



CAR Standards for Therapeutic Embolization

The standards of the Canadian Association of Radiologists (CAR) are not rules, but are guidelines that attempt to define principles of practice that should generally produce radiological care. The physician and medical high-quality physicist may modify an existing standard as determined by the individual patient and available resources. Adherence to CAR standards will not assure a successful outcome in every situation. The standards should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed to obtaining the same results. The standards are not intended to establish a legal standard of care or conduct, and deviation from a standard does not, in and of itself, indicate or imply that such medical practice is below an acceptable level of care. The ultimate judgment regarding the propriety of any specific procedure or course of conduct must be made by the physician and medical physicist in light of all circumstances presented by the individual situation.

1. Introduction and Definition

The deliberate occlusion of arteries, veins, or abnormal vascular spaces by embolic material injected through a selectively positioned catheter was one of the earliest and is now one of the most common therapeutic applications of interventional radiology. The technique can usually be performed through a percutaneous approach under local anaesthetic making it an attractive alternative to surgery in those patients with appropriate lesions. There are also certain lesions amenable to embolization for which no other effective form of medical or surgical therapy is applicable.

2. Radiologist Qualifications

That Physicians involved in the performance, supervision and interpretation of therapeutic embolization should be Diagnostic Radiologists and must have a Fellowship or Certification in Diagnostic Radiology with the Royal College of Physicians and Surgeons of Canada and/or the Collège des médecins du Québec. Also acceptable are foreign Specialist qualifications if the Radiologist so qualified holds an appointment in Radiology with a Canadian University.

As new imaging modalities and interventional techniques are developed additional clinical training, under supervision and with proper documentation, should be obtained before radiologists interpret or perform such examinations or procedures independently. Such additional training must meet with pertinent provincial/regional regulations. Continuing professional development must meet with the requirements of the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada.

3. Indications and Contraindications

Indications

Arterial:

- Acute bleeding
- gastrointestinal
- bronchial
- renal
- bladder
- gynaecologic
- epitaxis
- post-traumatic (including post-biopsy)

Tumors

- definitive treatment
- preoperative
- palliative

Vascular abnormalities

- intracranial
- arterial venous malformations - congenital
- arterial venous malformations - acquired
- fistulas - congenital
- fistulas - acquired
- hypersplenism
- priapism
- parathyroid ablation

Venous

- varicocele embolization - infertility ; pain ; cosmetic
- varices
- adrenal venous obliteration
- erectile dysfunction
- venous malformation

Contraindications

Whether a specific entity represents an absolute or relative contraindication depends upon the acuity of the patient's condition and the availability of an alternative therapy.

- Allergy to iodinated contrast
- Coagulopathy (should be corrected if appropriate)
- Renal failure
- Inability to place catheter selectively within the supplying vasculature so that embolization of normal vessels will cause significant morbidity
- Inability to visualize an artery known to supply a vital structure arising from the vascular field to be embolized (e.g., anterior spinal artery in embolization of vertebral lesions)
- Inability to guarantee that embolic particles will stay within the abnormal vascular bed

4. Examination Technique, Performance and Related Matters

A. Preprocedure

A treatment plan for each case should be established before the procedure is undertaken. The suspected etiology of the bleeding as well as the immediate post-treatment plans for the patient should be taken into consideration. An intravenous should be started prior to arterial embolization and the patient should be well hydrated before, during and after the procedure. Perioperative antibiotics should be given for solid organ embolization.

An angiogram of the affected area should be performed, choosing a route of access which is likely to allow selected catheter placement into the affected feeding vessels.

B. Procedure

Meticulous angiographic technique is necessary. State-of-the-art high quality fluoroscopy with rapid sequence image recording is necessary to monitor proper positioning of the catheter, transport of the embolic and hemodynamic changes that occur after vessel occlusion. Atraumatic punctures are preferable as bleeding around the puncture site is not well tolerated in a long procedure. As catheters delivering emboli may become obstructed and require exchanging, a sheath at the introduction site is recommended. The catheter chosen also depends on the potential type of embolic material to be used. Catheters with side holes are not appropriate for most embolizations - they are never to be used with coils.

Once the vascular anomaly has been identified, the type of embolic material, and its positioning are chosen. The choice of liquid or solid emboli, the permanent or temporary occlusion depends upon the state of the patient, the nature of the lesion, the plans for the patient in the immediate post-embolic period, the ability to selectively place the catheter, collateral blood supply to the lesion, supply of normal structures by the same vascular tree, and size of vascular shunts. Continuous fluoroscopic monitoring is essential during delivery of embolic material. Allowance must be made for changing hemodynamics during the embolization to avoid inadvertent embolization of non-pathologic vessels. Careful removal of the catheter from the vascular field and cautious post-embolization angiography are a part of this process.

C. Post-Procedure

Standard post-diagnostic angiography care is essential. In addition the patient should be kept hydrated and anti-pyretics administered if a large or solid organ embolization is performed. In-hospital observation is necessary for most arterial embolizations.

5. Materials Used for Embolization

Temporary occlusive agents:

- autologous blood clot
- gelfoam
- oxidized cellulose
- microfibrillar collagen

Permanent occlusive agents:

- ivalon
- Gianturco coils
- sialastic beads
- balloon emboli
- alcohol
- cyanoacrylate
- hypertonic dextrose

6. Complications of Embolization

Complications include those of any angiographic procedure. These are described in the Standards of Diagnostic Angiography. In addition, complications of embolization procedures can be divided into those which are specific to the organ system embolized and those of embolization as a whole. Complications occur more frequently in patients who are embolized for tumours as those patients are usually debilitated and are less capable of maintaining homeostasis.

A. Organ Specific

These essentially relate to loss of function of the devitalized organ. Abscess formation can occur after solid organ embolization, particularly in the spleen.

B. General Embolization Complications:

Post embolization syndrome is characterized by fever, high white blood cell count, pain, and not uncommonly gas within the tissue. It occurs in 40% of patients and lasts from 3-5 days.

The most serious complication of embolizing is occlusion of a non-target vessel either by over injection of emboli or by passage of emboli into collateral vessels. This can be avoided by careful fluoroscopic monitoring and using small injections for better control. Under certain circumstances an occlusion balloon catheter will help to control the flow of emboli.

Vascular rupture can occur if there is over-inflation of the balloon catheter within an artery.

References

1. Castaneda-Zuniga WR, Tadavarthy SM. Interventional Radiology. Williams and Wilkins, 1992. Chapter 3
2. Cope C, Burke D, Meranze S. Atlas of Interventional Radiology. JB Lippincott Company 1990. Chapter 6
3. Hemingway AP, Allison DJ. Complications of Embolization: Analysis of 410 Procedures. Radiology, 1988; 166:669-673
4. Johnsrude IS, Jackson DC, Dunnick NR. A Practical Approach to Angiography. Brown & Co., 1987. Chapter 5
5. Allison DJ, Wallace S, Machan IS. Interventional Radiology. In: Diagnostic Radiology. Grainger RG, Allison DJ. Second Edition. Churchill Livingstone, 1992