Lordotic Right Posterior Oblique Projection of the Left Coronary Artery
A Special View for Special Anatomy
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SUMMARY
The lordotic right posterior oblique projection of the left coronary artery is obtained by combining cranial angulation of the X-ray beam with rotation of the patient into the right posterior oblique position. This projection is helpful for separation of the main left coronary artery and the proximal portions of the left anterior descending and circumflex divisions, especially in patients in whom the left anterior descending artery is directed cephalad early in its course. The obtaining of an image from the lordotic right posterior oblique projection adds less than two minutes to the procedure and improves arteriographic assessment of the left coronary artery.

SINCE THE INTRODUCTION of the half-axial projection in our laboratory, there have been other reports describing special projections utilizing cephalad or caudal angulation of the X-ray tube in order to improve visualization of the left coronary artery and its proximal branches. The half-axial projection is not helpful in all situations. For example, in patients with a tortuous anterior descending branch of the left coronary artery (LAD), the initial course of which is directed superiorly before it passes down the interventricular groove, the half-axial projection may result in more proximal vessel overlap than occurs in the traditional right posterior oblique projection (RPO). (The RPO projection using cut film is similar to the left anterior oblique using cineangiography.) The purpose of this study was to obtain a view that overcomes this difficulty, and more reliably visualizes proximal left coronary artery branches which exhibit this particular anatomic variation. The lordotic RPO projection helps in the pursuit of these goals.

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Technique
In our laboratory we alternate cine and large film exposures in the various projections. The patient is on a Picker cradle with an overhead tube and under-table vacuum cassette changer. In addition to the usual cine and large film angiograms in frontal, lateral, and both oblique projections, the patient is rotated into the RPO position (50 to 60°). The overhead tube is tilted 20–30° cephalad (fig. 1). During a hand injection of 76% renografin, a large film sequence is obtained with a filming rate of 2 frames per second for 2 or 3 seconds. The patient is instructed to hold a deep breath during filming. In order to obtain a comparable projection by cineangiography, a C-arm-mounted image amplifier and X-ray tube are needed so that there is freedom to change the relationship of the patient to the X-ray beam in two planes.

Results
Case #7377. Figure 2 illustrates normal arteriograms in a patient with cardiomyopathy. The left posterior oblique (LPO) and RPO projections show the cephalad direction of the initial portion of the left anterior descending artery. There is significant overlap of the LAD and its diagonal branches in the LPO projection. The lordotic RPO projection shows excellent separation of the main left coronary artery at its bifurcation as well as the proximal portion of the left circumflex and left anterior descending with its diagonal and septal branches.

The following cases serve to demonstrate the value of the lordotic RPO projection in visualizing occlusive disease. In the first two cases the lesion would have been missed without the lordotic RPO view.
Case #7250. Prinzmetal's variant angina (fig. 3). No lesion near the origin of the LAD could be seen in RPO, lateral or half-axial views. Frontal and LPO views on cineangiogram and cut films were only suggestive of proximal LAD stenosis. The lordotic RPO projection clearly demonstrated significant partial occlusive disease of the left anterior descending shortly after its origin.

Case #7284 (fig. 4). LPO, RPO, frontal, lateral, and half-axial views on cut film and on cineangiography failed to show the origin of the left anterior descending artery because of foreshortening or overlap and were not helpful in demonstrating the lesion. Again the lordotic RPO view was the only projection which showed significant stenosis at the origin of the LAD.

Case #7095 (fig. 5). Severe occlusion of the proximal LAD could not be appreciated in RPO, frontal or LPO large films, but was noted in the cineangiogram. The lordotic RPO projection showed excellent separation of the primary division of the left coronary artery and demonstrated severe LAD stenosis between the origins of the first and second diagonal branches, a relationship not revealed by other views.

Case #7212. Occasionally the lordotic RPO projec-
Figure 3
Case #7250. Prinzmetal's variant angina. The RPO, lateral and half-axial views, a, b, and c, do not show the lesion of the proximal left anterior descending artery. The LPO view, d, is only suggestive of proximal left anterior descending stenosis. The lordotic RPO projection, e, shows significant stenosis of the left anterior descending artery near its origin. Abbreviations as figure 2. LC = left circumflex division.

Discussion
Since coronary arteriography has become a widely used technique of studying patients with coronary artery disease,4, 8 the finding of a normal coronary arteriogram in a patient with chest pain is not unusual.6 Possible explanations include ischemia due to abnormal affinity of hemoglobin for oxygen and occlusive disease of small coronary arteries.7, 8
Myocardial infarction in patients with normal or near normal coronary arteriograms has also been observed; one recent study places its incidence as high as 12%. The mechanism of infarction in these patients remains obscure. A recent report proposes platelet aggregates or thrombosis followed by lysis and recanalization as possible causes. Inadequate coronary arteriograms leading to erroneous interpretation could be another explanation for this contradictory finding. Visualization of occlusive lesions of the proximal branches of the left coronary artery is sometimes very difficult to achieve because of foreshortening and overlap of these vessels in traditional projections. Special projections may be necessary, and the suitable projection may depend on the individual's pattern of coronary anatomy.

Although coronary artery spasm is believed to be the major cause of pain in patients with Prinzmetal's variant angina, either significant focal obstructive disease of a single major coronary artery or normal coronary arteriograms have been associated with the syndrome in some cases. Our patient with variant angina (Case #7250) had repeated episodes of pain, ventricular irritability, and marked ST elevation in precordial leads within 36 hours of admission. Coronary arteriograms were performed with cine and large films utilizing RPO, LPO, frontal, and lateral projections with both filming techniques. In addition, the half-axial projection was obtained by large film technique. None of these views showed convincing evidence of stenosis of the proximal LAD. The lordotic RPO projection was the only view to demonstrate the lesion clearly. This patient had an aortocoronary bypass graft to the LAD soon after arteriography. His postoperative course has been uneventful and he is free of symptoms.
Table 1

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<td>21</td>
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<td>14</td>
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Numbers in parenthesis are number of cases.

Abbreviations: RPO = right posterior oblique; Sup = superior; Int = intermediate; Inf = inferior.

In our laboratory we obtain the half-axial view routinely unless the initial course of the LAD is directed superiorly, in which case the lordotic RPO is the special projection of choice. The disadvantage of the lordotic RPO view is that the X-ray beam penetrates the thorax in an oblique direction. The greater thickness of tissue traversed plus increased heart-to-film distance are both factors which reduce film contrast and require higher voltage and exposure time in order to obtain satisfactory diagnostic films. Lesions diagnosed with this special view are sometimes but not always visible on cineangiography. The techniques of cut film and cine film are complementary.

References
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