



# Aneurysm in Clinoid Segment of Left Internal Carotid Artery in Normotension-Glaucoma with Chronic Headache

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## ABSTRACT

**Introduction:** Aneurysm is an abnormal swelling or bulge in the arterial wall. The location of aneurysms varies, including cerebral aneurysm, thoracic aortic aneurysm and abdominal aortic aneurysm. Aneurysms usually do not cause symptoms unless rupture. **Case:** Female, 32 years, with chronic headache for last ten years. Eye examinations resulted in an increased cupping disk ratio in both eyes without elevated intraocular pressure. The CT angiography result revealed an aneurysm in the clinoid segment of the left internal carotid artery with a saccular morphology, with a neck measuring 4.39 mm and a dome measuring 2.1 mm. **Discussion:** Unruptured intracranial aneurysms, normotension glaucoma (NTG), and chronic headaches share vascular dysregulation mechanisms, such as vasospasm and impaired blood flow, which may explain their overlapping clinical manifestations. In this patient, the clinoid segment ICA aneurysm likely contributes to her chronic headaches, and treating it could potentially improve both headache frequency and NTG-related visual changes. **Conclusion:** Due to the unavailability of magnetic resonance imaging equipment and an interventional suite for digital subtraction angiography, this case underscores the utility of CT angiography for diagnosing anatomical issues, particularly in chronic headache cases, with catheter angiography still considered the gold standard. The patient was referred for an intervention procedure.

**Keywords:** Case report, chronic headache, internal carotid artery aneurysm, normotension glaucoma.

## ABSTRAK

**Pendahuluan:** Aneurisma adalah pembengkakan atau tonjolan abnormal pada dinding arteri. Lokasi aneurisma bervariasi, termasuk aneurisma serebral, aneurisma aorta toraks, dan aneurisma aorta abdomen. Aneurisma biasanya tidak menimbulkan gejala kecuali jika pecah. **Kasus:** Perempuan, berusia 32 tahun, dengan sakit kepala kronis selama 10 tahun terakhir. Hasil pemeriksaan mata menunjukkan peningkatan perbandingan *diameter cup* terhadap diskus saraf optik kedua mata tanpa tekanan intraokular yang meningkat. Hasil CT angiografi menunjukkan aneurisma pada segmen klinoid arteri karotis interna kiri dengan morfologi sakular, leher berukuran 4,39 mm, dan kubah berukuran 2,1 mm. **Diskusi:** Aneurisma intrakranial yang tidak pecah, glaukoma normotensi (NTG), dan sakit kepala kronis memiliki mekanisme disregulasi vaskular yang sama, seperti vasospasme dan gangguan aliran darah, yang mungkin menjelaskan manifestasi klinis yang tumpang tindih. Pada pasien ini, aneurisma segmen klinoid ICA kemungkinan berkontribusi pada sakit kepalanya yang kronis, dan mengobatinya dapat berpotensi meningkatkan frekuensi sakit kepala dan perubahan penglihatan terkait NTG. **Simpulan:** Karena ketidakterdapatannya peralatan pencitraan resonansi magnetik (MRI) dan ruang intervensi untuk angiografi subtraksi digital, kasus ini menyoroti kegunaan CT angiografi dalam mendiagnosis masalah anatomis, terutama pada kasus sakit kepala kronis, meskipun angiografi kateter masih dianggap sebagai standar emas. Pasien dirujuk untuk prosedur intervensi. **Fabianus Anugrah Pratama, Petrus Sewe Pajo. Aneurisma Arteri Karotis Internal Kiri Segmen Klinoid pada Glaukoma Tekanan Normal dengan Nyeri Kepala Kronis.**

**Kata Kunci:** Laporan kasus, nyeri kepala kronis, aneurisma arteri karotis internal, glaukoma tekanan normal.



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## INTRODUCTION

An aneurysm is an abnormal swelling or bulge in the arterial wall. An aneurysm may be validated by the use of several diagnostic studies, including CT scan, MRI, CTA (CT angiography), and MRA (MR angiography). The location of aneurysms varies, including cerebral aneurysm, thoracic aortic aneurysm,

and abdominal aortic aneurysm. Aneurysms usually do not cause symptoms unless they rupture. A cerebral aneurysm study reported that 18.6% were located at the internal carotid artery (ICA), with the prevalence in females being twice as compared to males; 47.4% complained of headaches.<sup>1</sup>

Normal tension glaucoma (NTG) is when typical glaucomatous disc changes, visual field defects, and open anterior chamber angles are associated with intraocular pressure (IOP) constantly below 21 mmHg.<sup>2</sup> Headaches are common, affecting 50% of the general adult population at any given time, with a reported lifetime prevalence of 66% worldwide.<sup>3</sup>

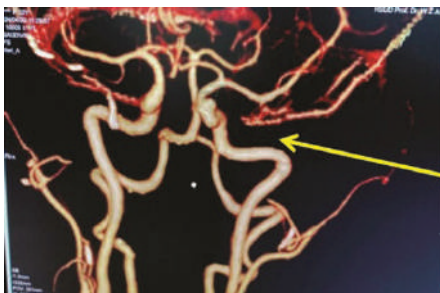
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Chronic daily headache refers to the presence of a headache more than 15 days per month for longer than 3 months.<sup>4</sup>

## CASE

A 32-year-old female doctor at a public health facility reported to the neurology clinic with the chief complaint of chronic headache and normotensive glaucoma. The symptoms began 10 years ago, lasted around 30 minutes, and disrupted her daily life and work, often triggered by stress or overwork. The pain was primarily felt around the left temple, sometimes around the right temple. She did not experience significant vision problems. To alleviate the symptoms, she used to take methampyrone 500 mg + diazepam 2 mg tablets to reduce her headaches. Eye examinations revealed an elevated cupping disk ratio (0.7 in the right eye, 0.71 in the left eye) with minimum peripheral visual field loss; her IOP was below 21 mmHg. The ophthalmologist referred the patient to a neurologist for chronic headaches. The neurologist conducted a CT angiography due to a suspected vascular cause due to the frequent and unpredictable headache episodes, each lasting around 30 minutes. The CT angiography revealed a saccular aneurysm in the clinoid segment of the left internal carotid artery (ICA), nearly compressing the left optic nerve. The saccular aneurysm with a neck measuring 4.39 mm and a dome of 2.1 mm with a ratio between the diameter of the supply vessel, which is the ICA at 4.39 mm, and the diameter of the aneurysm makes the ratio 1 (Figure 1). The patient's aneurysm in the clinoid segment is at risk for complications, as larger aneurysms and those with a high size ratio (greater than 1) have a greater likelihood of rupturing.<sup>5</sup> The patient was referred for an intervention procedure.



**Figure 1.** Saccular aneurysm in clinoid segment of left internal carotid artery (yellow arrow).

## DISCUSSION

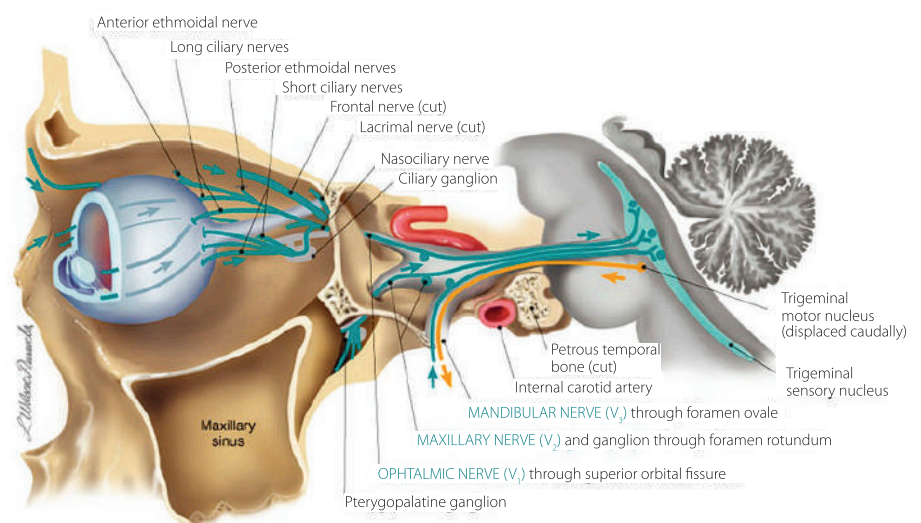
Unruptured cerebral aneurysms, normotension glaucoma (NTG), and chronic headaches appear unrelated; however, they share potential connections, particularly involving vascular dysregulation and neurological stress responses.

Intracranial aneurysms are more prevalent in women, and their location can vary,<sup>1,6</sup> with the ICA being a common site.<sup>1,6,7</sup> In Japan, middle carotid artery is more frequently affected, while studies from Poland and Singapore found the predominance of ICA involvement.<sup>1,6,7</sup> While many unruptured aneurysms remain silent, they can cause chronic headaches in some cases.<sup>6</sup> The location of this patient's aneurysm in the clinoid segment (C5) aligns with the ophthalmic segment of the ICA, a region known to cause headaches due to its proximity to cranial nerves (Figure 2).<sup>8,9</sup>

NTG is associated with optic nerve changes and visual field defects, despite normal intraocular pressure (IOP).<sup>2</sup> This case exhibited an elevated cupping disk ratio (0.7 in the right eye, 0.71 in the left eye) with minimum peripheral visual field loss, but her IOP was below 21 mmHg, thus making a diagnosis of NTG. NTG may be caused by vasospasm.<sup>10</sup> Vasospasm refers to the reversible disproportionate contraction of the arteries, resulting in a temporary decrease or shortage of the blood supply to the corresponding organ. Vasospasm is common and associated with a variety of diseases, for example, in the retina, particularly

in the case of migraines.<sup>11</sup> Ischemia due to vasoconstriction is considered to be a potential risk factor for the development of glaucomatous visual field damage.<sup>12</sup> Notably, those with normotensive glaucoma have a 63.5% increased likelihood and a 1.6 times higher relative risk of experiencing migraines compared to individuals with primary open-angle glaucoma (POAG).<sup>13</sup>

A study conducted in Erlangen, Germany, with 154 samples found that migraines were more prevalent in women and in cases of normotensive glaucoma.<sup>14</sup> The patient did not report any visual issues, including problems with visual acuity or field of vision, while performing daily duties as a doctor at a primary healthcare facility. When a headache occurs during work, the patient takes 500 mg of metamprone and 2 mg of diazepam to alleviate the pain and ends the workday early. Metamizole is a pyrazolone nonsteroidal anti-inflammatory drug (NSAID) with analgesic and antipyretic activity; its mechanism of action is to inhibit cyclooxygenase (COXs), enzymes involved in the synthesis of the precursors of prostaglandins (PGs).<sup>15</sup> Metamizole 1000 mg orally is included in the first-line drug recommendations for the acute treatment of migraine with recommendation level B.<sup>16</sup> A study involving 86 patients experiencing acute migraine attacks found a significant reduction in aura duration 60 minutes after treatment, compared to a placebo.<sup>17</sup> There is conflicting data regarding the utility of diazepam in chronic daily headache.<sup>18</sup>



**Figure 2.** Anatomical relationship between trigeminal ganglion with internal carotid artery.<sup>8</sup>



Headaches can be caused by structural problems or medication overuse (referred to as secondary headaches) and changes in brain function with completely normal brain structure (referred to as primary headaches, such as migraine) or a combination of both.<sup>19,20</sup> Chronic headaches, such as those experienced by this patient, may result from structural problems like aneurysms, which can irritate or compress cranial nerves.<sup>21</sup> Pain from an aneurysm cannot occur without the involvement of pain nerves. In this case, the trigeminal nerve is responsible for the headache, as the aneurysm is located in the clinoid segment. This area is known to cause pain through the V1 division of the trigeminal nerve, which supplies intracranial arteries and leads to referred pain in the temporal, retroorbital, and frontal regions.<sup>22</sup> The pain sensation from the V1 division primarily involves fibers that cross to the contralateral ventroposteromedial nucleus in the thalamus, with a smaller number of uncrossed fibers connecting to the

ipsilateral ventroposteromedial nucleus in the thalamus.<sup>23</sup> Normotension glaucoma, unruptured intracranial aneurysms, and chronic headaches each involve some degree of blood vessel dysfunction. In normotensive glaucoma, the primary concern is impaired blood flow to the optic nerve. Similarly, unruptured aneurysms develop as a result of weakened blood vessel walls, while chronic headaches, such as migraines, frequently involve irregular dilatation and constriction of blood vessels. This patient's chronic headache may be related to the aneurysm's compression of surrounding structures, particularly the V1 (ophthalmic) nerve.<sup>24</sup>

Treatment options for unruptured intracranial aneurysms (UIAs) include endovascular techniques or surgical clipping.<sup>25</sup> These interventions can relieve headaches in patients with UIAs; a study reported a 50% headache reduction post-endovascular treatment for ICA aneurysms.<sup>26</sup> Based on the unruptured intracranial aneurysm score

consensus,<sup>27</sup> this patient is a good candidate for either surgical clipping or an endovascular approach, as it not only prevents a rupture but also relieves her chronic headache symptom.<sup>27</sup> Given the association between migraines, NTG, and UIAs, addressing the aneurysm could potentially improve both her headache frequency and NTG-related visual changes.

## CONCLUSION

Due to the unavailability of magnetic resonance imaging equipment and an interventional suite for digital subtraction angiography, this case underscores the utility of CT angiography for diagnosing anatomical issues, particularly in chronic headache cases, with catheter angiography still considered the gold standard. This case presented a potential risk of aneurysm rupture due to a high size ratio. The patient was referred to the Interventional Department at Dr. Soetomo Hospital in Surabaya for further treatment.

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