

## AQUEDUCTOPLASTY WITH STENT PLACEMENT BY NEUROENDOSCOPY FOR THE MANAGEMENT OF A CYST OF THE IV VENTRICLE IN A CASE OF NEUROCYSTICERCOSIS

### *Acueductoplastía con colocación de stent por neuroendoscopia para manejo de un quiste del IV ventrículo en un caso de neurocisticercosis*

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#### ABSTRACT

**Introduction:** The most common parasitic infection of the central nervous system is neurocysticercosis which in 20% of cases is intraventricular, the fourth ventricle being one of the most frequent locations. These lesions cause obstructive hydrocephalus that requires the placement of a ventricle-peritoneal shunt (DVP) whose dysfunction rate is high due to the presence of adhesions and the formation of multiple compartments being the cyst isolated from the IV ventricle one of the most difficult treatment.

**Clinical Case:** We present the case of a 34-year-old patient with a history of neurocysticercosis who received antiparasitic treatment and the placement of a DVP, presenting multiple dysfunction with severe dilatation of the IV ventricle. It was decided to perform an aqueductoplasty and the placement of a stent in the Silvio aqueduct followed by the placement of a new left frontal DVP, after removing the DVP with parietooccipital "Y" connector and left posterior fossa. Tomographic control at week showed a decrease in ventricular size, catheters in an adequate position, clinical improvement and good patient evolution.

**Conclusion:** Endoscopic aqueductoplasty with stent placement in the Silvio aqueduct is an effective measure in cases of isolated cyst in the fourth ventricle, achieving good clinical and imaging evolution compared to other therapeutic options.

**Keywords:** Neurocysticercosis, Hydrocephalus, Fourth Ventricle, Cerebral Aqueduct, Stents. (source: MeSH NLM)

#### RESUMEN

**Introducción:** La infección parasitaria más común del sistema nervioso central es la neurocisticercosis la cual en el 20% de los casos es intraventricular, siendo el cuarto ventrículo una de las localizaciones más frecuentes. Estas lesiones causan hidrocefalia obstructiva que requiere la colocación de una derivación ventrículo-peritoneal (DVP) cuya tasa de disfunción es elevada debido a la presencia de adherencias y la formación de múltiples compartimentos siendo el quiste aislado del IV ventrículo uno de los de más difícil tratamiento.

**Caso Clínico:** Presentamos el caso de un paciente de 34 años con antecedente de neurocisticercosis que recibió tratamiento antiparasitario y la colocación de una DVP, presentando disfunción en múltiples ocasiones con severa dilatación del IV ventrículo. Se decidió realizar una acueductoplastía y la colocación de un stent en el acueducto de Silvio seguido por la colocación de una nueva DVP frontal izquierda, luego de retirar la DVP con conector en "Y" parietooccipital y de fosa posterior izquierda. En el control tomográfico a la semana se evidenció disminución del tamaño ventricular, catéteres en posición adecuada, mejoría clínica y buena evolución del paciente.

**Conclusión:** La acueductoplastía endoscópica con la colocación de stent en el acueducto de Silvio es una medida eficaz en casos de quiste aislado en el cuarto ventrículo, logrando una buena evolución clínica y de imágenes en comparación con otras opciones terapéuticas.

**Palabras Clave:** Neurocisticercosis, Hidrocefalia, Cuarto Ventrículo, Acueducto Cerebral, Stents. (fuente: DeCS Bireme)

Peru J Neurosurg 2019, 1 (4): 99-104

Neurocysticercosis is the most common parasitic infection of the central nervous system and has estimated that there are about fifty million infected people in the world. Of these cases, 15-20% correspond to intraventricular

involvement and are associated with high morbidity and mortality rates. Most intraventricular cysts are found in the fourth ventricle, which brings with it more risk of cerebral herniation and the development of basilar meningitis. <sup>1</sup>

**Submitted** : October 26, 2018

**Accepted** : February 12, 2019

**HOW TO CITE THIS ARTICLE:** Vargas J, Flores J, Rojas J, Palacios F. Aqueductoplasty with stent placement by neuroendoscopy for the management of a cyst of the IV ventricle in a case of neurocysticercosis. *Peru J Neurosurg* 2019; 1(4): 99-104



**Fig 1.** (A and B) Computed axial tomography (CT) of the brain ventricle in the immediate postoperative period after the last VPS surgery, in axial section at the level of lateral ventricles and the fourth ventricle that still shows ventricular dilation, with the right frontal ventricular catheter buried and functioning parietooccipital and left posterior fossa ventricular catheters. (C and D) Cerebral CT scan in axial section at the level of lateral ventricles and the fourth ventricle (1 month after the last one) that shows ventricular collapse, with the right frontal ventricular catheter buried, the parietooccipital ventricular catheter and left posterior fossa.

Intraventricular cystic lesions can cause non-communicating hydrocephalus and compress adjacent brain tissue. A nuclear magnetic resonance imaging (MRI) of the brain is necessary because it is difficult to distinguish the delicate wall of the cyst and can be interpreted as a dilatation of the fourth ventricle if the cyst occupies the entire ventricular space. In addition, proper identification of the cyst is necessary to choose the appropriate treatment.<sup>2</sup>

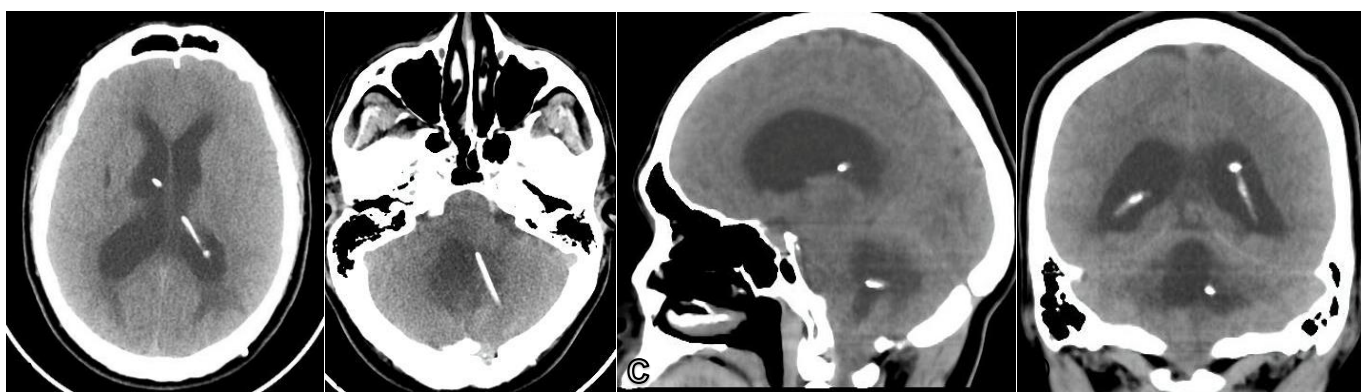
Although there is no agreement on an optimal treatment of the IV ventricle cyst, this may consist of the placement of a ventricular peritoneal shunt system (VPS), the performance of a neuroendoscopic aqueductoplasty or both.

We present the case of a patient with ventricular neurocysticercosis who had multiple dysfunctions of VPS and who was treated by aqueductoplasty and Stent by neuroendoscopy, achieving a good clinical and imaging evolution and with a minimally invasive approach, which demonstrates the usefulness of endoscopic surgery as first choice treatment.

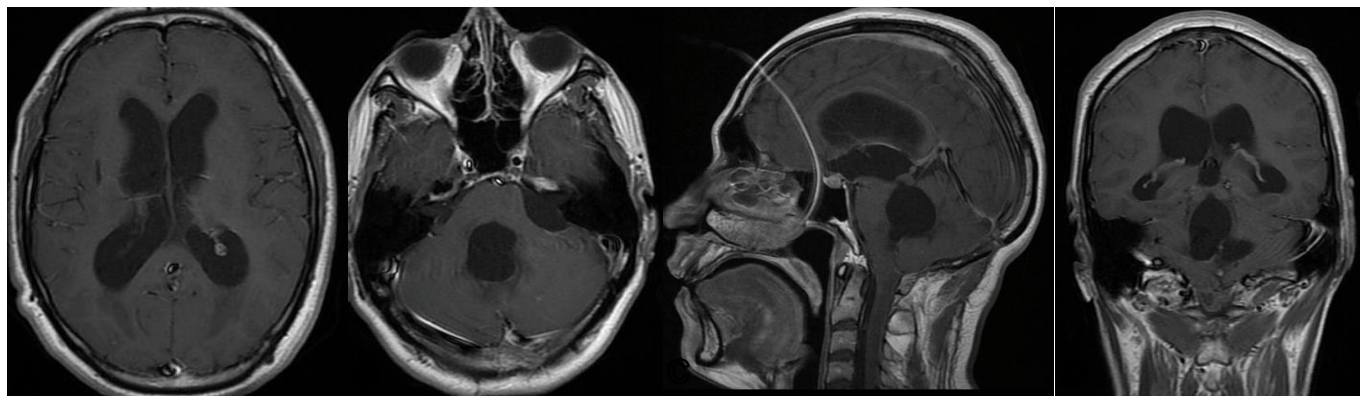
## CLINICAL CASE

**Historia y examen:** A 34-year-old male patient, from Junín, lived in Lima, with a medical history of ventricular neurocysticercosis 1 year ago with treatment with albendazole and corticotherapy for 8 weeks, in addition to structural epilepsy in treatment with phenytoin. The patient had multiple surgical antecedents of VPS placement with dysfunction reviews and prolonged use of ventricular external ventricular drainage as a complication of neurosurgical procedures. Prior to the current surgery, the patient had a buried right frontal ventricular catheter and a cyst of the IV ventricle, which was attempted to remove by suboccipital craniotomy, this attempt being failed due to the multiple adhesions present, so a left parietooccipital VPS was placed and another one in the posterior fossa both joint with “Y” connector (**Fig 1**). Upon discharge, he had a modified Rankin of 4 due to sequelae of diplopia and mild quadriparesis, indicating physical therapy and rehabilitation.

After hospitalization, the patient returned to his work and daily activities, returning to a modified Rankin of 1. Two



**Fig 2.** (A and B) Cerebral CT scan on admission, in axial section at the level of lateral ventricles and the fourth ventricle showing marked ventricular dilation with transependymal edema in addition to diffuse cerebral edema. (C and D) Cerebral CT scan in sagittal section and coronal section showing ventricular dilation and left parietooccipital and posterior fossa catheters.



**Fig 3.** (A and B) MRI of the brain with contrast on admission, in axial section at the level of lateral ventricles and the IV ventricle. (C and D) Brain MRI with contrast in sagittal and coronal section showing severe dilatation of the IV ventricle without evidence of cysticercus cysts.

weeks before admission, the patient began with a global headache, oppressive, of moderate intensity, associated with gait disturbance, nausea and non-explosive vomiting, without presenting visual acuity disturbance, so he came to the emergency room of our hospital where he had a cerebral non contrast CT scan which evidenced tetraventricular dilatation with an Evans index of 0.38, moderate transependymal edema, attached fossa catheter to the left side epidurium, partially collapsed basal cisterns and left parietooccipital catheter in proper position (**Fig 2**).

A brain nuclear magnetic resonance imaging (MRI) with contrast was performed, which also showed tetraventricular dilatation and transependymal edema, with no evidence of intraparenchymal or intraventricular cysticercosis. In the IV ventricle, a cystic cavity of 4x3.6x3.4cm (CC x AP x T) was observed without intralésional septa or contrast acquisition (**Fig 3**).

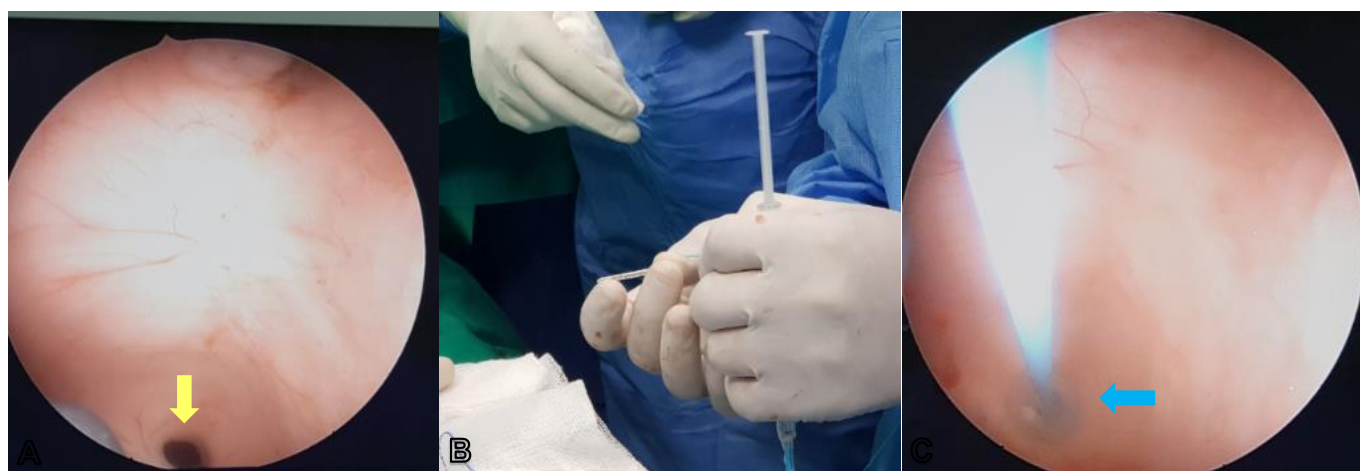
Likewise, a study of cerebrospinal fluid (CSF) was performed, whose cell count, biochemical study and culture values were normal. On physical examination, the patient had a Glasgow scale of 14 points, no meningeal signs, no sensory deficit, with paresis of the left cranial nerve VI, mild quadriplegia 4 + / 5, with gait disturbance. The rest of the

pairs cranial preserved.

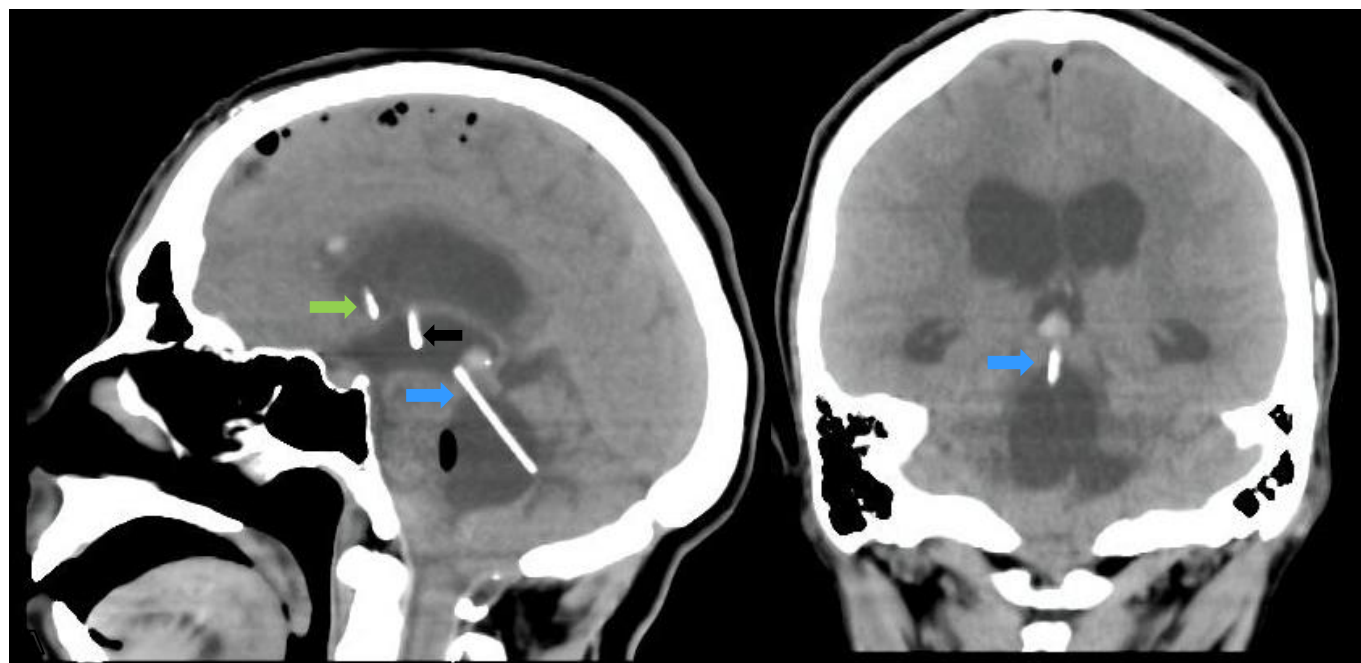
**Treatment:** It is decided to carry out a neuroendoscopy finding multiple adhesions in the right foramen of Monroe associated with attached frontal catheter which was tried to release without success. Fenestration of the Septum pellucidum is performed, removal of VPS with Y-connector followed by the placement of left frontal VPS.

The cyst of the fourth ventricle is aspirated using a flexible catheter (nasogastric tube 6) under the suspicion that there were cysticercosis in such cavity. This maneuver being unsuccessful, so we decide that an aqueductoplasty and the placement of an intra-aqueductal stent are performed (**Fig 4**). A cerebral CT scan is performed without contrast in the immediate postoperative period, where we observe a slight decrease in ventricular size and stent in an adequate position (**Fig 5**).

**Evolution:** After the procedure, the patient began to tolerate the oral route and the headache subsided, for that reason he was suspended analgesic medication. A brain CT scan a week later showed significant decrease in ventricular size, with clinical improvement and onset of ambulation aided by physical therapy and rehabilitation. (**Fig 6**)



**Fig 4.** Intraoperative images of Neuroendoscopy. (A) The third ventricle is visible and the Sylvio aqueduct (yellow arrow) is displayed at the bottom. (B) The intraventricular stent is observed in the hands of the neurosurgeon, who is placing a 2 Fr embolectomy catheter inside the stent to transport it to the Sylvio aqueduct and once placed remove the embolectomy catheter. (C) The embolectomy catheter with stent is observed at the end of this (celestial arrow), which is being placed in the Sylvio aqueduct.



**Fig 5.** Cerebral CT scan without contrast in sagittal section (A) and in coronal section (B) in the immediate postoperative period, where Stent is observed in Sylvian aqueduct in proper position (light blue arrow) and slight decrease in hydrocephalus, as well as ventricular catheter in front horn (green arrow). End of old proximal catheter can also be seen in non-functioning III ventricle (black arrow)

At 4 months after surgery, the control brain CT showed ventricular collapse and proper position of ventricular catheters. The patient was performing his work activity, had no headache, nausea or vomiting (Rankin 1); It had a 15-point Glasgow scale, minimal sequelae of mild quadriparesis and mild paresis of the VI left cranial nerve without significant gait disturbance or impaired visual acuity.

## DISCUSSION

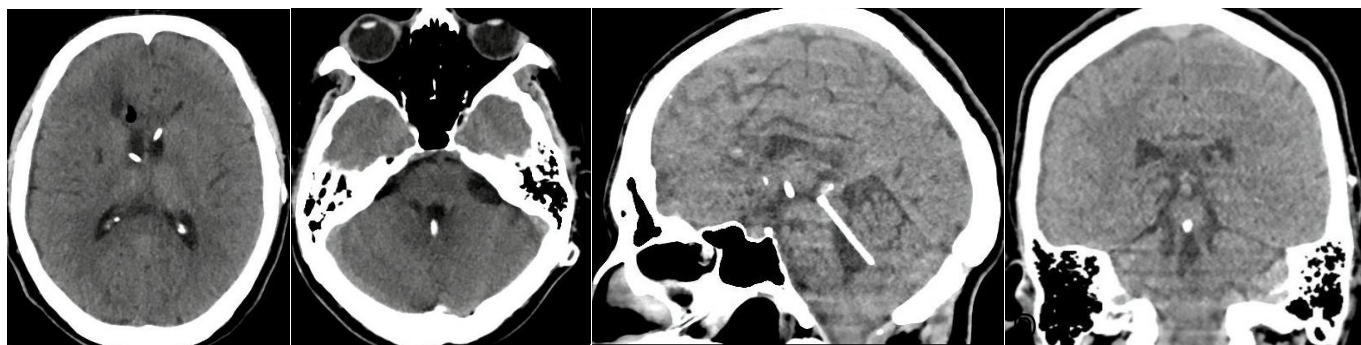
The management of intraventricular cysts associated with neurocysticercosis is not easy, so it usually requires associating the antiparasitic treatment with a surgical treatment to remove the cysts or perform a ventriculo-peritoneal shunt (VPS). The endoscopic approach is one of the least invasive procedures, managing to remove intraventricular cysts and treat hydrocephalus.<sup>6</sup> It can also be used to treat cases of cysts isolated from the IV ventricle. There is no consensus in the literature on which treatment is optimal, but as therapeutic options, it is considered to place a VPS, endoscopic fenestration, excision of the intraventricular cyst, and even conservative management in asymptomatic patients.<sup>3</sup>

Bergsneider et al. in their study mentions that there is insufficient statistically proven evidence to mention that medical treatment with albendazole and praziquantel with concomitant administration of corticosteroids results in a change in the natural history of ventricular neurocysticercosis. In addition, he mentions that VPS have a high rate of obstruction and dysfunction due to the migration of the cysts, so he suggests that surgical management with the excision of the cysts would be better.<sup>4</sup>

Tiwari et al reported in their study that patients with ventricular neurocysticercosis should be treated with albendazole at a dose of 15mg / kg / day for 3 to 4 weeks, even after surgery, with or without praziquantel at 100mg / kg / day for 3 to 4 weeks, since a rapid regression has been observed with this medicine, in patients with large cysts. However, he argues that the best option is surgery and he says that suboccipital craniotomy resection is much better than VPS, because the latter has a high rate of dysfunction. He also mentions that neuroendoscopy is a minimally invasive technique and that serves very well to remove intraventricular cysts from all locations, reducing the comorbidity associated with surgery.<sup>8</sup>

In this specific case, there is evidence of a patient who received medical treatment with antiparasitic drugs at adequate doses, with negative markers, but who, like most of the literature presented continuous VPS dysfunction. Therefore, it was decided to perform a neuroendoscopy in such a way that under direct vision an aqueductoplasty was performed and a stent was placed to communicate the IV ventricle with III ventricle, converting all ventricles into a single cavity, seeking drainage from IV to III ventricle and then to the peritoneal cavity through the frontal VPS system.

All this approach was achieved simply with a frontal incision of 3cm in length, which shows that endoscopic aqueductoplasty with stent placement is a surgical option that allows reducing the rate of DVP dysfunction, achieving a rapid post-surgical recovery, shorter stay hospitalization and an early return to work activity.



**Fig 6.** (A and B) Cerebral CT scan without contrast at 1 week after surgery, in axial section at the level of lateral ventricles and the IV ventricle showing a marked decrease in ventricular size. (C and D) Cerebral CT scan without contrast at 4 months after surgery, in sagittal section and in coronal section, showing collapse of the IV ventricle and lateral ventricle with a functioning VPS catheter and stent.

## CONCLUSION

Aquaductoplasty and Stent placement by neuroendoscopy for the management of isolated cyst of the IV ventricle associated with neurocysticercosis is an effective and minimally invasive surgical alternative, achieving an early clinical-radiological improvement, compared to other therapeutic options. This case report serves as a background for future comparative research between medical management, microsurgical management and endoscopic management, and thus be able to implement more effective health policies regarding this pathology.

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### Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

### Authors Contributions

*Conception and design:* All authors. *Drafting the article:* Vargas J. *Critically revising the article:* Flores J. *Reviewed submitted version of manuscript:* Flores J. *Approved the final version of the manuscript on behalf of all authors:* Flores J.

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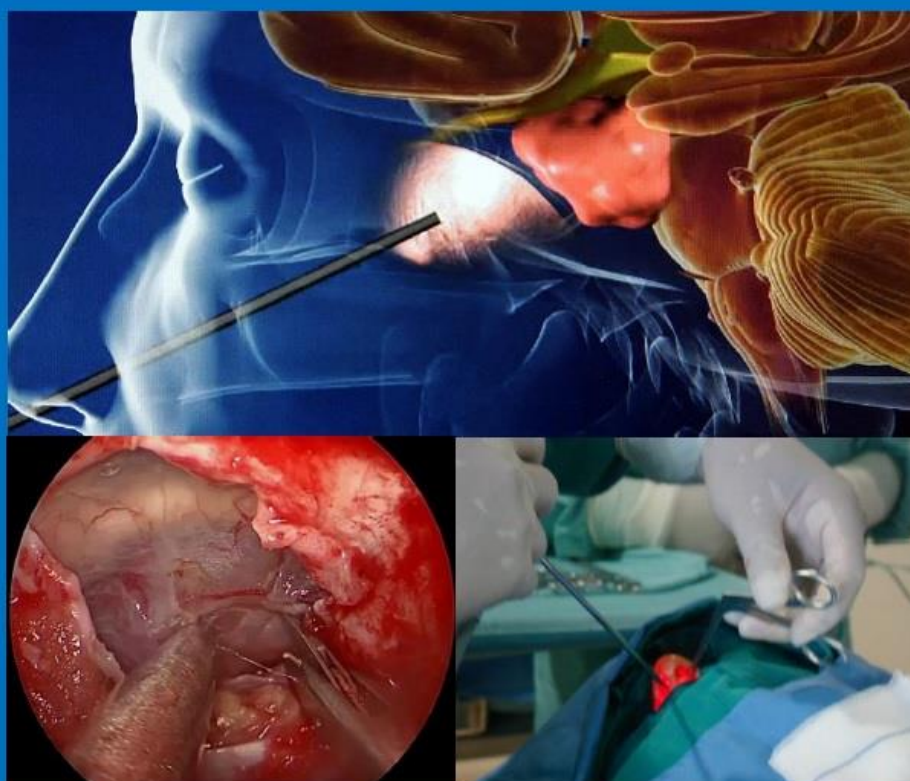
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**PJNS**

**PERUVIAN JOURNAL OF  
NEUROSURGERY**

Vol 2 | Issue 1 | Jan-Mar 2020

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