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## Enhanced recovery after surgery of a giant pilocytic astrocytoma: A case report



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### ABSTRACT

**Introduction:** Pilocytic astrocytoma (PA) is one of the most common benign glial tumors. Total resection is the main modality for the management of PA. Enhanced recovery after medical procedure (ERAS) is a widely used operative management approach. This case report discusses PA and its management with ERAS.

**Case presentation:** A 38-year-old male patient with complaints of blurred vision in both eyes in the last two years which became worse five months ago. Furthermore, the patient experienced severe headaches and left hemiparesis. Head computed tomography scan revealed the presence of space occupying lesion in the right frontoparietal area with a size of 7.3 x 7.4 x 6.1 cm which had caused a midline shift in the brain, uncus herniation, and edema. The surgery was performed at Pasar Minggu Regional Hospital of South Jakarta with ERAS management. The patient was sent home on the third day. ERAS in cases of brain tumors is very possible to do with a special approach and strategy. The purpose of implementing ERAS is to improve patient safety, accelerate functional healing, improve postoperative outcomes, and control the efficiency of patient care costs.

**Conclusion:** The use of the ERAS method is proven to be a better choice of surgical technique for elective brain tumor surgery based on postoperative clinical manifestation, avoidance of complications, reduced length of stay, and cost-effectiveness.

**Keywords:** cost effective, enhanced recovery after medical procedure, improved post operative outcome, pilocytic astrocytoma.

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### INTRODUCTION

Astrocytoma originates from astrocytes which are a type of glial cell in the cerebrum that are shaped like stars. Astrocytoma is the most common glioma, usually affecting the brain and occasionally the spinal cord. Among brain tumors, glial tumors comprise 60% of brain tumors.<sup>1,2</sup> Pilocytic astrocytoma (PA) is the most common primary tumor in children and young adults. This type of tumor accounts for 60% of brain tumor cases. The incidence of PA reaches 4.8 per million population per year. The development of this disease is found to be more common in the first two decades of life and decreases with age but the mortality rate increases. These tumors are more common in males than females.<sup>3-5</sup>

A study stated that the location of PA in adulthood was found in the cerebrum (29.7%), cerebellum (26.6%), brainstem (10.2%), ventricles (9.5%), spinal cord (7.9%), and optic nerve (2.5%). This finding is different from PA which is found

in children where the most common location is the cerebrum followed by the cerebellum, which is 37.4% and 18.6%, respectively.<sup>5</sup>

The local effects of PA are the result of several mechanisms, including direct invasion and consumption of oxygen causing hypoxic injury to normal brain parenchyma. In addition, free radicals, neurotransmitters, and inflammatory mediators are also responsible for disrupting the physiological functions of the brain.<sup>3</sup> Mass effect due to tumors also causes various clinical signs and symptoms. The clinical manifestations that patients often complain about are headaches and seizures, although there are some asymptomatic PA.<sup>5</sup> The primary choice of management for PA is total resection with a relatively good outcome in adults. A retrospective study of 254 adult patients with 77-month follow-up showed a recurrence rate of 28%. Adjuvant radiation therapy is associated with lower survival rates in adult PA patients.<sup>5,6</sup>

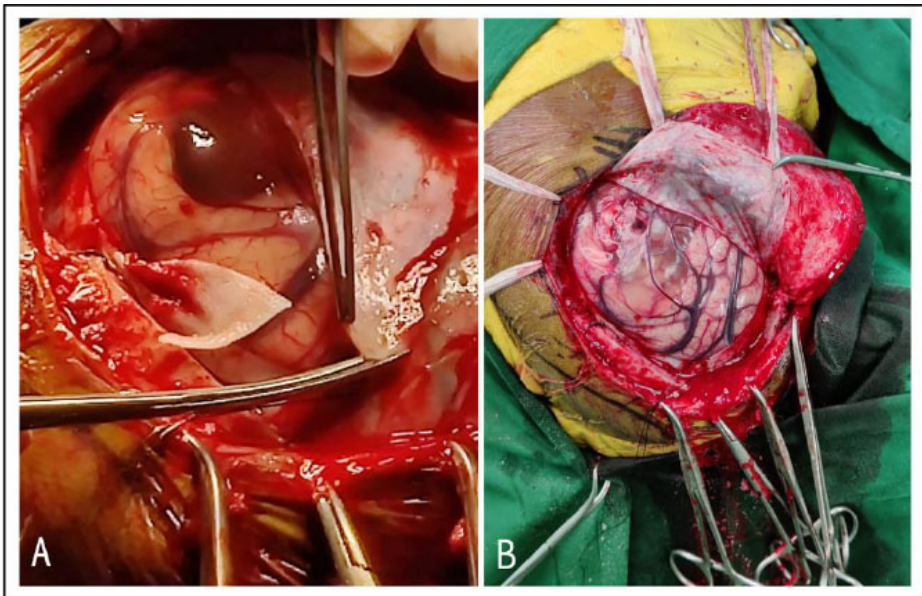
Enhanced recovery after surgery (ERAS) is a multidisciplinary approach to the care of surgical patients. The main goals of ERAS are to reduce the response to stress due to surgery, accelerate functional healing, improve post-operative outcomes, reduce the length of stay, be more cost-effective, and increase patient satisfaction without adding complications.<sup>7</sup> ERAS has been performed in many types of surgery, but it is still rarely performed in brain tumor surgery. This case report discusses pilocytic astrocytoma treated with ERAS.

### CASE PRESENTATION

A 38-year-old man came to the eye clinic with complaints of total dark vision in the right eye and decreased vision in the left eye after six months. Patients also feel weakness in the left limbs and severe headaches that are not relieved by medicine and are sometimes accompanied by nausea and vomiting. The complaint was first felt about two years ago when the patient began to complain of blurred vision



**Figure 1.** Preoperative head computed tomography scan. There was a space-occupying lesion in the right frontoparietal region.



**Figure 2.** Intraoperative image of the tumor during surgical removal of the tumor. A: During the process of opening the dura mater to expose the tumor. B: The dura mater has been released so that the tumor can be fully exposed.

and visualization of a circle in the right eye that was getting smaller. Then the patient was examined by an ophthalmologist who found only light perception in the right eye, while in the left eye, it became 1/6. The patient gets several medicines from the ophthalmologist while assessing whether the medicine can have a good effect or not. One year later, the complaints did not decrease and the patient began to experience other complaints such as headaches and left limb weakness where the left arm began to fall when holding objects. Over time, the left leg began to be difficult to walk.

About five months before the right eye began to be unable to see light and vision was getting blurry in the left eye, but the patient was still able to work and see with his left eye. One week before, complaints of severe headaches were not relieved at all by medication, then the left hand was not strong at all holding objects and the left leg had to be dragged to walk. The patient decided to come back to the hospital and had a head computed tomography (CT) scan without contrast and revealed a cystic lesion in the right frontoparietal region measuring 7.3 x 7.4 x 6.1 cm with midline shifting to the left as far as 1.5 cm, uncal

herniation and diffuse cerebral edema due to suspected giant arachnoid cyst and ependymal cyst (Figure 1).

The patient was then referred to a neurosurgeon for further examination. The results of the examination showed that the level of consciousness was comatose, anisocoria pupil 4 mm/3 mm with a negative light reflex in the right eye and positive in the left eye. On examination of the motor strength of the extremities, left hemiparesis was found with a motor strength of 3/5, while the left lower extremity was 4/5. The Babinski reflex was found to be positive in the left extremity.

The neurosurgery team decided to perform tumor removal surgery using the ERAS approach. The operation was performed by our senior author (M.T.) with a duration of approximately two hours and an amount of bleeding of approximately 100 cc. The intraoperative image can be seen in Figure 2. There was a tumor in the form of a well-defined cyst filled with yellowish fluid. The specimen and fluid were sent to the anatomic pathology laboratory and confirmed as a pilocytic astrocytoma.

Postoperatively, the patient was immediately extubated, the urinary catheter was released, and treated in the intensive care unit (ICU) for observation. Two hours after the operation the patient was fully conscious without significant complaints. The patient began to practice eating, gradually mobilized from sitting to walking, and was transferred to the general ward the next day. On the second day of treatment, the patient was in good condition and did not complain of headaches, nausea, or other complaints. His motor strength improved to 5/5 for the left upper and lower extremities (Figure 3). The patient was discharged on the third day of treatment.

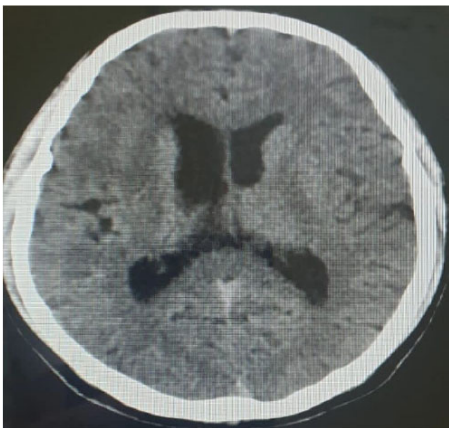
The patient then underwent another head CT scan one week postoperatively. An evaluation head CT scan showed that the tumor mass was no longer found, no brain hemorrhage was found, and no shift of the brain and midline shift were found (Figure 4).

## DISCUSSION

Based on the World Health Organization (WHO) classification in 2021, PA is



**Figure 3.** The clinical picture of the patient after two days postoperatively.



**Figure 4.** Head computed tomography scan evaluation one-week post-surgery. SOL in the frontoparietal region was fully resected.

included in the circumscribed astrocytic glioma group. Although according to the WHO classification, PA is a low-grade astrocytoma, it can have the possibility to evolve into a high-grade astrocytoma which is characterized by spread through the leptomeningeal.<sup>8</sup> Macroscopically, PA has clear boundaries and slow growth.

PAs are frequently located around the cerebrum, cerebellum, brainstem, optic nerve, and third ventricle areas. The tumor often manifests as a mural nodule within the cyst. Overlying leptomeninges invasion is common.<sup>9</sup> The main symptoms that often arise from PA are headaches, seizures, motor weakness according to the location of the tumor, visual disturbances and sometimes there is a disturbance of balance. This tumor can cause blockage of the flow of cerebrospinal fluid which can cause hydrocephalus and rapid loss of consciousness.<sup>10</sup>

In this patient, the main complaint was decreased visual function which affected both eyes, accompanied by weakness of the limbs and headaches which had gradually gotten worse in the last five months. These complaints occur without any loss of consciousness. Pilocytic astrocytoma can be seen on a head CT scan as an isodense or slightly hypodense lesion, round or oval, well defined with enhancing on contrast head CT scan. It also can be found an appearance of a cyst or tumor nodule in a cyst.<sup>10,11</sup> The same picture was also found on the head CT scan of this patient, which was the discovery of a cystic lesion in the right frontoparietal region with a size of 7.3 x 7.4 x 6.1 cm accompanied by midline shifting to the left as far as 1.5 cm. The primary management of PA is surgical resection. This operation can also be followed by radiotherapy, especially in cases where only a partial resection is performed. Chemotherapy may be a treatment option for progressive tumors and further surgery is not possible.<sup>11</sup> The prognosis for PA is generally good with a 10-year survival rate of > 90%. The success rate of surgery is related to the location of the tumor, the nature of the tumor, clinical manifestations, the age of the patient, and the selected surgical technique.<sup>11</sup>

Brain surgery has a high probability of causing problems both intraoperatively and postoperatively. The main problems that often arise during surgery are heavy bleeding, brain edema, and iatrogenic injury due to surgical procedures. They cause postoperative problems such as motor and sensory deficits, seizures, ischemia, postoperative bleeding, and even meningitis due to leakage of cerebrospinal fluid caused by damage to

the dura mater structure. Some of these things affect the length of patient care in the ICU and increase the risk of other complications.<sup>12,13</sup> Therefore, there are many problems with previous techniques commonly used in brain tumor surgery. It is necessary to have a better surgical technique so that the clinical outcome is better and the length of stay is reduced.

ERAS is a method that was first applied by Kehlet in 1997. ERAS consists of preoperative, intraoperative, and postoperative interventions, as well as patient discharge plans, which have been shown to reduce the length of patient care, improve patient outcomes, reduce morbidity, and reduce costs.<sup>14</sup> The ERAS protocol includes perioperative education in the form of patient education regarding physical and mental preparation before surgery.<sup>15</sup> While intraoperatively, it includes surgical techniques which are elements of ERAS, namely reducing the length of surgery as much as possible so that the use of anesthetics and opioids is shorter, minimizing actions that can injure other structures, controlling bleeding so that there is no excessive bleeding, using absorbable sutures and avoiding the use of drains wounds.<sup>15,16</sup> From a postoperative perspective, what is being done is to reduce interventions for patients by extubating as soon as possible, removing the urinary catheter, removing the arterial line, and avoiding unnecessary antiepileptic and pain medications. Mobilize the patient and provide oral nutrition as soon as possible and pay attention to comorbid diseases, pain management, and control fluid requirement.<sup>16-18</sup>

Previously, brain surgery was always associated with long length of stay and increased complications. However, Eagan's study in 2022 showed that elective craniotomy with ERAS, which consisted of pre, intra, and postoperative interventions, was able to reduce the length of stay, and the cost of treatment without increasing the risk of complications or reducing patient satisfaction.<sup>19</sup>

## CONCLUSION

Pilocytic astrocytoma is one of the most common benign glial tumors found in children and young adults. Surgical removal of the tumor is the main therapy

for this case. The use of the ERAS method is proven to be a better choice of surgical technique for elective brain tumor surgery based on clinical manifestations of postoperative patients, avoidance of postoperative complications, reduced length of stay, and cost-effectiveness so that patient satisfaction is fulfilled.

## CONFLICT OF INTEREST

The authors declare no conflict of interest to disclose regarding the materials or the methods used.

## AUTHOR CONTRIBUTION

The authors contributed equally to the writing of the manuscript. Patient treatment and surgery were done by Mardjono Tjahjadi. All authors discussed and analyzed the findings, collected the data, reviewed the results, and approved the final version of the manuscript.

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