Intravenous Digital Subtraction Angiography in Patients with Femoral Arteriovenous Fistulas and Ilio-Iliac Crossover Graft

Ingolf P. Arlart, and Siegfried Hutschenreiter

Department of Diagnostic Radiology and Department of Thoracic and Vascular Surgery, Ulm University, Federal Republic of Germany

Abstract. Fourteen patients with femoral arteriovenous (AV) fistulas and ilio-iliac crossover bypass grafts after postthrombotic occlusion of an iliac vein were studied by intravenous digital subtraction angiography (IV DSA). Digital radiography’s utility may be evaluated in the demonstration of the vascular status of AV fistulas and venous return through the reopened iliac vein or ilio-iliac graft. Digital subtraction imaging is a suitable modality to plan operations, such as closure of temporary AV fistula. In follow-up studies of these cases, patency of the crossover bypass can be assessed by noninvasive DSA of the ascending veins.

Key words: Intravenous digital subtraction angiography (IV DSA)—Venous occlusion, iliac—Postthrombotic disease—Vascular bypass grafting, ilio-iliac crossover—Arteriovenous fistula, posttraumatic

Reconstructive procedures in venous occlusive diseases of great vessels are generally limited. In patients with postthrombotic occlusive blockade of an iliac vein, operative thrombectomy and temporary ipsilateral femoral arteriovenous (AV) fistula is the invasive consequence of patient management. Following a reocclusion of the iliac vein a femoro-femoral crossover saphenous bypass was pioneered by Palma and Esperon [1]. This bypass was observed to remain patent in about 50% of the published cases. A modification of the classic Palma operation was published in 1980 by Vollmar and Hutschenreiter [2] that promised a higher success rate. In both methods an additional temporary ipsilateral femoral AV fistula was recommended as a measure to prevent occlusion [3]. The prerequisite for operative closure of the AV fistula is a nonrestricted return of venous blood via the recanalized vein or graft that is confirmed by arteriography.

With the advent of DSA [4–6], angiographic studies can be performed in outpatients by noninvasive intravenous injection of the contrast medium. This study reveals the usefulness of DSA to document AV fistulas, anastomoses, and venous blood return through the iliac vein to the bypass by comparing it with conventional catheter angiography.

Materials and Methods

The digital fluoroscopy system1 (Angiotron CM) used for this study combines a conventional trimodal iodide image intensifier with a digital video system. The video is acquired at 12-bit contrast resolution, the different images are displayed on a 512 x 512 matrix that is 8 bits deep. The exposure rate ranges from 350 to 1000 μR/sec depending on the size of the intensifier diameter (33/23/17 cm), i.e., about 50–133 nC/kg/image. The maximal continuous mode is limited to 25 sec per sequence. The immediate documentation of contrast filling of vessels is performed on-line after subtraction of a precontrast mask. Dynamic imaging, including venous return in our cases, can be visualized off-line by selecting different masks and late contrast phases.

Under fluoroscopic control, a 5-French multiholed catheter was introduced percutaneously transcubital and positioned in the superior vena cava. The dose of contrast medium was 40 ml of nonionic iopamidol2 (Solutrasl), which was injected at a 17 ml/sec flow rate. Total dose of contrast medium was limited to 120 ml, i.e., three different sequences per patient, to reveal IV DSA images of the entire pelvic region and, additionally, selective anastomotic regions using an intensifier size of 17 cm for zoom effect. Before the angiographic sequences, 30 mg of n-butyl-scopolamine was administered intravenously and abdominal compression applied to minimize bowel gas motion.

1 Siemens Corporation, Erlangen, FRG
2 Solutrasl 370, Byk-Gulden Lomberg Chemische Fabrik GmbH, Konstanz, FRG

Address reprint requests to: Prof. Dr. med. Ingolf P. Arlart, Steinbhoelvelstr. 9, Dept. of Diagnostic Radiology 1, D-7900 Ulm/Donau, FRG
1. Arlart and S. Hutschenreiter: IV DSA in Femoral AV Fistulas and Ilio-Iliac Bypass

Fig. 1. A. Intravenous digital subtraction angiogram of patient undergoing thrombectomy and ipsilateral femoral AV fistula after acute thrombotic occlusion of left iliac vein. Completely patent left iliac vein can be seen. B Selective digital angiogram (zoom effect) of upper part of recanalized left iliac vein that arises into inferior vena cava.

Fig. 2. Case 2 Intravenous digital subtraction angiogram of a completely reoccluded left iliac vein after thrombectomy. AV fistula remained patent.

Results

In 6 of 8 patients of Group 1, DSA demonstrated a patent AV fistula and completely reopened iliac vein (see Fig. 1). In two young women, however, a reocclusion of the operatively reopened iliac vein was well seen by the contrast study of venous return through the patent AV fistula (see Fig. 2). In three patients of Group 2, DSA showed a normal flow of the contrast medium through the AV fistula, entire crossover bypass, and contralateral iliac vein. Another two patients of this group had a significant stenosis of the ipsilateral common femoral vein between the AV fistula and anastomosis of the crossover graft (see Fig. 3). In one other patient DSA demonstrated a complete occlusion of both AV fistula and crossover bypass.

Three representative cases are selected to show digital subtraction angiograms of AV fistulas and venous return through either the reopened, reoccluded iliac vein or the ilio-iliac crossover graft.

Case Descriptions

Intravenous DSA studies were carried out in: Group 1—8 patients with ipsilateral femoral AV fistula after iliac vein thrombectomy and Group 2—6 patients with an ilio-iliac crossover Gore-tex bypass (high Palma bypass) after reocclusion of the reopened iliac vein. In 8 of 14 patients the control angiographic examination was repeated using the conventional technique.