Cardiologists Performing Peripheral Angioplasties: Impact on Utilization

CONTEXT. Angioplasty and stent placement for peripheral arterial occlusive disease has traditionally been performed by radiologists and surgeons. However, cardiologists have recently begun to perform these procedures. It is unknown whether this has affected how often the procedure is done.

OBJECTIVE. To assess how the proportion of peripheral angioplasties performed by cardiologists in a geographic area relates to population-based angioplasty rates.

DESIGN. Cross-sectional analysis of all U.S. Medicare beneficiaries undergoing peripheral arterial (i.e., renal, iliac, or lower extremity) angioplasty in 1996 using Part B (physician) claims for cardiovascular procedures. Physician specialty was obtained from the American Medical Association’s masterfile and Medicare.

MEASURES. For each of the 306 U.S. hospital referral regions (HRRs), we calculated the proportion of procedures performed by cardiologists and rates of peripheral arterial angioplasty (adjusted for age, sex, and race).

RESULTS. More than 37,000 peripheral arterial angioplasties were performed on Medicare beneficiaries in 1996 (50% for lower extremity, 33% iliac, and 17% renal arterial disease). Cardiologists performed 26% of these procedures overall, including 37% of the renal angioplasties. Few (12%) procedures were done as part of a cardiac catheterization; instead, most were done as a separate procedure. Use of peripheral angioplasty varied more than 14-fold across HRRs (median, 12 procedures per 10,000 beneficiaries; 10th to 90th percentile, 4.1 to 57.9). The mean angioplasty rate in HRRs where cardiologists performed 50% or more of the procedures was almost double that of regions where they performed none (21.9 vs. 12.1 procedures per 10,000 beneficiaries; \( P < 0.001 \)).

CONCLUSIONS. Cardiologists are performing a substantial proportion of peripheral angioplasties. Rates of these procedures are highest in regions where cardiologists do most of the angioplasties.

The role of percutaneous transluminal angioplasty in the treatment of peripheral arterial occlusive disease has expanded significantly over the past two decades. Peripheral angioplasty with and without stent placement is being used to treat claudication in patients with iliac\(^1\) and lower extremity arterial occlusive disease.\(^2\) Renal artery angioplasty has also been shown to reduce hypertension and preserve renal function in certain patients with renal artery stenosis.\(^2\) Nationally, there has been a 7-fold increase in the use of angioplasty to treat lower extremity disease between 1979 and 1996.\(^3\) However, in some regions the growth has been even more explosive. For example, the rate of peripheral angioplasties in Maryland increased 24-fold from 1979 to 1989.\(^4\)

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ORIGINAL ARTICLE

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See related editorial on pages 221–222 and primer on pages 232–233.
The development of angioplasty to treat peripheral arterial occlusive disease has provided an opportunity for cardiologists to expand their role in the care of patients with vascular disease. It is well established that patients with coronary disease often have coexisting peripheral disease. Therefore, cardiologists are often in a position to identify and treat renal, iliac, and lower extremity arterial occlusions at the time of cardiac catheterization, so called “drive-by” procedures. In fact, some cardiologists suggest that peripheral angioplasty is a logical extension of their current clinical practice, and others have sought additional training in peripheral vascular disease interventions through dedicated clinical fellowships.

Whereas the dramatic growth in the use of peripheral angioplasty may be attributable to a variety of factors (e.g., technical improvements, lower per-case costs, increased patient acceptance compared with surgery), the growing number of cardiologists trained to perform these procedures may also be an important factor. The impact of changes in specialty composition on the use of peripheral angioplasties has not been previously investigated. In this national study of the Medicare population, we describe the extent to which cardiologists perform peripheral angioplasties and explore the relationship between the proportion of procedures performed by cardiologists in a geographic area and population-based utilization rates.

**Methods**

**Patient Population**

Patients undergoing peripheral angioplasties or cardiac catheterization were identified in a database containing all claims for cardiovascular procedures occurring in the Health Care Financing Administration’s (HCFA’s) Common Working File, Part B, for 1996. The analysis was restricted to beneficiaries between 65 and 100 years of age who were living in the United States.

**Measures**

Table 1 provides an overview of the data sources, specific data elements, and assumptions made for calculating each of the following measures.

**Peripheral Angioplasty Procedures**

Claims were selected using the procedure codes of the HCFA’s Common Procedure Coding Systems (analogous to the current procedural terminology [CPT] codes10) and were mapped to one of the 306 hospital referral regions (HRRs) according to the beneficiary’s home ZIP code. The HRRs represent naturally occurring tertiary care referral markets within which most beneficiaries seek and receive inpatient coronary revascularization services. The HRRs were empirically derived from Medicare claims analysis for the Dartmouth Atlas of Health Care.11

**Table 1**

Description of Data Elements and Data Sources for Measures Calculated*

<table>
<thead>
<tr>
<th>DATA ELEMENT</th>
<th>DATA SOURCE</th>
<th>MEASURE CALCULATED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral angioplasty procedures†:</td>
<td>Medicare Part B Common Working File (procedures), HCFA Denominator File (population)</td>
<td>Rate per 10,000 Beneficiaries for each HRR (adjusted for age, sex, and race)</td>
</tr>
<tr>
<td>Renal angioplasty (CPT 35471)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iliac angioplasty (CPT 35472, 35473)</td>
<td></td>
<td></td>
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<tr>
<td>Lower extremity angioplasty (CPT 35470, 35474)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of specialist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiology</td>
<td>AMA Masterfile, Medicare UPIN</td>
<td>Market share: percentage of peripheral angioplasties performed by cardiologists for each HRR</td>
</tr>
<tr>
<td>Radiology</td>
<td>Medicare UPIN</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>Medicare UPIN</td>
<td></td>
</tr>
<tr>
<td>Cardiac diagnostic and therapeutic procedures (CPT 93510-93529, 93539, 93540, 93545, 92980-92984, 92995, 92996)</td>
<td>Medicare Part B Common Working File (procedures)</td>
<td>Percentage of peripheral angioplasties performed on the same day or within 30 days of cardiac catheterization</td>
</tr>
</tbody>
</table>

*AMA = American Medical Association; CPT = current procedural terminology; HCFA = Health Care Financing Administration; HRR = hospital referral region; UPIN = Unique Physician/Practitioner Identification Number.
†Multiple claims on the same day counted as one per type.
**Population Rates of Peripheral Angioplasty**

For each HRR, we calculated crude rates of peripheral angioplasty per 10,000 beneficiaries. The numerator of each rate was the number of peripheral artery angioplasty procedures for residents living in each HRR. We used the HCFA Denominator File to determine the number of fee-for-service beneficiaries eligible for Medicare Part B residing in each HRR alive on June 30, 1996. Crude rates were then adjusted using the indirect method for the following stratum: age (in 5-year age groups), sex, and race (black vs. nonblack), to give expected rates.12 No rates were calculated for HRRs in which fewer than 11 observed or 26 expected procedures were identified to ensure enrollee confidentiality and statistical stability. To reflect the significant right skew of the data, the median and the 10th to 90th percentile of the rates are reported to describe the national distribution of utilization rates.

**Physician Specialty**

Physicians performing peripheral angioplasties were classified into three mutually exclusive categories: cardiologists, radiologists, and others. To be as confident as possible that cardiologists were correctly classified, we used both self-identification in the American Medical Association physician file and Medicare’s Unique Physician/Practitioner Identification Number (UPIN) file. Only self-identified cardiologists billing for at least two diagnostic or therapeutic coronary interventional procedures were classified as interventional cardiologists and included in this analysis.13 On rare occasions (<1%) when an event was associated with more than one single physician specialty, the procedure was credited to both groups.

**Peripheral Angioplasties Performed by Cardiologists**

We calculated the proportion of peripheral angioplasties performed by cardiologists in each HRR. We treated this proportion as a continuous variable when assessing the relationship between overall rates and cardiologist involvement. For clarity of presentation, results are presented graphically for four groupings of HRRs, divided according to the proportion of procedures performed by cardiologists (0%, 1% to 25%, 26% to 49%, and 50% or greater). Angioplasty procedures were excluded from the calculation of specialty market share in 1.5% of cases in which there was no valid primary operator UPIN and 0.2% of cases that were associated with UPINs from differing specialties.

**Relationships to Cardiac Catheterization**

To learn whether cardiologists were performing peripheral angioplasties at the same time or as a consequence of cardiac catheterization, we examined peripheral angioplasties done in relation to cardiac catheterization. Specifically, we calculated the proportion of peripheral angioplasties performed on the same day or within 30 days of cardiac catheterization (angiography or angioplasty) for each specialty. To ensure identification of all procedures preceded by cardiac catheterization, the 8.5% of procedures that occurred in January 1996 were excluded from the calculation to allow for a 30-day run-in period.

**Analysis**

Linear regression was performed to assess the relationship between cardiology market share (i.e., the percentage of procedures performed by cardiologists in a given HRR) and utilization rate. P values less than 0.05 were considered statistically significant.

**Results**

In 1996, 31,262 Medicare enrollees in the United States had 37,207 peripheral angioplasties. Of these procedures, 17% were renal angioplasties (with or without stent placement), 33% were iliac artery interventions,

<table>
<thead>
<tr>
<th>TABLE 2</th>
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<tbody>
<tr>
<td><strong>Number of Peripheral Angioplasty Procedures Performed by Each Specialty in Medicare Beneficiaries</strong></td>
</tr>
<tr>
<td><strong>TYPE OF ANGIOPLASTY</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>All</td>
</tr>
<tr>
<td>Renal</td>
</tr>
<tr>
<td>Iliac</td>
</tr>
<tr>
<td>Lower extremity</td>
</tr>
</tbody>
</table>
and 50% were lower extremity interventions (Table 2). Fifty percent of the population was male, 8% was black, and the average age was 74 years (Table 3).

**Geographic Variation**

The rate of peripheral angioplasty per 10,000 beneficiaries varied more than 14-fold across HRRs (median, 12; 10th to 90th percentile, 4.1 to 57.9) (Figure 1). There was a significant, 15-fold variation in the use of lower extremity procedures (median 5.8; 10th to 90th percentile, 1.8 to 26.5) and a 7-fold variation in the use of renal artery angioplasty (median, 1.8; 10th to 90th percentile, 0.8 to 5.7). The use of iliac interventions varied less, but still substantially (median, 4.1; 10th to 90th percentile, 1.7 to 10.5).

**TABLE 3**

Demographic Characteristics of Medicare Beneficiaries Having Peripheral Angioplasty Procedures according to Specialty

<table>
<thead>
<tr>
<th>DEMOGRAPHIC CHARACTERISTICS</th>
<th>TYPE OF SPECIALIST</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CARDIOLOGIST</td>
<td>RADIOLOGIST</td>
</tr>
<tr>
<td>Patients, n</td>
<td>7484</td>
<td>20,579</td>
</tr>
<tr>
<td>Male</td>
<td>51%</td>
<td>49%</td>
</tr>
<tr>
<td>Black</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65–69 yr</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>70–74 yr</td>
<td>30%</td>
<td>29%</td>
</tr>
<tr>
<td>75–79 yr</td>
<td>24%</td>
<td>24%</td>
</tr>
<tr>
<td>80–84 yr</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>85+</td>
<td>5%</td>
<td>7%</td>
</tr>
<tr>
<td>Mean age, yr</td>
<td>73.9</td>
<td>74.3</td>
</tr>
</tbody>
</table>

**FIGURE 1.** Geographic variation in the use of peripheral angioplasty showing the ratio of peripheral angioplasty in each hospital referral region compared with the U.S. average.
Radiologists did most of the peripheral angioplasties (64%); however, cardiologists performed 26% of the procedures. Table 2 shows that cardiologists performed 37% of renal artery, 21% of iliac artery, and 26% of the lower extremity angioplasties. There was no significant difference in the age, sex, or race distribution of the patients treated by the three types of specialists (Table 3). The proportion of peripheral angioplasties performed by cardiologists varied markedly across geographic regions (Figure 2). Cardiologists performed no peripheral angioplasties in 32 of the 292 HRRs (11%) and performed 50% or more of the procedures in 48 HRRs (16%). In one HRR, 98% of peripheral angioplasties were done by cardiologists.

Relational to Cardiac Catheterization

To identify the procedures that may have been performed as a result of “drive-by” aortography, we calculated the proportion of peripheral angioplasties that were done at the same time or within 30 days of cardiac catheterization (Table 4). Among peripheral angioplasties performed by cardiologists, 27% occurred within 30 days of cardiac catheterization or angioplasty; 12% occurred as part of cardiac catheterization. In contrast, among all procedures done by radiologists or other specialists, only 3% and 5%, respectively, were performed within 30 days of a coronary procedure. The higher rate for cardiologists of peripheral angioplasties related to cardiac catheterization suggests a real difference in the pattern of care provided by cardiologists.

Since the renal arteries are most frequently imaged during pull-back aortography, we examined how often renal angioplasty was performed in relation to cardiac catheterization. Renal angioplasty was more likely to be associated with cardiac catheterization than lower extremity procedures. Seventeen percent of renal artery angioplasties completed by cardiologists occurred on the same day and 43% occurred within 30 days of a coronary procedure.

Impact of Cardiologists on Utilization

Utilization of peripheral angioplasty was positively correlated with the proportion of procedures performed by cardiologists (correlation coefficient = 0.46) (Figure 3). In regions where cardiologists performed more than 50% of procedures, the use of peripheral artery angioplasty was almost double that of regions where they performed none (21.9 vs. 12.1 per 10,000 beneficiaries; P < 0.001). Cardiologists did at least two thirds of peripheral angioplasties in each of the six HRRs that had the highest procedure rates in the United States. The strong positive relationship between the proportion of procedures done...
by cardiologists and utilization rates was also demonstrated when renal \( (P < 0.001) \), iliac \( (P < 0.001) \), and lower extremity angioplasty \( (P < 0.001) \) were considered separately.

**Discussion**

Cardiologists play an increasing role in the treatment of peripheral arterial disease in the Medicare population. They perform 26% of all peripheral angioplasties and almost 40% of angioplasties done for renal artery stenosis. Approximately one fourth of the peripheral angioplasties performed by cardiologists are done soon after cardiac catheterization. Examination of geographic variation in utilization rates reveals that the use of peripheral angioplasty is positively correlated with the proportion of procedures done by cardiologists. Regions in which cardiologists performed 50% or more of the peripheral angioplasties had population-based rates that were nearly twice as high as areas in which cardiologists performed none of these procedures.

Several possible mechanisms could explain our findings. One possibility is that cardiologists, radiologists, and other physicians treat populations with different disease prevalences. Since we adjusted for differences in the age, sex, and race distribution between HRRs, we believe it is highly unlikely that differences in the prevalence of peripheral arterial disease across the HRRs are sufficient to account for the variation in utilization rates observed here.

Another possible explanation is that cardiac catheterization offers cardiologists the opportunity to identify and treat patients with previously unrecognized peripheral artery lesions during cardiac catheterization. In certain instances, cardiologists have the opportunity to image the renal vessels while withdrawing the catheter after completing coronary angiography or angioplasty. In regions where cardiologists are skilled in both coronary and peripheral procedures, they may be more likely to examine the peripheral vessels and, consequently, intervene. Thus, the higher rate of intervention may reflect the earlier identification of potentially treatable lesions. Indirect evidence of this practice is the high proportion of peripheral angioplasties performed by cardiologists (27%), and particularly renal angioplasties (43%), that were done within 30 days of cardiac catheterization. If this association is borne out by future research, use of peripheral arterial angioplasty is likely to increase further, given the nearly 750,000 patients per year who undergo cardiac catheterization.

Finally, there may be specialty-specific differences in the care of patients with peripheral arterial occlusive disease. Cardiologists who are involved in management of peripheral vascular disease may recommend angioplasty over surgery for patients with more advanced lesions. Cardiologists and others have argued for the expanded use of angioplasty in patients who were traditionally treated medically, because angioplasty causes less morbidity than the previously available surgical alternatives.14

The impact of higher utilization rates of peripheral angioplasty on patient outcomes is unclear. Although the clinical benefit of peripheral artery angioplasty procedures to treat extremity and visceral ischemia remains

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**Table 4**

<table>
<thead>
<tr>
<th>TYPE OF ANGIOPLASTY</th>
<th>CARDIOLOGIST</th>
<th>RADIOLOGIST</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>All angioplasties</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same day</td>
<td>12%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Within 30 days</td>
<td>27%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Renal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same day</td>
<td>17%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>Within 30 days</td>
<td>43%</td>
<td>10%</td>
<td>18%</td>
</tr>
<tr>
<td>Iliac</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same day</td>
<td>20%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Within 30 days</td>
<td>34%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Lower extremity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same day</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Within 30 days</td>
<td>16%</td>
<td>2%</td>
<td>4%</td>
</tr>
</tbody>
</table>
controversial, there is increasing evidence of the efficacy of some of these procedures. Several single-institutional trials have demonstrated improvement in quality of life after iliac artery angioplasty with selective stenting. However, treating more distal disease has not been shown to be beneficial for most patients and several large epidemiologic studies have failed to demonstrate a significant reduction in amputation rates despite increased use of revascularization procedures. Small studies have demonstrated improvement in the blood pressure of the renal circulation, as well as reduced creatinine levels following angioplasty with and without stent placement. Although, the largest prospective randomized trial of renal artery angioplasty in patients with renal artery stenosis demonstrated no improvement in blood pressure control over medical management, the conclusions of this study have been questioned because of its high cross-over rate (44%), small numbers ($n = 106$), and lack of routine placement of endovascular stents.

There are several limitations to our study. First, given the lack of detailed clinical information in the Medicare claims data, it is not possible to determine the indications for the procedure or to assess the appropriateness of the intervention. Therefore, it is possible that the increased use of peripheral angioplasty by cardiologists reflects the treatment of patients with unrecognized, quality-of-life limiting lesions who are either treated or not treated with surgery in other regions. Next, since claims data do not provide sufficient data to adequately risk-adjust patients or to compare short-term outcome or complications among providers, we could not quantify the “correct” rate of intervention. Similarly, we could not measure long-term outcomes (e.g., restenosis, amputation, and need for bypass) because of the cross-sectional design.

Two principal conclusions can be drawn from this study. First, cardiologists are performing a substantial proportion of peripheral angioplasties. Second, greater involvement by cardiologists appears to be associated with higher population-based rates of peripheral angioplasty. Given the strong association between coronary arterial disease and peripheral vascular disease, the proliferation of cardiologists who are trained to perform peripheral angioplasty, and the use of cardiac catheterization to identify potentially treatable peripheral vascular occlusions, the stage is set for continued growth in the use of this technology. Whether patients will be helped or harmed by this growth is not known.

**Take-Home Points**

- Angioplasty and stent placement for peripheral arterial occlusive disease has traditionally been performed by radiologists and surgeons; however, cardiologists have begun to perform these procedures.
- Using national Medicare data, we sought to describe this practice and how it relates to utilization.
- Cardiologists perform one quarter of all peripheral angioplasties.
- Regions of the country where cardiologists perform a greater proportion of the procedures have higher rates of peripheral angioplasty.
- Whether patients are helped or harmed by more frequent use of peripheral angioplasty is unknown.
References


8. Isner JM. Reply to cardiologists and peripheral arterial disease: should the tail wag the dog [Letter]. Circulation. 1994;89:2458-59.


Disclaimer
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