Case Report

Adenotonsillectomy in a child with hydrocephalus

Gustav Syukrinto*, Cindy Julia Amanda*, Ratih Puspitasari**
*Department of Otorhinolaryngology Head and Neck Surgery, Tangerang City General Hospital, Tangerang
**Department of Anesthesiology, Tangerang City General Hospital, Tangerang

ABSTRACT

Background: Hydrocephalus is an expansion of the ventricular system resulting from the condition of the brain, with altered circulation of the cerebrospinal fluid. The expansion could lead to an increase in intracranial pressure (ICP). Some procedures in adenotonsillectomy also could increase ICP, and lead to brain injury. **Purpose:** To study complications in performing adenotonsillectomy procedures on a child with hydrocephalus. **Case report:** A 3-year-old girl presented with hydrocephalus with recurrent sore throat, runny nose, cough, and fever at least once a month for about one year. She also presented with a history of sleep disturbance, such as snoring, nocturnal awakening, often mouth breathing, and bedwetting. During an ear, nose, throat (ENT) examination, the tonsil size was T4/T4, with dilated crypts and no detritus. The nasendoscopy examination revealed that she had a grade III adenoid hypertrophy. Clinical question: What to consider in minimizing complications of adenotonsillectomy in children with hydrocephalus during and after the surgery? **Method:** A literature search was performed on PubMed and Google Scholar, with keywords "Adenotonsillectomy" AND "Hydrocephalus" AND " Intracranial Pressure". **Result:** Based on the search, some procedures were found, such as intubation, placing a mouth gag, and head positioning during operative surgery, could increase ICP. **Conclusion:** There are some considerations when performing adenotonsillectomy in children with hydrocephalus that should be carefully prepared, to prevent increased ICP and brain injury during and after surgery.

Keywords: adenotonsillectomy, hydrocephalus, intracranial pressure, tonsil hypertrophy

ABSTRAK

Latar belakang: *Hidrosefalus merupakan perluasan sistem ventrikel otak akibat gangguan sirkulasi cairan serebrospinal. Perluasan tersebut dapat menyebabkan peningkatan tekanan intrakranial (TIK). Beberapa prosedur pada adenotonsilektomi juga dapat meningkatkan TIK dan menyebabkan cedera otak.* ***Tujuan:*** *Untuk mengetahui komplikasi dalam melakukan tindakan adenotonsilektomi pada anak dengan hidrosefalus.* ***Laporan kasus:*** *Seorang anak perempuan berusia 3 tahun datang dengan hidrosefalus dan riwayat nyeri tenggorokan berulang disertai pilek, batuk, dan demam setidaknya sebulan sekali, selama kurang lebih satu tahun. Ia juga memiliki riwayat gangguan tidur, seperti mendengkur, terbangun di malam hari, sering bernapas melalui mulut, dan mengompol. Dari pemeriksaan Telinga, Hidung, Tenggorok (THT), didapati pembesaran tonsil ukuran T4/T4, dengan kriptus melebar dan tidak ada detritus. Dari pemeriksaan nasendoskopi, ditemukan hipertrofi adenoid derajat III.* ***Pertanyaan klinis:*** *Apa yang harus dipertimbangkan dalam meminimalkan komplikasi adenotonsilektomi pada anak dengan hidrosefalus, baik selama dan setelah operasi?* ***Metode:*** *Pencarian literatur dilakukan di* PubMed *dan* Google Scholar, *dengan kata kunci "Adenotonsilektomi" DAN "Hidrosefalus" DAN "Tekanan Intrakranial".* ***Hasil:*** *Berdasarkan penelusuran, didapati beberapa prosedur, seperti intubasi, pemasangan mouth gag, dan posisi kepala selama operasi bedah, dapat meningkatkan TIK.* ***Kesimpulan:*** *Terdapat beberapa pertimbangan dalam melakukan adenotonsilektomi pada anak dengan hidrosefalus, yang sebaiknya dilakukan secara hati-hati untuk mencegah peningkatan TIK dan cedera otak, baik pada saat atau setelah melakukan operasi.*

Kata kunci: *adenotonsilektomi, hidrosefalus, tekanan intrakranial, hipertrofi tonsil*

Correspondence address: Cindy Julia Amanda. Research Assistant at Department of Otolaryngology Head and Neck Surgery, Tangerang City General Hospital, Tangerang. Email: cindyjuliaa@gmail.com

INTRODUCTION

Adenoid and tonsil are part of Waldeyer's lymphatic ring, containing lymphoid tissue in the pharynx. They play an important role in the development of the immune system and serve as a defense against infections.[1] The adenoid located in the nasopharynx, and attached to the posterior wall of the nasopharynx. The palatine tonsils are located in the lateral oropharynx, or precisely in the tonsillar fossa. It's between the palatoglossal arch anteriorly and the palatopharyngeal arch posteriorly. These arches are also known as the palatine arches or palatine pillars.[2]

Adenotonsillar hypertrophy is a medical term for a condition where the adenoid and palatine tonsils become abnormally large. It can result from various causes, including recurrent infections, inflammation, or underlying medical conditions. Adenotonsillar hypertrophy in children can narrow the airways and possibly induce obstructive sleep-disordered breathing (oSDB) behaviors like mouth-breathing, snoring, and the most severe form of obstructive sleep apnea (OSA). oSDB is a spectrum of disorders, from primary snoring to hypoventilation and OSA. Over 40% of children with oSDB exhibit behavioral problems such as enuresis, hyperactivity, aggression, anxiety, depression, and somatization. It is also associated with poor performance, and decreased quality of life.[3,4]

Adenoidectomy is a surgical procedure where the adenoids are completely removed through the mouth. Tonsillectomy is defined as a surgical procedure performed to completely remove the tonsil, including its capsule, by dissecting the peritonsillar space between the tonsil capsule and the muscular wall. These two procedures combined is termed as adenotonsillectomy, in which both the palatine tonsils and the adenoid are completely removed.[5,6] In Sweden, the incidence of adenoidectomy had been reported to be 740 per 100,000 in children under the age of 10 years, with the most frequent registered indication, 60% was hypertrophy.[7] While in the UK, the incidence of tonsillectomy in childhood was 2.5 per 1000 person-years with indications: five to six sore throats (12.4%) in 1 year, two to four sore throats (44.6%) in 1 year, sleep-disordered breathing (12.3%), or obstructive sleep apnea (3.9%).[8] According to the American Academy of Otolaryngology-Head and Neck Surgery Foundation (AAO-HNS) 2018 updated guideline, the two most common indications for tonsillectomy are recurrent throat infections and oSDB. Adenotonsillectomy is an effective and safe procedure in most uncomplicated cases of obstructive sleep-disordered breathing (oSDB).[3]

Hydrocephalus is an expansion of the ventricular system resulting from the condition of the brain with altered circulation of the cerebrospinal fluid.[9] The incidence of congenital hydrocephalus was highest in Africa and Latin America (145 and 316 per 100,000 births, respectively) and lowest in the United States/Canada (68 per 100,000 births). This research also predicts that each year, nearly 400,000 new cases of pediatric hydrocephalus will develop worldwide.[10] The accumulation of cerebrospinal fluid (CFS) usually results in ventricular dilation and an increase in intracranial pressure (ICP). This accumulation may be due to obstruction in the normal flow of the CSF, problems with absorption, or excessive production of CSF. In children, the limit for ICP changes is up to 15 mmHg. Increased ICP more than that could damage the brain or spinal cord by

pressing important structures and restricting blood flow into the brain. Some presentation regarding the high ICP were headache, blurred vision, visual field reduction, vomiting and nausea, and loss of consciousness[11,12]

Performing adenotonsillectomy procedures on a child with hydrocephalus could be challenging. In children with intracranial pathologies, such as hydrocephalus, who will undergo adenotonsillectomy, the effect of endotracheal tube intubation, the use of mouth gag, head position during intubation or operative surgery, and choosing the right analgetic to prevent an increase of ICP that could lead to brain injury, should be considered.[13-16]

CASE REPORT

A 3-year-old girl was consulted by a pediatrician with hydrocephalus and recurrent sore throat infection. According to her mother, the patient had had recurrent sore throat, runny nose, cough, and fever at least once a month for over one year. She also presented with a history of sleep disturbance, such as snoring and nocturnal awakening. She often breathed through her mouth, especially when sleeping, and bedwetting at night. The patient's history of allergy was denied. The history of frequent headaches, blurred vision, vomiting, nausea, and seizures was also dismissed. Her brother was also diagnosed with hydrocephalus. Her development was normal, according to her age. The mother said that she often consumed snacks, fried foods, ice cream, and cold drinks that were unhygienic.

The patient had been consulted to a neurosurgeon before, and diagnosed with hydrocephalus before she came to our clinic. Her mother presented us with the result of a Multi-Slice Computerized Tomography (MSCT) scan of the head non-contrast. The MSCT showed dilatation of bilateral lateral ventricle, III and IV ventricles with Evan's index of 60%, with possible increased intracranial pressure shown by flattening gyri and narrowing cerebral sulci. However, after consulting with the neurosurgeon, a shunt surgery was not immediately necessary.

On physical examination, the patient was in good general condition. Her weight was 11.4 kg, with a head circumference of 54.5 cm. During ears, nose, and throat examination, her palatine tonsils were T4-T4, dilated crypts on both tonsils with no detritus, the uvula in the midline, and symmetrical palatoglossal arch. Using pediatric size nasendoscope, had found no abnormal findings except that she had a grade III adenoid hypertrophy (the adenoid occupied 75% of the choanal area). There were no abnormal findings in both of her ears. The patient had a complete blood count, complete blood chemistry, and hemostatic laboratory examination. All were within normal limits. In this case, the patient was diagnosed with adenotonsillar hypertrophy, and was planned to undergo adenotonsillectomy.

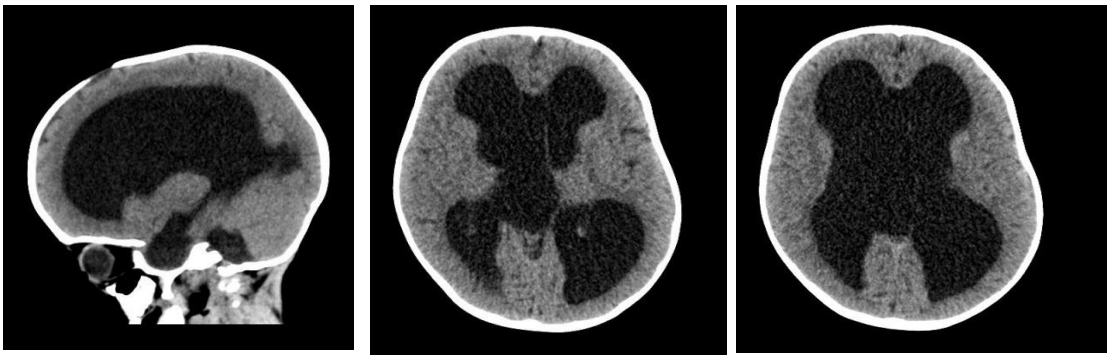

Figure 1. MSCT Brain (non-contrast)

Adenotonsillectomy was performed under general anesthesia with endotracheal tube intubation. The patient was lay supine during procedures. The anesthesiologist used a laryngoscope, and carefully did the intubation without causing the patient's head to be hyperextension. After that, a pillow was placed under the shoulder, then a rubber ring was placed under the head to stabilize and prevent the head from becoming more hyperextension. A mouth gag was used to open and stabilize the mouth with Draffin's bipods. First, the adenoidectomy was done using a curettage, followed by a cold dissection tonsillectomy procedure. There were no complications during either procedure, such as excessive bleeding, laceration, or oropharyngeal and oral cavity injury. The patient was hemodynamically stable, and showed no abnormal findings in her vital signs during operative surgery and right after the surgery.

One day after the surgery, on follow up, the patient had no complaints other than a bit of pain when swallowing her meal, and no history of bleeding through her mouth. During a physical examination, her pain scale rate was 2 using the Wong-Baker FACES pain scale. In her tonsillar fossa, there was no ongoing bleeding, no blood clotting, no hematoma, nor laceration in the oropharynx.

The patient was followed up in the first and third weeks after the surgery. In the first week, she had no complaints. She has no difficulty swallowing and feels no pain when eating her meal. There was no history of bleeding, fever, or feeling any lump in her throat. Physical examination showed minimal fibrin formation on her tonsillar fossa but no ongoing bleeding, blood clotting, hematoma, nor laceration. Using pediatric endoscope to examine her nasopharynx, on the post-operative site had no bleeding, clotting, laceration, swollen torus tubarius, nor residues.

In the third week after surgery, there were normal findings in the physical examination, and no complications. She could do her daily activities, and was happy with the result.

Figure 2. First week post adenotonsillectomy

CLINICAL QUESTION

What things should be considered in minimizing complications of adenotonsillectomy in children with hydrocephalus, during and after the surgery?

METHOD

Literature research was carried out through PubMed and Google Scholar, with keywords "Adenotonsillectomy" AND "Hydrocephalus" AND "Intracranial Pressure". It revealed 27 literatures in Pubmed, and 82 literatures in Google Scholar. The selection was based on the last five years' interval publication dates, English language, and free full text.

DISCUSSION

There are some considerations when performing adenotonsillectomy in children with hydrocephalus. An increase in ICP during procedures such as intubation, placing a mouth gag, head positioning, and choosing the right analgetic should be done carefully to prevent an increase of ICP that could lead to brain injury.[13-16]

Karali et al.[13] conducted a study to evaluate the use of mouth gags during adenotonsillectomy using an ultrasonographic optic nerve sheath diameter to measure intracranial pressure during the operative procedure. The result showed that the use of mouth gags, which are routinely used during adenotonsillectomy to provide proper imaging, showed a significant increase in ICP. Like using direct laryngoscopy and tracheal intubation, these procedures could induce the sympatho-adrenergic response. These responses could lead to undesirable hemodynamic effects such as increased blood pressure, intracranial pressures, and variations in heart rates. Inducing sympatho-adrenergic response will increase catecholamine levels and elevate blood pressure by stimulating the supraglottic region and activating proprioceptors on the base of the tongue.[14-16]

In clinical practice, ICP above 20 mmHg (200 mmH2O) is considered to be intracranial hypertension. It is known that pediatric patients might have a partially compensatory ability on increased intracranial pressure as compared to older patients. Increased ICP in children could damage the brain or spinal cord by pressing important structures and restricting blood flow into the brain.[17,18] In children with intracranial pathologies or risk factors associated with increased ICP, such as hydrocephalus, the risks may arise due to the use of a direct laryngoscope, endotracheal intubation, and the use of a mouth gag. These should be considered while performing adenotonsillectomy operations.[13,19]

Some studies reported the effects of patient head position on ICP. Especially the upright Trendelenburg position could cause an increase in ICP (9–13 mm Hg). However, the Trendelenburg position below 30° did not cause a significant increase in ICP when the head was in extension.[20,21] Head hyperextension should be avoided during adenotonsillectomy for those with ICP-related risk factors such as hydrocephalus.[13] Proper head positioning for children with hydrocephalus is also mandatory for successful intubation. Intubation could be much more challenging because the head circumference is larger than normal children's.[22] Keeping the head elevated to 30° will minimize venous outflow resistance and improve CSF displacement from the intracranial to spinal compartement.[17]

There are some other difficulties that could be found in anaesthetic management in children with hydrocephalus, such as difficulties in airway management, cardiovascular dysfunction, age-related needs of positioning, and congenital anomalies.[22] Children with hydrocephalus will likely have extensive multisystem disorders, such as congenital heart disease or major spinal defects linked to premature birth. Preoperative anaesthetic assessment and neurological status should be done before performing the anaesthetic procedures. More specific questioning should relate to ICP, such as alteration in the level of consciousness compared with baseline, or increased seizure activity. Standard monitoring is appropriate, and invasive vascular monitoring is not generally required unless there is another indication related to the patient's comorbidities.[22,23]

Pain and agitation can increase blood pressure and ICP. Choosing the right sedation and analgesia during and after operative procedures is necessary.[17] Some medications, such as barbiturates, etomidate, and propofol, decrease cerebral blood flow (CBF), mediated by decreased cerebral metabolism, thus

decreasing intracranial pressure (ICP). Ketamine is usually not administered for the anaesthetic management of patients at risk of intracranial hypertension because of the reported increases in cerebral metabolism, CBF, and ICP.[24] Postoperative pain is usually mild to moderate. Nonsteroidal anti-inflammatory drugs (NSAIDs) are effective and safe in treating postoperative pain.[23]

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