RADIOLOGY

The Half-Axial Projection

A New Look at the Proximal Left Coronary Artery

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SONES HAS WELL described the goal of selective coronary arteriography as the "selective opacification of both coronary arteries in appropriate projections to assure that all major

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Figure 1

Case #4734. Half-axial projection. A patient with aortic stenosis and no occlusive disease of the coronary arteries. Left anterior descending division and its branches (septal, first and second diagonal) show minimal overlapping. Left circumflex and its marginal branch show little overlapping. MLC = main left coronary artery. LAD = left anterior descending division, LC = left circumflex division, SA = septal artery, D1, D2 = first and second diagonal branches of anterior descending division, MI = first marginal branch of circumflex division.
segments of the coronary tree are adequately visualized in a plane perpendicular to the X-ray beam. With traditional projections, in which the X-ray beam is rotated about the long axis of the patient, the arteriographic assessment of the left coronary artery with its primary and secondary branches is often limited by foreshortening of the artery or overlapping of its branches, or both. Supplementing cine coronary arteriography by large film techniques, as recommended by Judkins, may sometimes help in the assessment of lesions in overlapping vessels since the differing tube and film positions with respect to the heart may provide better visualization of an equivocal lesion. An additional dividend of large films is that, by angulation of the tube, one can obtain yet another view of the proximal left coronary artery, the half-axial projection.

**Technique**

The half-axial projection of the left coronary artery is obtained following our usual cine and large film angiograms in the frontal, lateral and each oblique projection (we alternate cine and large film views, with the patient positioned in various degrees of rotation by means of a cradle-top table*). The overhead tube is tilted caudally (20–30°) and the patient positioned in the right posterior oblique (RPO) projection (30–60°). The patient is instructed to hold a deep inspiration and sequential large films† are obtained following hand injection of 5–8 ml 76% Renografin, with a filming rate of 2 frames/sec for 3 sec. Adherence to this technique will generally result in maximal display of the left coronary artery with its primary and secondary branches.

**Results**

Figure 1 illustrates a normal left coronary as visualized in the half-axial projection. The main left coronary artery with its bifurcation into the left anterior descending and left circumflex divisions is visualized clearly. Furthermore, the origins and early course of the two diagonal branches of the left anterior descending division are superbly displayed with minimal overlap of vessels. Similarly, the origin and proximal course of the first marginal branch of the left circumflex artery are seen with little overlapping by the parent left circumflex division. No other projection so consistently displays the complex anatomy of the proximal portions of the primary and secondary branches of the left coronary artery as does the half-axial projection.

Two examples serve to demonstrate its value. Cases #4695 and #4893 had a full complement of cine and large film angiograms. Both patients were shown to have significant partial occlusive disease of the left anterior descending artery. But traditional projections did not adequately define the relation of the occlusive process to the origin of the first diagonal branch of the parent vessel.

Case #4695. A significant partial occlusive lesion of the left anterior descending artery was demonstrated in the traditional left posterior oblique and lateral projections. Of the two, the lateral projection best demonstrated the lesion. Figure 2 (top) (lateral projection) shows a tight stenosis of the left anterior descending artery proximal to the first diagonal branch. However, because of overlapping vessels, in neither this projection nor in the left posterior oblique projection was it clear whether the occlusive lesion involved the origin of the diagonal branch. The traditional right posterior oblique projection (fig. 2, middle) failed to visualize the lesion at all because of foreshortening of the proximal left anterior descending artery in this projection. By contrast, the advantage of combining caudal tilt of the X-ray tube with the RPO projection is illustrated by the half-axial projection (fig. 2, bottom) which clearly shows a highly significant occlusive lesion proximal to but not involving the origin of the large first diagonal branch. The half-axial view provided the best display of the proximal left anterior descending artery in this patient, and permitted us to plan only one bypass graft (to the distal left anterior descending artery). This one graft provided reva-

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*Cardiac table, Picker Corp.
†Picker C-P 420 changer.

**Figure 2**

Case #4695. Unstable angina. Abbreviations as in figure 1. (Top) Lateral projection. Severe partial occlusive lesion in the left anterior descending artery, distal to the first septal artery and proximal to the first diagonal branch. Overlap of origin and proximal course of the diagonal branch by the left anterior descending artery. (Middle) RPO projection. No occlusive lesion visualized. (Bottom) Half-axial projection. Severe partial occlusive lesion in left anterior descending artery, proximal to the origin of its major diagonal branch.
cularization for both the parent vessel and its first diagonal branch.

Case #4893. Significant partial occlusive disease of the left anterior descending artery was demonstrated in conventional frontal and left posterior oblique projections: of the two, the left posterior
oblique projection provided the most information (fig. 3, top). Two occlusive lesions were noted in the proximal left anterior descending artery; however, the relation of the more distal lesion to the first diagonal branch was not clear from either projection because of overlap of the two vessels. The right posterior oblique projection (fig. 3, bottom left) failed to visualize the lesions because of foreshortening of the left anterior descending artery in this projection. Again, the advantage of combining caudal tube tilt with the right posterior oblique projection is shown by the half-axial projection (fig. 3, bottom right), which shows the two partial occlusive lesions. The more distal occlusive lesion (white arrows) not only narrows the left anterior descending artery but also significantly narrows the origin of the first diagonal branch. The size of this diagonal branch indicates the functional importance of the lesion at its orifice. In this patient, therefore, the knowledge gained by the half-axial view demanded that we plan two bypass grafts—one to the distal left anterior descending artery and another to its diagonal branch.

Other examples may be cited in which the half-axial view has better defined the occlusive disease of the left coronary artery:

a. an occlusion in the main left coronary artery (fig. 4);

b. a lengthy occlusive lesion of the proximal left anterior descending artery and a similar lesion in the terminal left circumflex artery (fig. 5);

c. a highly significant occlusion at the origin of the left circumflex artery (fig. 6).

Discussion

We have recently added the half-axial view to our usual cine and large film coronary angiographic...
assessment of the left coronary artery. In 33 of the last 72 coronary arteriograms, the half-axial view has materially improved our angiographic assessment of the main left coronary artery with its primary and secondary branches, which together may present a very complex pattern.

The half-axial view is limited in value in two situations:

1. In the patient with an exceptionally high right diaphragm, the clear area between the right diaphragm and spine is relatively narrow, and the proximal left coronary artery must be displayed in this narrow zone in order to keep exposure times acceptably short. In such patients, one may resort to two contrast injections, with the left anterior descending division best visualized in approximately 30° RPO rotation and the left circumflex division best visualized in approximately 60° RPO rotation. In such patients, one may also wish to decrease the caudal angulation of the tube.

2. The half-axial projection may not clarify the anatomic picture in patients with a tortuous proximal left anterior descending artery whose initial course is superiorly directed before it passes down the interventricular groove. Here the half-axial view may actually produce more overlap than traditional projections. This represents one of the few situations in which one may expect no help from the half-axial projection.

As has been previously mentioned, we obtain large film coronary angiograms utilizing an overhead tube while the patient is rotated on a cradle-top table. If one used the large film coronary arteriographic technique advocated by Judkins and wished to employ the half-axial projection, the patient would be rotated into an LAO position against a lateral film changer; the lateral tube would be tilted cranially.

Summary

The half-axial view is a dividend of large film selective coronary arteriography. The half-axial projection is obtained by combining caudal tilt of the overhead tube with rotation of the patient into the right posterior oblique position. Thus, the main left coronary artery and the proximal portions of its primary and secondary branches are maximally displayed because the X-ray beam is nearly perpendicular to these vessels and overlap is minimized. The half-axial view adds less than two minutes to the procedure and in nearly half of our patients adds significantly to the arteriographic assessment of the left coronary artery.

References

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Correction


**Figure 4**
Case #4952. Half-axial projection. Chronic, progressice angina. Significant partial occlusive lesion in the left main coronary artery (arrow). Less critical occlusive lesions in the left anterior descending artery distal to the origin of the second septal artery, and in both diagonal branches as well. Abbreviations as in figure 1.

**Figure 6**
Case #4744. Half-axial projection. Unstable angina. A 90% occlusive lesion at the origin of the left circumflex artery (arrow). Minor changes in diameter of the left main coronary artery and the left anterior descending artery just distal to the origin of the circumflex division. Abbreviations as in figure 1.