and completes the reentrant circuit.

Evidence to support the theory that His bundle depolarization occurred by anterograde AV nodal conduction includes: 1) gradual prolongation in stimulus to His interval (S-H) with closer coupling of the premature impulse (reflecting decremental properties of the AV node); 2) shorter stimulus to His intervals (S-H) with pacing sites in closer proximity to the AV node; 3) evidence of splitting of the His bundle electrogram with critically timed atrial premature impulses; and 4) prolongation of the H-V interval with the second beat of tachycardia initiation in the presence of right bundle branch block.

In several of the earlier reported cases, the second ventricular response to an atrial premature impulse was conducted with a left bundle branch block morphology. In the presence of dual AV nodal pathways, Pimenta et al demonstrated normal ventricular activation with the second ventricular response to an atrial premature impulse. This was explained by delay in the AV node, allowing recovery of conduction in the left bundle branch system. Lin et al also were able to duplicate this mode of tachycardia induction with diltiazem-induced delay in AV nodal conduction, allowing normal conduction of the second QRS complex. The patient reported by Ezri et al had orthodromic tachycardia induction associated with left bundle branch block and an H-V interval of 100 ms. In our patient, orthodromic tachycardia was initiated with both normal and prolonged infra-Hisian conduction. In the second QRS complex with right bundle branch block, there may have been additional block in the left posterior hemifascicle. Retrograde concealed conduction to the left bundle branch may also explain this phenomenon. With atrial pacing during sinus rhythm, intra-Hisian conduction delay prevented the second impulse from conducting to the ventricle and initiating tachycardia.

The effects of procainamide therapy in preventing the initiation of tachycardia with atrial premature impulses did not appear to be mediated by decreased anterograde or retrograde conduction via the accessory pathway. Rather, it appeared to have a direct effect on intra-atrial conduction, which prevented the atrial premature impulse from reaching the AV node.

This unusual mode of orthodromic tachycardia initiation associated with rapid anterograde and retrograde accessory pathway conduction may explain the paucity of clinical symptoms prior to a catastrophic presentation with atrial fibrillation. Although procainamide therapy may decrease orthodromic tachycardia initiation, it offers little protection from a rapid ventricular response during atrial fibrillation. Therefore, surgical ablation of the bypass tract was chosen as the most appropriate therapy for this patient.

REFERENCES

3 Neus H, Schlepper M, Spies HF. Double ventricular responses to an atrial extrasystole in a patient with WPW syndrome type B. Eur J Cardiol 1974; 2:175-79
7 Lin FC, Yeh SJ, Wu D. Double atrial responses to a single ventricular impulse due to simultaneous conduction via two retrograde pathways. J Am Coll Cardiol 1985; 5:168-75

Digital Subtraction Angiography in Angioplasty of Total Coronary Artery Occlusion*

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This report describes a digital subtraction angiographic technique used to simultaneously display the proximal and distal segments of three totally occluded coronary arteries in two patients undergoing percutaneous transluminal coronary angioplasty (PTCA). The advantage of this technique over routine cineangiography for PTCA of total occlusions is illustrated.

The selection of patients with angina pectoris and chronically occluded coronary arteries for percutaneous transluminal coronary angioplasty (PTCA) depends on the patient's clinical syndrome, demonstration of myocardial ischemia on noninvasive tests, the duration of total occlusion, and the angiographic appearance of the lesions. Frequently, inadequate and delayed visualization of the distal artery in these patients prevents a determination of the length or position of the occluded segment, increasing the uncertainty involved in advancing the coronary guide wire. This report illustrates the advantages of using digital subtraction angiography (DSA) over routine contrast cineangiography during PTCA of chronic total occlusions to allow simultaneous visualization of proximal, occluded and distal arterial segments.

CASE REPORT

Successful PTCA of three totally occluded coronary arteries was performed in two patients, 53 and 37 years old, with an average of three months of class 3 or 4 angina pectoris. Patient 1 had a total occlusion of the proximal left anterior descending and dominant right coronary arteries. Patient 2 had a total occlusion of a large left circumflex marginal branch and a history of a non-Q wave infarct in that distribution two months prior to PTCA. Inadequate and delayed visualization of the distal segments of all three involved vessels occurred from retrograde or intracoronary antegrade collateral channels with routine cineangiography using 6 to 10 ml of 76 percent sodium meglumine diatrizoate injected at 3 to 4 ml per second. Digital angiography of all involved coronary arteries was performed.

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*Digital Subtraction Angiography in Angioplasty (Carlson et al)
formed with injection of diluted sodium meglumine diatrizoate (76 percent in an equal volume of 5 percent dextrose) using a Philips digital vascular imaging system. Images were acquired using electrocardiographic gating in a pulsed progressive scan mode of one frame per cardiac cycle. The digital vascular imaging system used a fixed pulse width of 6 to 10 ms and automatically set the kilovolts (range 60 to 90) and milliamperes (range 850 to 1200). Studies were remasked using the image in which contrast adequately filled the proximal arterial segment. When this mask image was subtracted from a later image in the same run in which the distal arterial segment was best visualized, the resultant image revealed the proximal vessel with negative and the distal vessel with positive contrast. This image was displayed in the catheterization laboratory next to the monitor displaying live fluoroscopy in the same view.

The best single-frame cineangiographic images display either the proximal or the poorly visualized distal segments, but not both (Fig 1). In the DSA display, simultaneous visualization of the proximal and distal segments allow one to determine the length and position of the entire intervening occluded segment. Comparison of the two display formats reveals the obvious advantage of the digital display over routine cineangiography during PTCA.

A 2.0 mm followed by a 3.0 mm Simpson-Roberts balloon dilatation catheter and .018 high torque floppy guide wire were used to dilate both occlusions in patient 1. A 2.5 mm Simpson-Roberts balloon dilatation catheter and .018 high torque floppy guide wire were used to dilate the left circumflex marginal occlusion in patient 2. All three totally occluded lesions were successfully dilated (Fig 2).

**DISCUSSION**

This report illustrates the advantages of DSA over routine cineangiography for PTCA of total occlusions. The simultaneous display of both proximal and distal segments allows the length and position of the intervening occluded segment to be deduced. This technique is particularly applicable for PTCA of very long arterial occlusions since it permits the coronary guidewire to be safely advanced with confidence across the lesion.

All three arteries in this report had delayed filling from right-to-right or left-to-left collateral channels. This technique could also be applied to occluded arteries with delayed distal filling from the contralateral artery using simultaneous injections of both coronary arteries via two arterial access.
Occult Spontaneous Esophageal Perforation*
Unusual Clinical and Radiographic Presentation

Robb W. Glenny, M.D.; William J. Fulkerson, M.D., F.C.C.P.; and Carl E. Ravin, M.D., F.C.C.P.

We report a unique presentation of spontaneous esophageal perforation or Boerhaave’s syndrome. Our patient had no risk factors predisposing her to baroregic rupture of the esophagus, and she had none of the “classic” presenting signs. She was asymptomatic, and her clinical course appeared to be chronic. Her chest roentgenogram demonstrated bilateral thick-walled cavities with air-fluid levels. Computerized axial tomography of the chest and swallow of meglumine diatrizoate (Gastrografin) showed the cavities and esophagus to communicate. This patient’s presentation and radiographic studies extend the reported description of Boerhaave’s syndrome.

Spontaneous rupture of the esophagus (Boerhaave’s syndrome) is usually a catastrophic event followed by life-threatening complications. The mortality of untreated cases is nearly 100 percent. Prompt diagnosis and medical or surgical treatment can be lifesaving. Patients usually complain of severe chest and abdominal pain and shortness of breath and may have marked hemodynamic instability. Chest roentgenograms most commonly demonstrate pleural effusions and subcutaneous emphysema. We report the findings in a patient with spontaneous esophageal perforation who denied any acute symptoms and who had unusual radiographic manifestations. Her abnormal chest roentgenogram, which was taken for unrelated preoperative assessment, prompted further investigation. The diagnosis was suspected by computerized axial tomography of the chest and was confirmed by swallow of meglumine diatrizoate (Gastrografin).

Case Report

A 51-year-old woman was admitted to Duke University Medical Center for elective soft-tissue reconstruction and arthrodesis of her right foot. She denied any symptoms of chest pain, fever, chills, cough, or production of sputum. There was no history of vomiting, dysphagia, alcohol abuse, loss of consciousness, or seizure disorder. She had never undergone esophageal instrumentation. Physical examination showed the patient to appear to be well; however, her temperature was 39°C (102.2°F), and her respiratory rate was 30/min. Blood pressure was 110/70 mm Hg, and pulse rate was 110 beats per minute. The findings from examination of the skin were normal, and there was no subcutaneous crepitus. The patient was edentulous, but the oropharynx was otherwise unremarkable. Her palate moved normally with swallowing. Examination of her neck revealed no mass or tenderness. Auscultation of the chest demonstrated decreased breath sounds at both bases. There were no crackles or wheezes. The findings from cardiac examination were remarkable for a regular tachycardia and a midsystolic click. The

REFERENCES


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