Laparoscopic Omental Flap Cerebral Revascularization in Moyamoya Disease: A Systematic Review

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Abstract

Moyamoya disease is a rare cerebrovascular disorder characterized by progressive stenosis and occlusion of the internal carotid arteries, leading to insufficient blood supply to the brain. Cerebral revascularization is a crucial treatment option to improve blood flow and prevent stroke in these patients. Traditionally, harvesting the omental flap for indirect revascularization has been associated with laparotomy and potential complications. This systematic review aims to assess the safety and effectiveness of laparoscopic omental flap harvesting for cerebral revascularization in Moyamoya disease patients based on available literature.

Methods

A comprehensive search of relevant databases was conducted to identify studies reporting on laparoscopic omental flap cerebral revascularization in Moyamoya disease patients. The search period extended from January 2011 to September 2023. Studies that met the inclusion criteria were assessed for quality and data extraction. Key outcomes of interest included intraoperative and postoperative complications, length of hospital stay, and long-term outcomes.

Results

Five studies met the inclusion criteria and were included in this systematic review. The combined cohort consisted of 41 patients with Moyamoya disease who underwent laparoscopic omental flap cerebral revascularization. Intraoperative complications were infrequent, with three cases (7.3%) reported across the studies, including mesenteric injury and the need for micro anastomosis. The average overall length of hospital stay was 6.2 days, with a mean ICU stay of 3.0 days. Postoperative complications included incisional hernias, recurrent neck pain, and partial scalp necrosis. Long-term outcomes demonstrated partial or complete resolution of symptoms in the majority of patients, with only one patient requiring subsequent direct bypass due to disease progression.

Conclusion

This systematic review suggests that laparoscopic omental flap mobilization and transposition is a

safe and effective method of indirect cerebral revascularization in patients with Moyamoya disease. The procedure appears to have a low rate of intraoperative complications and provides satisfactory long-term outcomes in terms of symptom resolution. However, further studies with larger patient cohorts and longer follow-up periods are needed to validate these findings and establish laparoscopic omental flap revascularization as a viable option for Moyamoya disease treatment.

Keywords: Moyamoya disease, cerebral revascularization, laparoscopic omental flap, systematic review

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Test and Answers

What is Moyamoya disease characterized by? a) Progressive stenosis and occlusion of coronary arteries b) Progressive stenosis and occlusion of internal carotid arteries c) Progressive stenosis and occlusion of pulmonary arteries d) Progressive stenosis and occlusion of femoral arteries

Why is cerebral revascularization important in Moyamoya disease? a) To treat high blood pressure b) To improve blood flow and prevent stroke c) To reduce cholesterol levels d) To manage migraines

What is the traditional approach for harvesting the omental flap for revascularization in Moyamoya disease? a) Laparoscopy b) Angiography c) Laparotomy d) Endoscopy

In the systematic review, how many studies met the inclusion criteria? a) Two b) Three c) Four d) Five

What were the key outcomes of interest in the systematic review? a) Intraoperative and postoperative complications b) Length of hospital stay and surgical technique c) Blood pressure management and postoperative complications d) Postoperative complications and long-term outcomes

What percentage of patients in the systematic review experienced intraoperative complications? a) 3% b) 7.3% c) 10% d) 15%

What is the average length of hospital stay reported in the systematic review? a) 2.0 days b) 4.5 days c) 6.2 days d) 8.0 days

What is the main conclusion drawn from the systematic review regarding laparoscopic omental flap revascularization in Moyamoya disease? a) Laparoscopy is not a suitable approach. b) Laparoscopy has a high rate of intraoperative complications. c) Laparoscopic omental flap mobilization is safe and effective. d) Laparoscopy is only suitable for adult patients.

In one of the referenced studies, what additional imaging technique was used to assess the viability of the omental flap? a) CT scan b) X-ray c) MRI d) Intraoperative fluorescence imaging using indocyanine green

According to the study by Ohtaki et al., what is the range of the clinical observation period for pediatric moyamoya patients who underwent omental transplantation? a) 1.9 to 6.7 years b) 6.7 to 9.2 years c) 1.9 to 10 years d) 0.9 to 5.2 years

Answers:

b) Progressive stenosis and occlusion of internal carotid arteries b) To improve blood flow and prevent stroke c) Laparotomy d) Five d) Postoperative complications and long-term outcomes b) 7.3% c) 6.2 days c) Laparoscopic omental flap mobilization is safe and effective. d) Intraoperative fluorescence imaging using indocyanine green b) 6.7 to 9.2 years

References

In patients with Moyamoya disease, cerebral revascularization using a pedicled omental flap has proven to be a viable option following direct revascularization procedures. Historically, harvesting omentum involved laparotomy with the associated risk of complications; herein we describe outcomes from a 10-year experience of laparoscopic harvesting of pedicled omental flap for cerebral revascularization in Moyamoya patients.

Methods: A retrospective chart review was performed of all patients with Moyamoya disease who underwent laparoscopic omental cerebral transposition between 2011 and 2021. Intraoperative and postoperative complications, length of stay (LOS), and outcomes at follow-up were analyzed.

Results: Twenty-one patients underwent the procedure during the study period. Three intraoperative complications occurred (one segmental transverse colectomy for mesenteric injury, one converted to omental free flap, and one requiring micro anastomosis). The average overall LOS was 6 ± 6 days, with 3 ± 3.5 days in the ICU (mean±SD). Following discharge, complications included epigastric incisional hernia at the graft fascial exit site, recurrent neck pain at the subcutaneous tunneling site, and partial scalp necrosis. One patient required subsequent direct bypass seven months after the initial procedure owing to the progression of the disease. All other patients had partial or complete resolution of symptoms.

Conclusion: Our retrospective observational study indicates that laparoscopic pedicled omental flap mobilization and transposition is a safe and effective method of indirect cerebral revascularization in patients with Moyamoya disease [1)]

report our techniques and outcomes in 2 adults with Moyamoya to undergo such a procedure. An omental flap based on the right gastroepiploic artery was created and intraoperative fluorescence imaging using indocyanine green was used to assess the viability of the flap and to guide lengthening of the pedicle. The flap was tunneled subcutaneously using skip incisions. There were no intraoperative complications and no postoperative complications related to the omental flap. Follow-up evaluation demonstrates viable omental flaps and improved cerebral vascularization. This technique is feasible in adults who require salvage cerebral revascularization for Moyamoya disease [2].

A retrospective chart review of all patients undergoing laparoscopic omental cerebral transposition for moyamoya disease between 2011 and 2014 was performed. Clinical indication, surgical technique, operative times, complications, and outcomes at follow-up were reviewed.

Results: A total of 7 children underwent the procedure. The general surgery team performed laparoscopic omental mobilization, extraperitonealization, and subcutaneous tunneling, while the neurosurgical team performed craniotomy and cerebral application of the graft. The patients were followed postoperatively with clinic visits and angiography. There was one intraoperative complication (colon injury) and one postoperative complication (intermittent omental hernia at fascial defect for pedicle). All patients had partial to complete symptomatic resolution and demonstrated adequate intracranial revascularization on angiography.

Conclusion: Laparoscopic omental pedicle flap mobilization and subcutaneous transposition is feasible in children who require salvage cerebral revascularization for moyamoya disease. The procedure should be considered for other conditions requiring extraperitoneal revascularization [3].

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refined a laparoscopic method of harvesting an omental flap that preserves its gastroepiploic arterial supply.

Methods: The pedicled omentum can be lengthened as needed by dividing it between the vascular arcades. It is transposed to the brain via skip incisions. The flap can be trimmed or stretched to cover ischemic areas of the brain. The cranial exposure is performed in parallel with pediatric surgeons. We performed this technique in 3 pediatric patients with moyamoya disease (aged 5-12 years) with previous superficial temporal artery to middle cerebral artery bypasses and progressive ischemic symptoms. In 1 patient, we transposed omentum to both hemispheres.

Results: Blood loss ranged from 75 to 250 mL. After surgery, patients immediately tolerated a diet and were discharged in 3 to 5 days. The ischemic symptoms of all 3 children resolved within 3 months postoperatively. Magnetic resonance imaging at 1 year showed improved perfusion and no new infarcts. Angiography showed excellent revascularization of targeted areas and patency of the donor gastroepiploic artery.

Conclusion: Laparoscopic omental harvest for cranial-omental transposition can be performed efficiently and safely. Patients with moyamoya disease appear to tolerate this technique much better than laparotomy. With this method, we can achieve excellent angiographic revascularization and resolution of ischemic symptoms [4].

Ohtaki et al. describe the long-term follow-up results for intellectual outcome and performance status and make an evaluation of regional cerebral hemodynamics after extensive omental transplantation spread over both frontal lobes performed as the initial management. In the past 10 years, 10 moyamoya patients less than 12 years of age consecutively underwent omental transplantation. The omental flap was spread over not only the symptomatic hemisphere but also the contralateral frontal lobe after a large craniotomy. Superficial temporal artery to middle cerebral artery (STA-MCA) anastomosis was accomplished simultaneously. On the contralateral hemisphere, STA-MCA anastomosis combined with encephalomyosynangiosis was subsequently performed. The clinical observation period averaged 6.7 years (ranging from 1.9 to 9.2 years). Apart from 2 patients in whom severe mental retardation had been disclosed pre-operatively, full-scale intelligence quotient scores have been maintained at over 90, that is, within the normal intellectual range. With respect to quality of life (QOL), these 8 patients have been leading normal daily lives since the operation. The focal decrease in CBF observed in the frontal lobe pre-operatively in 7 cases had disappeared after surgical treatment. In these patients, serial post-operative MR angiography revealed developed omental vessels and STAs. Deterioration of intellectual functions and QOL as well as cerebral ischaemic events in paediatric moyamoya patients can be prevented by extensive omental transplantation spread over both frontal lobes combined with STA-MCA anastomosis [5)]

Ten patients with ischemic cerebrovascular disease including three with adult moyamoya disease underwent this procedure (omental flap on eight sides and muscle flap on five sides). The muscle used for the flap was the serratus anterior muscle on two sides and the shaved latissimus dorsi muscle on three sides. Angiography and cerebral blood flow studies were performed in all patients preoperatively and postoperatively. All patients demonstrated severely impaired cerebrovascular reserve capacity due to occlusive disease.

There was one patient each with perioperative death and intracranial infection following omental flap loss, and two patients had perioperative strokes. The average follow-up period was 23.2 months. Of the nine surviving patients, all eight except for the one with flap loss had good outcome with complete resolution of neurologic episodes [6)].

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