Bradycardia symptomatic causes headache associated with frontal diffuse astrocytoma: a case report

Cyndiana Widia Dewi Sinardja1*, Kumara Tini2, Dewa Putu Wisnu Wardhana3, Putu Utami Dewi4, Ni Luh Putu Rustiari Dewi5

ABSTRACT

Background: Headache is the most common symptom in patients with brain tumors, whereas a developing brain tumor generally increases intracranial pressure and brain edema. Brain tumors have symptoms including nausea, vomiting, seizures, neurological deficits, and mental status or consciousness changes. Heart rhythm disturbances can occur, including bradycardia (heart rate below 60x/minute), a common symptom in brain tumor patients.

Case Presentation: In this case report, a young adult male patient was found with headache symptoms, a previous history of syncope, and sinus bradycardia on the EKG examination, but on physical examination, there were no symptoms of neurological deficits. Head CT scan with contrast found a tumor in the left frontal lobe associated with high intracranial pressure and brain edema that explained the symptoms.

Conclusion: The relationship between headache and bradycardia, accompanied by a history of syncope, is close and can be regarded as an early sign of a brain tumor. In this case, a brain tumor found based on pathological examination is diffuse astrocytoma.

Keywords: Symptomatic Bradycardia, Syncope, Frontal Diffuse Astrocytoma.


INTRODUCTION

Based on the Framingham Heart Study, the causes of headaches and syncope were found to be due to heart disease (9.7%), seizures (5.0%), vasovagal (21.2%), orthostatic (9.3%), drugs (6.7%), unknown (36.3%) and others (11.8%). Headache or syncope is very difficult to determine the cause, either primarily due to the heart or nerves. Increased intracranial pressure caused by brain tumor affects the sympathetic nervous system and stimulates vagal (vasovagal) reflexes, which results in patients experiencing bradycardia, av block, and even asystole, which in this condition would require the installation of a permanent pacemaker, hypertension, and breathing problems, as well as edema in the brain which affects changes mental status or consciousness.

Primary brain tumors grow directly from intracranial tissue, both from the brain itself, the central nerve system (CNS), and the membranes covering the brain (meninges). The incidence of brain tumors in all age groups according to Zulch 4.2-5. 4/100,000 population. In children, the highest is in the 1st decade or 3-8 years, with a peak at 5-9 years old. In adulthood, the highest is at 30-70, peaking at 55-65 years. The incidence of brain tumors (primary/secondary) is 46/100,000, and primary brain tumors are around 15/100,000 from the Glasgow study, part of neuro pathology in 1981 that the most common tumor found in the supratentorial area in adults is astrocytoma which includes glioblastoma multiforme as much as 40%. Glioblastoma is a malignant differentiation from low diffuse astrocytoma. Astrocytoma is a primary intracranial tumor often found around 60% or 5-7 new cases/100,000/ population. In Indonesia, astrocytoma is the second most common brain malignancy after meningioma from 2003-2010. The cerebrum is the most common location in the fronto-temporo-parietal area, with a predominance in the frontal lobe (64%) followed by the temporal lobe (29%).

We report a case of symptomatic sinus bradycardia in a brain tumor. At that time, the patient complained of vomiting, was said to have fainted, and had persistent headaches. Physical examination revealed no neurological deficits, normotension, and no cardiovascular abnormalities. However, the electrocardiogram at rest found heart rate abnormalities, namely sinus bradycardia (40x/minute), and the heart rate did not change to normal after being given atropine sulfate. Surprisingly, this patient was found to have a brain tumor based on the results of a head CT scan. After that, dexamethasone administration was started and the patient was referred to the neurosurgery department for further surgical management. Highlights of this case are that bradycardia and headache followed by syncope can be the first and the only warning sign of brain tumors, which is more likely to be missed diagnosis...
CASE REPORT

A 45-year-old man came to the emergency room at the Universitas Udayana Hospital with complaints of recurrent vomiting for the past 2 days accompanied by headaches. Headaches are felt like throbbing in the right and left temples, intermittent since 1 week ago. The patient also fainted suddenly at work some time ago. There were no complaints of neurological deficits such as weakness in half of the body and seizures. The patient has a history of smoking 1 pack per day and a history of drinking alcohol, although it is rare. Diabetes mellitus, hypertension, stroke, and heart disease were previously denied by the patient. Physical examination found blood pressure 138/70 mmHg, respiratory rate 22x/minute, with a regular pulse 40x/minute. No abnormalities were found on physical examination of the heart, lungs, abdomen, and neurological. Laboratory tests for complete blood, electrolytes, blood gas analysis, kidney and liver function, and blood sugar were still within normal limits and even a chest X-ray examination was also normal.

The ECG showed sinus rhythm with a pulse below 60x/minute (sinus bradycardia) (Figure 1). Because the pulse was obtained 40x/minute on the monitor and the patient had a headache which is also known as symptomatic sinus bradycardia, at that time, he was given an injection of Atropine Sulphate 0.5 mg IV up to the maximum dose even though the pulse did not experience a significant change (Figure 2). Subsequent treatment was given salbutamol 3x4 mg tablet, and the neurology department consulted the patient because of severe headaches and repeated vomiting. A contrast-enhanced CT scan was also performed and a multi-loculated heterogeneous cystic-density intra-axial mass was found in the left frontal lobe causing a midline shift of 1.3 cm to the right and extensive vasogenic edema around it (Figure 3).

Patients received phenytoin therapy 60 mg in 0.9% NaCl 100 ml finished in 30 minutes, mannitol 100 ml every 4 hours, dexamethasone 3 x 10 mg IV. In addition, the neurosurgery department consulted the patient for the diagnosis purpose. Based on anatomic pathological examination, the type of tumor was found, namely diffuse astrocytoma (WHO grade II) in the left frontal region.

DISCUSSION

Astrocytoma is a type of brain tumor that often occurs in males (1.18 ratio greater than females) in young adulthood (the highest incidence is found at 30-40 years). These tumors have various variations (WHO grade I-IV) depending on their location, have clear boundaries, are gray-white, grow in a widespread infiltrate, have the potential to become invasive, progressive and damage the underlying brain tissue, and have various signs and symptoms. Sinus bradycardia is one of the signs and symptoms of arrhythmia we often encounter in normal circumstances or certain diseases, especially as an early sign and symptom of a brain tumor. A person can be said to have sinus bradycardia if he has a pulse rate of less than 60x per minute in a non-athlete population. However, in population studies using cut-off points, the pulse rate was ≤50 x/minute. Bradycardia

Figure 1. ECG Sinus Bradycardia.

Figure 2. ECG sinus rhythm after administration of Sulfa Atropine and Salbutamol.

Figure 3. (A and B) CT scan sagittal section. A heterogeneous multiloculated cystic density intra-axial mass was seen in the left frontal lobe causing a midline shift of 1.3 cm to the right and extensive vasogenic edema around it.
can be influenced by intrinsic factors from the presence of conduction disturbances in the heart's electricity, namely ischemic heart disease and sick sinus syndrome. In extrinsic conditions without cardiac abnormalities, metabolic disorders, drug influences, and brain tumors can occur. In this case, we can conclude that the bradycardia that occurs is caused by extracardiac abnormalities based on physical examination and support in the form of a CT scan which found a brain tumor in young adult males.

Neurological disorders, both trauma and non-trauma, can cause bradyarrhythmias caused by increased intracranial pressure and brain edema. Increased intracranial pressure and brain edema trigger an increase in blood pressure, changes in breathing patterns, and bradycardia is known as the Cushing's reflex, which gives a poor prognosis to patients. In cases where there are findings in the form of tumors and brain edema, it causes low cerebral perfusion pressure so that the cerebro-protective neuroendocrine system is active, which is a response from the autonomic system to maintain cerebral perfusion pressure by increasing intracranial pressure. In the early stages of increased intracranial pressure, sympathetic nerve stimulation will occur, resulting in increased heart rate, cardiac output, and blood pressure. Along with a persistent increase in intracranial pressure, it causes the release of vagal responses, which cause bradycardia, hypertension, and irregular breathing patterns. However, in low to moderate intracranial pressure conditions, the parasympathetic response will be more dominant than the sympathetic response. In cases where no increase in pressure is found, blood and changes in breathing patterns are Cushing's reflex so that the possibility of an increase in intracranial pressure that occurs is low to moderate.

Several brain locations, including the brainstem, thalamus, hypothalamus, amygdala, and insular cortex, influence the neurophysiology of the cardiovascular system. Each part has its influence on the cardiovascular abnormalities that arise. The insular cortex regulates the heart-brain axis. Stimulation of the caudal and posterior insular rostral affects decreasing and increasing heart rate, whose effect is reversible with beta-blockers but has no effect on atropine administration. Stimulation of the posterior insula can also cause atrioventricular block, QT prolongation, myocardial injury, arrhythmias, and seizures. Abnormalities in the temporal lobe will result in cardiac asystole, bradycardia, manifestations of syncope, and seizures. However, several studies state that autoregulation of the heart is more dominated by the frontal lobe and electrical stimulation of this lobe impacts decreasing heart rate (bradycardia). So, it is necessary to watch out for patients with bradycardia and neurological symptoms experiencing problems that cause the intracranial increase.

According to the AHA, the management of symptomatic bradycardia is by administering sulfa atropine 0.5 mg IV, which can be repeated every 3 to 5 minutes with a maximum dose of 3 mg. The use of albuterol or salbutamol can also be used to treat extracardiac bradycardia. Research by Evan CH et al. Found that the results of enteral use of albuterol (salbutamol) can reduce the frequency of symptomatic bradycardia and reduce the use of chronotropic agents. Salbutamol is a β2 agonist which also activates β-adrenergic receptors in the heart; which can trigger chronotropic effects and inotropic by reducing parasympathetic effects and increasing sympathetic effects. Administration of salbutamol causes an increase in pulse up to 8 beats per minute at a dose of 400 μg. However, this effect was only found in pulse at rest. Different effects were found on pulse rate during activity. If the symptomatic bradycardia does not improve with medication, further treatment can be done with a pacemaker installation. In this case, pacemaker installation cannot be done at this hospital because there are no Catheterization Laboratory (Cath. Lab.) facilities. However, in this case, the patient improved with dexamethasone to reduce brain edema and atropine sulfate and salbutamol to increase his heart rate. Although there was an improvement after administration of sulfa atropine and salbutamol, other treatments must focus on the underlying neurological process, namely the treatment of the tumor, either surgically, chemotherapy, and/or radiotherapy.

CONCLUSION

In this case report, it is emphasized to be more thorough in carrying out a thorough examination and analyzing the causes of headaches and syncope with bradycardia called symptomatic bradycardia, without being accompanied by neurological deficits or seizures (classical symptoms associated with the central nervous system), where one of the signs and these symptoms are due to a brain tumor. Therefore, it is very necessary to carry out other supporting examinations, such as a CT scan of the head or MRI of the head in symptomatic bradycardic patients, to establish the extracardiac diagnosis, thus supporting further treatment of these patients.

CONFLICT OF INTEREST

There is no competing interest regarding the manuscript.

ETHICS CONSIDERATION

This study follows COPE and ICMJE protocols regarding the publication ethics guidelines. In addition, informed consent was obtained from the patient before the study was conducted.

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AUTHOR CONTRIBUTION

All authors equally contribute to the study from the data acquisition and data analysis until interpreting the outcome of the case study through publication.

REFERENCES


