Iliofemoral Venous Thrombectomy

Indications, Technique, and Results in Forty-five Cases

By Gardner W. Smith, M.D.

SUMMARY
Experience with iliofemoral venous thrombectomy in 45 cases has been reviewed. The indications for this procedure have been presented, and only two absolute contraindications are recognized. Certain aspects of surgical technique and of postoperative care have been discussed, with emphasis on the use of local anesthesia, the balloon catheter, and early postoperative ambulation.

Results indicate that iliofemoral venous thrombectomy does relieve early morbidity and appears to be as successful as nonoperative management in the prevention of pulmonary embolism. Clinical improvement has been achieved in 76% of the entire group, and these results are influenced by both the preoperative duration of symptoms and the degree of success in removing the thrombus at operation. Of particular significance is a group of 14 patients followed for 2 or more years, only 14% of whom were afflicted by the sequelae of deep venous insufficiency. This finding provides encouraging support for the thesis that iliofemoral venous thrombectomy may ameliorate the late postphlebitic sequelae of deep venous thrombosis.

Additional Indexing Words:
Pulmonary embolus 
Deep venous insufficiency
Postphlebitic syndrome
Anticoagulant therapy

Despite a rapidly enlarging experience,1-9 the surgical treatment of deep venous thrombosis has not achieved wide acceptance. This lack of enthusiasm is based upon two factors: (1) the relatively satisfactory early results of nonoperative management, and (2) the fear of producing pulmonary embolism by operative manipulation. However, the patient with iliofemoral venous thrombosis faces not only early pain and edema and the risk of pulmonary embolism, but also the late possibility of chronic deep venous insufficiency. This risk of long-term sequelae varies from 50 to 90% for untreated patients,10-12 and may be as high as 60% for patients adequately treated with anticoagulants alone.4 Furthermore, although intraoperative pulmonary emboli have occurred, their incidence is certainly less than 3%13 and only two fatalities have been reported.14,15

Thus it appears that both objections have little basis in fact.

Two years ago the results of iliofemoral venous thrombectomy in a small group of patients were compared with the clinical outcome in a similar group managed conservatively.13 It was concluded that surgical therapy was superior to medical management in the relief of early morbidity and was equally as effective in the prevention of pulmonary embolism. These early results also suggested that the surgically treated patients did better in relation to long-term venous insufficiency. During the ensuing 2 years the surgical series has almost tripled, and the results are presented here.

Clinical Material
A total of 47 patients have been treated surgically for iliofemoral venous thrombosis (table 1). Two negative explorations due to diagnostic error left 45 determinant cases in which iliofemoral venous thrombectomy was

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Table 1
Patients Treated by Iliofemoral Venous Thrombectomy

<table>
<thead>
<tr>
<th>Determinant cases</th>
<th>47</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>47</td>
</tr>
<tr>
<td>Negative exploration</td>
<td>2</td>
</tr>
<tr>
<td>Side involved (cases)</td>
<td>45</td>
</tr>
<tr>
<td>Right</td>
<td>12</td>
</tr>
<tr>
<td>Left</td>
<td>33</td>
</tr>
<tr>
<td>Sex</td>
<td>27</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>46</td>
</tr>
<tr>
<td>Average</td>
<td>20-83</td>
</tr>
<tr>
<td>Range</td>
<td>15</td>
</tr>
<tr>
<td>Surgical</td>
<td>15</td>
</tr>
<tr>
<td>Medical</td>
<td>17</td>
</tr>
<tr>
<td>Trauma</td>
<td>7</td>
</tr>
<tr>
<td>Spontaneous</td>
<td>6</td>
</tr>
<tr>
<td>Associated with oral contraceptives</td>
<td>3</td>
</tr>
<tr>
<td>Associated with pregnancy</td>
<td>4</td>
</tr>
<tr>
<td>Duration of symptoms</td>
<td>58 hr</td>
</tr>
<tr>
<td>Average</td>
<td>2 hr–16 days</td>
</tr>
</tbody>
</table>

performed. The group consisted of 27 men and 18 women, whose average age was 46 years. As has been observed in the past, the left leg was involved almost three times as frequently as the right. The mean duration of symptoms prior to operation was 58 hours, and the longest was 16 days; only two patients were accepted for surgery after more than 10 days of symptoms. In 15 patients the onset of disease was in the postoperative period and was considered to be a surgical complication. Seventeen patients developed deep venous thrombosis during the course of a medical illness; the illness of four was associated with pregnancy and of one with oral contraceptives. In seven patients the iliofemoral thrombosis followed trauma, not always to the lower extremities, and two of these patients were also taking oral contraceptives. No specific antecedent cause could be identified in six patients.

Indications for Surgery

Basically, the indication for iliofemoral venous thrombectomy is the presence of either phlegmasia alba or phlegmasia cerulea dolens. Immediate restoration of venous flow results in rapid resolution of edema and relief of pain, and removal of the offending clot obviates the risk of pulmonary embolism. Furthermore, the venous valves are saved from destruction, aborting the postphlebitic syndrome at its inception.

There are perhaps only two absolute contraindications to this approach. (1) Surgical therapy offers no advantage over conservative management to the patient with established deep venous insufficiency secondary to a previous episode of thrombophlebitis. (2) The presence of an associated lethal disease in a terminal patient should dampen surgical enthusiasm.

Bilateral massive edema of the lower extremities suggests involvement of the inferior vena cava and is a relative contraindication to iliofemoral venous thrombectomy because of the risk of dislodging an embolus. With proximal caval control, however, this situation may be approached surgically.

The duration of thrombosis compatible with surgical removal remains poorly defined and is the subject of some controversy. Our experience has shown that a thrombus present for more than 7 to 10 days is too well organized to allow for complete success. This relative contraindication, however, does not apply to phlegmasia cerulea dolens because every effort should be made to salvage the afflicted limb from venous gangrene. We have also noted, as have others, that operative findings often indicate a duration of thrombosis which exceeds the clinical history.

Three of our patients required proximal caval interruption in addition to thrombectomy when a pulmonary embolus occurred prior to surgery. Others believe that thrombectomy alone is adequate treatment.

Anatomic factors and clinical experience indicate that deep venous thrombi originating in the veins of the calf cannot be completely removed. Fortunately, thrombosis is initiated in the iliofemoral region in 60 to 75% of patients with phlegmasia dolens. Further...
thermore, although a distal thrombus may not be completely extracted, the preservation of superficial femoral and popliteal valves may be of some benefit and such patients should be approached surgically with the expectation of satisfactory, but not perfect, results.

Finally, preoperative phlebography is generally unnecessary because the clinical diagnosis of iliofemoral venous thrombosis is so apparent that further confirmation is superfluous. In fact, it has been suggested that preoperative phlebograms are indicated in the opposite normal extremity to detect occult bilateral disease. This may also demonstrate extension of the propagating tail of the thrombus into the inferior vena cava, an event which certainly occurs more frequently than is recognized. Despite these considerations, we have not felt that phlebographic studies are necessary and, as a result of this policy, we have had two negative explorations, neither of which was detrimental to the patients. Others of the same opinion have reported a similar experience.

Operative Technique

Certain aspects of the technique of iliofemoral venous thrombectomy deserve comment. The use of local anesthesia reduces the operative risk and enables the patient to cooperate during surgery. An alert patient can assist in the removal of a proximal clot by straining. This Valsalva maneuver also increases venous pressure, creating a gradient through the open venotomy and reducing the risk of pulmonary embolism. The incision should be made vertically over the femoral triangle because the usual oblique incision transects many lymphatic channels and increases postoperative wound complications. Anticoagulants are not administered prior to operation, but heparin is given intravenously after all dissection is complete and just before opening the femoral vein.

A number of techniques have been described for accomplishing the thrombectomy, but the Fogarty catheter is clearly the most effective, especially for removal of the proximally situated thrombus. The distal progress of the catheter is frequently impeded by valves which may be damaged by forcible manipulation. Distal thrombus is most easily extruded by vigorous, orderly massage, working from the ankle to the groin. For this reason the complete extremity should be included in the operative field. Fogarty and Hallin have also described a technique for temporary proximal caval occlusion, but this has seemed unnecessary on the bases of both previous experience and theoretical grounds. It is occasionally necessary to apply a clip to the vena cava prior to thrombectomy, and care must then be taken to avoid disrupting the clip by inserting the balloon catheter too far proximally.

It is important to achieve good bidirectional flow at operation, and so it is well to remember that 81% of patients have a valve above the inguinal ligament which must be made temporarily incompetent before proximal patency can be evaluated. Recent evidence suggests that back-bleeding alone may not be a completely reliable indication of total removal of proximally located clot. Loss of blood during this procedure is insidious but significant, and blood for transfusion must be available. Finally, drainage of the wound is important, considering both the lymphatics severed at operation and the postoperative use of anticoagulants.

Postoperative Care

Postoperative care is totally directed at the prevention of recurrent thrombosis. Patients are maintained on heparin given intravenously for 5 days, usually in conjunction with intravenously administered clinical dextran. Although perhaps less important, warfarin (Coumadin) is then administered orally for 6 weeks. Postoperative use of antibiotics has not been necessary except for specific indications. The leg is elevated and given full-length elastic support, which is maintained for 1 year whether or not there is evidence of residual deep venous insufficiency. Finally, because venous stasis is promoted by inactivity, early
Results of Iliofemoral Venous Thrombectomy

<table>
<thead>
<tr>
<th>Operative result</th>
<th>Good (86%)</th>
<th>Poor (14%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>23 (69%)</td>
<td>14 (31%)</td>
</tr>
<tr>
<td>3 patients excluded*</td>
<td>21 (50%)</td>
<td>13 (31%)</td>
</tr>
<tr>
<td>By duration of symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5 days</td>
<td>18 (50%)</td>
<td>13 (31%)</td>
</tr>
<tr>
<td>&gt; 5 days</td>
<td>3 (33%)</td>
<td>2 (22%)</td>
</tr>
<tr>
<td>Follow-up of &gt; 2 yr.†</td>
<td>5 (36%)</td>
<td>7 (50%)</td>
</tr>
</tbody>
</table>

*Two with venous gangrene on admission and one with surgical ligation of common iliac vein excluded.
†Average duration of follow-up: 21 months.

ambulation is mandatory. The danger of dislodging emboli is remote after the vigorous efforts already directed to this purpose, and active exercises or ambulation is indicated within 12 to 24 hours of surgery.

Results

The surgical results are based upon clinical evaluation, although postoperative phlebograms were obtained in 11 cases, principally because of a clinically unsatisfactory response. Asymptomatic patients who do not require elastic support are considered to have excellent results. Minimal symptoms of pedal edema or aching pain, or only intermittent need for elastic hose, is considered a satisfactory result. All other results are classified as failures. The success of iliopoplural venous thrombectomy appears to be correlated with both the preoperative duration of symptoms and achievement of good bidirectional flow at operation. Furthermore, from 2 to 5 years is required for a postphlebitic syndrome to develop, and accordingly, data on 14 patients followed for more than 2 years have been separately tabulated.

Thrombectomy results are tabulated in table 2. Of the entire group of patients, 47% had excellent results, 29% satisfactory results, and 20% had failures. Operative deaths occurred in 4% of the group. Both operative fatalities resulted from poor patient selection, in that both patients had chronic congestive heart failure and both had suffered unrecog-

ized massive pulmonary embolism before surgery. Both patients were, in fact, too ill to be considered for either caval ligation or pulmonary embolectomy, and thrombectomy was attempted as an ill-advised lesser alternative.

Analysis of results based on the preoperative duration of symptoms revealed that the average duration of symptoms in patients with an excellent result was 41 hours, whereas in patients whose results were considered failures, the average duration of symptoms was 5 days. Results tabulated accordingly showed that a duration of symptoms of less than 5 days was associated with a good result in 80% of cases, as opposed to only 55% in patients with symptoms for more than 5 days.

A good operative result is defined as the achievement of good bidirectional flow at the time of surgery. This goal was attained in 69% of patients. Among those 31 patients, there were 19 excellent clinical outcomes, eight satisfactory results, and two failures. The two operative deaths were in this group. Conversely, among the 14 patients with poor operative flow, there were only two excellent results, five satisfactory, and seven failures.

Although the average duration of follow-up for the entire group is 21 months, 14 patients have been followed for 2 or more years. Of these, 56% have had acceptable clinical results. One of the two failures had a poor surgical result initially and has now been followed for 6½ years. During this time he has developed

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the only true postphlebitic syndrome encountered. The other failure had had a preoperative pulmonary embolus, for which a caval clip was applied at the time of thrombectomy. He had an excellent result for 4 months, but then suffered recurrent thrombosis which was conservatively managed and he now has peripheral edema requiring continuous elastic support.

Four patients with phlegmasia cerulea dolens are included in this series. Two were admitted with established venous gangrene. One of these, with symptoms for 16 days, had a poor operative result and ultimately required a below-knee amputation. In the other, with preoperative pulmonary emboli, a caval clip was applied at the time of a surgically successful thrombectomy, but nonetheless a below-knee amputation due to pre-existing gangrene was required. A third patient had had symptoms for 10 days without established gangrene. However, his thrombus was too well organized to be fully extracted at the time of surgery. He represents not only an early failure, but also a late death from massive pulmonary embolism which occurred 10 weeks after thrombectomy and almost immediately after long-term anticoagulation was discontinued. One patient in this group has had an excellent result.

Of the 11 postoperative phlebograms, nine were grossly abnormal. Among these nine patients there were no excellent clinical results. Clinical results of five were satisfactory and of four were failures. Two phlebograms were normal; one patient had an excellent and the other a satisfactory clinical outcome.

Five patients had preoperative pulmonary emboli. One had an excellent result. Of the other four, previously discussed, there were two operative deaths, one failure with phlegmasia cerulea dolens, and one failure because of recurrent thrombosis 4 months after thrombectomy.

Among three patients who received no postoperative anticoagulants and one whose anticoagulants were discontinued after 5 days, two had an excellent response, one was satisfactory, and one was considered a failure.

Postoperative complications are presented in Table 3. Delayed wound healing was generally caused by prolonged serous and lymphatic drainage. The high incidence of wound complications is undoubtedly related to both operative damage to engorged lymphatics and the postoperative use of anticoagulants. No intraoperative pulmonary emboli have occurred. The postoperative pulmonary embolus that was fatal 3 months after operation has been discussed. The other postoperative embolus occurred 2 months after thrombectomy in an asymptomatic patient who had just undergone aortic valve replacement. He required caval ligation at that time because of multiple pulmonary emboli. Table 4 shows the cause of the seven late deaths; only one was related to thromboembolic disease.

**Discussion**

Iliofemoral venous thrombectomy has three major goals: relief of early morbidity, avoidance of pulmonary embolism, and prevention of chronic deep venous insufficiency. Estimates of the relief of early morbidity must be somewhat qualitative and subjective, although some quantitation was achieved in a previous comparative series. Nevertheless the
immediate relief of pain and regression of edema in the successful case are impressive. Furthermore, early ambulation is a welcome change from the prolonged rest in bed required by conservative management.

Thrombectomy appears to be at least as successful as conservative management in providing protection from pulmonary embolism. The incidence of this complication of iliofemoral venous thrombosis is variously reported but probably reaches at least 22%, with 7% fatal emboli. No intraoperative or early postoperative pulmonary emboli have occurred in this series, and both of the late pulmonary emboli occurred long after thrombectomy, one of them following an unrelated surgical procedure. The late embolus in the patient with a poor result from the thrombectomy supports the contention of others that patients in whom thrombectomy is incomplete should perhaps have a proximal caval interruption performed as well.

Proponents of iliofemoral venous thrombectomy have been enthusiastic chiefly about the final goal, prophylaxis for the postphlebitic syndrome. Clinical results in this series are generally comparable to reports by others that approximately three out of four patients achieve an acceptable response. In the few groups in which surgical and conservative management have been compared, the surgical approach seems superior. However the technique is relatively new and few reports include follow-up for 2 or more years. There is usually a 6- to 12-month symptom-free interval before the onset of chronic deep venous insufficiency, and symptoms of the postphlebitic syndrome become progressively manifest between 2 and 10 years after the initial episode. However, the 86% good results in the present series among patients followed for 2 or more years is encouraging, and both failures were apparent even before the 2-year interval. Thirteen of the 14 patients in this group were reported on previously and now, after an additional 27 months of follow-up, two excellent results have become satisfactory; one satisfactory result has become excellent; one reported failure has become a satisfactory result, but no new failures have appeared. This information lends credence to the contention that thrombectomy and the preservation of venous valves will improve the long-term prognosis for iliofemoral venous thrombosis.

The present series again confirms the impression of many others that patients with a long history of symptoms prior to surgery do not do as well as those treated early. However some patients in the group with symptoms for more than 5 days did show improvement with surgery; this lends support to the contention of others that surgery should be attempted in all cases. The lack of correlation between phlebographic findings and clinical outcome may also support this contention. Others have noted improvement despite phlebographic abnormalities suggesting that partial patency with the preservation of only one or two valves may be sufficient for a satisfactory response. Despite these considerations, we believe that a duration of symptoms of greater than 7 to 10 days is generally an indication for conservative management.

The importance of achieving good bidirectional flow at operation is emphasized by the 50% failure rate among cases in which this was not accomplished, compared to a 6% failure rate among those in which it was achieved. Finally, it is generally true that the success of this operation is predicated upon the use of anticoagulants. However, our small experience, and that of others with patients in whom this adjunct was necessarily omitted suggests that satisfactory results can be obtained even if anticoagulants cannot be used after operation.

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