Abstract. A study of 72 patients angiographically examined by the percutaneous transbrachial technique with 4–5F catheters is reported. Even though the patients were preselected to reduce the risk of the technique, an unacceptably high incidence (7%) of major complications, including 3 patients requiring surgery for brachial thrombosis, was encountered. Although transbrachial catheterization with single 4F catheter midstream injections as reported in the literature may be safe, this technique is unwarranted when selective studies are planned and the alternative transfemoral approach is available.

Key words: Angiography—Aortography—Brachial artery—Heart catheterization

Recent technical and economic developments have led to the shift of elective arteriography from inpatients to outpatients. Catheters of 4–5F size have been developed for both midstream and selective injections of the aorta and its multiple branches. A study in which patients referred for digital and routine arteriography were preselected for the transbrachial approach when risk factors were felt to be suitable was undertaken. By using the transbrachial approach, we hoped to avoid the neurological complications associated with the transaxillary approach and avoid the necessity of prolonged patient observation required by the transfemoral approach.

Patient Selection

Screening was performed by way of telephone communication with the referring physician. Patients were excluded from the study if they had any of the following parameters: diastolic hypertension of 100 mmHg or greater, insulin-dependent diabetes, renal insufficiency, age of 70 years or older, and weight less than 110 pounds. When any of these conditions was encountered, the patient was scheduled as a day admission and the transfemoral approach utilized. Patients in whom there were contraindications to the femoral approach were also included in this study.

There were 72 patients in this series. Fifty-nine patients were treated strictly on an outpatient basis; that is, they presented themselves to the department and were held generally no longer than 30–60 minutes after the procedure. The remaining 13 patients were either inpatients or were patients in a temporary observation unit, the transbrachial approach being used because of peripheral vascular occlusive disease. They are included in this study because the technique did not significantly differ from the outpatient group. The majority of the patients had digital subtraction aortic arch and carotid angiography, with one-third of them having selective studies of the carotid arteries. The patient population is presented in Table I.

Transbrachial Technique

All patients were studied by two experienced angiographers comfortable with transaxillary catheterizations. The left antecubital brachial approach was used in right-handed patients. Occasionally, patients were studied from the right antecubital fossa, either because they were left-handed or because they had left subclavian occlusive disease. Blood pressures were obtained routinely in both arms prior to catheterization. Local anesthesia was obtained by infiltrating 3–5 ml of 1% lidocaine superficially and on each side of the artery, with the angiographer carefully avoiding the medially adjacent brachial nerve. Catheterization was performed by the one-wall puncture technique [11] with a 4-cm. 19-gauge beveled needle and a 0.028-inch guide wire. A Desilets-Hoffman sheath was employed in only six of the patients. Pigtail catheters (4F or 5F) were used for midstream injections, the size of the catheter depending on the size of the patient, and the catheters were always removed over a guide wire. Selective catheterization was performed in
Table 1. Transbrachial arteriography patients

<table>
<thead>
<tr>
<th>No.</th>
<th>Procedure</th>
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<tbody>
<tr>
<td>55</td>
<td>Arch and carotids</td>
</tr>
<tr>
<td>9</td>
<td>Abdominal, pelvic, and peripheral</td>
</tr>
<tr>
<td>1</td>
<td>Combined peripheral and arch</td>
</tr>
<tr>
<td>6</td>
<td>Selective renal</td>
</tr>
</tbody>
</table>

35% of the patients with 4.5F or 5F catheters, the indication being based on the clinical picture and the adequacy of the nonselective studies. Meglumine iothalamate (60%) was used for aortic and standard selective injections, with dilution by one-half for digital subtraction selective injections. Sodium and meglumine diatrizoate (76%) was used for the coronary studies.

From the left brachial approach, a Simmons 1 catheter was used if only left carotid arteriography was needed. If right carotid or bilateral carotid arteriography was planned, a Simmons 2 catheter was used, as it would generally reach through the innominate artery into the right common carotid artery in its “sidewinder” configuration. The left vertebral artery was rarely but easily catheterized from the left brachial approach with the same configuration, whereas the right vertebral artery was very difficult to catheterize.

With a right brachial approach, right carotid visualization was obtained with an innominate injection through the pigtail catheter. The left common carotid artery was catheterized by a Simmons catheter.

Heparin (3000–4000 U) was routinely given intravenously with reversal by 40–50 mg protamine sulfate intravenously at the completion of the study. After a brief 30–60-minute observation period in the department, the outpatients were discharged and accompanied by a family member or friend. The arm was placed in an armboard to keep the elbow straight overnight. Follow-up was accomplished by direct telephone call to the patient or by communication with the attending physician.

Results

In the 72 patients included in this study, there was only one failure to catheterize the ascending aorta: an extremely tortuous left brachial artery prevented catheter passage. There were five (7%) major and three (4%) minor complications, with an overall complication rate of 11% (Table 2). This high complication rate necessitated stopping routine brachial catheterization.

Three patients (4%) developed brachial thromboses, which were treated successfully by surgical thrombectomy. Two of these occurred during catheter removal, one with a 4F catheter passed through a sheath, and the other with a 5F catheter, no sheath having been used. In both patients, catheter exchanges were necessary for selective studies. The third patient had only nonselective ascending aorta and innominate injections through a 5F pigtail catheter passed from the right brachial approach without a sheath. The study in this patient demonstrated severe diffuse fibromuscular dysplasia involving both internal carotid and vertebral arteries. The patient did well and, on telephone calling 2 days later, had no complaints; however, on the fourth postangiography day, the patient developed an ischemic right hand. Surgery was successfully performed with vein patch grafting. The surgeon commented on finding an abnormally thin artery.

One patient had two major hemorrhages from the puncture site, the first episode occurring 1 hour after catheter removal while still in the hospital. The brachial approach had been elected because of a right femoral arteriovenous fistula complicating a previous transgraft coronary angiogram. In this patient, a 5F pigtail catheter was used for a digital subtraction aortic arch study and followed by a 5F selective catheter for a right iliofemoral angiogram. The arm became swollen and painful, but without pulse or motor loss. The patient was observed for 3 additional hours and, because the pain decreased significantly, was discharged with the arm immobilized on an arm board. Two days later he rebled, but was not admitted because he was stable and had only mild discomfort at the time of examination. Frequent follow-up visits demonstrated gradual resolution of the hematoma with no sequelae.

The final major complication occurred in a woman in whom a 4F pigtail catheter had been used.