



Embolization in Meningiomas: Functions and Clinical Implications

Fuming Logager*

Department of Neurosurgery, Naval Medical University, Shanghai, China

*Corresponding Author: Fuming Logager, Department of Neurosurgery, Naval Medical University, Shanghai, China; E-mail: logagerming090@yahoo.com

Received date: 25 March, 2024, Manuscript No. CICR-24-136268;

Editor assigned date: 27 March, 2024, PreQC No. CICR-24-136268 (PQ);

Reviewed date: 10 April, 2024, QC No. CICR-24-136268;

Revised date: 17 April, 2024, Manuscript No. CICR-24-136268 (R);

Published date: 24 April, 2024, DOI: 10.4172/CICR.1000300

Description

Meningiomas are common intracranial tumors arising from the meninges, with varying degrees of vascularity. Embolization, a minimally invasive procedure involving the occlusion of blood vessels supplying the tumor, has emerged as a valuable adjunctive therapy in the management of meningiomas. This manuscript provides an overview of the role of embolization in meningiomas, including its indications, techniques, outcomes, and complications. Furthermore, it discusses the mechanisms underlying embolization and its impact on tumor vascularity, surgical resectability, and patient outcomes.

Meningiomas constitute the most frequent primary intracranial tumors, accounting for approximately one-third of all central nervous system neoplasms. While most meningiomas are benign and slow-growing, their proximity to critical neurovascular structures often poses challenges in their management. Embolization, originally developed for the treatment of vascular malformations and tumors, has emerged as a valuable tool in the multimodal management of meningiomas. By selectively targeting tumor vasculature, embolization aims to reduce tumor vascularity, facilitate surgical resection, and improve patient outcomes.

Mechanisms of embolization

Embolization involves the selective occlusion of tumor-feeding arteries using embolic agents, typically delivered *via* endovascular catheterization. The embolic agents can be liquid, such as cyanoacrylate glue or ethylene vinyl alcohol copolymer (Onyx), or particulate, such as Polyvinyl Alcohol (PVA) particles or microspheres. Upon injection into the feeding arteries, these agents block blood flow to the tumor, leading to ischemia, necrosis, and shrinkage of the meningioma. Additionally, embolization induces thrombosis within the tumor vasculature, further compromising tumor perfusion and facilitating subsequent surgical resection.

Indications for embolization

Embolic agents are commonly used in meningiomas with high vascularity, large tumor size, or complex vascular anatomy. The primary indications for embolization in meningiomas include:

Preoperative tumor devascularization: Embolization reduces intraoperative bleeding and facilitates safe surgical resection by decreasing tumor vascularity and improving surgical access.

Symptomatic relief: In cases where surgical resection is not feasible or desirable, embolization can provide symptomatic relief by reducing tumor size and mass effect, alleviating symptoms such as headache, seizures, and neurological deficits.

Adjuvant therapy: Embolization may be used as an adjunctive therapy in combination with surgery, radiation therapy, or radiosurgery to enhance treatment efficacy and long-term tumor control.

Techniques of embolization

Digital Subtraction Angiography (DSA): DSA is performed to visualize the arterial supply to the meningioma and identify the feeding arteries. Selective catheterization of these arteries is then performed under fluoroscopic guidance.

Superselective embolization: Superselective catheterization allows for precise delivery of embolic agents into the tumor-feeding arteries while minimizing collateral damage to normal brain tissue.

Onyx embolization: Onyx is a liquid embolic agent with unique properties that enable controlled and targeted embolization. Its slow polymerization allows for better penetration into the tumor vasculature and reduces the risk of reflux or non-target embolization.

Particle embolization: Particulate embolic agents, such as PVA particles or microspheres, are used to occlude larger tumor vessels and achieve proximal occlusion of the feeding arteries.

Clinical outcomes and complications

Surgical resectability: Embolization has been shown to improve surgical resectability in meningiomas by reducing tumor vascularity, minimizing intraoperative bleeding, and facilitating tumor devascularization.

Symptomatic relief: Embolization can provide symptomatic relief in symptomatic meningiomas by reducing tumor size and mass effect, alleviating symptoms such as headache, seizures, and neurological deficits.

Complications: While embolization is generally safe, it carries inherent risks, including thromboembolic events, vessel dissection, ischemic stroke, and non-target embolization. Careful patient selection, meticulous technique, and close post-procedural monitoring are essential to minimize complications.

Future directions and emerging trends

Targeted therapies: Advances in molecular imaging and targeted therapies hold promise for personalized treatment approaches in meningiomas. Targeted embolization using novel molecular markers or monoclonal antibodies may enhance tumor specificity and reduce off-target effects.

Combination therapies: Combining embolization with other treatment modalities, such as radiation therapy, immunotherapy, or targeted drug delivery, may improve treatment efficacy and long-term tumor control.

Minimally invasive techniques: Emerging techniques, such as Transarterial Chemoembolization (TACE) and transvenous embolization, offer less invasive alternatives to traditional embolization approaches and may expand the treatment options for meningiomas.

Embolization has emerged as a valuable adjunctive therapy in the management of meningiomas, offering benefits in terms of tumor devascularization, surgical resectability, and symptomatic relief. By

selectively targeting tumor vasculature, embolization reduces tumor vascularity, facilitates safe surgical resection, and improves patient outcomes. However, careful patient selection, meticulous technique, and close post-procedural monitoring are essential to minimize complications. Continued research and innovation in embolization techniques, targeted therapies, and combination approaches hold promise for further improving the management of meningiomas and enhancing patient care.