

VASCULAR EMBOLIZATION: INDICATIONS, MATERIALS AND TECHNIQUES

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Summary

Recent advances in medicine have allowed the treatment of many illnesses to be more focal and less invasive. For example, a blocked coronary artery can now be opened with balloon dilation (angioplasty) and/or placing a stent with cardiac catheterization rather than needing open heart surgery for coronary artery bypass.

Embolization or embolotherapy is a relatively new set of minimally invasive procedures performed by interventional radiologists and other endovascular specialists. It has become a primary or complimentary method of treatment in a wide variety of pathologic processes. Each of these conditions has a different underlying pathophysiology driving the process, and therefore requires a different treatment plan. Advances in embolic agents as well as catheters and guiding sheaths have allowed more safe and effective ways to treat even the most complex and difficult of these lesions.

This chapter will introduce the reader to the principles of embolization, discuss the various embolic agents currently available and describe the equipment and techniques utilized in the performance of these procedures.

1. Introduction

1.1. Background

Embolization is a set of minimally invasive procedures, which are typically performed by interventional radiologists and other endovascular subspecialists to stop flow within a vessel. Embolization is performed for a wide spectrum of indications. The goal of

every embolization is to effectively treat the underlying problem with minimal or no damage to the surrounding structures.

Embolotherapy is utilized to treat a wide spectrum of pathologic processes, including neoplastic, congenital and post-traumatic ones. Each of these conditions has a different underlying pathophysiology driving the process, and therefore requires a different treatment plan. Depending on the underlying process, embolization may be an ideal therapy, a prelude to or complementary to other treatment, the only viable palliative therapy or may not appropriate at all.

<u>Goal of Embolization</u>	<u>Indications</u>
Stop Bleeding	Gastrointestinal-ulcers, diverticulae, varices, tumors, epistaxis Genitourinary-Iatrogenic, tumors, AVMs bronchial, intracranial, traumatic
Treat Vascular Lesion Malformation Pain, Prevent Bleeding, Cosmetic,	AVM's, AVF's, Aneurysms, Pseudoaneurysms, testicular varicocele, PCS
Infarct Tumor Malignant tumors usually inoperable tumors &/or patients- +/- Chemo +/- other rx i.e. Chemo, RFA Benign Tumors-Rx prevent symptoms or bleeding	Liver-HCC, Metastatic Endocrine, GI Kidney- RCC Other Sarcomas, endocrine tumors Fibroids, Renal Angiomyolipoma, ?Prostate
Preoperative Prevent Bleeding, Shrink Tumors	Any Vascular tumor- Head & Neck, Spine, Bone Renal, RP, Liver,

Table 1. Common indications for embolization

Knowledge of the standard and variant vascular anatomy of the involved territory as well as an understanding the target lesion circulation is essential to achieve safe and effective embolization and can avoid complications. With the advent of CT and MR angiography much of this information can be obtained noninvasively, which is very helpful for treatment planning; but ultimately, a conventional angiogram will be done at the time of the procedure and this will usually provide the most accurate depiction of the vascular anatomy.

The materials used in embolization can be categorized into permanent and temporary agents. The size of the agent will determine the level of vascular occlusion. Depending on the pathophysiology of the ailment and clinical scenario, an appropriate agent(s) is selected. For example, a neoplastic process will require occlusion at the small

vessel/capillary level to achieve ischemia/infarction but a post-traumatic process may require occlusion at the arterial level to halt a potentially life threatening hemorrhage. All agents require deployment via a needle or catheter access in the targeted vessel.

1.2. History

The first documented embolization is by Dawbain in 1904 when paraffin was injected into the external carotid artery of a patient with head and neck tumor preoperatively. Subsequently new embolic agents such as gelfoam pledgets by Carey in 1974, PVA particles by Tadavarthy in 1974 and steel coils by Gianturco and Wallace in 1975 were introduced. Over the last two decades, numerous embolic agents have been developed and the catheter and microcatheter equipment used to deliver them have been refined and modified. Today embolic therapy is routinely used to treat disease processes from uterine fibroids to vascular malformations.

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Bibliography

Baur JR, Ray CE. (2004). Transcatheter Arterial Embolization in the Trauma Patient: A Review. *Seminars in Interventional Radiology*: 2004;21 (1):11-22. [This is a review of the indications for embolization in the trauma patient and to provide guidelines regarding techniques and material selection]

Funaki B. Microcatheter embolization of lower gastrointestinal hemorrhage: an old idea whose time has come. *Cardiovasc Intervent Radiol* 2004;27:591-599. [This article reviews the current status of co-axial microcatheter embolization with an emphasis on the technical aspects of the procedure]

Lee KH, Sung KB, Lee DY, Park SJ, Kim KW, Yu JS. Chemoembolization for hepatocellular carcinoma: anatomic and hemodynamic consideration in the hepatic artery and portal vein. *Radiographics* 2002; 22:1077-91. [This report discusses the thorough understanding of the anatomic variants and hemodynamic features of the hepatic artery and portal vein as the first step in performing effective and safe TACE for HCC]

Mitty HA, Sterling KM, Alvarez M, Gendler R. Obstetric Hemorrhage: Prophylactic and Emergency Arterial Catheterization and Embolotherapy. *Radiology* 1993;188(1):183-187. [This reports on prophylactic arterial catheterization and its role in patients with increased risk for obstetric hemorrhage]

Sze DY, Kao JS, Frisoli JK, McCallum SW, Kennedy WA 2nd, Razavi MK. Persistent and recurrent postsurgical varicoceles: venographic anatomy and treatment with N-butyl cyanoacrylate embolization. *J Vasc Interv Radiology*. 2008; 19(4):539-545. [This review concludes NBCA embolization effectively treats duplicated vessels, resulting in a high rate of clinical success on short-term follow-up]

Tulsyan N, Kashyap VS, Greenberg RK, Sarac TP, Clair DG, Pierce G, Ouriel K. The endovascular management of visceral artery aneurysms and pseudoaneurysms. *J Vasc Surg* 2007;45:276-283. [This study reviews the outcomes of the management of visceral artery aneurysms with catheter-based techniques]

Biographical Sketches

Dr. David Siegel is Chief of Interventional Radiology Services for the North Shore LIJ Health System and Associate Professor of Radiology at the Hofstra-North Shore LIJ School of Medicine. He is an attending in the Departments of Radiology, Surgery and Urology.

Dr. Siegel is a Fellow of the Society of Interventional Radiology, a Fellow and Vice president of the International Society of Angiology and a member of the Radiological Society of North America, the American College of Radiology, the New York State Radiological Society, and the Society of Pediatric Interventional Radiology.

While performing the entire gamut of imaging guided interventional procedures he has a particular interest in GU and GYN Intervention, Aneurysm Treatment and Imaging, and the treatment of Vascular Malformations. Dr. Siegel has one of the largest personal experiences with percutaneous renal tumor cryoablation, gonadal vein embolization for the treatment varicocele and pelvic congestion syndrome and uterine fibroid embolization. He served as a principal investigator for the “Uterine Artery Embolization Fibroid Registry for Outcomes Data” study, the ongoing “MRI/TRUS Fusion Guided Prostate Biopsy- An Improved Way to Detect and Quantify Prostate Cancer. A Phase II Study” and the soon to begin “Safety and Efficacy of Embosphere Microspheres for Uterine Artery Embolization for Symptomatic Uterine Fibroids” He has authored over 25 articles, participated in over 30 scientific abstracts and poster presentations and delivered more than 50 invited lectures.

Dr. Chris Sung is a board certified radiologist with a certificate of advanced qualification in Interventional Radiology. He is an assistant Professor of Radiology at the Hofstra-North Shore LIJ School of Medicine. He is an attending in the Department of Radiology at the LIJ Medical Center. He is a member of the Society of Interventional Radiology, Radiological Society of North America, the American College of Radiology, and the New York State Radiological Society.