Posterior communicating artery aneurysm presenting as isolated oculomotor palsy: The role of rapid identification, intervention, and multidisciplinary care - A case study

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Abstract

Background: Posterior communicating artery (PCOM) aneurysms are the prevalent type of aneurysm with high rupture risks. Isolated oculomotor nerve (CN III) palsy is a key symptom warranting heightened awareness in primary care. Given the need for advanced imaging, early referral is paramount. This study highlights the significance of prompt identification, targeted intervention, and comprehensive management in optimizing patient outcomes.
Case: A 58-year-old woman presented with isolated CN III palsy. The patient underwent rapid referral to tertiary care with magnetic resonance angiography (MRA) and digital subtraction angiography (DSA), revealing an aneurysm in the PCOM. Subsequently, coiling was performed to achieve complete occlusion. The procedure resulted in significant neurological recovery, with restoration of CN III function. Post-coiling, the patient receives close nurse monitoring, incorporating fall management and comprehensive education before discharge. CN III palsy is one of the unique-noticeable presentations of PCOM aneurysms, though symptoms may include facial pain, occasional headaches, and migraines. Coiling was chosen due to its less invasiveness and was recommended for posterior circulation aneurysms. Blood pressure control is essential to prevent aneurysm formation, rupture, and recurrence. Regular imaging follow-ups were needed to ensure long-term outcomes.
Conclusion: PCOM aneurysm care involves a multidisciplinary approach. Rapid identification, early referral, immediate occlusion, and comprehensive rehabilitative programs were mandatory to improve patient outcomes.

Keywords: aneurysm; coiling; oculomotor nerve palsy; posterior communicating artery

Introduction

Cerebral artery aneurysms are a condition that is commonly the focus among clinicians due to its potential for sudden rupture and causing life-threatening conditions. The posterior communicating artery (PCOM) is one of the most prevalent sites for cerebral aneurysms, accounting for 25% of all intracranial aneurysms that are considered to be at high risk of rupture (Chen et al., 2015; Chung et al., 2017; Elhadi et al., 2014). In primary care settings, aneurysm in PCOM is often challenging to identify, as the symptoms frequently vary or are minimal. One of the typical symptoms that can appear in PCOM aneurysm

is oculomotor or cranial nerve III (CN III) paralysis, given the close anatomical relationship between the PCOM and CN III as it exits the brainstem (Corliss & Hoh, 2019).

Accurate imaging, primarily digital subtraction angiography (DSA) is required to confirm an aneurysm in PCOM. Hence, a precise examination and prompt referral are crucial, as delays may increase the propensity for rupture (Hackenberg & Etminan, 2021). Therefore, a thorough knowledge of signs and symptoms is imperative for primary care practitioners, including nurses and general practitioners, since PCOM aneurysms tend to have symptoms that are difficult to distinguish from other cerebral aneurysm locations (Chen et al., 2020). In this case study, we reported a case of a 58-year-old female with PCOM aneurysm presented as isolated right CN III palsy that was successfully treated with coiling. This study aims to highlight isolated CN III palsy as one of the signs and symptoms of PCOM aneurysms and demonstrate the practical and efficient interprofessional approach to managing PCOM aneurysms.

Case Presentation

A 58-year-old female came to the hospital with a complaint of inability to open her right eyelid. The sudden complaint arose while she was working in a field. Concurrent with the onset of right eyelid ptosis, the patient experienced throbbing, moderate to severe intensity gripping pain in the right side of her head that she never experienced before. The patient reported feeling generally well and fully conscious during the ptosis event. There were no issues with urination, defecation, speech slurring, or drooping lips. The patient also denied any previous ocular disorder and sensory disturbances. A computed tomography (CT) scan was performed for diagnostic purposes, yielding results within normal limits. Due to the requirement for further investigation with advanced tertiary care modalities, the patient was referred to Dr. Moewardi General Hospital for confirmation of diagnosis and management.

The patient came to Dr. Moewardi General Hospital three months later for evaluation. The ptosis of the right eye persisted, not exacerbated by activity, and remained unchanged since onset. Additionally, the patient complained of blurry vision, double vision, and glare in bright environments, specifically worsening when looking upwards or toward the right-lateral direction. The patient did not report pain upon eye movement, had no history of ocular disease, and did not wear corrective lenses. Notably, the patient had not experienced similar complaints previously. From past medical history, it was known that the patient had uncontrolled hypertension for the past 7 years. After being assessed by the interprofessional collaboration team, the patient was hospitalized for five days and underwent coiling management. The patient's complaints improved significantly, and she was scheduled for evaluation one week after discharge from the hospital.

Intervention or Clinical Examination

Ethical consideration

Informed consent was obtained directly from the patient. The patient agreed that her case/conditions was written as a case study manuscript and published in a journal. Copies of the written consent were available.

Clinical Findings

On physical examination, the patient's general impression and vital signs were within normal limits except for blood pressure, 161/96 mmHg, with a mean arterial pressure of 117.67 mmHg at the presentation time. Neurological examination revealed no higher brain dysfunctions. All meningeal signs yielded negative and normal results. Motor, reflex, coordination, autonomic, and sensory systems were normal. Examination of the right eye with ptosis revealed lateral-inferior temporal gaze direction with complete closure due to ptosis and absence of direct and indirect pupillary reflex in the right eye, indicative of a lesion of right CN III palsy (Figure 1). Examination of the left eye revealed no abnormalities. Other cranial nerve examinations were within normal limits. A yellow hand band was given to the patient to indicate the high risk of falling, as determined by a Morse Fall Scale score of 46.

Imaging Findings

Further diagnostic tests were conducted to identify the cause of the patient's symptoms. Magnetic resonance imaging (MRI) was performed, which did not show any signs of bleeding, infarction, or space-occupying lesions in the brain parenchyma on T1, T1 with contrast, T2, fluid-attenuated inversion recovery (FLAIR), diffusion-weighted imaging (DWI) axial, and gradient recalled echo (GRE) sequences. However, MRI fast imaging employing steady-state acquisition (FIESTA) and magnetic resonance angiography (MRA) revealed a saccular-type aneurysm of the right internal carotid artery at the level of the cavernous sinus, which was compressing the right CN III (Figure 2).

Visual evoked potential (VEP) was also performed, and findings of prolonged attention of right P100 with interpretation of prechiasmal lesion were obtained, eliminating the suspicion of optic nerve lesion (Figure 3A and Figure 3B). DSA was then performed to confirm the diagnosis definitively. The DSA results revealed a saccular-type aneurysm measuring 5.75 mm x 8.78 mm with a long shape and wide neck in the PCOM, suspected to be compressing the CN III exiting through the oculomotor sulcus of the cerebral peduncle, leading to the patient's CN III lesion. Subsequently, the patient was scheduled for coiling of the aneurysm under general anesthesia. The doctor and nurse explained the procedure to the patient and her family

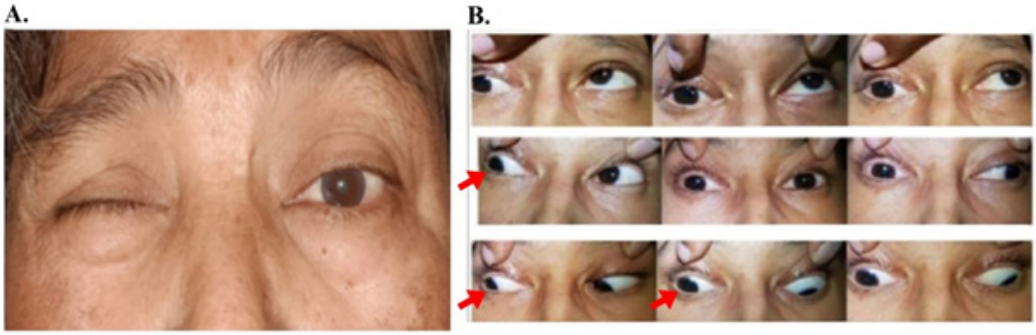

Figure 1. (A) Ptosis of the right eyelid. (B) Lateral-inferior temporal gaze. The right eyeball can only move laterally and inferiorly (red arrow), indicating palsy of the right medial rectus, right inferior rectus, and right inferior oblique muscles innervated by the oculomotor nerve.

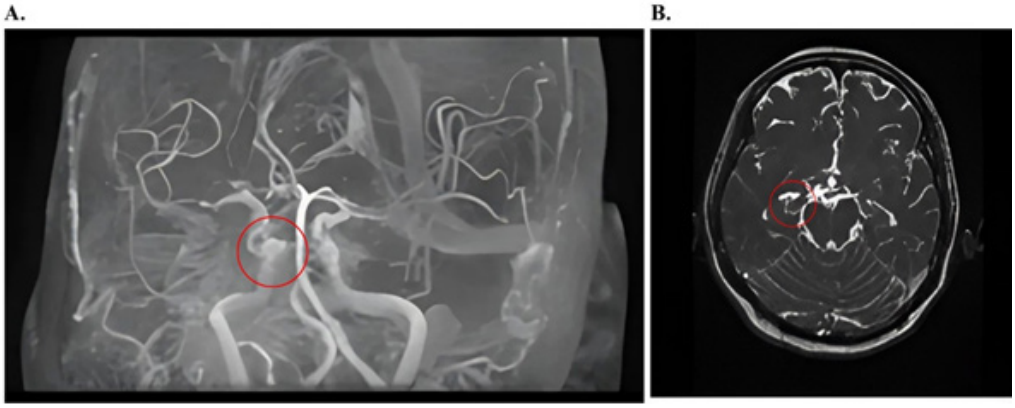

Figure 2. (A) Magnetic resonance angiography (MRA) imaging showed a saccular-type aneurysm in the posterior communicating artery (PCOM) at the level of the cavernous sinus (red circle). (B) Magnetic resonance imaging fast imaging employing steady-state acquisition (MRI-FIESTA) confirms the presence of PCOM aneurysm at the level of the cavernous sinus (red circle).

before the intervention. Coiling was performed using Axium Prime 3D 5 mm x 10 cm coil, Axium Prime Helix 4 mm x 10 cm coil, and Axium Prime Helix 4 mm x 8 mm coil into the aneurysm feeder, achieving 99% aneurysm occlusion (Figure 3D).

The patient was closely monitored for 48 hours in the high-care unit post-procedural. The nurses regularly assessed vital signs, including blood pressure and heart rate, and frequent neurological examinations to detect any new deficits or signs of altered mental status. After two days, the patient was clinically stable without throbbing pain in the right head, although the ptosis in the right eye had not improved. The patient began standing and walking again with the assistance of a walking frame for support during slow-paced walking exercises. After three days, the patient was discharged under close monitoring by family members and was provided discharge education on fall management, including using a walking frame daily and ensuring a safe home environment by removing tripping hazards by the nurses and the physiotherapist.

In addition, before discharge, the patient was given an order to follow the dietary approaches to stop hypertension (DASH) diet and prescribed antihypertensive drugs daily by the doctor and the dietician. A follow-up was scheduled for one week, along with routine CT angiography (CTA) imaging every 6-12 months to monitor the progress and probability of recurrence. A week after the coiling procedure, the patient returned to the outpatient clinic and showed minimal ptosis in the right eye. Movement of the right eye, apart from abduction, remained restricted, but improvement was noted in other eye movements (Figure 4). The patient's condition was stable, and no headaches or pain were experienced. Neurological evaluation did not reveal any deficits; the patient recovered well overall.

Discussion

PCOM aneurysm is concerning due to the frequent misdiagnosis, particularly in the early stage, as the symptoms may be various or minimal. Therefore, great clinical judgment through anamnesis, along with excellent clinical identification from interprofessional healthcare practitioners, are required to improve prognosis and reduce the likelihood of aneurysm rupture, reducing the mortality rate for this condition (Chen et al., 2020). Our case demonstrated a successful approach to

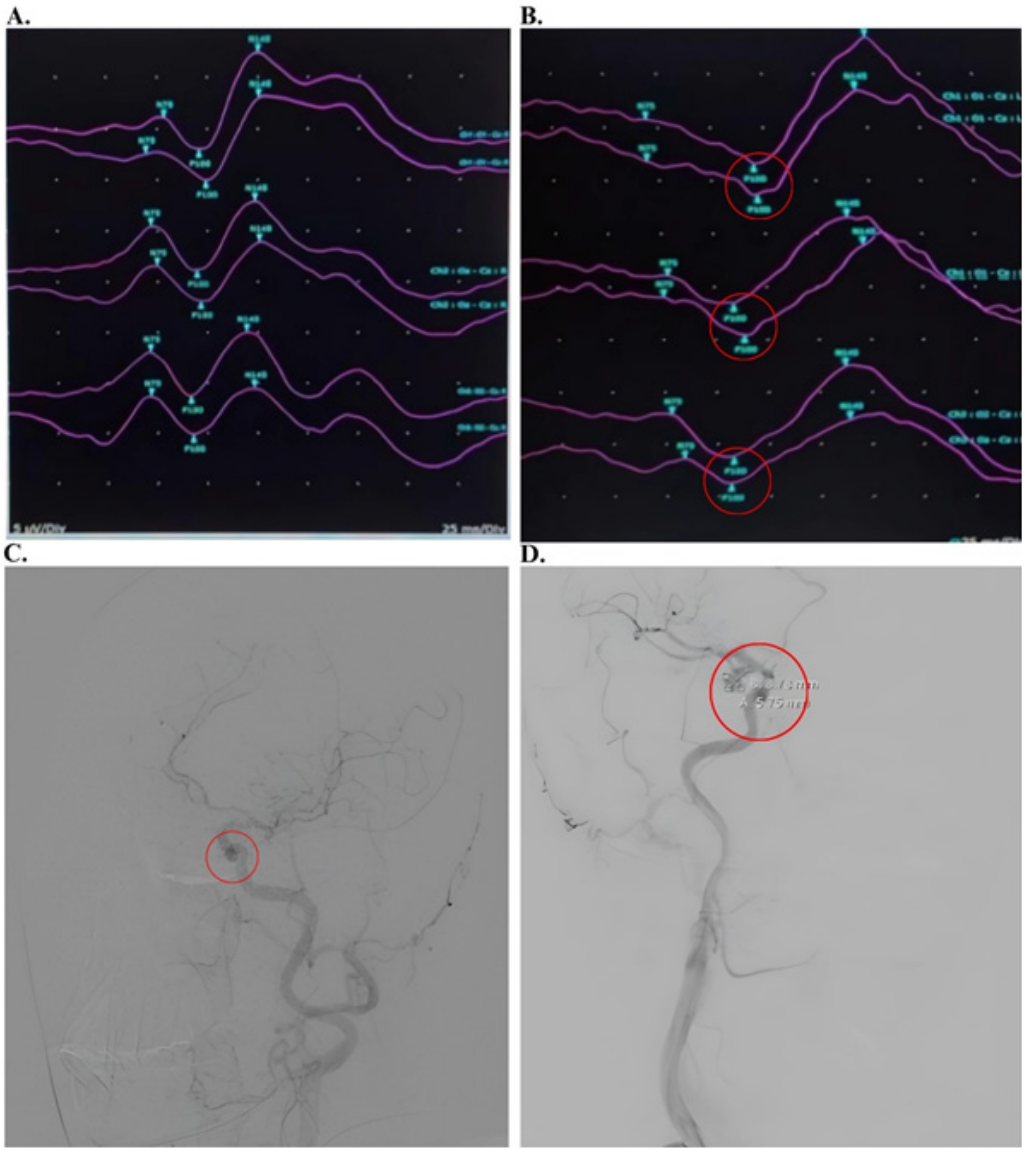

Figure 3. (A) Normal visual evoked potential (VEP) on the left eye. (B) VEP showed prolonged latency of the right P100 (red circle), suggesting a prechiasmal lesion of the right optic nerve, supporting the diagnosis of CN III palsy. (C) Digital subtraction angiography (DSA) before the coiling procedure showed a posterior communicating artery (PCOM) aneurysm (red circle). (D) DSA, after the coiling procedure, showed complete occlusion (red circle).

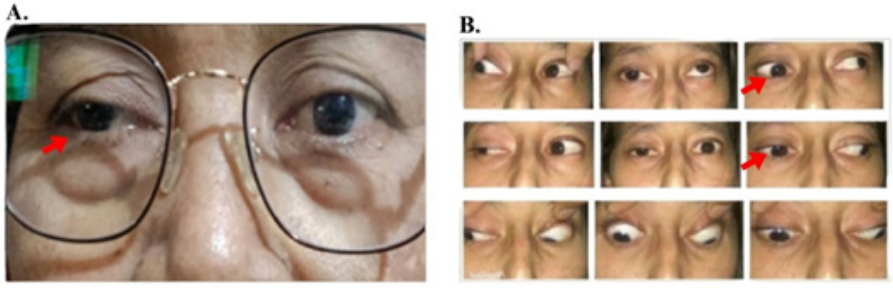

Figure 4. (A) Minimal ptosis in the right eye (red arrow). (B) The right eye can move medially (red arrow) but still has limited upward movement.

Table 1. Angioarchitecture type of PCOM aneurysm (Chung et al., 2017)

Type	Location
Type 1	Lateral aneurysm with the orifice on the ICA or PCOM away from the bifurcation.
Type 2	Bifurcation aneurysm with the orifice near the ICA-PCOM bifurcation.
Type 3a	Aneurysm lesion where the dilation occurs along an axis different from the PCOM axis.
Type 3b	Infundibulum, where the dilation is primarily parallel to the PCOM axis.
Type 4	Lateral aneurysm with the orifice on the ICA or PCOM away from the bifurcation.
Type 5	Bifurcation aneurysm with the orifice near the ICA-PCOM bifurcation.
Type 6	An aneurysm that does not visually show the PCOM.
Type 7	Lateral aneurysm with the orifice on the ICA or PCOM away from the bifurcation.
Type 8	Bifurcation aneurysm with the orifice near the ICA-PCOM bifurcation.

ICA: internal carotid artery; PCOM: posterior communicating artery.

this condition with interprofessional collaboration. Referral to a tertiary hospital with available DSA in ptosis eyelid without a suspected ocular condition is necessary, as PCOM aneurysm may present with only isolated CN III palsy.

The isolated CN III palsy resulted from a significant anatomical relationship between the PCOM and CN III. The CN III originates from the oculomotor nucleus, which is more ventral to the cerebral aqueduct at the level of the superior colliculus. The CN III exits through the interpeduncular fossa of the oculomotor sulcus of the mesencephalon. Subsequently, the CN III exits and travels close to the circle of Willis. In particular, it travels between the posterior cerebral artery (PCA) and the superior cerebellar artery (Corrêa et al., 2022; Davis et al., 2016; Joyce et al., 2024; Park et al., 2017). Additionally, when the CN III travels around the PCA, it travels close to the PCOM. If an aneurysm forms on the PCOM site, the enlarged blood vessels may apply pressure on the adjacent CN III, causing nerve compression. This compression leads to impaired function. Thus aneurysms in PCOM are presented as CN III palsy, as evidenced by a large number of case reports (Almaghrabi et al., 2021; Chaudhry et al., 2018; Daniel et al., 2022; Danko & Williams, 2021; Guo & Wu, 2019; Jacob et al., 2023; Kajitani et al., 2021; Lee et al., 2016; Sun et al., 2016; Toyota et al., 2014).

While PCOM aneurysms often correlate with CN III palsy manifestations such as lateral-inferior gaze, pupil dilation, and ptosis of the eyelids, primary healthcare must acknowledge other variations of symptoms. In the absence of CN III compression, the PCOM aneurysm has been reported to manifest as facial pain due to direct compression on the trigeminal root and cavernous sinus (Zelman et al., 2016). PCOM aneurysm can compress nearby arteries, such as the anterior choroidal artery or small perforating arteries that supply the internal capsule and thalamus, resulting in hemiparesis and sensory deficit (Cai et al., 2022; Tanaka et al., 2023). In the different scenarios, oligosymptomatic with only occasional headaches or migraines was previously documented (Danko & Williams, 2021; Sirakov et al., 2020).

These various signs and symptoms require an explicit confirmation of diagnosis through visualization, which can be facilitated through angiographic techniques. In such cases, DSA is considered the gold standard. Once diagnosis is confirmed, occlusion of the aneurysm lumen has to be accomplished. In our case, we chose the coiling method to achieve occlusion due to several factors. First, the complex anatomical structure of the posterior circulation made surgical clipping challenging (Zhu et al., 2022). Second, coiling offers a significantly less invasive technique to achieve occlusion (Tsianaka et al., 2019). Third, the coiling approach is recommended in posterior circulation aneurysms based on Indonesia's neuro-interventional consensus 2020 (Sani, 2020). Fourth, the dome-to-neck ratio aneurysm is anticipated to be greater than two in this case. Therefore, the enormous dome makes the coil more stable within the aneurysm sac. This stable coil position efficiently limits coil movement or herniation into the parent vessel (Darsaut et al., 2023; Zhu et al., 2022).

Immediate clinical identification, precise visualization, and rapid occlusion are essential to control the rupture risk, as PCOM aneurysms were highly at risk of rupture. In particular, bifurcation type 2 and type 5 (based on Chung et al.; Table 1) have a significantly higher risk of rupture due to higher shear stress on the blood vessel wall (Chung et al., 2017). Aneurysm rupture is considered life-threatening, with an estimated 50% mortality rate and only about a quarter of survivors achieving full recovery.

Consequently, the most logical recommendation for preventive and rehabilitative approaches is controlling blood pressure. Control of blood pressure is a triple strategy to prevent aneurysm formation and rupture, along with the rehabilitative approach to prevent recurrence (Czekajło, 2019). Therefore, we are also highlighting the post-operative care for this patient, including the DASH diet and routine blood pressure control drugs. This approach is aligned with the recommendation of the American Heart Association/American Stroke Association (AHA/ASA) (Thompson et al., 2015). Although there is not yet a consensus on blood pressure target in post-

occlusion intracranial aneurysms, the European Stroke Organization (ESO) suggests <130/80mm/Hg would be beneficial for those with unruptured cases (Etminan et al., 2022).

Moreover, rehabilitative care for this patient needs to involve a multi-faceted approach with long-term follow-up. Post-coiling, patients need to be observed for immediate complications such as bleeding, infection, altered mental status, and new neurological deficits. Along with close monitoring after occlusion, nurses should implement fall management to prevent additional injuries. Patients should be provided with mobility aids such as handrails or grab bars for home safety precautions, given the high risk of falls in such cases (Comino-Sanz et al., 2018). A yellow hand band needs to be implemented to enhance the awareness of high fall risk, particularly in elderly patients with reduced mobility and independence (Wisconsin Hospital Association, 2007). Postoperative status and neurological diseases are among the leading causes of falls, making assessment and risk detection is crucial in reducing fall incidents (Montejano-Lozoya et al., 2020)

Radiographic follow-up is also an essential part of the education that must be provided before discharge. AHA/ASA recommended follow-up with MRA or CTA at regular intervals. An initial follow-up study is suggested 6 to 12 months after the initial intervention, followed by subsequent annual imaging, which may be considered reasonable for ongoing monitoring (Thompson et al., 2015).

Nursing Implication

This case emphasized the important role of a multidisciplinary approach in such a high-risk neurovascular case. Nurses, as one of the primary healthcare providers, should give immediate identification in the clinical setting with the primary goal of rapid referral to the tertiary hospital for complete occlusion, as delayed treatment may result in rupture and permanent damage to the optic pathways and adjacent cerebral regions (Al-Abdulwahhab et al., 2020; Taweesomboonyat et al., 2019). Post-intervention patient close monitoring with adequate fall assistive modalities and education on adherence to a strict therapeutic diet was essential to be implemented.

Strengths and Limitations of the Study

This case highlights successful comprehensive care in a PCOM aneurysm patient. In the current case, we perform multiple modalities to exclude possible differential diagnoses, such as VEP to rule out any optic neuropathy or other visual pathway disorders that could mimic aneurysm-related symptoms. However, this case study is limited by the lack of a long-term follow-up report and the absence of radiographic imaging of the patient during the post-treatment period.

Conclusion

PCOM aneurysm is a common intracranial aneurysm that potentially becomes life-threatening if ruptured, demanding a prompt multidisciplinary approach. Isolated CN III palsy without ocular suspects represents one of the key symptoms that primary healthcare should recognize. Early identification requires clear anamnesis and clinical judgment in primary care, followed by immediate referral to a tertiary hospital for investigation using DSA as the gold standard. Given the significant risk of rupture, swift occlusion must be accomplished, with coiling being more favored due to its less invasiveness and efficacy on posterior circulation. Post-occlusion care includes close monitoring, fall management, blood pressure control, and regular long-term radiographic follow-up. This comprehensive care aims to ensure better patient recovery.

Declaration of Interest

All authors declare that this case study has no conflict of interest.

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Data Availability

The data is available from the corresponding author's email at a reasonable request.

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