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Vance L. Smith
Laura Peterson
Wright State University, laura.peterson@wright.edu
Jean E. Starr
Bhagwan Satiani

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External Iliac Artery Stenting: High Incidence of Concomitant Revascularization Procedures

Vance L. Smith, MD, MBA, Laura Peterson, MD, Jean E. Starr, MD, FACS, and Bhagwan Satiani, MD, MBA, FACS

Abstract
Objectives: To review immediate results, patency rates, hemodynamic success, and incidence of concomitant procedures with external iliac artery stenting (EIAS). Methods: Demographic features, category and clinical grade, Trans-Atlantic Inter-Society Consensus II classification lesion type, pre- and postprocedure ankle-brachial indices, and primary patency were compared between group 1 (EIAS without distal revascularization) and group 2 (EIAS with concomitant distal revascularization). Results: No mortality and a 100% immediate technical success rate was recorded in group 1 (n = 12) and group 2 (n = 24). Eleven patients (30.6%) also had stenting of the adjacent common iliac artery. Two thirds of group 2 patients required concomitant femoral or distal revascularization. Conclusions: No difference in stent patency rates was found between patients in group 1 versus group 2. Patients requiring EIAS tend to have more diffuse arterial disease necessitating complicated open reconstruction and/or distal revascularization, as well as more proximal iliac stenting.

Keywords
stenting, iliac stenting, concomitant procedures

Introduction
For patients with aortoiliac occlusive disease, surgical revascularization has traditionally been the primary method for treating disabling claudication or critical limb ischemia. The success of endovascular therapies directed toward the Trans-Atlantic Inter-Society Consensus (TASC) A and B lesions has now been recognized and in most cases regarded as preferable to open surgical techniques. While the initial TASC guidelines recommended an open surgical approach for the more complex TASC C and D lesions, this has also been challenged in recent reports, which propose an expanded role for endovascular therapies in these lesions. However, not enough emphasis has been placed on the fact that patients requiring external iliac artery stenting (EIAS) have been noted to also need concomitant procedures either with common iliac artery stent (CIAS) or with distal revascularization procedures.

The purpose of this study was to review immediate results, patency rates, hemodynamic success, and incidence of concomitant procedures with EIAS at our institution.

Methods
A retrospective chart/electronic medical record review in the Division of Vascular Diseases and Surgery at The Ohio State University Medical Center was performed from June 2004 to December 2007. Thirty-six patients undergoing EIAS, with and without concomitant distal revascularization, were included. Demographic features, prevalence of risk factors, category and clinical grade of vascular lesions (Rutherford classification), TASC lesion type, and pre- and postprocedure ankle-brachial indices (ABIs) were recorded. Initial hemodynamic success (defined as an increase of the ABI from preprocedure >0.15) was measured for all patients. The patients were divided into 2 groups based on the procedure that was performed: group 1 (external iliac artery [EIA] stent without any additional procedures other than CIAS [n = 12]), and group 2 (EIA stent with a concomitant distal intervention/bypass or a local reconstruction in the groin [n = 24]). The 36 patients were further subdivided into 4 subgroups based upon the exact procedure: (1a) EIA stent only (n = 6); (1b) EIA and common iliac artery (CIA) stent only (n = 6); (2a) EIA/CIA stent and distal revascularization, including open or endovascular procedures.

1 Department of Surgery & The Ohio State Heart & Vascular Center, Division of Vascular Diseases & Surgery, The Ohio State University College of Medicine, Columbus, OH, USA

Corresponding Author:
Bhagwan Satiani, S# 3018, 456 W. 10th Avenue, Columbus, OH 43210, USA
Email: bhagwan.satiani@osumc.edu
Figure 1. Distribution of risk factors.

Results

The study population consisted of 6 women and 30 men. The prevalence of risk factors were smoking (67.6%), hyperlipidemia (59.5%), coronary artery disease (43%), diabetes (10.8%), and hypertension (69.4%; Figure 1). The mean follow-up for the entire cohort was 20.9 months (standard deviation ±19.3).

Of the 36 patients, 11 patients (30.6%) also had stenting of the ipsilateral CIA. No mortality was seen and a 100% technical success rate was recorded in both groups. Patients in group 2 underwent concomitant 13 femoral–popliteal bypasses and 5 femoral–femoral bypass procedures. Six (16.6%) patients had associated open femoral procedures consisting of endarterectomy with or without a patch or a local interposition graft (including 2 who had both).

The Rutherford classification of disease showed a predominance of category 3, class I lesions (n = 21). Anatomically, the majority of the lesions were TASC B (n = 24; Figure 2). Primary patency, as assessed by life-table analysis, was 100% for the first 10 months after intervention (Figure 3).

Primary patency was also determined in each of the subgroups. Primary patency was similar for groups 1a, 1b, and 2b. Group 2a (El stent and concomitant distal revascularization) had primary patency rate similar to the other groups for the first 10 months, then declined to 70% thereafter (Figure 4).

The average preprocedure ABI was 0.63 ± 0.25 and the postprocedure ABI was 0.83 ± 0.25. Although the initial hemodynamic success was no different in groups 1 and 2, there was a trend toward a greater improvement in postprocedural ABI in group 2. Patients with TASC C lesions in group 2 exhibited a significantly greater improvement in postprocedural ABI compared with TASC A and B lesions undergoing the same treatment (P < .05).

Discussion

Prior to technical advancements in endovascular technology, femoral disease extending proximally into the EIA was treated with retroperitoneal endarterectomy, unilateral iliofemoral bypass, or crossover femoral bypass. Patients with predominantly unilateral atherosclerotic disease involving the iliofemoral system are now uniquely suited to a combined approach of iliac artery angioplasty/stenting with or without open reconstruction of the femoral/profunda artery, sometimes with distal revascularization as well. The argument against extending iliac stents across the inguinal ligament into the
Transluminal Angioplasty

The BAS Results Compared With CIA Percutaneous
iliac artery

femoral area is that of stent fracture when crossing the inguinal
ligament as well as intimal hyperplasia due to external forces
on the vessel. The question remains as to whether external
iliac disease behaves more like CIA occlusive disease and is
easily treatable with percutaneous techniques or to infraingu­
inal disease for which open surgical techniques may still be a
better option.

The EIAS Results Compared With CIA Percutaneous
Transluminal Angioplasty (PTA)/Stenting

Because of the widely held belief that EIA PTA/stenting has a
lower long-term patency compared with CIA PTA/stenting, a
review of EIA endovascular intervention is reasonable. The
tANGIOUS disease pattern is such that 7% to 66% of patients
reported in the literature who underwent EIA stents also
required CIA angioplasty/stent (Table 1). Thirty percentage
of our patients also required CIA stenting. In a study by Maurel
and colleagues, 90 patients treated with EIA stents were
followed up for a mean of 23 months. The primary patency
rate was 97%, 89.7%, and 83.7% at 1, 2, and 3 years, respecti­
vively. Lee et al compared the results of EIA and CIA stenting
in patients with occlusive lesions. In 49 patients with EIA
lesions, the primary patency rate following treatment was
93% and 90% versus 88% and 78% for CIA lesions at 1 year
and 3 years, respectively. Powell et al reported much less favor­
able results after PTA and selective stenting for EIA lesions
with 47% and 18% primary patency rates at 12 and 36 months,
respectively. There are likely selection biases in some studies
reporting inferior patency rates with EIA interventions. These
biases include differences in severity of clinical ischemia,
stenting techniques, and types of stents. Although our series
does not directly compare CIA with EIA stents, patency rates
were not significantly different between patients with EIAS
alone and those with CIA and EIA stents.

Influence of TASC Classification on Outcomes

The TASC classification provides a standardized method of
anatomically describing arterial lesions as well as providing a
common framework for reporting outcomes following treat­
ment. For totally occluded or severe and complex lesions of the
iliac arteries (TASC C or D), surgical intervention has been re­
commended or preferred, whereas endovascular intervention has
been advocated for TASC A and B lesions. The majority of
patients (66%) in our report had TASC B lesions. Although
patients with TASC C lesions had significantly greater rise in
immediate postprocedural ABI (0.27) compared with the other
2 groups (0.23 for TASC A lesions and 0.26 for TASC B lesions;
P < .05), there appeared to be no significant difference in
patency rates. Maurel and colleagues reported that 77.7% of EIA
lesions treated by endovascular means were classified as TASC
A and B lesions. Like other authors they reported that TASC C
or D lesions were associated with a much higher risk of resteno­
sis. One of the reasons given for poorer outcomes in some
series with EIA lesions compared with CIA lesions treated with
stents is that patients with EIA lesions tend to have more severe
multisegmental disease (TASC C lesions.) This is supported in
our current series with one third requiring concomitant CIA
stenting and two third requiring concomitant distal vasculari­
ization. Only 6 patients underwent EIA stenting alone.

Primary patency has been reported to be significantly lower
in patients with TASC type C or D lesions. In a large series of
533 CIA and EIA lesions followed for a mean of 72 months,
69% were classified as TASC A and B, whereas 31% were
TASC C and D lesions. The procedure time and complication
rate were both higher in the more severe TASC C and D groups.
However, no significant differences existed in initial and long­
term patency between the 2 groups.

Whether the presence of EIA disease, regardless of severity,
is a significant predictor of poor outcomes after angioplasty/
stenting in women has been debated. Ti­ran observed signifi­
cantly worse results in women among a group of 67 patients
with claudication or critical limb ischemia treated with EIA stenting with a primary patency rate of only 61% and 47% at 1 and 3 years compared with a global rate of 76% and 56% for the entire series.11 Our numbers are too small to draw any conclusions on the influence of gender in our cohort.

Concomitant Procedures

Management of concomitant femoral artery and distal infragenual disease is an important consideration in patients with aortoliac disease. In a recent report, 50% of patients required a local endarterectomy with or without a profundoplasty and another 11% needed simultaneous lower extremity bypass in patients undergoing an aortofemoral bypass.13 In the same series, comparing open to endovascular intervention, 21% of the angioplasty/stent group required either femoral reconstruction or a bypass. In our experience, 20 patients (55%) underwent associated infragenual bypass and/or distal endovascular procedures and 6 (16.6%) also had an endarterectomy or an interposition graft. In a similar series of patients with EIA stenting, 8 (12%) of 91 patients had associated open femoral or distal procedures performed.7 In a recent report of 223 interventions for aortofemoral disease, concomitant open surgical procedures were performed in 26 patients (8.5%).14 Eighteen underwent open femoral endarterectomy, 8 femoral-femoral, and 4 femoral–popliteal bypasses. In addition, an associated endovascular procedure involving the femoral/popliteal system was necessary in 17 patients.

One of the few reported experiences describing results with EIA stenting combined with concomitant femoral endarterectomy was published by Nelson and colleagues.15 Four (12%) of the 34 patients in the series also needed CI angioplasty and 14 (41%) had distal revascularization performed. With a mean follow-up period of 13 months, 1-year primary patency and primary-assisted patency rates were 84% and 97%, respectively.

The overall experience in patients requiring EIA stenting is that a significant number will also require CIA stenting, local femoral reconstruction, or distal femoral endovascular or bypass procedures. It behooves the vascular surgeon to be prepared to do more than EIA stenting in this group of patients.

Influence of Concomitant Distal Disease

The influence of associated distal disease on the clinical outcome of iliac revascularization with either open surgical procedures or endovascular methods has been debated. Stein reported a clinical benefit of 23.3% at 4 years following aortofemoral surgical bypass in patients with outflow disease compared with 84% in patients with good outflow.16 Laborde et al studied 455 patients comparing patients with aortoliac disease, external iliac disease, and multilevel disease to determine outcomes.17 The presence of associated distal disease was a powerful predictor of unsatisfactory outcomes following iliac stent placement. At 3 years, only 60.8% showed clinical success compared with 91.6% with aortoliac disease and 97.9% with external iliac disease pattern. Ballard et al examined the treatment of TASC type D iliac lesions and found that ipsilateral superficial femoral artery occlusion was an independent predictor of both bypass graft failure and stent failure.18 Our experience with patients who require EIA/CIA stenting with concomitant distal revascularization confirms that primary patency dropped off after the first 10 months in contrast to the other 3 subgroups (Figure 4).

Conclusion

In summary, our results show good technical and short-term success with EIA stenting and concomitant CIA stenting and/or distal revascularization. The use of endovascular techniques for TASC C and D lesions is still debated. The vascular surgeon should be prepared to perform a local revascularization or

### Table 1. Incidence of Concomitant Procedures in Patients Undergoing External Iliac Artery Stenting

<table>
<thead>
<tr>
<th>Year Reported</th>
<th>No. of Patients (arteries)</th>
<th>Mean Follow-Up (months)</th>
<th>Associated Common Iliac Angioplasty/Stent</th>
<th>Associated Open Femoral Procedures</th>
<th>Associated Infrainguinal Bypass and/or Distal Endovascular Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulis et al.</td>
<td>2011</td>
<td>223</td>
<td>N/A</td>
<td>26/223 (8.5%)</td>
<td>17/223 (7.6%)</td>
</tr>
<tr>
<td>Maurel</td>
<td>2009</td>
<td>90 (107)</td>
<td>23</td>
<td>20/90 (22%)</td>
<td>8/91 (12%)</td>
</tr>
<tr>
<td>Nelsonb</td>
<td>2002</td>
<td>34</td>
<td>13</td>
<td>4 (12%)</td>
<td>36 (100%)</td>
</tr>
<tr>
<td>Timaran</td>
<td>2001</td>
<td>67 (87)</td>
<td>28</td>
<td>45/87 (51%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Lee</td>
<td>2000</td>
<td>69 (98)</td>
<td>21</td>
<td>7/98 (7%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Changd</td>
<td>2008</td>
<td>171 (193)</td>
<td>24</td>
<td>104 (66%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Kashyap</td>
<td>2008</td>
<td>83 (127)</td>
<td>21</td>
<td>N/A</td>
<td>12 (14.4%)</td>
</tr>
<tr>
<td>Authorsf</td>
<td>2011</td>
<td>36</td>
<td>20.9</td>
<td>11 (30.6%)</td>
<td>6 (16.6%)</td>
</tr>
</tbody>
</table>

Abbreviations: El, external iliac; CI, common iliac; FP, femoral-popliteal; N/A, not available.

* Series included El and CI lesions.
* Series only included patients with El stenting and combined common femoral endarterectomy.
* Series reported additional concomitant procedures in entire cohort (common and external iliac stents).
* Series only included patients with El and CI stenting and combined common femoral endarterectomy.
* Series compared aortofemoral reconstruction with angioplasty/stenting of both El and CI arteries.
* Two patients had both associated open procedures and FP/distal endovascular procedures.
distal procedure to improve outflow at the time of EIA stenting in over two thirds of this population. In addition, almost one third of patients needing EIA stenting will need CIA stenting as well.

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