

Carbon Dioxide Angiography

- Author: Kyung J Cho, MD, FACR, FSIR; Chief Editor: Eugene C Lin, MD [more...](#)

Updated: Sep 26, 2013

Adverse Effects and Management

The occurrence and severity of the adverse effects of angiography may be related to the dose or to air contamination.

CO₂ aortography and celiac arteriography may cause nausea and pain lasting 2-3 minutes. No specific treatment is required. Placing the patient in a left- or right-side-up position may relieve the pain. A decrease in the doses of CO₂ usually reduces the frequency and severity of pain.

The injection of CO₂ for runoff of the lower extremities may cause pain. Decreasing the amount of CO₂ with selective injection and stacking technique helps in reducing the pain.

The injection of CO₂ into a peripheral vein for upper-extremity venography may cause pain at the injection site. The mechanism of pain is probably the explosive delivery secondary to gas compression. Purging the injection tube with 3 cc of CO₂ and administering 20-40 mg of lidocaine immediately before the injection of CO₂ for venous imaging helps in reducing the pain.

When CO₂ is trapped in an aortic aneurysm, the gas bubbles may occlude the inferior mesenteric artery, resulting in colonic ischemia.

Inadvertent injection of excessive volumes of CO₂ or air contamination may cause a vapor lock in the pulmonary artery, which results in severe hypotension. When air contamination occurs, fluoroscopy of the chest shows gas bubbles in the pulmonary artery that persists for longer than 30 seconds. If hypotension develops, the patient should be placed in the Trendelenburg and left lateral decubitus positions. If possible, air should be aspirated from the pulmonary artery using a catheter.^[22, 23]

Contributor Information and Disclosures

Author

Kyung J Cho, MD, FACR, FSIR William Martel Professor of Radiology, Interventional Radiology, University of Michigan Health System, Frankel Cardiovascular Center

Kyung J Cho, MD, FACR, FSIR, is a member of the following medical societies: [American College of Radiology](#), [American Heart Association](#), [American Medical Association](#), [American Roentgen Ray Society](#), [Association of University Radiologists](#), and [Radiological Society of North America](#)

Disclosure: Nothing to disclose.

Coauthor(s)

Irvin F Hawkins Jr, MD Professor of Radiology, Professor of Surgery, University of Florida College of Medicine

Irvin F Hawkins Jr, MD is a member of the following medical societies: [Florida Medical Association](#), [Radiological Society of North America](#), and [Society of Cardiovascular and Interventional Radiology](#)

Disclosure: Angiodynamics Royalty Consulting

Specialty Editor Board

Anthony Watkinson, MD Professor of Interventional Radiology, The Peninsula Medical School; Consultant and Senior Lecturer, Department of Radiology, The Royal Devon and Exeter Hospital, UK

Anthony Watkinson, MD is a member of the following medical societies: [Radiological Society of North America](#), [Royal College of Radiologists](#), and [Royal College of Surgeons of England](#)

Disclosure: Nothing to disclose.

Bernard D Coombs, MB, ChB, PhD Consulting Staff, Department of Specialist Rehabilitation Services, Hutt Valley District Health Board, New Zealand

Disclosure: Nothing to disclose.

Douglas M Coldwell, MD, PhD Professor of Radiology, Director, Division of Vascular and Interventional Radiology, University of Louisville School of Medicine

Douglas M Coldwell, MD, PhD is a member of the following medical societies: [American Association for Cancer Research](#), [American College of Radiology](#), [American Heart Association](#), [American Physical Society](#), [American Roentgen Ray Society](#), [Society of Cardiovascular and Interventional Radiology](#), [Southwest Oncology Group](#), and [Special Operations Medical Association](#)

Disclosure: Sirtex, Inc. Consulting fee Speaking and teaching; DFINE, Inc. Honoraria Consulting

Robert M Krasny, MD Resolution Imaging Medical Corporation

Robert M Krasny, MD is a member of the following medical societies: [American Roentgen Ray Society](#) and [Radiological Society of North America](#)

Disclosure: Nothing to disclose.

Chief Editor

Eugene C Lin, MD Attending Radiologist, Teaching Coordinator for Cardiac Imaging, Radiology Residency Program, Virginia Mason Medical Center; Clinical Assistant Professor of Radiology, University of Washington School of Medicine

Eugene C Lin, MD is a member of the following medical societies: [American College of Nuclear Medicine](#), [American College of Radiology](#), [Radiological Society of North America](#), and [Society of Nuclear Medicine](#)

Disclosure: Nothing to disclose.

References

1. Beese RC, Bees NR, Belli AM. Renal angiography using carbon dioxide. *Br J Radiol*. Jan 2000;73(865):3-6. [Medline].
2. Boyd-Kranis R, Sullivan KL, Eschelmann DJ, et al. Accuracy and safety of carbon dioxide inferior vena cavography. *J Vasc Interv Radiol*. Oct 1999;10(9):1183-9. [Medline].
3. Diaz LP, Pabon IP, Garcia JA, de la Cal Lopez MA. Assessment of CO2 arteriography in arterial occlusive disease of the lower extremities. *J Vasc Interv Radiol*. Feb 2000;11(2 Pt 1):163-9. [Medline].
4. Hawkins IF. Carbon dioxide digital subtraction arteriography. *AJR Am J Roentgenol*. Jul 1982;139(1):19-24. [Medline].
5. Sullivan KL, Bonn J, Shapiro MJ, Gardiner GA. Venography with carbon dioxide as a contrast agent. *Cardiovasc Intervent Radiol*. May-Jun 1995;18(3):141-5. [Medline].
6. Taylor FC, Smith DC, Watkins GE, et al. *Cardiovasc and Intervent Radiol*. 1998;22:150-151.
7. Kyung J, Cho, Irvin F, Hawkins, *Carbon Dioxide Angiography*, informa healthcare; 2007.
8. Caridi JG, Hawkins IF Jr, Klioze SD, Leveen RF. Carbon dioxide digital subtraction angiography: the practical approach. *Tech Vasc Interv Radiol*. Mar 2001;4(1):57-65. [Medline].
9. Hawkins IF, Caridi JG, Klioze SD, Mladinich CR. Modified plastic bag system with O-ring fitting connection for carbon dioxide angiography. *AJR Am J Roentgenol*. Jan 2001;176(1):229-32. [Medline].
10. Moresco KP, Patel NH, Namyslowski Y, et al. Carbon dioxide angiography of the transplanted kidney: technical considerations and imaging findings. *AJR Am J Roentgenol*. Nov 1998;171(5):1271-6. [Medline].
11. Spinosa DJ, Angle JF, Hagspiel KD, et al. Lower extremity arteriography with use of iodinated contrast material or gadodiamide to supplement CO2 angiography in patients with renal insufficiency. *J Vasc Interv Radiol*. Jan 2000;11(1):35-43. [Medline].
12. Eschelmann DJ, Sullivan KL, Bonn J, Gardiner GA. Carbon dioxide as a contrast agent to guide vascular interventional procedures. *AJR Am J Roentgenol*. Nov 1998;171(5):1265-70. [Medline].
13. Hahn ST, Pfammatter T, Cho KJ. Carbon dioxide gas as a venous contrast agent to guide upper-arm insertion of central venous catheters. *Cardiovasc Intervent Radiol*. May-Jun 1995;18(3):146-9. [Medline].
14. Hawkins IF, Johnson AW, Caridi JG, Weingarten KE. CO2 fine-needle TIPS. *J Vasc Interv Radiol*. Mar-Apr 1997;8(2):235-9. [Medline].
15. Kerns SR, Hawkins IF. Carbon dioxide digital subtraction angiography: expanding applications and technical evolution. *AJR Am J Roentgenol*. Mar 1995;164(3):735-41. [Medline].
16. Vlachogiannakos J, Patch D, Watkinson A, et al. Carbon-dioxide portography: an expanding role?. *Lancet*. Mar 18 2000;355(9208):987-8. [Medline].
17. Weaver FA, Pentecost MJ, Yellin AE, et al. Clinical applications of carbon dioxide/digital subtraction arteriography. *J Vasc Surg*. Feb 1991;13(2):266-72; discussion 272-3. [Medline].
18. Criado E, Kabbani L, Cho K. Catheter-less angiography for endovascular aortic aneurysm repair: A new application of carbon dioxide as a contrast agent. *J Vasc Surg*. Jul 14 2008;[Medline].
19. Mahnken AH, Bruners P, Mommertz G, Mühlenbruch G, Jacobs MJ, Günther RW, et al. Carbon dioxide contrast agent for CT arteriography: results in a porcine model. *J Vasc Interv Radiol*. Jul 2008;19(7):1055-64. [Medline].
20. Schatlo B, Gläsker S, Zauner A, Thompson GB, Oldfield EH, Pluta RM. Correlation of end-tidal CO2 with transcranial Doppler flow velocity is decreased during chemoregulation in delayed cerebral vasospasm after subarachnoid haemorrhage—results of a pilot study. *Acta Neurochir Suppl*. 2008;104:249-50. [Medline].
21. Giday SA, Ko CW, Clarke JO, Shin EJ, Magno P, Jagannath SB, et al. EUS-guided portal vein carbon dioxide angiography: a pilot study in a porcine model. *Gastrointest Endosc*. Oct 2007;66(4):814-9. [Medline].
22. Caridi JG, Hawkins IF. CO2 digital subtraction angiography: potential complications and their prevention. *J Vasc Interv Radiol*. May-Jun 1997;8(3):383-91. [Medline].
23. Matsuo T, Fujiwara H, Gobara H, Mimura H, Kanazawa S. Central Retinal and Posterior Ciliary Artery Occlusion After Intralesional Injection of Sclerosant to Glabellar Subcutaneous Hemangioma. *Cardiovasc Intervent Radiol*. Jun 20 2008;[Medline].
24. Cho KJ, Hawkins IF Jr. Discontinuation of the plastic bag delivery system for carbon dioxide angiography will increase radiocontrast nephropathy and life-threatening complications. *AJR Am J Roentgenol*. Nov 2011;197(5):W940-1. [Medline].

25. Huang SG, Woo K, Moos JM, et al. A prospective study of carbon dioxide digital subtraction versus standard contrast arteriography in the detection of endoleaks in endovascular abdominal aortic aneurysm repairs. *Ann Vasc Surg.* Jan 2013;27(1):38-44. [Medline].
26. Johnston WF, Zamora AJ, Upchurch GR Jr. Transient paralysis from carbon dioxide angiography in a patient after four-vessel endovascular thoracoabdominal aortic aneurysm repair. *J Vasc Surg.* Dec 2012;56(6):1717-20. [Medline].
27. Koizumi J, Hashimoto T, Myojin K, et al. Carbon dioxide (CO2) vs iodinated contrast digital subtraction angiography during balloon-occluded retrograde transvenous obliteration (BRTO) using foam sclerosant for gastric varices. *J Vasc Interv Radiol.* Nov 2012;23(11):1453-1459.e1. [Medline].
28. Kusuyama T, Iida H, Mitsui H. Intravascular ultrasound complements the diagnostic capability of carbon dioxide digital subtraction angiography for patients with allergies to iodinated contrast medium. *Catheter Cardiovasc Interv.* Nov 15 2012;80(6):E82-6. [Medline].
29. Moos JM, Ham SW, Han SM, et al. Safety of carbon dioxide digital subtraction angiography. *Arch Surg.* Dec 2011;146(12):1428-32. [Medline].
30. Nadolski GJ, Stavropoulos SW. Contrast alternatives for iodinated contrast allergy and renal dysfunction: options and limitations. *J Vasc Surg.* Feb 2013;57(2):593-8. [Medline].

Medscape Reference © 2011 WebMD, LLC