

Puff of Smoke: Moyamoya and the nursing role following STA-MCA bypass

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Abstract

Superficial temporal artery (STA) to middle cerebral artery (MCA) bypass, also referred to as STA-MCA bypass, is a direct revascularisation treatment for moyamoya disease. Moyamoya disease is a rare cerebrovascular condition characterised by progressive narrowing of the distal segments of the internal carotid arteries. Untreated, this may cause varied and progressive symptoms for patients, with a significantly increased risk of stroke annually. STA-MCA bypass is performed several times a year at Royal North Shore Hospital by specialist cerebrovascular neurosurgeons. This is a quaternary service with patient referrals received from throughout Australia.

This paper will provide an overview of moyamoya, the surgical treatment and nursing care. The pre- and post-procedure nursing care for these patients is paramount, including perioperative blood pressure management, neurological assessment and wound care. The paper will also explore a case study of a patient who underwent a STA-MCA bypass, highlighting the value of specialised neuroscience nursing care, and additional considerations when managing patients living at a distance from the local health district.

Key Words

nursing, neuroscience, Moyamoya, STA-MCA

Overview

Superficial temporal artery to middle cerebral artery (STA-MCA) bypass is a cerebrovascular procedure performed several times a year at Royal North Shore Hospital by specialist cerebrovascular neurosurgeons for the treatment of moyamoya. This is a quaternary service with patient referrals received from across Australia. Specialised neuroscience nursing care is essential to manage patients with moyamoya, pre- and post-procedure.

What is Moyamoya disease?

Moyamoya is a rare cerebrovascular condition characterised by progressive narrowing of the distal segments of the internal carotid arteries (ICA), causing reduced perfusion to the affected cerebral hemisphere (Ihara et

al., 2022). This initiates a process of angiogenesis and the formation of a network of compensatory vessels (Cheikh et al. 2019). The English translation of the Japanese term moyamoya is “puff of smoke” which refers to the appearance of the compensatory vessels on cerebral angiography (Cheikh et al. 2019). There is higher incidence of moyamoya in people from east Asian countries (Ihara et al., 2022). Moyamoya disease (MMD) refers to bilateral disease affecting both the right and left ICA, whereas moyamoya syndrome (MMS) refers to cases where this

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phenomenon occurs unilaterally (Velo et al., 2022). Patients typically present with either ischaemia or haemorrhage, although other symptoms such as headaches, cognitive changes or seizures may occur (Ihara et al., 2022). Patients may present with transient or sustained ischaemic changes from hypoperfusion through the narrowed ICA, often exacerbated by increased haemodynamic demand such as physical activity or dehydration (Canavero et al., 2021). Haemorrhage may occur due to rupture of fragile smaller collateral vessels (Shang et al., 2020). The goal of treatment for both MMD or MMS is prevention of ischaemia or haemorrhage, and subsequent deficits (Canavero et al., 2021). Untreated MMD can cause progressive symptoms with 18% risk of stroke in the first year, and an ongoing 3.2-5% annual risk of stroke (Shi et al., 2023; Shang et al., 2020). Treatment is dependent on presentation, however, often requires a form of revascularisation procedure to increase perfusion.

What is a STA-MCA bypass?

The mainstay treatment to address MMS and MMD is a superficial temporal artery (STA) to middle cerebral artery (MCA) bypass. This is a direct revascularisation treatment for moyamoya, which utilises an artery in extracranial circulation from the scalp, the STA, and redirects this to the intracranial circulation (Velo et al., 2022). The STA branch is dissected, passed through the skull, and anastomosed to an appropriate branch of the MCA to bypass the area of stenosis (Velo et al., 2022). The goal of the procedure is to prevent occurrence of cerebral ischaemia or haemorrhage (Canavero et al., 2021). Whilst STA-MCA is the mainstay treatment for MMD or MMS, it can also be done for patients with critical ICA stenosis.

Neuroscience nursing care

Specialised neuroscience nursing care and thorough neurological assessment is essential pre and post procedure to manage patients and identify potential deterioration. First and foremost, following STA-MCA bypass, strict blood pressure parameters are maintained to prevent hyperperfusion or hypoperfusion and maintain patency of the graft (Zhao et al., 2018). Most commonly, systolic blood pressure is maintained between 110-140mmHg in the peri-operative, and immediate post-operative period, and patients are also instructed to stay well hydrated. Hypotension in the perioperative period has been associated with higher rates of hypoperfusion and transient neurological deficits (Oh et al., 2021). Cerebral hyperperfusion syndrome (CHS) is also a recognised complication of revascularisation surgery, which can result in haemorrhage (Shi et al., 2023). Symptoms include unilateral headache, seizures, aphasia and motor or sensory disturbances, and typically appear two days post-procedure (Shi et al., 2023). Incidence of CHS ranges from 6.7-38.2% and is more common in adult patients who initially present with haemorrhage (Shi et al., 2023). Therefore, comprehensive neurological assessment is key to detect any deterioration. The necessitation of specialised neuroscience nursing care for such patients is not well explored in the literature, however, practically at Royal North Shore Hospital, this is a key priority, ensuring early detection of subtle neurological changes.

Antiplatelet medications are also prescribed to reduce incidence of ischaemic complications (Cheikh et al., 2019). Aspirin is the most prescribed antiplatelet medication in the literature, demonstrating a decrease in post-

operative embolic ischaemic events when compared to no antiplatelet agent (Xue et al., 2023). Thus, timely administration of such medications by nursing staff is essential. Finally, another recognised complication of STA-MCA bypass is impaired wound healing (Zhao et al., 2019). This may be due to several factors, but notably, resection of the STA impacts normal perfusion of the scalp and thus may affect wound healing (Acker et al., 2019). A 2024 study found that delayed wound healing occurs in approximately 23% of STA-MCA bypass cases, with significant complications in 11% of cases (Ota et al., 2024). The nature of STA-MCA bypass also requires single layer closure of the wound over the redirected vessel. Therefore, it is essential to ensure no pressure is placed on the wound to ensure patency and avoid graft occlusion. Thus, vigilant wound assessment and provision of patient education by nursing staff is vital.

Case study

A young female of Chinese and Vietnamese descent was referred by the Queensland Health Service for work up of possible moyamoya and consideration of treatment. The patient initially presented with recurrent transient ischaemic attacks, resulting in left arm and face paraesthesia and weakness, particularly when exercising, or dehydrated.

Based on the suspected diagnosis, the patient was commenced on aspirin to reduce incidence of thromboembolic events (Xue et al., 2023). Adequate daily hydration was also encouraged to ensure euvolemia and prevent cerebral hypoperfusion (Oh et al., 2021). Whilst an inpatient, she underwent a cerebral angiogram and single-photon emission computed tomography (SPECT) Diamox study to examine cerebral perfusion. Subsequently, she was found to have right ICA stenosis and

reduced blood flow to the right anterior cerebral circulation and thus was diagnosed with right-sided MMS. Upon confirmation of MMS, the patient underwent a successful right-sided STA-MCA bypass. Post-procedure, she was monitored in the intensive care unit and neurosurgery ward for 7 days with vigilant neurological monitoring, blood pressure control and further specialised neuroscience nursing care, and thus had an uneventful recovery.

On day seven post-surgery, she was discharged from hospital, however due to the nature of the surgery, she was discharged to local accommodation in Sydney rather than home to Queensland. This allowed her to attend a face-to-face follow up review on day 14 post-surgery with the specialist cerebrovascular surgeon. At this appointment in the neurosurgery clinic, the wound was reviewed and was noted to have dehisced, requiring further suturing. This required the patient to remain in Sydney for an additional seven days to monitor the surgical wound, at which point the wound had healed sufficiently and sutures were removed. The patient was then able to return home to Queensland.

Discussion

STA-MCA bypass is a specialised neurosurgical procedure which is not currently available in the Queensland Health Service, requiring referral to a quaternary cerebrovascular centre. Whilst this patient received a successful treatment for MMS, referral from interstate resulted in extended travel, as well as a young patient undergoing major neurosurgery with limited psychosocial supports during her initial period of recovery. Consequently, in cases such as this, extensive multidisciplinary case management is essential to optimise the patient experience. Significant allied health involvement from physiothera-

pists and occupational therapists was required to ensure the patient was safe to be discharged alone to local accommodation. Furthermore, significant psychosocial support was provided by the social work department to navigate the psychological stressors associated with the surgery and prolonged time away from family. Oh et al. (2024) explored the physiological and psychological symptoms in adolescents with MMD. Whilst the patient in this case study was only slightly outside of the cohort explored in this study, the findings of increased feelings of tension and anxiety, and the emphasis on protective factors such as support network of friends remain relevant to the case study (Oh et al., 2024). Once the patient returned to Queensland, future follow-up appointments were organised through telehealth. Telemedicine has been demonstrated as an effective alternative to face-to-face reviews in neurosurgical patients (Eichberg et al., 2021). However, in this case, telehealth was only appropriate once the patient had recovered from the procedure and their surgical wound had healed, prior to which, face-to-face reviews were necessary.

Conclusion

Care of patients following STA-MCA bypass is specific and requires specialised neuroscience nursing care to reduce incidence of peri-operative complications and improve recognition of potential deterioration. Interstate referrals to quaternary referral centres improve health equality by facilitating access to specialist care, however, these referrals require thorough multidisciplinary involvement to ensure a safe, positive patient experience.

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