Coronary angiography is increasingly performed with multi–detector row computed tomography (CT) in the clinical setting. Successful use of this method, however, depends on the radiologist’s knowledge of its potential pitfalls and familiarity with methods for minimizing or avoiding them. To identify artifacts and other pitfalls that commonly degrade image quality and that could result in misinterpretation, contrast-enhanced coronary angiograms acquired with a multi–detector row CT scanner with four detector rows in 110 consecutive patients were analyzed. The problems identified were classified into four broad categories: (a) motion-related artifacts caused by cardiac, pulmonary, or other body motion; (b) beam-hardening effects caused by metallic implants, severe calcifications, or air bubbles in the pulmonary artery that obscured the underlying coronary vessel lumen; (c) structural artifacts produced by adjacent contrast material–filled structures and overlying vessels; and (d) artifacts that resulted from technical errors or limitations. The most frequently observed artifacts were those related to cardiac motion. The most effective methods for minimizing cardiac motion artifacts are (a) premedication with β-blockers to maintain optimal heart rate during scanning and (b) optimal selection of the reconstruction window.

©RSNA, 2004

Introduction

Conventional coronary angiography is considered the reference standard for evaluation of coronary artery stenosis, in-stent stenosis, and the patency of coronary artery bypass grafts. However, the risk of potentially serious adverse effects and the costs associated with such effects have led to a search for noninvasive alternatives. Good

Index terms: Angiography, comparative studies, 54.1244 • Computed tomography (CT), artifact, 54.12119 • Computed tomography (CT), multi-detector row, 54.12113 • Coronary vessels, bypass graft, 54.4553, 54.4558 • Coronary vessels, CT, 54.12116, 54.12117

RadioGraphics 2004; 24:787–800 • Published online 10.1148/rg.243035502

1From the Department of Diagnostic Radiology and Research Institute of Radiological Science (H.S.C., B.W.C., K.O.C., M.I.K., J.K.), Cardiology Division, Cardiovascular Center (D.C.), and Cardiovascular Surgery, Cardiovascular Center (K.J.Y.), Yonsei University College of Medicine, Seoul, South Korea. Received February 3, 2003; revision requested March 24 and received May 13; accepted October 1. Address correspondence to B.W.C., Department of Diagnostic Radiology, Yonsei University College of Medicine, 134 Sinchon-dong, Seodaemun-gu, Seoul 120–752, South Korea (e-mail: bchoi@yumc.yonsei.ac.kr).

©RSNA, 2004
multi-detector row CT coronary angiography does not provide consistent depiction of all coronary vessels, it is not the current diagnostic reference standard for patients who are suspected of having coronary artery disease that will probably require therapeutic intervention or surgery, and for these patients we did not recommend multi-detector row CT angiography. However, we did recommend it for 33 patients in whom coronary artery disease was to be excluded. Ten of these 33 patients also underwent subsequent conventional angiography, followed by coronary stent insertion. Because coronary artery bypass graft patency is accurately evaluated with multi-detector row CT (11), only the first 30 patients referred for follow-up of a bypass graft underwent initial conventional angiography and subsequent multi-detector row CT angiography. The interval between the two studies in the 40 patients who underwent both was 38–53 days (mean and standard deviation, 47.08 days ± 5.61). An additional 47 patients underwent only multi-detector row CT coronary angiography for graft follow-up.

At multi-detector row CT angiography, initial scout images were acquired to determine anatomic coverage. For the examination of native coronary arteries, the CT angiographic volume extended from 1 cm below the carina to the base of the heart. Patients who were being evaluated for graft patency were scanned from 1 cm above the uppermost graft vessel on the ascending aorta to the base of the heart. A second scout scan was obtained with a bolus injection of 15 mL of iopamidol, a nonionic contrast agent containing 370 mg of iodine per milliliter (Iopamiro; Bracco, Milan, Italy), to estimate the circulation time. For multi-detector row CT angiography, the non-ionic contrast agent was infused at a rate of 4 mL/sec during the first half of the total scanning time and 2 mL/sec during the remaining half. The total amount of contrast material per patient ranged from 100 to 180 mL, according to the total scanning time. The breath-holding time, which depended on patient heart rate and on anatomic coverage, ranged from 20 to 40 seconds. Pitch, which also depended on patient heart rate, varied from 1.0 to 4.0 and was adjusted automatically in increments of 0.1, according to the manufacturer-provided preprogrammed settings. The default pitch value was based on the heart rate just before scanning. Thus, at imaging in a patient with a heart rate that varied from 45 to 75 beats per minute, pitch varied from 1.2 to 1.5. An oral β-blocker, propranolol hydrochloride (Pranol; Daewoong, Seoul, Korea), was used in patients suspected of having coronary artery disease, but it was not used in those referred for follow-up of a bypass graft. Patients with coronary artery disease were instructed by the referring cardiologist to begin taking the β-blocker on
the day before multi-detector row CT angiography; therefore, premedication 1 hour before the CT examination was not needed. The dosage was 60–120 mg three times per day, with the last dose being taken on the day of the CT examination.

Images were routinely reconstructed from CT data acquired at 40% and at 70% of the R-R interval with a retrospectively electrocardiographically gated algorithm. If the routine reconstructions of data from 40% and 70% of the R-R interval were not sufficient to depict the coronary arteries, subsequent tailored reconstructions were performed with data acquired at 30%, 50%, 60%, and 80% of the R-R interval. If the resultant images were not adequate, cardiologists determined whether to perform conventional angiography as a reference standard. To identify artifacts and their causes, the axial CT source images, three-dimensional volume-rendered images, multiplanar reformatted images, and maximum intensity projection images were analyzed, and artifacts were classified into four categories. All of the artifacts identified (Table) could have been reduced or controlled with specific steps.

<table>
<thead>
<tr>
<th>Problem</th>
<th>No. of Cases</th>
<th>Cause</th>
<th>Manifestation</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artifact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac motion</td>
<td>110</td>
<td>Heart rate exceeded speed of acquisition</td>
<td>Blur</td>
<td>Prior administration of β-blockers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heart rate varied</td>
<td></td>
<td>Prior administration of β-blockers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inappropriate reconstruction window was selected</td>
<td>Stepladder artifact</td>
<td>Selection of appropriate reconstruction window</td>
</tr>
<tr>
<td>Pulmonary motion</td>
<td>10</td>
<td>Respiration during image acquisition</td>
<td>Blur</td>
<td>Oxygen supplementation; instruction in breath holding</td>
</tr>
<tr>
<td>Body motion</td>
<td>10</td>
<td>Voluntary motion</td>
<td>Stepladder artifact</td>
<td>Minimization of anatomic coverage; instruction</td>
</tr>
<tr>
<td>Beam hardening</td>
<td>90</td>
<td>Surgical clip, marker, or wire (n = 77); coronary stent (n = 13)</td>
<td>Blooming artifact</td>
<td>Use of nonmetallic materials and image reconstruction algorithms; optimization of the reconstruction window; observation of distal flow</td>
</tr>
<tr>
<td>Metallic object</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calciﬁcation</td>
<td>10</td>
<td>Atherosclerosis</td>
<td>Blooming artifact</td>
<td>Use of various reconstructions; observation of distal flow</td>
</tr>
<tr>
<td>Air bubble</td>
<td>1</td>
<td>Contrast material administration; surgery</td>
<td>Low-attenuating artifact</td>
<td>Use of different reconstructions</td>
</tr>
<tr>
<td>Structure-related</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrast material—ﬁlled structure</td>
<td>5</td>
<td>Left atrial appendage</td>
<td>Obscured coronary artery</td>
<td>Tracing of anatomy</td>
</tr>
<tr>
<td>Overlying vessel</td>
<td>11</td>
<td>Cardiac veins</td>
<td>Obscured coronary artery</td>
<td>Observation of distal flow</td>
</tr>
<tr>
<td>Technical error or limitation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incomplete anatomic coverage</td>
<td>4</td>
<td>Incorrect selection of volume</td>
<td>Omission of the region of interest</td>
<td>Review of surgical records; scout imaging</td>
</tr>
<tr>
<td>Poor contrast enhancement</td>
<td>3</td>
<td>Inaccurate estimation of circulation time</td>
<td>Nondepiction of coronary artery or graft vessel</td>
<td>5-second scanning delay</td>
</tr>
<tr>
<td>Misregistration</td>
<td>1</td>
<td>Inappropriate pitch for heart rate</td>
<td>Skipped section</td>
<td>Manual selection of pitch</td>
</tr>
<tr>
<td>Anatomic deletion</td>
<td>2</td>
<td>Erroneous segmentation with automated reconstruction software</td>
<td>Nondepiction of part of a coronary vessel or graft</td>
<td>Different image reconstructions</td>
</tr>
<tr>
<td>Poor depiction of flow dynamics</td>
<td>3</td>
<td>Competitive, sluggish, or retrograde blood flow</td>
<td>Nondepiction of patent vessel</td>
<td>Comparison with conventional angiograms</td>
</tr>
</tbody>
</table>
Cardiac Motion–related Artifacts

Contrast-enhanced multi-detector row CT coronary angiographic images were obtained by using a retrospectively electrocardiographically gated reconstruction algorithm. Nonetheless, image quality was to some extent affected by cardiac motion in all of the patients. Many factors, including a heart rate greater than 70–75 beats per minute during imaging of the native coronary arteries (Fig 1), variations in heart rate during breath holding (Fig 2), arrhythmia (Fig 3), and inappropriate selection of pitch, affected image quality. Artifacts resulted in many cases and generally followed one of two patterns: motion blurring or stepladder effects. Blurring occurred when movement in the cardiac structure of interest exceeded the temporal resolution of scanning, either because of a fast heart rate or because of an inappropriate selection of the reconstruction window for the particular coronary artery. Regarding coronary arterial motion, the right coronary artery exhibits the highest-velocity movement and greatest positional change in the x and y planes, followed (in order of decreasing movement) by the
circumflex branch of the left coronary artery, the left main coronary artery, and the left anterior descending artery (12–17) (Figs 4, 5). There is a significant negative correlation between heart rate and image quality (18).

The easiest way of reducing cardiac motion artifacts is to lower the heart rate. As the heart rate increases, the number of arteries that can be evaluated decreases: According to the results from one study, the overall sensitivity of CT angiography for depiction of stenosis decreased from 62% with a heart rate of less than 70 beats per minute to 33% with a heart rate of more than 70 beats per minute (19). Patient-specific factors such as rapid heart rate or arrhythmia may be controlled with administration of a β-blocker. We found that a heart rate–lowering drug is routinely necessary to acquire diagnostic images, because a

**Figure 4.** Minimization of cardiac motion-related blurring with an optimal reconstruction window. Axial images reconstructed from data acquired at 40% (a) and 70% (b) of the R-R interval show right coronary artery blurring (arrow), less severe in b, that is probably attributable to rapid filling of the left ventricle during early diastole. Although the right coronary artery in our study was generally best visualized at 40% of the R-R interval, in this case the optimal reconstruction window for depiction of the right coronary artery was at 70%.

**Figure 5.** Minimization of stepladder artifacts with maintenance of an optimal heart rate and selection of an optimal reconstruction window. Volume-rendered images reconstructed from data acquired at 40% (a) and 70% (b) of the R-R interval, with a heart rate of 55 beats per minute, show a stepladder artifact, which is less pronounced in b. Note also the improved depiction in b of patency both in the in situ graft of the left internal mammary artery to the distal left anterior descending artery (arrowhead) and in the Y-graft (straight arrow) of a radial artery from the left internal mammary artery to the diagonal artery (curved arrow).
heart rate greater than 70–75 beats per minute, or variation in the heart rate during scanning, consistently induces artifacts (3,4,8–10,12,18–20). Others have reported that premedication with a β-blocker 1 hour before multi-detector row CT angiography is useful for decreasing heart rate and improving image quality (3). In our series, a β-blocker was used in patients suspected of having coronary artery disease, but it was not used in patients referred for follow-up imaging of a coronary artery bypass graft. The dosage was 60–120 mg three times daily, administered orally, beginning on the day prior to scanning and ending on the day of scanning.

As for the reconstruction window, the left anterior descending artery is generally best visualized at 60%–70% of the cardiac cycle. The right coronary artery is most consistently visualized early in diastole, at approximately 40% of the R-R interval. The left circumflex artery is best visualized at 50% of the cardiac cycle (12). Depiction of the right coronary artery and the left circumflex artery is easily affected not only by rapid atrial contraction during diastole but also by movement along the axis perpendicular to the plane of imaging (1). However, multiple reconstructions with different phase windows tailored to each case may be useful (17). Artifacts caused by cardiac motion or an inappropriate reconstruction window are much less frequent with the use of multi-detector row CT scanners and three-dimensional reconstruction algorithms. Stepladder artifacts may result from faulty data reconstruction that produces a gap or overlap between sections, but they more often result from cardiac motion (Figs 1, 2). Reconstructed axial images, although apparently acquired in the same time-window during the R-R interval, may differ in actual cardiac phase; the result of this disjuncture is an apparent stepladder-like contour of the heart. As the heart rate increases, the duration of diastole decreases (18). Variations in heart rate during breath holding are an inevitable physiologic problem; the heart rate initially slows, then progressively increases (21). The accelerated heart rate in the latter part of the breath hold makes it difficult to evaluate the distal segments of the coronary arteries and, in particular, the anastomoses of bypass grafts to the distal right coronary artery or its branches. To reduce stepladder artifacts caused by variations in heart rate, the duration of breath holding must be minimized. Ordinarily, this might be accomplished by decreasing the anatomic coverage per acquisition so as to reduce the scanning time. However, evaluation of coronary artery bypass grafts typically requires broader anatomic coverage and more scanning time than does evaluation of native coronary arteries, and an additional distal acquisition is helpful for evaluating distal arterial branches and grafts on the inferior surface of the heart. The use of multi-detector row CT scanners with 16 detector rows (eg, Somatom Sensation; Siemens Medical Solutions, Forchheim, Germany) also helps to minimize cardiac motion-related artifacts: With these scanners, complete coverage of the relevant anatomy can be achieved in 18–22 seconds.

**Pulmonary and Voluntary Motion-related Artifacts**

Motion artifacts other than those from cardiac motion result either from respiratory motion (Fig 6) or from voluntary motion that is generally preventable with careful instruction of the patient. Artifacts caused by respiration or voluntary movement affect both multi-detector row and single-detector row CT equally, have unpredictable patterns, and cannot be corrected with image data reconstruction methods. These artifacts usually cause a severe degradation of image quality in two ways: First, physical motion causes blurring and severe gaps and overlaps between sections. Second, respiratory or voluntary movement produces a phase-mismatch artifact similar to that produced by acceleration of the heart rate toward the end of a long breath hold. In this context, respiratory artifacts frequently affect the depiction of the inferior aspect of the heart toward the end of scanning performed over a relatively long time.
This is a common problem in the evaluation of coronary artery bypass grafts, because of the broader anatomic coverage needed for bypass evaluation than for evaluation of the native coronary artery. However, artifacts related to pulmonary or voluntary motion can be distinguished from cardiac motion–related artifacts in that the stepladder effect in the former group is apparent in the anterior chest wall, as well as along the heart border. Oxygen supplementation may help dyspneic patients hold their breaths for a longer period. Preoxygenation has been reported to result in a prolonged breath-hold interval in most patients, thereby allowing more complete coverage of the anatomy, including distally located bypass anastomoses (22).

**Beam Hardening and Structure-related Artifacts**

The most commonly encountered beam hardening and structure-related artifacts are those produced by surgically implanted high-attenuating materials or by contrast enhancement in natural structures. Beam hardening effects are usually caused by metallic objects such as clips (Fig 7), markers, and wires (Fig 8) used in coronary artery bypass surgery or by coronary stents (Fig 9), but they may also be caused by naturally occurring coronary calcifications (Fig 10). High-attenuating objects generally appear larger than they are. Although the depiction of coronary calcifications provides useful information regarding atherosclerosis, the resultant artifacts may interfere with the evaluation of luminal stenosis in a diseased coronary arterial segment (23). Low-attenuating artifacts, which are caused by objects such as air bubbles introduced into the main pulmonary artery during contrast material administration or

---

**Figure 7.** Beam hardening effects caused by surgical clips. (a) Volume-rendered image from data acquired at 70% of the R-R interval shows a “blooming” artifact in which the surgical clips appear larger than their actual size. This beam hardening effect degrades depiction of the left internal mammary arterial graft (straight arrows), but not that of the right coronary artery (arrowhead) and left anterior descending artery (curved arrow). (b) Volume-rendered image from data acquired at 40% of the R-R interval is degraded by cardiac motion as well as by beam hardening effects (arrows). Arrowhead indicates the right coronary artery.

**Figure 8.** High-attenuating artifacts caused by pacing wires. Volume-rendered image shows multiple wires (straight arrows), which are distinguishable from the right coronary artery (arrowhead), left internal mammary artery, and left anterior descending artery (curved arrow) by differences in their attenuation and anatomic locations.
Figure 9. High-attenuating artifact caused by a metallic stent. (a) Volume-rendered image depicts both the distal coronary artery segment and the stent (arrow) in the left anterior descending artery and, thus, indicates stent patency. (b) Multiplanar reformatted image shows a high-attenuating artifact (arrow) that prevents accurate evaluation of the stent lumen.

Figure 10. High-attenuating artifacts caused by coronary arterial calcifications. (a) Volume-rendered image shows high-attenuating artifacts caused by calcifications, which prevent accurate evaluation of luminal patency in the left anterior descending artery (arrow) and the diagonal artery (arrowhead). (b) Multiplanar reformatted image shows variable contrast material filling in a patent but extensively calcified left anterior descending artery (arrow), as well as distal flow (arrowheads).

Figure 11. Low-attenuating artifact from an air bubble in contrast material. Axial source image shows an air bubble in the main pulmonary artery (arrow), which causes a low-attenuating artifact with beam hardening that obscures an adjacent coronary artery bypass graft.
into the mediastinum during surgery, are rarely observed (Fig 11); however, bypass grafts that traverse the anterior mediastinum and overlie the pulmonary artery are particularly susceptible to such artifacts. Artifacts caused by overlapping contrast-filled normal anatomic structures such as the left atrial appendage (Fig 12) and the cardiac veins (Fig 13) may obscure the proximal segments of the left coronary arteries. Both high-attenuating and low-attenuating artifacts may be exacerbated by motion or by inappropriate selection of the reconstruction window (Fig 7), or they may be minimized with reduced motion and an optimal reconstruction window. Any negative effects of beam hardening or structure-related artifacts on the accuracy of image interpretation can be avoided with a review of the axial source images. The use of nonmetallic surgical materials also helps to ensure the accuracy of coronary artery bypass graft evaluation with multi-detector row CT.

**Figure 12.** High-attenuating artifact caused by multiple overlapping contrast material–filled structures. Volume-rendered images from data acquired at 70% (a) and 40% (b) of the R-R interval show an artifact caused by the left atrial appendage (arrowheads), which overlies the saphenous venous graft to the obtuse marginal branch (arrow). The artifact is more severe in b than in a because the left atrial appendage is larger in early diastole, before the atrium has emptied, than in late diastole, after the rapid filling phase of the ventricle but before atrial contraction.

**Figure 13.** High-attenuating artifact caused by multiple overlapping contrast material–filled vascular structures. Volume-rendered image (a) and thin-slab maximum intensity projection image (b) show a cardiac vein (arrow) that overlies the left coronary arteries (arrowheads) and makes evaluation of stenosis more difficult. In such cases, an oblique thin-slab maximum intensity projection image may be helpful.
Artifacts Caused by Technical Errors and Limitations

Artifacts that result from technical errors in image data acquisition and interpretation may be avoided with appropriate planning and execution of the scanning procedure, including instruction and practice of the patient in breath holding, as well as the optimal selection of anatomic coverage, scanning delay, pitch, and reconstruction window. To improve interpretation, it is essential to use reconstructions tailored to each case. Insufficient anatomic coverage in the evaluation of bypass grafts can be avoided with an awareness of surgical records and with scout imaging of the entire thorax to determine the area that should be included in CT angiography. Inaccurate estimation of the circulation time, which may result in a useless study, can easily be avoided with a 5-second scanning delay after peak enhancement of the aorta (Fig 14), because graft vessels enhance later than do native coronary arteries. Three-dimensional reconstructions based on automated segmentation occasionally omit a portion of the coronary artery or graft vessel (Fig 15) or inaccu-

Figure 14. Improved depiction of a coronary artery bypass graft with delayed scanning. (a) Axial image obtained before peak contrast enhancement of the aorta and graft vessels shows an apparently patent saphenous venous graft (large arrow) and left internal mammary artery (arrowhead). Small arrows in a and b indicate metallic clips. (b) Axial image obtained with a 5-second delay after peak enhancement of the aorta shows an enhanced left internal mammary artery (arrowhead) and stenosis in the saphenous venous graft (large arrow).

Figure 15. Image data postprocessing errors, apparent on a volume-rendered image compared with a multiplanar reformatted image. (a) Volume-rendered image shows deletion (straight arrow) of a left internal mammary artery bypass graft (curved arrow) to the left anterior descending artery, while a Y-graft of the left internal mammary artery to the obtuse marginal artery (arrowhead) is well depicted. (b) Multiplanar reformatted image shows patency in the left anterior descending artery (arrows).
rately depict the vessel anatomy (Fig 16). To clarify anatomic relationships, every case with a suspected lesion should be interpreted by using various three-dimensional reconstructions, maximum intensity projections, and multiplanar reformations in conjunction with the axial source images.

The selection of pitch is important, particularly when substantial variations in the heart rate are expected. We use a multi-detector row CT scanner that determines pitch automatically as a function of heart rate, with the default pitch value being based on the heart rate just before scanning. We measure heart rate variations before scout imaging and, if large variations are present, manually select a heart rate below the median value to determine pitch. This enables us to avoid the unintended gap between sections that occurs when the actual heart rate is markedly slower than the heart rate that corresponds to the default pitch value.

Artifacts that are related to flow dynamics also limit the usefulness of multi-detector row CT coronary angiography. Because multi-detector row CT coronary angiography does not depict the temporal course of contrast enhancement, it cannot be used to detect sluggish, retrograde, or antegrade flow. Competitive flow in a coronary artery bypass graft has been reported as an important cause of graft failure, particularly in bypass grafts that are connected to a moderately stenotic coronary artery (24–26). In our study, multi-detector row CT coronary angiography failed to depict any of the patent graft segments in which competitive flow was present. Balanced competitive flow in these arterial segments prevented

**Figure 16.** Motion blurring artifact, minimized with optimal selection of the reconstruction window. (a, b) Volume-rendered images from CT data acquired at 40% (a) and 70% (b) of the cardiac phase show two parallel saphenous venous grafts from the aorta to the diagonal artery (straight arrow) and from the aorta to the obtuse marginal artery (arrowhead). In a, the grafts appear to communicate, probably because of motion blurring near a metallic clip (curved arrow); in b, however, the separation of the grafts is clearly depicted. (c, d) Multiplanar reformatted images from data acquired at 40% (c) and 70% (d) of the cardiac phase show the same artifact (arrow), which is more severe in c than in d.
effective contrast material filling of the lumen—a failure that led in two cases to an incorrect finding of occlusion (Fig 17). Conventional angiography in these cases would have depicted the patent lumen of the proximal native coronary artery segment, because selective graft angiography is usually performed with a high-pressure injection of contrast material through a catheter. In another case in our study, only the distal segment of a graft vessel on conventional angiograms appeared to be filling with contrast material, apparently by retrograde flow from the native coronary artery. Delayed scanning was performed for comparison immediately after CT angiography, but the images from delayed CT provided no new information. Despite the overall high accuracy of multi-detector row CT for evaluating graft patency (11), this particular limitation (ie, the inability to depict an arterial segment in which there is competitive flow) is clinically significant. Depiction of patency in the proximal lumen of the native coronary artery and flow distal to the anastomosis nevertheless may be valuable in cases of suspected competitive flow.

Myocardial bridging—an anatomic variant in which a short segment of the main coronary artery, which normally traverses the epicardium, descends into the myocardium—also may be misinterpreted as stenosis at multi-detector row CT coronary angiography (Fig 18a), whereas it is easily detected on conventional angiograms, which show a typical “milking” effect (27) (Fig 18b, 18c). Although multi-detector row CT of the coronary arteries is a diastolic imaging technique, low temporal resolution (eg, 250 msec) relative to heart rate (eg, 69 beats per minute) in patients with myocardial bridging may prevent the differentiation of systole from diastole. Multiplanar reformation, however, enables the depiction of myocardial fibers overlying the arterial segment (Fig 18d).
Conclusions

Multi-detector row CT coronary angiography is rapidly developing, and its use is becoming more prevalent, but artifacts and other pitfalls of this method can cause significant problems for the accurate diagnosis of coronary artery disease. Four categories of artifacts are distinguished according to their source. The most frequently occurring artifacts are related to cardiac motion. These artifacts can be minimized or avoided with maintenance of an optimal heart rate of less than 70 beats per minute during scanning and with the selection of an optimal reconstruction window. Radiologists should be aware that an interpretation based exclusively on three-dimensional reconstructions of image data from the two separate phases of the cardiac cycle, without a review of axial source images, may be inaccurate and misleading. Every case with a suspected lesion should be interpreted by using all of the available reconstructions and with consideration for the anatomic relationships. In addition, the use of multi-detector row CT scanners with more than four detector rows enables improved temporal resolution and reduced breath-holding time, and, thus, helps to minimize motion-related artifacts and other pitfalls.

Figure 18. Myocardial bridging in a coronary artery segment. (a) Volume-rendered image shows apparent narrowing in a middle segment of the left anterior descending artery (arrow). (b, c) Conventional angiograms show the typical milking effect: The lumen of the arterial segment (arrow) is compressed by myocardial contraction in the systolic phase (b) but recovers its normal diameter in the diastolic phase (c). (d) Multiplanar reformatted image provides excellent depiction of myocardial bridging (arrow).
References


