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1: *Cardiovasc Intervent Radiol* 1999 Mar-Apr;22
(2):150-1

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Balloon occlusion versus wedged hepatic venography using carbon dioxide for portal vein opacification during TIPS.

Taylor FC, Smith DC, Watkins GE, Kohne RE, Suh RD

Department of Radiology, Loma Linda University Medical Center,
11234 Anderson Street, Loma Linda, CA 92354, USA.

Balloon occlusion hepatic venography using carbon dioxide (CO₂) is proposed as a safer yet simpler alternative to wedged catheter techniques that have caused hepatic lacerations during the transjugular intrahepatic portosystemic shunt (TIPS) procedure. The image quality of CO₂ wedged catheter and balloon occlusion venograms was comparable in our small series, with no venographic-related complications occurring in the balloon occlusion group.

PMID: 10094998, UI: 99196853

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1: *Abdom Imaging* 1999 May-Jun;24(3):301-3

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Abdominal
Imaging

Aortocaval fistula: diagnosis with carbon dioxide angiography.

Rajan DK, Croteau DL, Kazmers A

Department of Radiology, Wayne State University School of Medicine, Detroit Receiving Hospital, 3L-8, 4201 St. Antoine, Detroit, MI 48201, USA.

Aortocaval fistulas are an uncommon complication of atherosclerotic aneurysms that can present with a variety of clinical symptoms. Many of these patients present with oliguric renal failure, a contraindication for the use of iodinated contrast in radiological studies. We present a case of an aortocaval fistula diagnosed by using carbon dioxide gas without the use of traditional contrast media.

PMID: 10227899, UI: 99244656

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1: *Rofo Fortschr Geb Rontgenstr Neuen Bildgeb
Verfahr* 1999 Apr;170(4):384-90

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[Transfemoral pelvic vein angiography with CO₂: experiences with pressure- and volume-controlled injections].

[Article in German]

**Albrich H, Gmeinwieser J, Manke C, Strotzer M, Kasprzak P,
Feuerbach S**

Institut für Röntgendiagnostik, Klinikum der Universität Regensburg.

PURPOSE: To evaluate the efficacy of CO₂ in aortobifemoral DSA with a pressure- and volume-controlled injector. **MATERIALS AND METHODS:** In an intraindividual prospective study, 42 patients with arterial occlusive disease underwent stepwise aortobifemoral DSA with CO₂ and with iopromid 300. **RESULTS:** With Co₂, diagnostic images were obtained in 74% of the iliac, 98% of the femoral, 89% of the popliteal arteries, but in only 36% of the arteries of the lower leg. 73% of the stenoses were correctly identified. With therapeutic relevance 8% of the stenoses were overestimated. The length of 1 of 53 occlusions was overestimated and 3 occlusions were simulated. No stenoses or occlusion was missed. There were no severe side-effects. The injector proved to be safe and easy to handle. Fragmentation of the CO₂ bolus could be compensated by postprocessing with a minimum opacification summation mode. **CONCLUSIONS:** With the equipment used, CO₂ was a safe alternative to iodinated CM in routine stepwise aortobifemoral DSA of the iliac, femoral, and popliteal arteries. Because of the risk of overestimation, occlusions and high grade stenoses should be verified with selective injections or iodinated CM before PTA or operations.

PMID: 10341798, UI: 99273344

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1: Radiologe 1999 May;39(5):404-14

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Der Radiologe

[Radiodiagnosis following kidney transplantation].

[Article in German]

Schenk JP, Hansmann J, Hallscheidt P, Weingard K, Wiesel M, Leutloff CU, Dux M, Richter GM, Kauffmann GW

Abteilung Radiodiagnostik, Radiologische Universitätsklinik Heidelberg.

Diagnostic imaging after renal transplantation is of high importance in the differential diagnosis of peri- and postoperative complications. Sonography with color duplex imaging is the method of choice in the diagnosis of acute transplant rejection. MRI is an additional method in the diagnosis of transplant dysfunction especially in diagnosis of perirenal fluid collections. MR angiography and MR urography are noninvasive diagnostic modalities with the potential to replace angiography and pyelography. Angiography, complemented by carbon dioxide angiography, still is the gold standard in the diagnosis of transplant artery stenosis.

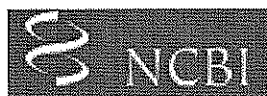
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PMID: 10384696, UI: 99312690

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1: *Cardiovasc Surg* 1999 Apr;7(3):323-6

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Arteriography in chronic renal failure: a case for carbon dioxide.

Fitridge RA, Petrucco M, Dunlop CM, Thompson MM, Sebben RA

University of Adelaide, Department of Surgery, The Queen Elizabeth Hospital, Woodville, SA, Australia. rfitridge@medicine.adelaide.edu.au

PURPOSE: The aim of this study was to assess the utilisation of carbon dioxide arteriography, performed with a simple injection system, as the imaging technique of choice in patients with chronic renal failure. **METHODS:** Patients with chronic renal impairment who required arterial imaging or intervention were recruited for carbon dioxide angiography. Demographic data were prospectively recorded and pre- and post-arteriogram renal function was quantified. Radiographic images were graded by an independent radiologist. **RESULTS:** Twenty-eight patients underwent renal or aorto-femoral studies with only one failure. There were no cases of contrast-induced nephropathy. Twenty-two of the films (79%) were graded as excellent or good, four as acceptable and two were considered to be poor (non-diagnostic). **CONCLUSIONS:** This study has demonstrated that carbon dioxide angiography is a safe and clinically effective procedure in patients with chronic renal failure.

PMID: 10386750, UI: 99313321

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1: *J Thorac Cardiovasc Surg* 1999 Sep;118
(3):557-8

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J Thorac Cardiovasc Surg

Carbon dioxide embolism during endoscopic saphenectomy for coronary artery bypass surgery.

Chavanon O, Tremblay I, Delay D, Bouveret A, Blain R, Perrault LP

Department of Surgery, Montreal Heart Institute, Quebec, Canada.

PMID: 10469975, UI: 99400851

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1: *Hepatogastroenterology* 1999 Jul-Aug;46
(28):2249-53

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Published erratum appears in *Hepatogastroenterology* 1999 Nov-Dec;46
(30):following table of contents

Ultrasonographic evaluation of portal blood flow using transhepatic carbon dioxide injection.

**Sakaguchi H, Seki S, Tamori A, Gotoh T, Koh N, Kuroki T,
Takashima S, Nakamura K, Yamada R**

Third Department of Internal Medicine, Osaka City University Medical
School, Japan.

BACKGROUND/AIMS: The evaluation of portal blood flow in hepatic mass is important for the diagnosis of hepatocellular carcinoma. We have designed a new method to easily evaluate portal blood flow in hepatic mass using ultrasonography with injection of carbon dioxide into the intrahepatic portal vein by direct puncture with a fine needle.

METHODOLOGY: We evaluated 29 masses in the liver of 20 patients ultrasonically with injection of carbon dioxide into the intrahepatic portal vein. **RESULTS:** Of 29 space-occupying lesions (SOLs), 13 were found to have portal blood flow and 16 were found to have no portal flow by this method. All 15 SOLs which had no portal flow were histologically confirmed to be hepatocellular carcinoma. Of 13 SOLs with portal flow, 5 were confirmed to be hepatocellular carcinoma. For 7 of 9 SOLs in which both this method and arterial portographic computed tomography were performed, the results were in agreement. **CONCLUSIONS:**

Ultrasonographic evaluation of portal blood flow using transhepatic carbon dioxide injection appears to be useful for the evaluation of portal flow in mass and may aid in the diagnosis and management of mass in patients with liver disease.

PMID: 10521975, UI: 99451449

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1: *J Vasc Interv Radiol* 1999 Oct;10(9):1183-9

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Accuracy and safety of carbon dioxide inferior vena cavography.

Boyd-Kranis R, Sullivan KL, Eschelmann DJ, Bonn J, Gardiner GA

Department of Radiology, Thomas Jefferson University Hospital and Jefferson University Hospital and Jefferson Medical College, Philadelphia, PA 19107, USA.

PURPOSE: The purpose of this study was to assess the accuracy of carbon dioxide compared to iodinated contrast material for determining inferior vena cava (IVC) diameter prior to filter placement, and to assess the safety of CO₂ when used for this purpose. **PATIENTS AND METHODS:** Consecutive patients undergoing inferior vena cavography prior to filter placement were prospectively evaluated with use of both CO₂ and iodinated contrast material. The diameter of the IVC was measured and compared in the same four locations in each patient for both agents. The diameter was corrected for magnification and pin-cushion distortion. The ability of CO₂ to correctly classify IVC diameter as < or =28 mm or >28 mm, based on the IVC diameter with iodinated contrast material, was determined. A consensus panel assessed renal vein visualization with CO₂ and iodinated contrast material. Blood pressure and arterial oxygen saturation were measured immediately before and after CO₂ injection. **RESULTS:** Among 30 patients, there was no significant difference in the measured diameter of the IVC with CO₂ versus iodinated contrast material after correction for magnification and pin-cushion distortion. One of 30 patients (3.3%) in this study was misclassified as having an IVC < or =28 mm with CO₂ when, in fact, the IVC diameter was >28 mm based on iodinated contrast material. This could be clinically significant for certain IVC filters. Forty-seven percent of renal veins identified on contrast venography were identified by CO₂ vena cavography. There was no significant difference in the blood pressure or oxygen saturation values measured before and after CO₂ injection. However, one patient with pulmonary artery hypertension did experience transient, symptomatic hypotension after CO₂ injection. **CONCLUSIONS:** In most patients, CO₂ vena cavography accurately evaluated IVC diameter prior to filter placement. In 3.3% of patients, the discrepancy in measurements between CO₂ and iodinated contrast material could be clinically significant, depending on the type of filter placed. CO₂ was less accurate than iodinated contrast material in identifying renal veins. Although CO₂ vena cavography is safe in the



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1: *Eur J Radiol* 1999 Sep;31(3):182-7

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CO₂ as a contrast medium in endoluminal treatment of high flow vascular malformations.

Gorriz E, Carreira JM, Reyes R, Gallardo L, Pulido JM, Romero A, Maynar M

Vascular and Interventional Radiology Unit, Hospital Universitario Nuestra Senora del Pino, Las Palmas de Gran Canaria University, Spain. vascular@ccdis.dis.ulpgc.es

PURPOSE: To evaluate the diagnostic usefulness of CO₂ as a radiologic contrast medium in pre and post-embolization of hemodynamically active vascular malformations. **MATERIAL AND METHODS:** Eight pre- and post-embolization angiographies were performed on five patients with hemodynamically active vascular malformations. In all cases sequentially iodinated contrast medium and CO₂ were used. Procedures were performed using Philips Integris V equipped with specific software to process images obtained with CO₂ as contrast medium and with a purpose-built gas injector pump. The images were assessed by three interventional radiologists who evaluated the findings by consensus. They were asked whether uptake of the malformations were better, worse or the same with iodinated contrast and CO₂. The images were judged according to the following characteristics; quality, the filling in of the contrast in afferent artery of the HAVM, caliber and number of vessels and existence of pathologic communications in HAVM. These characteristics were assessed in all the patients of the study, both before and after embolization. **RESULTS:** The CO₂ angiographic results were compared to those obtained using iodinated contrast material. Iodinated contrast provided superior image quality in all performed studies. The filling of arterial afference of HAVM was well defined with both contrast media. In all performed cases with CO₂, the malformations showed more vessels. No immediate nor subsequent complications developed with CO₂ injections, except in one female patient, who presented an intense sensation of cramps in the lower limbs. **CONCLUSION:** CO₂ is a useful diagnostic and assessment tool before and especially during the embolization of hemodynamically active vascular malformations. It improves quantification and uptake of the malformation's vascular architecture, detecting collateral circulation and arteriovenous shunts. It also detects residual post-embolization disease when iodinated contrast agent is unsuccessful.



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1: *Scand J Urol Nephrol* 1999 Dec;33(6):400-5 [Related Articles, Books, LinkOut](#)

Renovascular disease and renal insufficiency--diagnosis and treatment.

Christensson A

Department of Vascular and Renal Diseases, Malmo University Hospital, Sweden. Anders.Christensson@medforsk.mas.lu.se

Renovascular disease as cause of end-stage renal disease has become more frequent during the last decade. In order to minimize the need for dialysis treatment non-invasive screening for the disease is needed. However, both ultrasonic duplex scanning and renal scintigraphy are not sufficient for detection of all stenosis. Furthermore, there is little data on non-invasive tests in patients with renal insufficiency. Renal arteriography is the gold standard for detection of renovascular disease. One disadvantage is the risk of contrast-agent induced acute renal insufficiency. This problem can be avoided using carbon dioxide angiography. In the near future spiral computed tomography and magnetic resonance angiography may be alternatives for identifying patients with renovascular disease. Ischaemic nephropathy is potentially curable. Percutaneous transluminal renal angioplasty is first line treatment in most cases. Intervention often results in improvement or preservation of renal function which is very important in order to avoid chronic dialysis.

Publication Types:

- Review
- Review, tutorial

PMID: 10636581, UI: 20100536

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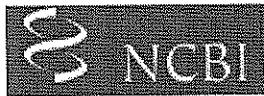
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1: *Clin Radiol* 1999 Dec;54(12):833-8

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Carbon dioxide angiography of the lower limbs: initial experience with an automated carbon dioxide injector.

Bees NR, Beese RC, Belli AM, Buckenham TM

Department of Radiology, St George's Hospital, London, UK.

Carbon dioxide (CO₂) has been used as an arterial contrast agent since 1971. The development of digital subtraction angiography and an automated CO₂ injector has increased the practicability and safety of using CO₂ routinely. Sixty-three patients had lower limb and/or renal arteriograms performed over a 6-month period using CO₂ in comparison with iodinated contrast medium. The majority (mean 74%, range 53-86%) of non-selective studies were diagnostic to the level of the popliteal artery, and 84% of selective lower limb studies were diagnostic. No serious complications occurred. The contrast and spatial resolution of CO₂ digital subtraction arteriography (CO₂DSA) was not consistently as good as iodinated contrast medium in peripheral lower limb or renal studies. However, due to the absence of allergic reactions and lack of nephrotoxicity, CO₂ is a diagnostic alternative to iodinated contrast medium in selected patients.

PMID: 10619301, UI: 20084319

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1: *Vasa* 1999 Nov;28(4):243-9

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[Digital subtraction angiography with carbon dioxide--basic principles, technique and clinical application].

[Article in German]

Barbey MM, Farber A, Marienhoff N, Gmelin E

Diagnostische Radiologie II, Zentrum Radiologie, Medizinische Hochschule Hannover.

Carbon dioxide digital subtraction angiography Carbon dioxide (CO₂) digital subtraction angiography offers the possibility for diagnostic and interventional angiographic procedures in high risk patients for ionidated contrast material. As a gaseous contrast agent its physicochemical properties have special requirements concerning the radiologists knowledge, the X-ray equipment, the injector and the catheters. This article reviews the current literature concerning the history, physics and physiology, indications and contraindications, clinical use, adverse effects and possible complications of carbon dioxide digital subtraction angiography.

Publication Types:

- Review
- Review, tutorial

Comments:

- Comment in: *Vasa* 2000 Feb;29(1):89

PMID: 10611841, UI: 20077965

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1: *AJR Am J Roentgenol* 1998 Aug;171(2):333-7 Related Articles, Books, LinkOut

Lower limb angiography: a prospective study comparing carbon dioxide with iodinated contrast material in 30 patients.

Rolland Y, Duvauferrier R, Lucas A, Gourlay C, Morcet N, Rambeau M, Chaperon J

Radiology Department, Hopital Sud, Rennes, France.

OBJECTIVE: We prospectively compared patients' tolerance for and the usefulness of carbon dioxide (CO₂) with iodinated contrast material in the study of lower limb arteries in 30 patients. **SUBJECTS AND METHODS:** We systematically performed digital subtraction angiography with electronic injection of CO₂ (injection average, 330 ml) and digital subtraction angiography with iodinated contrast material in 30 patients (20 men and 10 women; mean age, 67.5 years) suffering from lower limb ischemia. Patients were monitored for vital signs and comfort. Four reviewers subjectively evaluated vessel visibility at five levels (pelvis, thigh, knee, calf, and ankle). We used the Student's t test to evaluate the tolerance and the global examination quality. The chi-square test was used to evaluate the stratified analysis of the observers and scores of the image quality according to the anatomic level studied. Bartlett's test of equality of variances was used to compare the variances between the readers. **RESULTS:** CO₂ was less well tolerated ($p < .01$) than iodine was. Fifty-three percent of patients reported CO₂ was equally well tolerated (53%), 40% reported more discomfort than with iodine, and 4% reported less discomfort than with iodine. Both techniques were equivalent for imaging of the iliac arteries, but CO₂ performed poorly in the arteries below the knee ($p \ll .001$). **CONCLUSION:** CO₂ angiography with electronic injection proved to be less comfortable than iodinated angiography. CO₂ arteriography is equivalent to iodinated arteriography for imaging the iliac arteries but imaging performance progressively degrades in the more distal arteries of the legs.

Comments:

- Comment in: *AJR Am J Roentgenol* 1999 Jul;173(1):240-1

PMID: 9694446, UI: 98357819



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1: Clin Radiol 1998 Jun;53(6):448-50

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Imaging of the portal vein during transjugular intrahepatic portosystemic shunt procedures: a comparison of carbon dioxide and iodinated contrast.

Sheppard DG, Moss J, Miller M

Department of Radiology, West Glasgow Hospitals University NHS Trust, UK.

We report our experience with wedged hepatic injections of carbon dioxide (CO2) in the imaging of the portal vein during transjugular intrahepatic portosystemic shunt (TIPS) procedures. In all patients CO2 allowed quick and effective visualization of the portal vein. The image quality and extent of visualization of the portal vein was considered superior to iodinated contrast media in all cases. We suggest that CO2 should be used more frequently during TIPS.

PMID: 9651062, UI: 98313082

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1: *Gut* 2000 Jun;46(6):856-60

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CO(2) wedged hepatic venography in the evaluation of portal hypertension.

Debernardi-Venon W, Bandi JC, Garcia-Pagan JC, Moitinho E, Andreu V, Real M, Escorsell A, Montanya X, Bosch J

Hepatic Haemodynamic Laboratory, Liver Unit, IMD, Institut d'Investigacions Biomediques August Pi I Sunyer (IDIBAPS), Hospital Clinic, University of Barcelona, Spain.

BACKGROUND/AIMS/METHODS: During hepatic vein catheterisation, in addition to measurement of hepatic venous pressure gradient (HVPG), iodine wedged retrograde portography can be easily obtained. However, it rarely allows correct visualisation of the portal vein. Recently, CO(2) has been suggested to allow better angiographic demonstration of the portal vein than iodine. In this study we investigated the efficacy of CO(2) compared with iodinated contrast medium for portal vein imaging and its role in the evaluation of portal hypertension in a series of 100 patients undergoing hepatic vein catheterisation, 71 of whom had liver cirrhosis. **RESULTS:** In the overall series, CO(2) venography was markedly superior to iodine, allowing correct visualisation of the different segments of the portal venous system. In addition, CO(2), but not iodine, visualised portal-systemic collaterals in 34 patients. In cirrhosis, non-visualisation of the portal vein on CO(2) venography occurred in 11 cases; four had portal vein thrombosis and five had communications between different hepatic veins. Among non-cirrhotics, lack of portal vein visualisation had a 90% sensitivity, 88% specificity, 94% negative predictive value, and 83% positive predictive value in the diagnosis of pre-sinusoidal portal hypertension. **CONCLUSIONS:** Visualisation of the venous portal system by CO(2) venography is markedly superior to iodine. The use of CO(2) wedged portography is a useful and safe complementary procedure during hepatic vein catheterisation which may help to detect portal thrombosis. Also, lack of demonstration of the portal vein in non-cirrhotic patients strongly suggests the presence of pre-sinusoidal portal hypertension.

PMID: 10807900, UI: 20270054

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1: *Ann Vasc Surg* 2000 Mar;14(2):114-7

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Staged thoracic and abdominal aortic aneurysm repair using stent graft technology and surgery in a patient with acute renal failure.

Eton D, Terramani TT, Katz M

Department of Surgery, Division of Vascular Surgery, University of Southern California, School of Medicine, Los Angeles, CA, USA.

A 52-year-old male presented with severe hypertension and acute renal failure. Carbon dioxide (CO₂) angiography identified a saccular thoracic aortic aneurysm, right renal artery stenosis, left renal artery occlusion, an infrarenal aortic aneurysm, celiac artery, and inferior mesenteric artery (IMA) orificial stenoses. Via an anterior retroperitoneal approach, bilateral renal artery thromboendarterectomy, infrarenal aortic aneurysmectomy, and IMA reimplantation were performed. The patient's tortuous iliac arteries were straightened to permit future passage of a thoracic stent graft by mobilizing the aortic bifurcation and anastomosing it to a Dacron graft within 4 cm of the renal vessels. Two weeks later, a stent graft was placed via a femoral incision utilizing CO₂ angiography, successfully excluding the saccular thoracic aneurysm. Recovery from both procedures was quick, with rapid return of renal function, and alleviation of the hypertension. At 8 months follow-up, his renal arteries and aorta are patent.

PMID: 10742424, UI: 20209692

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1: *Nippon Igaku Hoshasen Gakkai Zasshi* 1995
Apr;55(5):289-95

Related Articles, Books,
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[Evaluation of anastomosis between intrahepatic or extrahepatic vessels by intra-arterial digital subtraction angiography using carbon dioxide].

[Article in Japanese]

Miyazono N, Inoue H, Ueno K, Nishida H, Kanetsuki I, Miyake S, Nakajo M

Department of Radiology, Faculty of Medicine, Kagoshima University.

Carbon dioxide (CO₂) intraarterial subtraction angiography (IADSA) was performed in 31 patients with various hepatobiliary diseases. The injection sites of CO₂ were proper hepatic artery (10/31; group A), segmental hepatic artery (18/31; group B), and peripheral inferior phrenic artery (3/31; group C), respectively. In group A, only the third order branches of the portal venous system were visualized anterogradely in 8 of 10 patients. In group B, the microcatheter was placed coaxially through a 5 French guiding catheter at the main arterial supply of the tumor in 7 patients and at the peripheral segmental branch of the hepatic artery in 11 patients. The portal venous system was visualized retrogradely in all of the patients regardless of the injection site. The injected CO₂ may flow back into the portal vein through the anastomosis known as the peribiliary or periportal plexus. In group C, not only the portal vein but also the pulmonary artery or pericardial vein were visualized by this method. CO₂-IADSA was useful to image the minute communications between the various vessels, which have been not hitherto visualized by iodinated contrast medium.

Publication Types:

- Clinical trial
- Controlled clinical trial

PMID: 7784148, UI: 95303573

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1: Eur J Vasc Endovasc Surg 1995 Aug;10 (2):156-61

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Carbon dioxide: an alternative to iodinated contrast media.

Yusuf SW, Whitaker SC, Hinwood D, Henderson MJ, Gregson RH, Wenham PW, Hopkinson BR, Makin GS

Vascular Unit, University Hospital, Nottingham, U.K.

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OBJECTIVES: To study the use of carbon dioxide as a contrast medium for arteriography. METHODS: Carbon dioxide was used as a contrast medium for intra-arterial digital subtraction lower limb angiography in 12 examinations on 11 patients. RESULTS: No complication was encountered and no significant changes occurred in the arterial pH, PaCO2 and PaO2. The quality of images as assessed by an independent observer was adequate for the majority of the vessels (77%). CONCLUSIONS: Carbon dioxide is a safe alternative in patients at an increased risk of adverse reaction to iodinated ionic or non-ionic contrast medium and is very cheap.

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- Publication Types: Clinical trial, Controlled clinical trial

PMID: 7655966, UI: 95384710

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1: *Ann Vasc Surg* 1995 Sep;9(5):448-52

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Carbon dioxide/digital subtraction arteriography-assisted transluminal angioplasty.

Frankhouse JH, Ryan MG, Papanicolaou G, Yellin AE, Weaver FA

Department of Surgery, University of Southern California School of Medicine, Los Angeles 90033-4612, USA.

During a 62-month period, carbon dioxide was used to supplement or completely replace iodinated contrast agents in performing 27 transluminal angioplasties in 26 patients. The arterial segments addressed included the following: renal in two cases, iliac in five, femoral/popliteal in 15, infrapopliteal in two, and combined in three. Indications for intervention included lower extremity gangrene in 11 cases, ischemic ulceration in 10, rest pain in three, claudication in one, and ischemic nephropathy in two. Contraindications to iodinated contrast agents included renal insufficiency resulting from diabetes (n = 20) or ischemic nephropathy (n = 2) and congestive heart failure (n = 4). Eight procedures used carbon dioxide as the sole contrast agent, whereas 19 required supplementation of carbon dioxide with a mean of 39 ml of nonionic contrast medium. Technical success was achieved in 25 procedures with significant hemodynamic improvement in 20 patients. Complications included transient deterioration in renal function in two patients and myocardial infarctions in two. At 30 days 18 patients had demonstrated significant clinical improvement. Patients at high risk for iodinated contrast-related complications may undergo transluminal angioplasty using carbon dioxide/digital subtraction arteriography to reduce or eliminate the need for iodinated contrast agents.

PMID: 8541193, UI: 96099942

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1: *Transplantation* 1996 Feb 27;61(4):652-4 [Related Articles, Books, LinkOut](#)

CO2 angiography--a technique for vascular imaging in renal allograft dysfunction.

Kuo PC, Petersen J, Semba C, Alfrey EJ, Dafoe DC

Department of Surgery, Stanford University Medical Center, California 94305, USA.

Use of iodinated contrast for vascular imaging can be associated with nephrotoxicity and hypersensitivity reactions. Renal injury following conventional angiography is more likely to manifest in the setting of preexisting renal dysfunction. In the setting of suboptimal renal allograft function, these considerations are particularly relevant. Recently, CO2 has received attention as a nontoxic, injectable, rapidly absorbed gas that is a cost-effective alternative to standard contrast agents in high-risk patients, such as renal transplant recipients. We report the clinical course of a patient with transplant renal artery stenosis and a serum creatinine of 2.8 mg/dl who has successfully undergone angiography and percutaneous transluminal angioplasty using CO2 as the sole contrast agent. This case illustrates the potential use for CO2 as a contrast agent for vascular imaging in patients with suboptimal renal function who require definitive vascular imaging or therapy.

PMID: 8610396, UI: 96196977

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1: Arch Surg 1996 May;131(5):503-7; discussion 507-8

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A prospective study of carbon dioxide-digital subtraction vs standard contrast arteriography in the evaluation of the renal arteries.

Schreier DZ, Weaver FA, Frankhouse J, Papanicolaou G, Shore E, Yellin AE, Harvey F

Department of Surgery, University of Southern California School of Medicine, Los Angeles, USA.

OBJECTIVE: To compare carbon dioxide-digital subtraction arteriographic (CO2-DSA) images of renal artery anatomy with standard iodinated contrast arteriographic (ICA) images. DESIGN: One hundred patients with vascular disease who required abdominal aortography were evaluated by both CO2-DSA and ICA modalities. Two blinded readers interpreted arteriograms for the degree of renal artery stenosis, and a third reader was employed to resolve differences in reader interpretations. SETTING: University medical center. MAIN OUTCOME MEASURES: The sensitivity, specificity, negative predictive value, positive predictive value, and accuracy were calculated for the ability of CO2-DSA to demonstrate a 60% or greater stenosis of the main renal artery; kappa values for CO2-DSA and ICA were calculated to assess intraobserver variability. RESULTS: Of the 200 main renal arteries imaged, 17 (9 by means of CO2-DSA), 8 means of ICA) were eliminated because of inadequate visualization of the renal artery. In identifying a renal artery stenosis of 60% or greater, CO2-DSA had a sensitivity of 0.83, specificity of 0.99, positive predictive value of 0.94, and negative predictive value of 0.98. The overall accuracy was 0.97. The kappa was 0.75 for CO2-DSA and 0.70 for ICA, hence, the variation in the interpretations of CO2-DSA and ICA were comparable. CONCLUSION: Images by means of CO2-DSA accurately reflect pathologic changes in renal arteries and are thus useful in the diagnosis of clinically occult occlusive renal artery disease in patients at risk of contrast medium-related nephrotoxicity.

PMID: 8624196, UI: 96208999

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1: *Rofo Fortschr Geb Rontgenstr Neuen Bildgeb
Verfahr* 1996 May;164(5):445-8

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Published erratum appears in *Rofo Fortschr Geb Rontgenstr Neuen
Bildgeb Verfahr* 1996 Aug;165(2):180

[Carbon dioxide as an alternative contrast medium in peripheral angiography].

[Article in German]

Zwaan M, Kloess W, Kagel C, Kummer-Kloess D, Matthies-Zwaan
S, Schutz RM, Weiss HD

Institut fur Radiologie, Medizinischen Universitat zu Lubeck.

A closed gas pressure pistol was used in 50 patient CO₂ angiography as a supplementary method to conventional injection with liquid contrast medium. These were diagnostic pelvis-leg angiographies (n = 36), therapeutic angiographies (n = 8), haemodialysis fistulas (n = 3), suspected stenosis of a renal transplant artery (n = 1) and suspected renal artery stenosis (n = 1). 246 renal angiography series were performed with CO₂. Dosages varied in accordance with the imaged vascular area between 10 ccm;(shunt imaging) and up to 100 cm³ (pelvis-leg angiography), at pressures between 400 mbar in case of haemodialysis fistulas up to 2000 mbar in the pelvis-leg area. Short-term feeling of fullness and even nausea were accompanying symptoms in 4 patients. The image quality was slightly inferior to that of conventional contrast medium images due to an elevated signal-to-noise ratio. Injector-monitored CO₂ angiographies enabled imaging of the distal aorta or of peripheral vascular sections, imaging of the upper extremity and presentation of kidney transplants in patients with a relative or absolute contraindication to iodised contrast media.

PMID: 8634409, UI: 96233686

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1: *Rofo Fortschr Geb Rontgenstr Neuen Bildgeb Verfahr* 1997 Jan;166(1):51-3

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[The diagnosis of intra-abdominal hemorrhages with CO2 as the contrast medium].

[Article in German]

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Textor HJ, Wilhelm K, Strunk H, Schuller H, Schild HH

Radiologische Universitätsklinik Bonn.

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PURPOSE: Evaluation of carbon dioxide (CO2) as contrast medium for detection of intraabdominal haemorrhage. METHOD: We performed in 5 patients 7 DSA examinations (one with upper and three with lower gastrointestinal bleeding, one traumatic spleen rupture) using an iodinated contrast-medium and CO2 for the localisation of haemorrhage. RESULTS: With iodinated contrast medium it was possible to localise the haemorrhage in three of 5 patients. With CO2 the localisation was possible in all cases. There were no side effects. CONCLUSION: CO2 is useful for detection of intraabdominal bleeding. Even in cases with negative angiographic results with iodinated contrast medium, CO2 may enable localisation of the bleeding vessel. Because of this, we use CO2 and iodinated contrast media in all cases of intraabdominal haemorrhage. Further studies are required.

PMID: 9072105, UI: 97205609

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1: *J Radiol* 1997 Jan;78(1):41-7

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[Evaluation of carboxy-angiography in the study of arteriopathy of the lower limbs].

[Article in French]

Rolland Y, Duvaferrier R, Lucas A, Gourlay C, Rambeau M, Morcet N

Departement d'Imagerie Medicale, Hopital Sud, Rennes.

PURPOSE: We prospectively compared the safety and the usefulness of CO2 with iodinated contrast material in the study of lower limb arteries.

PATIENTS AND METHOD: The study included 30 patients (20 men, 10 women, mean age 67) suffering from lower limb ischemia: stage II (3), stage III (13), stage IV (9), Leriche syndrome (1), post-operative (4). We systemically performed an aortic injection (L3), via a 4F catheter, of (1) CO2-DSA (5 to 6 injections of 75 ml at a flow rate of 20 ml/s) and (2) DSA with iodine contrast material (100 ml at a flow rate of 8 ml/s). Patients were monitored for pain and vital signs. Four reviewers did a subjective evaluation of the vessel visibility at five levels (pelvis, thigh, knee, calf, ankle).

RESULTS: No side effect was found. Concerning pain, the patients had the same sensation in 53%; pain was more disagreeable with CO2 in 40%, more disagreeable with iodine in 7%. Concerning vessel visualization, there was a good coherence between the readers and we found the same quality in 61%. CO2 was less informative in 35%, and more informative in 4%. Image quality decreased with fragmentation of the gas and remoteness of injection site.

CONCLUSION: CO2 angiography, with electronic injection, is a safe alternative to conventional angiography with iodinated contrast material. The disagreeable sensations can be reduced with explanations given before injection and reducing flow rate. Image stacking software could imitate the side effects of fragmentation of the CO2 bubble. This method appears to be a good alternative for patients with severe renal impairment or allergic problems.

PMID: 9091619, UI: 97226892



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1: *Rofo Fortschr Geb Rontgenstr Neuen Bildgeb Verfahr* 1997 Mar;166(3):238-42

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[Carbon dioxide (CO2) as contrast medium for the new installation and follow-up of a TIPS].

[Article in German]

Wilhelm K, Textor J, Strunk H, Brensing KA, Schuller H, Schild H

Radiologische Universitätsklinik Bonn.

PURPOSE: To determine the efficacy of CO2 as negative contrast medium compared with iodinated contrast medium in creation and control of TIPS. MATERIAL AND METHODS: CO2 was used during TIPS procedures in 33 patients. In 21 patients a wedged hepatic venography was obtained for planning the shunt tract. Additional TIPS-control DSA was performed in 42 cases by direct portal venography to verify the TIPS function and patency. In all cases CO2 gas was used in addition to iodinated contrast medium. RESULTS: CO2 produced excellent wedged hepatic venographies in all patients. Visualisation of the portal veins and collaterals was superior to iodinated contrast medium. The TIPS-control DSA performed with CO2 were comparable to those performed with iodinated contrast medium. Complications were not observed in our study. CONCLUSION: CO2 is an effective contrast medium for TIPS procedures. In particular the visualisation of portal veins performed by CO2-wedged hepatic venography is superior to iodinated contrast medium.

PMID: 9156596, UI: 97279614

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(38):1133-6

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[The angiography of kidney transplant arteries using carbon dioxide].

[Article in German]

Zwaan M, Steinhoff J, Fricke L, Kagel C, Lorch H, Weiss HD

Institut für Radiologie, Medizinische Universität zu Lubeck.

BACKGROUND AND OBJECTIVE: After renal transplantation hypertension occurs in 60-80% of patients, in 3-23% of them due to renal artery stenosis in the transplanted kidney. Angiographic assessment of the severity of the stenosis would best be done with a non-nephrotoxic contrast medium. We investigated the use of carbon dioxide, a bubble-forming contrast medium excreted via the lung, for its suitability in the angiography of the arterial system in the renal transplant. **PATIENTS AND METHODS:** In an uncontrolled series of observations on six patients with renal transplants and hypertension who were being treated with three or four antihypertensive drugs, the transplant's arteries were demonstrated with carbon dioxide, injected by Seldinger technique into the ipsilateral femoral artery, and the results recorded by subtraction angiography. **RESULTS:** The angiograms demonstrated postoperative kinked renal artery, a plaque in the external iliac artery, and a sharply angled origin of the external iliac artery in one case each, and three normal cases. **CONCLUSIONS:** Carbon dioxide is a suitable medium for demonstrating renal arteries in a transplanted kidney and is preferable to conventional contrast media for the angiographic diagnosis of possible renal artery stenosis.

PMID: 9378023, UI: 97479140

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1: Abdom Imaging 1994 Jul-Aug;19(4):330-3 Related Articles, Books, LinkOut

Retrograde visualization of the portal venous system using CO2 intraarterial digital subtraction angiography.

Miyazono N, Inoue H, Kanetsuki I, Nakajo M

Department of Radiology, Faculty of Medicine, Kagoshima University, Japan.

Carbon dioxide (CO2) intraarterial digital subtraction angiography (IADSA) provides retrograde visualization of the portal vein via a peripheral segmental hepatic artery. IADSA was performed in 12 patients with known hepatic diseases by injecting a peripheral hepatic artery with both CO2 gas and an iodinated contrast medium. The portal vein was constantly visualized only with CO2 IADSA in all patients. The injected CO2 may flow back into the portal vein through an anastomotic system known as the peribiliary or periportal plexus. This new method is safe and useful to image the portal venous system in patients with hepatic malignancy.

PMID: 8075556, UI: 94355863

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1: *Presse Med* 1994 Jan 8-15;23(1):19-22

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[Aorto-arteriography of the lower limbs using carbon dioxide].

[Article in French]

Fernand M, Marzelle J, Cormier F, Cormier JM

Clinique de La Defense, Nanterre.

OBJECTIVES: Carbon dioxide is often used as a contrast medium for angiocardiology and has recently been proposed for peripheral arteriography. We therefore evaluated this method of opacification in comparison with iodine medium. METHODS: From December 1992 to February 1993, arteriographies using carbon dioxide contrast medium were performed in 13 patients (age range 57-83) with severe arteriopathies requiring revascularization: 2 aorta plus renal arteries, 2 aorta plus iliac and lower limb arteries, 9 lower limb arteries only. The intraarterial injections of carbon dioxide were delivered rapidly (< 20 sec) at a rate of 30 cm³/s (50 cm³/injection) for the aorta and 10-15 cm³/s (15-60 cm³/injection) for peripheral arteries. In 8 of the patients, control arteriographies were performed with iopamidol. RESULTS: The injections of carbon dioxide were well tolerated being painless in 12/13 patients. Digital subtraction images were satisfactory in 6, mediocre but conclusive in 5 and poor in 2. Images of distal arteries were the most difficult to interpret and images of the aorta were generally good. The low viscosity of carbon dioxide allowed the use of small 4F catheters. CONCLUSIONS: Carbon dioxide can be routinely used as a contrast medium, notably in diabetic patients, patients with renal impairment and those who are allergic to iodine based compounds.

PMID: 8127810, UI: 94173833

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Efficacy of CO₂-DSA in embolization.

Teshima Y, Iwasaki N

Department of Radiology, Dokkyo Medical College, Koshigaya Hospital, Japan.

Intra-arterial digital subtraction angiography using CO₂ (CO₂-IA-DSA) is effective for detecting arteriovenous and arterioportal shunts in the liver. We carried out CO₂-IA-DSA in addition to selective arteriography using a iodinated contrast medium in 31 patients with unresectable hepatocellular carcinoma (HCC). As a result, CO₂-IA-DSA detected an AV shunt in 4/31 patients and an AP shunt in 16/31 patients for a total of 20 cases of shunt, whereas conventional hepatic IA-DSA detected only AP (AV shunt) shunts in 3/31 patients. For HCC without any shunt, Gelfoam embolization was carried out after injection of Lipiodol and Farmorubicin (FARM). In patients with an AP shunt, injection of Lipiodol and FARM was performed after the shunt had been embolized with Gelfoam. In patients with an AV shunt, Lipiodol and FARM were injected after the shunt had been embolized with a metallic coil. In conclusion, detection of shunts by CO₂-IA-DSA is useful for determining the optimal approach for transcatheter arterial injection.

PMID: 8137467, UI: 94185227

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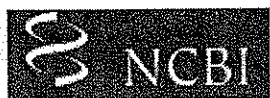
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1: Hinyokika Kiyo 1993 Sep;39(9):823-6

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[Congenital arteriovenous malformation of the kidney: report of two cases--detection by digital subtraction angiography with carbon dioxide].

[Article in Japanese]

Miyanaga T, Kitamura M, Sato Y, Terakawa T, Sakaguchi S, Tsushima J

Department of Urology, Yao Tokushukai Hospital.

Two cases of arteriovenous malformation of the kidney were reported. The first case was a 19-year-old female, complaining of right flank pain and gross hematuria. Right selective renal arteriography revealed a 2 x 1.5 cm large cisoid type arteriovenous malformation at the most distal region of the lower branch of the renal artery. Transcatheter embolization, using Gelfoam and absolute ethanol, was successfully done, which was confirmed with repeated digital subtraction angiography with carbon dioxide (CO2-DSA). The second patient was a 55-year-old female with past history of right idiopathic renal bleeding, complaining of right flank colicky pain and gross hematuria. Right selective renal arteriography was done without any pathological findings, while CO2-DSA documented an arteriovenous malformation in the hilar region. Transcatheter embolization was not done, because the malformation seemed to be proximally located. Thus CO2-DSA was thought to be a reliable method in the diagnosis of arteriovenous fistula.

PMID: 8213376, UI: 94026553

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1: *J Vasc Surg* 1993 Jul;18(1):23-30

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Follow-up evaluation after renal artery bypass surgery with use of carbon dioxide arteriography and color-flow duplex scanning.

Harward TR, Smith S, Hawkins IF, Seeger JM

Section of Vascular Surgery, University of Florida College of Medicine, Gainesville 32610-0286.

PURPOSE: Postoperative evaluation of renal artery bypass grafts historically has been obtained by contrast renal arteriography before discharge from the hospital. Recent reports have advocated replacing arteriography with abdominal duplex scanning for evaluating and monitoring the integrity of renal artery bypasses. We propose a combination of these two techniques, which provides minimal risk to the patient and renal parenchymal function. **PURPOSE:** Between July 1, 1990, and Dec. 31, 1991, 17 patients (8 men, 9 women) underwent 24 renal artery bypasses for poorly controlled hypertension or deteriorating renal function. In the immediate postoperative period each patient underwent carbon dioxide (CO₂) renal arteriography to detect any technical defects and to define bypass graft anatomy. Subsequently, color-flow duplex scanning of the renal artery bypass grafts were done at 3-month intervals with the postoperative CO₂ arteriogram for baseline comparison. CO₂ arteriography clearly defined proximal/distal anastomotic anatomy, bypass conduit integrity, and bypass conduit runoff. **RESULTS:** Procedural morbidity was zero because no hematomas developed and serum creatinine remained stable. Duplex scanning for a mean follow-up of 8.3 months revealed antegrade flow in 23 bypasses with peak systolic velocity of 60 to 100 cm/sec. One bypass graft had a peak systolic velocity greater than 150 cm/sec suggestive of a proximal anastomotic stenosis; however, the patient died before a repeat, verifying CO₂ arteriogram could be obtained. Recurrent hypertension developed in one patient with velocities less than 100/cm/sec, and repeat CO₂ arteriography revealed no evidence of graft or anastomotic stenosis. **CONCLUSION:** CO₂ arteriography and duplex scanning provide an accurate means of initially evaluating and subsequently monitoring renal artery bypass grafts, with minimal risk of renal or patient morbidity.

PMID: 8326656, UI: 93316482



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1: *Ann Surg* 1993 Jun;217(6):688-97; discussion 697-8

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Carbon dioxide gas as an arterial contrast agent.

Seeger JM, Self S, Harward TR, Flynn TC, Hawkins IF Jr

Department of Surgery, University of Florida, College of Medicine, Gainesville.

OBJECTIVE: To investigate the clinical utility of CO₂ gas as an arterial contrast agent, the experience with CO₂ arteriography at the University of Florida was reviewed. **SUMMARY BACKGROUND DATA:** Preliminary studies have demonstrated the feasibility of CO₂ arteriography and shown that arterial injection of CO₂ gas appears non-toxic (which could limit the risks of contrast induced renal injury and allergic reaction). However, numerous technical problems make CO₂ arteriography a demanding technique and recent studies have suggested that distal lower extremity vessels are difficult to image using CO₂ arteriography, especially when significant arterial occlusive disease is present. **METHODS:** One hundred twenty-eight CO₂ arteriograms done in 115 patients were reviewed. CO₂ arteriograms were graded as excellent, good, poor, or inadequate by two blinded observers and results of CO₂ studies compared to results of standard contrast studies (done in 98 patients for image comparison). In addition, a therapeutic plan based on the CO₂ arteriograms was compared with the therapy each patient received. **RESULTS:** One hundred-seventeen (91%) of the CO₂ arteriograms were of good or excellent quality and agreement between CO₂ studies and standard contrast studies was seen in 93 of 98 cases (95%). Accurate therapeutic plans based on CO₂ studies were possible in 92% of cases with inadequate visualization of infrapopliteal arteries being the major limitation (7 cases). No allergic reactions occurred and only one patient potentially had contrast-induced nephrotoxicity. **CONCLUSIONS:** CO₂ arteriography provides accurate, clinically useful arterial imaging with minimal risk. Thus, this new technology significantly increases the utility of arteriography in patients with peripheral vascular disease.

PMID: 8507115, UI: 93282718



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1: Cardiovasc Intervent Radiol 1988 Apr;11(2):101-7

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Intraarterial digital subtraction angiography with carbon dioxide: superior detectability of arteriovenous shunting.

Takeda T, Ido K, Yuasa Y, Nishimura G, Hashimoto S, Kyo E, Okawa S, Nakatsuka S, Miura H, Kobayashi S, et al

Department of Diagnostic Radiology, Keio University School of Medicine, Tokyo, Japan.

Intraarterial digital subtraction angiography (IADSA) with carbon dioxide (CO2) was performed on 41 patients with liver or renal diseases. CO2 produced no hypersensitivity reactions, and the pain or feeling of warmth was relatively mild compared with iodinated contrast media. Although the image quality of the arterial or capillary phase was inferior to that with iodinated contrast media, the detectability of arteriovenous shunting was excellent. IADSA with CO2 may become an effective method for detecting arteriovenous shunting which cannot be demonstrated with conventional angiography or DSA with iodinated contrast medium.

PMID: 3134131, UI: 88270467

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1: Invest Radiol 1994 Jun;29 Suppl 2:S45-6

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Carbon dioxide as an angiographic contrast agent. A prospective randomized trial.

Bettmann MA, D'Agostino R, Juravsky LI, Jeffery RF, Tottle A, Goudey CP

Department of Radiology, Dartmouth-Hitchcock Medical Center, Lebanon, New Hampshire 03756.

Publication Types:

- Clinical trial
Randomized controlled trial

PMID: 7928269, UI: 95013241

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1: *Pediatr Radiol* 1997 Oct;27(10):807-10

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Pediatric Radiology

Carbon dioxide (CO2) angiography in children.

Kriss VM, Cottrill CM, Gurley JC

Department of Diagnostic Radiology University of Kentucky Medical Center, 800 Rose Street, Lexington, KY 40536-0084, USA.

BACKGROUND: When iodinated contrast material is contraindicated, carbon dioxide (CO2) gas can be injected intravascularly to produce high-quality digital subtraction angiograms. OBJECTIVE: CO2 angiography, although previously described in adults, has never before been reported in children. MATERIALS AND METHODS: We present three children with renal transplants who required renal angiography. Because of elevated creatinine levels, iodinated contrast was not used to search for possible renal artery stenosis. Instead, CO2 angiography was used to evaluate the renal artery anastomosis. RESULTS: In all three cases, the renal artery anastomosis was clearly visualized using CO2 angiography and showed no evidence of renal artery stenosis. CONCLUSION: Digital CO2 angiography is an effective method for pediatric renal angiography. The technique can easily be adapted for virtually any angiographic laboratory capable of digital subtraction imaging. Digital CO2 angiography also lacks the risks of a conventional iodinated contrast medium, namely nephrotoxicity, allergic reaction and volume overload.

PMID: 9323247, UI: 97467266

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1: *AJR Am J Roentgenol* 1998 Aug;171(2):333-7 Related Articles, Books, LinkOut

Lower limb angiography: a prospective study comparing carbon dioxide with iodinated contrast material in 30 patients.

Rolland Y, Duvauferrier R, Lucas A, Gourlay C, Morcet N, Rambeau M, Chaperon J

Radiology Department, Hopital Sud, Rennes, France.

OBJECTIVE: We prospectively compared patients' tolerance for and the usefulness of carbon dioxide (CO₂) with iodinated contrast material in the study of lower limb arteries in 30 patients. **SUBJECTS AND METHODS:** We systematically performed digital subtraction angiography with electronic injection of CO₂ (injection average, 330 ml) and digital subtraction angiography with iodinated contrast material in 30 patients (20 men and 10 women; mean age, 67.5 years) suffering from lower limb ischemia. Patients were monitored for vital signs and comfort. Four reviewers subjectively evaluated vessel visibility at five levels (pelvis, thigh, knee, calf, and ankle). We used the Student's t test to evaluate the tolerance and the global examination quality. The chi-square test was used to evaluate the stratified analysis of the observers and scores of the image quality according to the anatomic level studied. Bartlett's test of equality of variances was used to compare the variances between the readers. **RESULTS:** CO₂ was less well tolerated ($p < .01$) than iodine was. Fifty-three percent of patients reported CO₂ was equally well tolerated (53%), 40% reported more discomfort than with iodine, and 4% reported less discomfort than with iodine. Both techniques were equivalent for imaging of the iliac arteries, but CO₂ performed poorly in the arteries below the knee ($p < .001$). **CONCLUSION:** CO₂ angiography with electronic injection proved to be less comfortable than iodinated angiography. CO₂ arteriography is equivalent to iodinated arteriography for imaging the iliac arteries but imaging performance progressively degrades in the more distal arteries of the legs.

Comments:

- Comment in: *AJR Am J Roentgenol* 1999 Jul;173(1):240-1

PMID: 9694446, UI: 98357819



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1: Acad Radiol 1998 Apr;5 Suppl 1:S58-9;
discussion S60-2

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Prospective randomized crossover pilot study of the safety and efficacy of carbon dioxide versus iodinated contrast for peripheral angiography.

Oliva V, Common A, Bettmann MA

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Department of Radiology, Centre Hospitalier de l'Universite de Montreal, Canada.

Publication Types:

- Clinical trial
- Randomized controlled trial

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PMID: 9561045, UI: 98221816

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1: *Fortschr Med* 1993 Mar 20;111(8):122-5

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[Carbon dioxide--contrast medium for digital subtraction angiography].

[Article in German]

Strunk H, Thelen M, Schild H, Lippok K

Klinik mit Poliklinik für Radiologie, Universität Mainz.

Fundamental considerations: Despite appreciable improvements in conventional iodine-containing contrast media, vascular studies involving patients with renal insufficiency, hyperthyroidism or known allergic reaction to conventional contrast media continue to pose a problem. Own study: Testing the investigation of the possibility of visualizing vessels using carbon dioxide as a gaseous contrast medium. In 30 patients, angiography of the pelvis and legs (DSA) employing conventional iodine-containing media and/or CO₂ were carried out simultaneously. Results, handling and toleration were compared. In two further patients, percutaneous transluminal angioplasty and stent implantation, respectively, were successfully performed under CO₂ control. Results: All the findings obtained with "normal" DSA were also obtainable with CO₂. The CO₂ examination, however, was often plagued by incomplete contrasting of the blood vessels, with interruption of the contrast medium column, which made assessment more difficult. In two of the 30 patients undergoing angiography of the pelvis and legs, the investigation had to be abandoned on account of persistent intensive lower abdominal pain under CO₂ injection.

PMID: 8509004, UI: 93285544

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