

Postoperative coma in a patient with complete basilar syndrome after anterior cervical discectomy

[Coma postopératoire chez un patient atteint d'un syndrome basilaire complet après une discectomie cervicale antérieure]

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Purpose: Ischemic brainstem stroke resulting from occlusion of the basilar artery during cervical spine surgery in a previously asymptomatic patient is a rare event. We report the development of a large ischemic brainstem stroke, resulting from occlusion of the basilar artery during anterior cervical discectomy, in a patient without previous neurological deficit, or signs of vertebrobasilar insufficiency.

Clinical features: A 55-yr-old, diabetic and hypertensive male who developed a cervical spine infection, underwent surgery for anterior discectomy at C₅–C₆. During the 2.5-hr long procedure the patient was lying supine with his neck hyperextended. Except for a temporary reduction in systolic blood pressure, the intraoperative course was uneventful. At the end of surgery the patient remained unconscious with flaccid paralysis in all extremities, fixed pinpoint pupils, low respiratory rate, and no response to painful stimuli. Naloxone administration did not improve the clinical picture, while brain computed tomography showed a large brainstem and cerebellar stroke, implicating basilar artery occlusion. The patient died five days later from stroke complications. Intraoperative surgical manipulation with a severely inflamed vertebral system, as well as prolonged neck hyperextension occluding the blood flow of vertebrobasilar arteries might have contributed to fatal brainstem stroke in this patient.

Conclusion: Neck surgery carries a potential risk for posterior circulation stroke, and this report heightens awareness of this rare, but serious complication.

Objectif : Un accident ischémique du tronc cérébral, résultat de l'occlusion de l'artère basilaire pendant une opération de la colonne cervicale chez un patient auparavant asymptomatique, est un événement rare. Nous présentons le cas d'un important accident ischémique du tronc cérébral causé par l'occlusion de l'artère basilaire pendant une discectomie cervicale antérieure chez un patient sans déficit neurologique ou signes d'insuffisance vertébro-basilaire connus.

Éléments cliniques : Un homme de 55 ans, diabétique et hypertendu, ayant une infection de la colonne cervicale, a subi une discectomie antérieure en C₅–C₆. Pendant l'opération de 2,5 h, le patient était en décubitus dorsal avec le cou en hyperextension. L'opération s'est déroulée sans incident, sauf une réduction temporaire de la tension artérielle systolique. À la fin de l'opération, le patient est demeuré inconscient et présentait une paralysie flasque aux extrémités, des micropupilles fixes, une fréquence respiratoire faible et aucune réaction aux stimuli douloureux. L'administration de naloxone n'a pas corrigé la situation et la tomographie par densitométrie du cerveau a montré un accident vasculaire important du tronc cérébral et du cervelet consécutif à l'occlusion de l'artère basilaire. Le patient est décédé cinq jours plus tard des complications de l'accident vasculaire. Les manipulations chirurgicales peropératoires d'un système vertébral sévèrement enflammé et l'hyperextension prolongée du cou, bloquant le débit sanguin des artères vertébrobasilaires, ont pu contribuer à l'accident vasculaire fatal du tronc cérébral.

Conclusion : L'opération du cou comporte un risque potentiel d'accident circulatoire postérieur et notre article présente cette complication rare, mais grave.

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THE overall incidence of perioperative stroke after surgery is 0.02%¹ to 0.2%.² The incidence is far greater in patients having peripheral vascular procedures³ or following a recent stroke,⁴ and the disease is associated with a high-mortality risk.^{4,5} Major preoperative comorbidity,⁶ anesthesia, as well as “non-high-risk surgery”,⁷ are considered independent risk factors for perioperative stroke. Perioperative ischemic events are usually cardioembolic in origin,⁸ and occur postoperatively after an asymptomatic interval.^{2,6,8} Severe intraoperative ischemic insult of the posterior circulation resulting in intraoperative stroke and irreversible coma in a previously asymptomatic patient, is a rare neurological event. We report a patient who presented with complete basilar syndrome and coma after anterior cervical discectomy for vertebral infection.

Case report

We obtained consent for publication of personal health information from the patient’s family, according to patient health information guidelines of the Chang Gung Memorial Hospital. A 55-yr-old male visited the Neurology clinic complaining of fever and progressive neck pain over the previous ten days. The patient had a ten-year history of hypertension controlled with enalapril, 5 mg *po*, qid and noninsulin-dependent diabetes without regular treatment. He did not smoke or use recreational drugs, and was consuming alcohol on an occasional basis. On physical examination he appeared well. His blood pressure was 130/82 mmHg, pulse 80 beats·min⁻¹, respiratory rate 18 breaths·min⁻¹, and temperature 37.5°C. His neck was tender over the C₄–C₅ level, but was otherwise flexible with full range of motion. On neurologic examination, the patient was awake, alert, and oriented to time, place, and person. There was normal muscle bulk and tone, with full strength in both arms, and legs and plantar responses were flexor. Cranial nerve examination was normal. The white cell count was 12.7 × 10³·μL⁻¹ (neutrophils 74%, lymphocytes 26%), hematocrit 43%, and the platelet count was 220 × 10³·μL⁻¹. A postprandial blood glucose level was 396 mg·dL⁻¹, and C-reactive protein 116.7 mg·L⁻¹ (upper normal limit 5 mg·L⁻¹). All other blood tests were within normal range. Magnetic resonance imaging study of the cervical spine showed loss of the normal cervical lordosis, paraspinous infection extending from the C₂ to C₇ levels with abscess formation in the epidural space on the left, and lateral osteophytes from C₃ to C₇, bilaterally (Figure 1A). No compression of the spinal cord was observed. While both vertebral arteries were intact on preoperative magnetic resonance angiography, the left

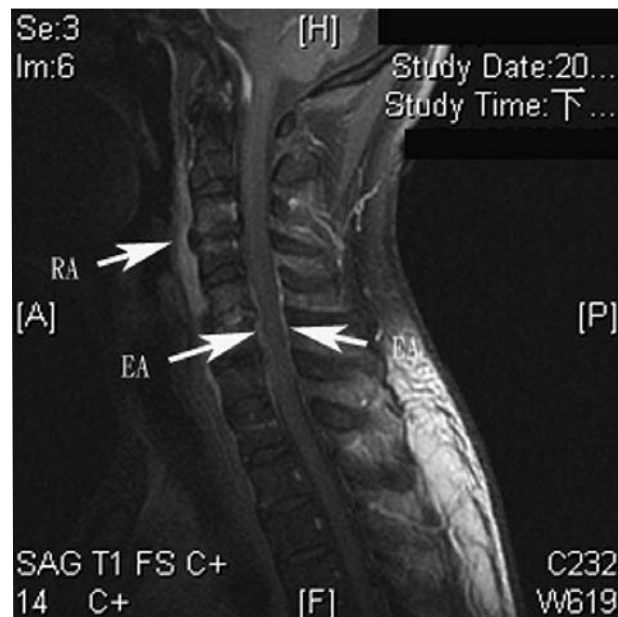


FIGURE 1A Magnetic resonance imaging of cervical spine. A T₂-weighted sagittal image before the operation revealed infectious spondylitis of cervical spine (C₂–C₇) with retropharyngeal (RA) and epidural (EA) abscesses at the anterior and posterior part of the spine, respectively.

was visualized in the vicinity of the abscess (Figure 1B). Three days later, the patient was admitted to the hospital for surgical exploration.

On the day of the surgery, blood glucose level was 230 mg·dL⁻¹ and the patient was treated with D5W1/4NS / insulin solution, which reduced the glucose level to 114 mg·dL⁻¹ in the immediate preoperative period. In the operating room, the patient was placed in the supine position and standard anesthesia monitors were applied. Anesthesia was induced with thiamylal sodium 200 mg *iv* and maintained with sevoflurane (2–3% end-tidal) in oxygen (FiO₂: 1.0). After receiving rocuronium 40 mg *iv* and fentanyl 150 μg *iv*, orotracheal intubation was performed using a standard 7.5-mm endotracheal tube. No additional muscle relaxants or opioids were given during the operation. Neither a central *iv* nor an arterial line was inserted. After induction of anesthesia, a pillow was placed under the patient’s shoulders, keeping his neck extended throughout the procedure. During surgery, severe inflammation was found around the cervical spine, and the necrotic tissue was sent for pathology examination and culture. An anterior microdiscectomy at the C₅–C₆ level was also performed. Systolic blood

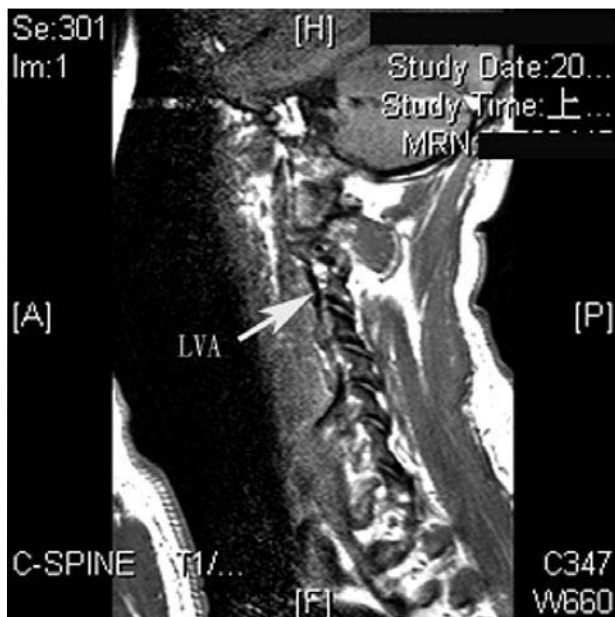


FIGURE 1B Preoperative magnetic resonance imaging showed that both vertebral arteries were intact, while the left vertebral artery (LVA) was in the vicinity of the abscess.

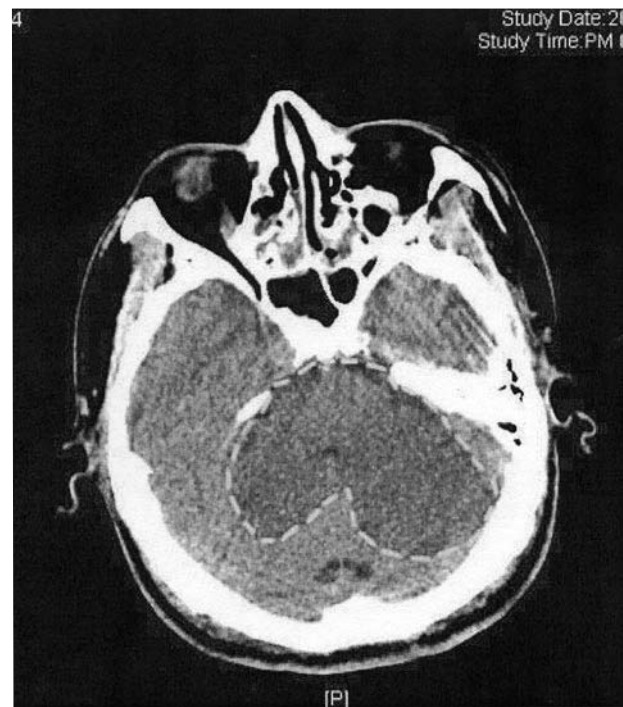


FIGURE 2 Postoperative brain computed tomography scan showed a low-intensity area, indicating a large brainstem infarction at the pons.

pressure was maintained between 85 to 150 mmHg throughout the procedure which lasted for 2.5 hr. Forty-five minutes after skin incision, systolic blood pressure was reduced to about 60% of the preoperative level for ten to 15 min. Total blood loss did not exceed 100 mL. At the end of the case, neostigmine 2.5 mg *iv* and atropine 1 mg *iv* were administered to reverse residual neuromuscular block.

One hour after the end-tidal sevoflurane concentration was no longer detectable, the patient was still unconscious with fixed pinpoint pupils and no response to painful stimuli. All four limbs were hypotonic and hyporeflexive, with extensor plantar responses. Spontaneous respiratory rate was 5 to 8·min⁻¹ and tidal volume was 250 to 300 mL. Oculocephalic and corneal reflexes were absent. Naloxone 0.8 mg *iv* was administered to exclude possible opioid intoxication, without any improvement. Arterial blood gases, electrolytes and blood glucose were all within the normal range. Computed tomography of the brain showed a large low-density area involving the pons, medulla, and bilateral cerebellar peduncles and vermis (Figure 2), implicating basilar artery occlusion. Transthoracic echocardiography could detect neither

intra-cardiac thrombosis and vegetation, nor a patent foramen ovale. The patient was transferred to the intensive care unit on ventilatory support and started on aspirin 100 mg·day⁻¹ and dextran 30 mg·hr⁻¹ therapy. Tissue and blood cultures revealed oxacillin-resistant staphylococcus aureus, and the patient was treated with *iv* teicoplanin and aztreonam. Despite active treatment, he died five days later due to a large brainstem stroke.

Discussion

Important risk factors for perioperative stroke in non-cardiac, non-carotid surgery include a history of hypertension, diabetes, smoking, previous neurologic symptoms and an abnormal heart rhythm.⁹ The majority of stroke events perioperatively are due to embolism from a cardiac source,⁸ and typically occur several days postoperatively.^{2,6} Only a minor fraction of these events arise in the posterior circulation.⁶ The size of the infarct depends on the location and speed of occlusion, the extent of thrombus, and the adequacy of collateral blood flow. Atherothrombotic events usually occur at the vertebrobasilar junction, while emboli commonly target the distal part or top

of the basilar artery. Dissections typically involve the vertebral artery, and occasionally extend to the basilar artery.

In this patient, preoperative magnetic resonance angiography showed both vertebral arteries intact, with the left artery proximal to the abscess. There were no symptoms or signs of vertebrobasilar insufficiency preoperatively, and postoperative echocardiography failed to detect any potential cardiac source of emboli. The patient presented with clinical signs of complete basilar syndrome associated with coma. Bilateral long tract signs with cerebellar and cranial nerve involvement implicated occlusion of the proximal and middle parts of the basilar trunk. Of note, intracranial artery stenosis is predominant in young (18–45 yr) ischemic stroke patients from Taiwan in both the carotid and vertebrobasilar systems, while dissection is the most common cause of significant extracranial stenosis.¹⁰ In addition, vertebrobasilar infarctions are associated with a low incidence of carotid stenosis.¹¹ In our patient, the lack of ischemic injury in the thalamus and occipital lobe, which are supplied by the posterior cerebral artery (“top of the basilar” syndromes), supports the hypothesis of vertebrobasilar insufficiency associated with adequate collateral flow from the anterior circulation.

Symptomatic vertebrobasilar disease carries approximately twice the risk for postoperative stroke, compared to carotid artery stenosis.^{12,13} Intracranial vertebrobasilar artery dissection is much more frequent than previously believed, and can be asymptomatic in as many as 10% of patients,¹⁴ while intraoperative malpositioning of the neck has been implicated as a precipitating factor for dissection and/or thrombosis.^{15–18} Rotation¹⁹ and hyperextension²⁰ of the neck induce potentially harmful flow changes in the posterior circulation, and is associated with a higher incidence of infarctions in subjects with hypoplastic vertebral arteries (HVA).²⁰ Since HVA has been estimated to occur in at least 25% of patients who are considered high-risk for cerebral vascular disease,²⁰ it presents a major risk factor for posterior circulation ischemia,²¹ especially when combined with malpositioning of the neck.

Spondylotic occlusion of the extracranial part of the vertebral arteries can also initiate ischemic events in the posterior circulation,^{22–24} while traumatic occlusion due to surgical injury^{25–28} also remains a potential cause, especially in the presence of anomalous vascular anatomy.^{26,28}

The role of intraoperative hypotension in precipitating a stroke is not well established. However, low blood pressure at a critical moment may render anastomotic

flow channels ineffective and thus, aggravate ischemia. In the patient we report, systolic blood pressure was reduced to about 60% of preoperative values for ten to 15 min. Amongst surgical patients with symptomatic vertebrobasilar stenosis postoperative stroke cases had intraoperative hypotension in common,¹² while anterior cervical spine surgery has been associated with dramatic reductions in carotid artery flow.²⁹ Therefore, hypotension could have contributed to the evolution of the infarct through decreased collateral supply. Nonetheless, the lack of ischemic injury in areas supplied by posterior cerebral artery supports the presence of adequate collateral flow from the anterior circulation.

Diabetes and impaired glucose tolerance are recognized risk factors for ischemic stroke and transient ischemic attacks,^{30,31} while hyperglycemia is an important modifier of the ischemic damage per se.^{32,33} In this patient, a long history of hypertension and uncontrolled diabetes increased the risk for vasculopathy-associated morbidity. We theorize that severe inflammation of the vertebral arteries, as well as surgical manipulation combined with prolonged neck hyperextension, led to severe flow changes of proximal basilar artery.

This is a fatal complication that could possibly have been ameliorated or even avoided if neurophysiological monitoring with brainstem auditory and somatosensory evoked potentials had been employed.^{34,35} However, this type of monitoring is not standard practice for surgery which is not considered high-risk for neurological compromise. However, intraoperative evaluation of the vertebrobasilar circulation in special, high-risk conditions can be potentially life-saving. In this patient, due to the catastrophic nature of the insult,³⁶ any further intervention for aggressive treatment was deemed futile.

This report should remind clinicians that neck surgery carries a potential risk for posterior circulation stroke. Risk factors must be carefully identified, and consideration given to meticulous care in patient positioning and neurophysiologic monitoring when deemed appropriate.

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