



# Endoscopic Third Ventriculostomy in the Pediatric Population: Case Series Report\*

## *Terceira ventriculostomia endoscópica na população pediátrica: Relato de série de casos*

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### Abstract

**Objective** Hydrocephalus is characterized by multi- or uniloculated ventricular dilatation, and there are differences between the etiology and therapeutic response of each type. Endoscopic third ventriculostomy (ETV) is indicated for the treatment of obstructive hydrocephalus, with a reported efficacy between 50% and 76%. Reduced efficacy of the procedure has been demonstrated in communicating hydrocephalus due to multifactorial pathogenesis, and, in patients with myelomeningocele, its efficacy ranges from 15% to 20% at birth. The present study aims to compare the efficacy of ETV in the treatment of congenital obstructive hydrocephalus (COH) and acquired obstructive hydrocephalus (AOH) in the pediatric population.

**Methods** A retrospective study of 169 endoscopic surgeries performed by the senior author in two institutions, one public (Hospital João XXIII, Belo Horizonte, Minas Gerais) and another private (Hospital Felício Rocho, Belo Horizonte, Minas Gerais), in the period from 2003 a 2020. From the selection of 169 patients, only 77 cases fit the age profile  $\leq 12$  years of the present study. Of these, 46 were male, and the age range ranged from 10 days to 12 years. The study included multiple etiologies, which were divided into 2 groups, 34 related to COH, and 43 to AOH.

**Results** Regarding the cases of COH, 22 were submitted to ETV as the main treatment, with 14 (63.63%) effective and 8 (36.36%) ineffective procedures. As for

### Keywords

- ▶ hydrocephalus
- ▶ therapy
- ▶ ventriculostomy
- ▶ pediatric
- ▶ management

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the cases of AOH, 13 patients underwent ETV, and 8 (61.53%) procedures were effective, and 5 (38.46%), ineffective.

**Conclusions** Through the calculation of the  $p$ -value of 0.49, we concluded that it cannot be stated that the efficacy of ETV is greater in COH than in AOH.

## Resumo

**Objetivo** A hidrocefalia é caracterizada por dilatação ventricular multi ou uniloculada, e há diferenças entre a etiologia e a resposta terapêutica de cada tipo. A terceiro ventriculostomia endoscópica (TVE) está indicada no tratamento da hidrocefalia obstrutiva, com uma eficácia relatada entre 50% e 76%. O procedimento demonstrou eficácia reduzida em hidrocefalia comunicante devido à patogênese multifatorial, sendo que, em pacientes com mielomeningocele, sua eficácia é de 15% a 20% no nascimento. Este estudo visa comparar a eficácia da TVE no tratamento da hidrocefalia obstrutiva congênita (HOC) e hidrocefalia obstrutiva adquirida (HOA) na população pediátrica.

**Métodos** Realizou-se um estudo retrospectivo de 169 cirurgias endoscópicas realizadas pelo autor sênior em duas instituições, uma pública (Hospital João XXIII, Belo Horizonte, Minas Gerais) e outra privada (Hospital Felício Rocho, Belo Horizonte, Minas Gerais), no período de 2003 a 2020. Da seleção de 169 pacientes, apenas 77 casos se enquadraram no perfil de idade  $\leq 12$  anos do presente estudo. Destes, 46 eram do sexo masculino, e a faixa etária variou de 10 dias a 12 anos. O estudo contemplou múltiplas etiologias, que foram divididas em 2 grupos, sendo 34 relacionadas à HOC, e 43, à HOA.

**Resultados** Entre os casos de HOC, 22 foram submetidos a TVE como tratamento principal, sendo que 14 (63,63%) procedimentos foram eficazes, e 8 (36,36%), ineficazes. Já entre os casos de HOA, 13 pacientes foram submetidos a TVE, sendo 8 (61,53%) procedimentos eficazes, e 5 (38,46%), ineficazes.

**Conclusões** Por meio do cálculo do valor de  $p$  de 0,49, concluiu-se que não se pode afirmar que a eficácia da TVE é maior nas HOCs do que nas HOAs

## Palavras-chave

- ▶ hidrocefalia
- ▶ terapia
- ▶ ventriculostomia
- ▶ pediátrico
- ▶ manejo

## Introduction

Hydrocephalus is a disease that can be characterized by multi- or uniloculated ventricular dilatation, and there are significant differences between the etiology and therapeutic response of each type.<sup>1</sup> Endoscopic third ventriculostomy (ETV) is indicated for the treatment of hydrocephalus related to obstructive mechanisms, with a reported efficacy ranging from 50% to 76%. Reduced efficacy has been shown in communicating hydrocephalus due to multifactorial pathogenesis, and, in patients with myelomeningocele, its efficacy ranges from 15 to 20% at birth.<sup>2</sup> The present study aims to compare the efficacy of ETV in the treatment of congenital obstructive hydrocephalus (COH) and acquired obstructive hydrocephalus (AOH) in the pediatric population.

## Methodology

We conducted a retrospective study of 169 endoscopic surgeries performed by the senior author in two institutions, one public (Hospital João XXIII, Belo Horizonte, Minas Gerais, Brazil) and one private (Hospital Felício Rocho, Belo Horizonte, Minas Gerais, Brazil), from 2003 to 2020. Patients aged  $\leq 12$  years were selected. We excluded cases of communi-

cating hydrocephalus, or those in which, besides the ETV, additional procedures were performed, such as septostomies or tumor biopsies. Thus, only 77 cases were selected for research analysis.

## Results

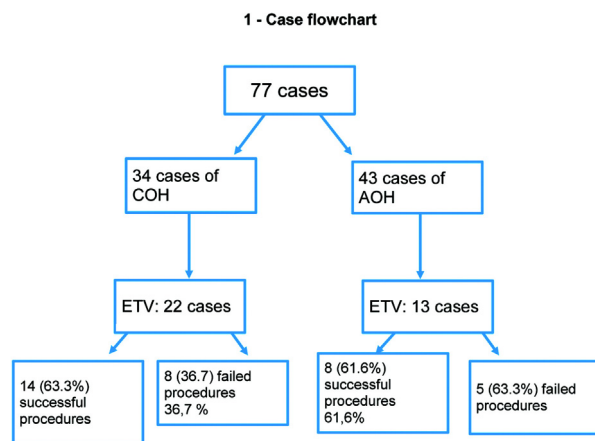
Out of the 77 cases found, 34 were of COH, and 43 were of HOA. Regarding the cases of COH, 22 underwent ETV as the main treatment, with 14 (63.63%) effective and 8 (36.36%) ineffective procedures. As for the cases of AOH, 13 patients were submitted to ETV, and 8 (61.53%) procedures were effective and 5 (38.46%), ineffective. Through the calculation of the  $p$ -value of 0.49, we concluded that it cannot be stated that the efficacy of ETV is greater in COH than in AOH.

## Case Flowchart

▶ Fig. 1.

## Discussion

An analysis of 158 children under the age of 2 was performed by The International Infant Hydrocephalus Study,<sup>4</sup> and the authors found that the shunt was more successful than ETV.



**Fig. 1** Case flowchart: Of the 77 patients with hydrocephalus, 34 had congenital obstructive hydrocephalus (COH) and 43 had acquired obstructive hydrocephalus (AOH). Of the 34 cases of COH, 22 patients underwent endoscopic third ventriculostomy (ETV), with a success rate of 63.3% (14 patients). As for the cases of AOH, 13 patients underwent ETV, with 61.6% of effectiveness (8 cases). We excluded cases in which other procedures associated with the ETV had been performed, such as intraventricular drain (IVD) placement, septostomies, tumor biopsies, or choroid plexus coagulation.

Actual comparisons of the outcomes of pediatric patients submitted to long-term peritoneal ventricle shunt and ETV have not been made yet, because the studies are often limited by a retrospective design and relatively heterogeneous patients. If we evaluate the results of ETV throughout time and the effects of the shunt in the treatment of infant hydrocephalus, it is clear that aqueductal stenosis has a high efficacy and results in good quality of life for the patients, with no differences in the comparison of patients initially treated through ETV or shunt.<sup>3,4</sup>

The study by Kulkarni et al. indicates that the ETV Success Score (ETVSS) increases with age. If we compare the ETVSS with the success rate of the peritoneal shunt, the former has less failure with the progression of postoperative days.<sup>3</sup>

Furthermore, in the same literature by Kulkarni et al. it was possible to analyze that, in infants, the ETV failure rate is higher when compared to that of children. However, our study could not conclude information about comparisons of the failure rate of the third ventriculostomy in infants and children, since there was no age division, and the pediatric population was grouped in a filter of less than 12 years. Moreover, this point was not addressed in the study because the objective is to compare the efficacy of TVE in the treatment of congenital obstructive hydrocephalus (COH) and acquired obstructive hydrocephalus (AOH) in the pediatric population. According to Baldauf et al.,<sup>5</sup> the ETVSS in children younger than 2 years of age depends on etiology and age. These authors evaluated 21 patients, and found a ETVSS of 43% in the treatment of COH. In children younger than 2 years of age, the ETVSS was of 37.5%. In contrast, Sufianov et al.<sup>6</sup> evaluated 41 infants and children younger than 2 years of age, and concluded found a ETVSS of 71.4% among children, and of 75% among infants.

To assess the efficacy of the surgery, an evaluation of the need to place a valve a posteriori is required. Therefore, for

the evaluation of the patient, we suggest requesting a magnetic resonance imaging (MRI) scan of the brain after three months of longitudinal follow-up. The MRI enables the analysis of the dimensions of the third ventricle, and this is an important test for the definition of the concept of effectiveness. It should be emphasized that the follow-up is individual, using the particularities of the patient's condition to adjust the frequency of consultations. Furthermore, in case of ineffective surgery, the patient must be submitted to placement of the shunt drainage valve.<sup>3,4</sup>

To better elucidate the concepts of efficacy or inefficacy according to the proposed therapy, we provide a brief description of two cases managed by the supervisor of the present work. The first case involved a 5-year-old child with symptoms of intracranial hypertension (headache, vomiting, and papilledema). A computed tomography (CT) scan revealed a triventricular hydrocephalus (3rd and 4th ventricles and the lateral ventricles) due to a possible congenital obstruction of the aqueduct. A third ventriculostomy was performed, which was effective, and implantation of a drain valve was not required.

The other case involved a 10-month-old infant with COH and an arachnoid cyst, resulting in a significant increase in cranial perimeter and bulging fontanel. On endoscopy, an arachnoid cyst was observed obstructing the interventricular foramen, and a septostomy and third ventriculostomy were performed. The cyst was opened, with the possibility of accessing the third ventricle, and the third ventriculostomy procedure could be performed. The procedure was efficient, uneventful, and there was no need for readmission for valve placement. The procedure was efficient, uneventful, and there was no need for readmission for valve placement.

## Conclusion

The study aimed to select 77 individuals from the pediatric range  $\leq 12$  years, evaluating success rate of third ventriculostomy as an innovative procedure for the treatment of hydrocephalus obstructive congenital and acquired obstructive hydrocephalus. With this, the p-value calculation was performed and resulted in 0.49, concluding that it is not possible to state that the effectiveness of TVE is higher in COHs than in AOHs.

## Conflict of Interests

The authors have no conflict of interests to declare.

## References

- 1 Peraio S, Amen MM, Ali NM, Zaher A, Mohamed Taha AN, Tamburrini G. Endoscopic Management of Pediatric Complex Hydrocephalus. *World Neurosurg* 2018;119:e482–e490. Doi: 10.1016/j.wneu.2018.07.187 [Internet]
- 2 Feng Z, Li Q, Gu J, Shen W. Update on endoscopic third ventriculostomy in children. *Pediatr Neurosurg* 2018;53(06):367–370
- 3 Deopujari CE, Karmarkar VS, Shaikh ST. Endoscopic third ventriculostomy: Success and failure. *J Korean Neurosurg Soc* 2017;60(03): 306–314

- 4 Kulkarni AV, Sgouros S, Leitner Y, Constantini S International Infant Hydrocephalus Study Investigators. International Infant Hydrocephalus Study (IIHS): 5-year health outcome results of a prospective, multicenter comparison of endoscopic third ventriculostomy (ETV) and shunt for infant hydrocephalus. *Childs Nerv Syst* 2018;34(12):2391–2397
- 5 Baldauf J, Oertel J, Gaab MR, Schroeder HW. Endoscopic third ventriculostomy in children younger than 2 years of age. *Childs Nerv Syst*. 2007;23:623–626
- 6 Sufianov AA, Sufianova GZ, Iakimov IA. Endoscopic third ventriculostomy in patients younger than 2 years: outcome analysis of 41 hydrocephalus cases. *J Neurosurg Pediatr* 2010;5:392–401