effect: Z = 0.91, P = 0.72, P ¡ 0.36. Tau2; 0.00; Chi^2 = 20.00, df = 11, P = 0.05; vs. I^2 = 45%, test for overall effect: Z = 1.09, P = 0.27. In a randomized controlled trial

of 70 preterm infants aged 24 to 34 weeks with progressive enlargement of the cerebral ventricles, only 34 infants were assigned to irrigation and fibrinolytic therapy following intraventricular hemorrhage to remove blood and cytokines. Two shunts failed, requiring 13 revision surgeries (44%). Only 36 were evaluated with standard therapy, resulting in only 5 shunt failures. Only 14 infants underwent revision surgery (50%), while 12 infants underwent revision surgery (25%), a difference that was not statistically significant. Only 3 patients (8%) experienced secondary intraventricular hemorrhage, increasing the risk of subsequent shunt surgery and the need for more blood transfusions. Therefore, there was no reduction in the number of surgeries or mortality associated with shunt surgery. [6]. Figure 3 shows graphic representation of pediatric patients with hydrocephalus and surgical treatment, while figure 4 shows graphics of hydrocephalus studies and surgical interventions

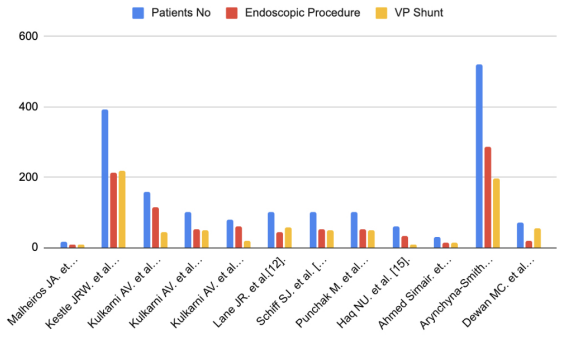

Figure 3: Graphic representation of pediatric patients with hydrocephalus and surgical treatment.

Management of Endoscpic Third Ventriculostomy (ETV) for Hydrocephalus

To perform Endoscopic Third Ventricle Surgery and avoid the placement of a pulmonary venous shunt, a thorough understanding of the classic pathophysiology is essential, involving three well-known factors:

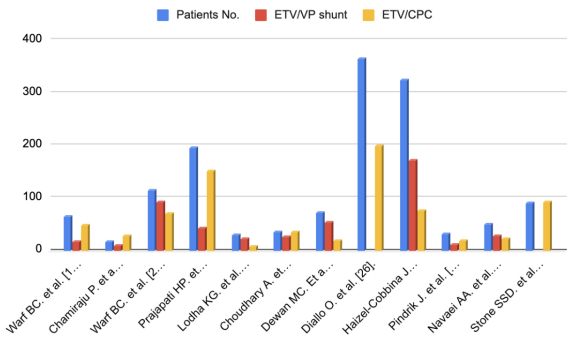

Figure 4: Graphics of hydrocephalus studies and surgical interventions

cerebrospinal fluid (CSF) production, circulation, and absorption. Some concepts are based on seven factors, including CSF production, pulsatility, primary and secondary CSF pathways, absorption, venous flow, and respiration; these factors may have varying degrees of relevance in each individual hydrocephalic condition. The management of ETV focuses on resolving CSF pathologies and pulsatility. Therefore, the primary objective is to restore CSF communication between a ventricle and the subarachnoid space while simultaneously reducing stress pulsatility following increased ventricular wall distensibility or expansion. [31].

Congenital Hydrocephal

Congenital hydrocephalus usually presents in utero between the 3rd and 4th week of gestation. The formation of the ventricular system and amniotic fluid begins before the neural tube closes. While the lateral ventricles begin to develop during the fifth week of gestation, the fourth cerebral ventricle develops around the 8th week of gestation, along with the choroid villi. [32]. The fourth ventricle begins producing fluid around the 22nd week of gestation. [33]. The ventricles are lined by ependymal cells, which embryonically derive from radial glia and can be classified into multiciliated ependymal cells (E1 cells), which are active in the flow of cerebrospinal fluid (CSF) across the ventricular wall, and ciliated ependymal cells (E2 cells). and the E3

cell uniciliate, which covers the signaling of its maturation of the ciliated ependyma in the middle of its gestation and will be in full maturation 6 months after birth. [34].

Endoscopic Aqueductoplasty (EA)

EA is a means of restoring the physiological dynamics of cerebrospinal fluid (CSF). This procedure offers an alternative to the endoscopic third ventriculostomy surgery (ETV), as it avoids the risk of severe arterial bleeding. EA has been performed in cases of membranous occlusion, frequently showing a type of failure. [35]. A contributing factor to closure with reduced CSF flow is aqueductal closure through the stoma after ETV, accounting for approximately 50% of cases. Aqueductal aqueductal occlusion is considered a high-risk procedure for injury to structures such as the midbrain. Neurological deficits, such as oculomotor or trochlear nerve palsy, as well as Parinaud's syndrome and periaqueductal syndrome, are also associated with EA. Long-term ETV is more successful with less risk in cases of segmental membranous occlusion, including tumor-related occlusion, of the aqueduct. [36]. An exception is patients with isolation of the fourth ventricle and those with post-infectious and post-hemorrhagic hydrocephalus during the first year. Even after shunt placement, complicated drainage with aqueductal stenosis can occur. Aqueductoplasty can establish communication between the cerebrospinal fluid and the ventricular compartment, but stenting is necessary to maintain an open pathway. Aqueductoplasty, combined with stenting, is the endoscopic treatment method for isolated fourth ventricles. [37,38,39].

VP-shunt complications

VP- shunt disconnection: During surgery or procedures, some CSF shunts are structured with several separate components. If one of these components becomes disconnected, it can cause a failure. This can occur suddenly, perhaps after placement and/or during surgery. All components of the multicomponent shunt system are at imminent risk of disconnection, as the catheters are fully inserted into these connectors. If the knots are poorly tied, disconnection can incorrectly secure the connection points. An example of shunt migration is a spring-loaded shunt system, as the catheters used are coated with polyvinylpyrrolidone, which is prone to excessive migration of the ventricular catheter. The hydrogel catheter lubricant likely increases the propulsion of the shunt valve at the connection point. These disconnections lead to an obstruction of cerebrospinal fluid flow, resulting in hydrocephalus. [40]. Migration: As the child grows, the catheter may retract or move from its initial location, creating a blockage of CSF drainage. This catheter migration, whether proximal or distal, can cause shunt failure after successful placement. This migration phenomenon can occur in both the proximal catheter, as the ventricle retracts, and in the distal catheter, such as in the cardiac atrium, the pleural space, and the peritoneum. Migration is also attributed to the removal of the catheter tip from the ventricle, as the head tends to grow, although this is not frequent. In children, by placing the catheter tip at the appropriate depth, the original procedure will remain in place until adulthood. Once the distal shunt, such as the valve, is established, it can become anchored as the infant grows; with traction from the distal structures, the intraventricular catheter can be pulled out of the ventricles directly into the brain parenchyma, obstructing the catheter's entry and blocking the flow of cerebrospinal fluid (CSF). The steering system has right-angle connectors called Rickham reservoirs, which resist proximal catheter migration. Therefore, diagnosis of this migration will be achieved through transverse imaging studies that will show the migration of the catheter tip from the ventricle. During the procedure, surgical replacement of the ventricular catheter will be performed if migration is present. We will proceed to suture the proxi-

mal catheter as a preventative measure and the valve to the pericranium, anchoring it as a system around the trephined orifice. [41]. Ventricular Shunt overdrainage: When decompression of the ventricular system occurs, and consequently, when pressure drops from extra-axial convexities or subdural hematomas, an overdrainage complication can develop in a functional shunt, draining more cerebrospinal fluid (CSF) than is optimal for the patient. [42]. This chronic overdrainage is considered an underlying cause of slit-ventilation syndrome, which may be related to the siphoning effect of the distal catheter. CSF siphoning occurs due to the gravitational force acting on the fluid column within the distal catheter. [43,44]. This siphoning can end up in the skull and is exacerbated by an upright posture. In VA and VPL shunts, a section created by intermittent negative ambient pressure at the distal end of the catheter will be exacerbated by the siphoning effect. [45]. Clinical and endoscopic studies from the University of Wisconsin in patients with chronic shunts have hypothesized that obstructions tend to recur in the proximal shunt, with complications resulting from chronic drainage syndrome that may go undetected for years. [46]. We will note the investments and significant efforts in developing updated and improved shunt valves and/or anti-siphon devices to address both acute and chronic complications of overdrainage and the distal catheter effect. However, the use of lumboperitoneal shunts in patients with ventricular overdrainage syndrome shows promise in reducing shunt failures. [47,48]. A recent prospective randomized controlled trial of post-infectious hydrocephalus (PIH) compared external ventricular drainage (EVD) and ventriculosubgaleal shunt (VVS) for treatment, hoping for cerebrospinal fluid (CSF) clearance for shunt placement via ventriculoperitoneal shunt. The study included 42 cases divided into two groups: 21 patients in group A (VVS) and 21 patients in group B (external ventricular drainage). This study showed a significant difference in the number of patients admitted to the pediatric intensive care unit (PICU) until the resolution of the infection, with the external ventricular drainage group having a higher rate of admission. However, there was no difference in complications, although mortality rates were similar. [49].

Discussion

Patients with large CSF volumes typically undergo a procedure with VPS. Patients with subdural collections often present with cognitive problems and smaller brain volumes, but mortality does not vary. Although some studies suggest that subdural collections are due to brain atrophy with a thin cortical mantle, CSF volume was not related to age and sex preoperatively; on the contrary, it was related to higher rates of subdural collection volumes. [11,12]. A recent randomized, prospective, comprehensive controlled study conducted on 158 five-year-old children, assessed using the Mark 2 health index (HUI-2), questioned the results compared through covariance with adjustment of baseline variables between age at surgery and initial developmental status of hydrocephalus (HOQ), as a measure of quality of life. Initially, of 78 patients, 19 were treated with shunting and 61 with endovascular anastomosis (EVA), at a mean age of 62.1 months (SD 6.3). The mean 5-year HUI-2 score was 0.90 (SD 0.19) for EVA and 0.94 (SD 0.10) for shunting ($p = 0.21$). The mean 5-year HOQ score was 0.81 (SD 0.15) for EVA and 0.85 (SD 0.12) for shunting ($p = 0.42$). Therefore, they believe that overall health status is high, with no significant difference in quality of life observed between the two surgical types in infants treated for aqueductal stenosis. [11,12]. The gross brain volume indicates that smaller brain volumes are normalized between 12-24 months without reflecting the absolute loss of volume. [13]. Arynchyna-Smith et al. proposed a revision study of (ETV) after the failure of (ETV+CPC) in children. The revision ETV showed a success rate of 29% of patients, a lower rate than the initial ETV+CPC. None

of the patients presented with neurological deficits, infected wounds, or diabetes during the revision ETV. However, there was a significant difference between the two groups by age: older patients in the ETV group had a different success rate than those in the ETV+CPC group, as shown by a difference in ventricular size as measured by focal heart rate monitoring. [17]. Surgical Techniques for Subgaleal Ventricular Insertion Before placing the patient in the supine position, we must observe the coronal sutures and try to locate the Kocher point for insertion of the ventricular catheter. It is also extremely important not to restrain the thin skin of premature infants throughout the procedure. First, we must place the ventricular catheter in the frontal horn. Next, this ventricular catheter will be connected to a reservoir, using a right-angle connector, on a short, closed-end tube with slots, establishing unidirectional flow from both the ventricle and the subgaleal pouch. [50]. If the reservoir is not used, the tube will be fixed to the periosteum with a suture to prevent the catheter from migrating into the lateral ventricle; to prevent this, the reservoir must be used. Then, a subgaleal pouch will be created by blunt dissection with the fingers or with blunt-tipped Metz scissors with curved ends. [51]. Once dissected, care must be taken to avoid dissecting the subgaleal space too superficially or too deeply. Since larger subgaleal pouches tend to prolong the subgaleal ventricle shunt, the dissection should always be lateral, towards the ear, then over the occiput (but not the forehead), carefully approaching the midline to avoid skin perforation. The subgaleal catheter will be placed to drain into the pouch, and the wounds will be closed in two layers. The effectiveness of the subgaleal ventricle shunt will be assessed by the reduction in head circumference, the softening of the anterior fontanelle, and the reduction in ventricular size, observed with cranial ultrasound and other imaging studies. If the subgaleal pouch is tense anteriorly in a soft, fluctuant manner, with subgaleal fluid, cranial imaging studies are recommended to confirm ventricular enlargement. [52]. When a shunt fails, endoscopic third ventriculostomy (ETV) is recommended. When shunt dysfunction and recurring infection occur, ETV is recommended as an adjuvant treatment. [54,55,53]. This method works well, although it is not as good as ventriculoperitoneal shunting in situations of fourth ventricle obstruction and endoscopic transforaminal transventricular foraminoplasty with flexibility of the foramina of Magendie and Luschka in an open suboccipital craniotomy. [57,58,56]. Additionally, ETV is often helpful in situations of fourth ventricle neurocysticercosis. [60,59]. A combination rigid-flexible endoscope will be helpful for the endoscopic transluminal endoscopy (ETV) and biopsy, which will be carried out via a single burr hole. [62,61]. ETV will be recommended in cases of hydrocephalus with posterior fossa lesions, such as cerebellar infarction with a cerebellopontine angle tumor and no severe brainstem compression. (63). The diagnosis of basal meningitis will also be aided by a biopsy of the basal cisterns. (64). (TVE); is helpful in removing brain clots from intraventricular hemorrhages. [66,65]. Additionally, full-term newborns with normal birth weight and patients with Chiari type 1 deformities, whether or not they have syringomyelia, benefit greatly from it. [68,67]. Limitations and Future Directions Cerebrospinal fluid (CSF) occlusion in the aqueduct is regarded as a high-risk procedure for harm to tissues including the midbrain, and endoscopic third ventriculostomy (VTE) accounts for about 50% of cases. These kinds of pathology are also linked to neurological impairments such oculomotor or trochlear nerve palsy, as well as Parinaud's syndrome and periaqueductal syndrome. Overdrainage, proximal and distal shunt blockage, catheter breakage or migration, and when to use third ventricle endoscopy are all limits to take into account. Revisions are also required, but deciding whether to fix the shunt or just replace it with a new ventricular system is crucial. Any component that is positioned incorrectly may result in drainage failure, necessi-

tating either third ventricle endoscopy or revision of the pulmonary venous shunt. Although the usage of new shunt systems is increasing, the surgeon's experience must still be taken into account to prevent damaging vascular or anatomical structures. Although some research is still continuing, hydrocephalus has previously been treated with new stem cell procedures. Neuronavigation has shown promise in the assessment and treatment of burr holes and in cases of tumor-induced obstructive hydrocephalus.

Conclusion

Endoscopic third ventriculostomy (ETV) and choroid plexus cauterization (CPC) are combined operations used to treat hydrocephalus in children. These treatments range from straightforward Kocher point stenting to intricate shunt systems. Cerebrospinal fluid (CSF) flow is managed with a single choice, which permits some control over normal head circumference. Ventriculoperitoneal shunting and various treatments to remove extra CSF result from overdrainage. This review illustrates the path from the implantation of a ventriculoperitoneal shunt to the choice to carry out a third ventriculoscopy in order to manage excess CSF and avoid childhood hydrocephalus symptoms. Management is usually simple and short-lived, but when postoperative failure happens, it becomes complicated, necessitating adjustments to retract or reposition the shunt and, eventually, the choice to undergo a third ventriculoscopy. This study shows that every part of the shunt needs to be exact in order to prevent failure, which will result in excess fluid and, ultimately, chronic hydrocephalus. Intraventricular bleeding and consequences, such as midbrain lesions and lesions of other anatomical structures, might result from the enlargement of the lateral ventricles with cranial growth. This study demonstrates that while there are variations in the infants' age and sex, there are no variations in the complications, and surgery is nearly always the only treatment for hydrocephalus symptoms.

Conflict of Interest

The authors declare that they have no competing interests.

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