Operating Expenses for the Diagnosis and Treatment of Peripheral Vascular Disease in an Academic Interventional Radiology Department: Cost Calculations According to a Microeconomic Method

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PURPOSE: A correct understanding of the true costs of a procedure is necessary to make informed decisions in cost-effectiveness analyses. The actual comprehensive costs of performing cardiovascular and interventional radiology (CVIR) procedures were analyzed in the present study, as opposed to charges or ratios of costs to charges (RCCs), as often used in the literature.

MATERIALS AND METHODS: Costs included labor, equipment, administration, facility establishment and maintenance, overhead, and consumable supplies. Cost identification was initially performed with use of an hourly rate that reflected the cost of operating the CVIR section. This was then combined with the costs of the consumable supplies used during each type of procedure. Eight types of vascular procedures were studied in 235 consecutive patients to determine mean procedure duration and supplies consumption. Costs were then compared with charges and RCCs of these procedures.

RESULTS: The hourly rate for operating one angiography suite was $690. Average cost by procedure, including hourly rate plus consumable supplies, were: aortic arteriogram, $1,442; aortobifemoral arteriogram, $1,554; unilateral limb arteriogram, $1,307; simple iliac or femoropopliteal angioplasty, $2,119; arterial stent placement, $2,780; percutaneous thrombectomy, $1,998; arterial in situ thrombolysis, $3,133; and arteriogram after thrombolysis, $926. RCCs calculated for each procedure ranged from 0.39 (thrombectomy) to 1.92 (control arteriography during or after thrombolysis) and were lower than expected based on previous reports.

CONCLUSIONS: The average actual costs of several common diagnostic and therapeutic procedures for peripheral vascular occlusive disease were established, allowing determination of the relative importance of different cost components. This methodology may serve as a template for future cost analyses.

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Abbreviations: CVIR = cardiovascular and interventional radiology, FTE = full-time employee, PTA = percutaneous transluminal angioplasty, RCC = ratio of cost to charge

SINCE the introduction of percutaneous treatment of vascular disease, physicians and patients have recognized that such approaches may have cost advantages associated with decreased invasiveness. Costs, charges, reimbursement for medical services, and ratios of costs to charges (RCCs) are terms that are occasionally confused or used interchangeably in the literature (1–5). Actual reimbursement for a medical procedure can be obtained relatively easily. However, this varies depending on the medical institution, doctor, geographic region, and third-party payer (6). Actual costs to the provider are much more difficult to obtain, and accurate, comprehensive determination of procedural costs requires meticulous and extensive investigation. The true financial costs of a procedure (ie, the actual operating expenses) include items such as consumable supplies, labor with fringe benefits, equipment purchase and maintenance, administrative expenses, plant operations, taxes, overhead, and all liabilities referable to the procedure performed.

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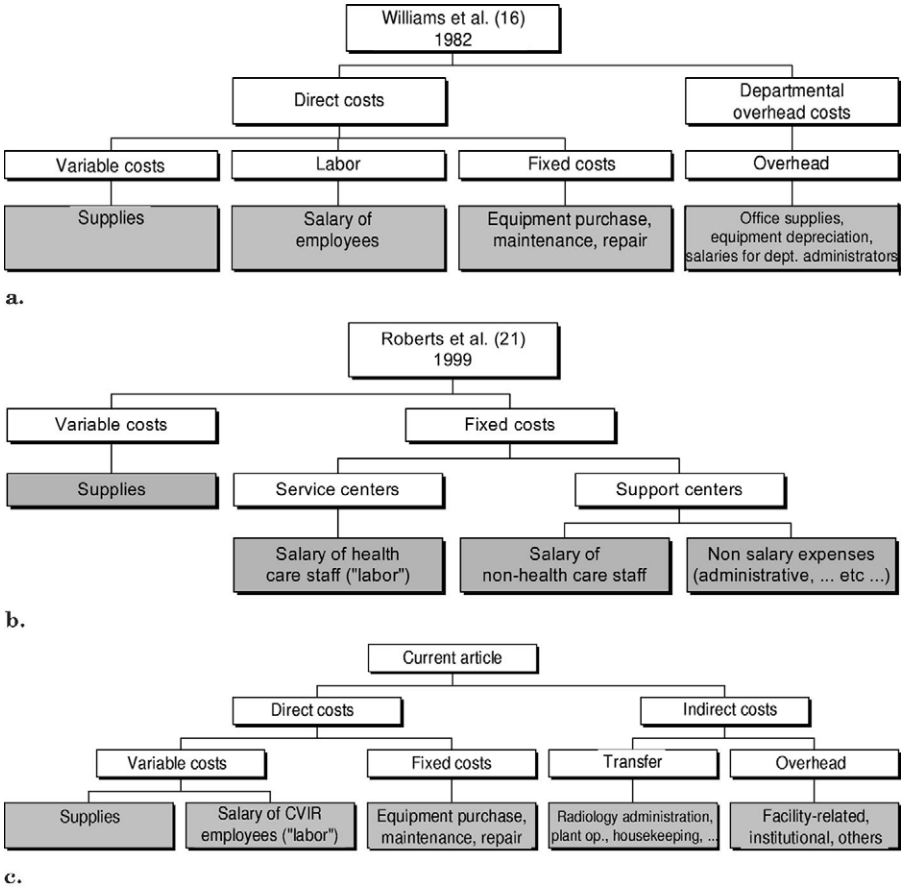

Figure 1. Different reported approaches in the classification of costs.

The present study investigated comprehensive procedural costs for the performance of angiography and percutaneous vascular interventions from the perspective of the administrator of our cardiovascular and interventional radiology (CVIR) section as a basis for cost-effectiveness analysis (1,2,7–13). It provides a template that can be easily adapted and applied to calculate costs in other care units (ie, cost centers) within the hospital.

MATERIALS AND METHODS

Calculation of Costs

The study was approved by our institutional Committee for the Protection of Human Subjects from Research Risks. This study consisted of two components. First, we determined the comprehensive costs of running the CVIR section, independent of the procedure:

$$\text{Hourly CVIR cost per angiosuite} = \frac{(\text{Labor cost} + \text{Fixed costs}) + (\text{Transfer costs} + \text{Overhead})}{\text{Number of operating hours per year}}.$$

Second, we prospectively calculated the actual cost of the eight most commonly performed procedures by adding the time-adjusted hourly CVIR cost (according to mean procedure duration) to the cost of consumable supplies:

$$\text{Total procedural cost} = (\text{Hourly CVIR cost} \times \text{Average procedure duration}) + \text{Supplies cost}$$

To facilitate comparison, the total yearly cost of the CVIR section was calculated and converted to an hourly cost. Through review of our recorded hours of operation including weekend and after-hours procedures, we assumed 254 working days in a fiscal year (5 days per week for 52 weeks minus seven bank holidays in our state) and 10.5 hours of operation daily (8:00 AM to 6:30 PM). This totaled 2,667 hours of operation per year per operating angiography suite. The hourly functioning cost of the angiography suite excludes the cost of consumable supplies, which are calculated independently of procedure duration.

Cost Classification

The CVIR section is a component of the diagnostic radiology department, in turn a component of the academic medical center. Therefore, shared plant facilities and integrated fiscal responsibility exist, and costs accrue directly and indirectly to the CVIR section (**Fig 1**). Direct costs are the expenses that are generated from inside the CVIR section to perform a given procedure. The indirect or subcontracted costs are those shared with other sections or departments (eg, housekeeping, plant operations, central supply). They are incurred when the CVIR section uses supplies or labor in other cost centers at our institution.

As a result of the confusion in terminology between existing reports, we have followed classifications classically used in cost accounting (14,15), which subdivide direct costs into variable and fixed components. Variable costs include consumable supplies and salaries of the personnel involved in the procedures (ie, "labor"). Fixed direct costs are those that do not vary during the time frame of the study; they include the purchase, depreciation, maintenance, and repair costs of the angiographic equipment and other related equipment.

Indirect costs are subdivided into transfer costs and overhead costs. Transfer costs are costs ascribable to the radiology department as a whole. The component attributable to the CVIR section is calculated based on arbitrary landmarks such as square footage or percentage of relative value units. Overhead includes indirect costs that cannot be assigned on the basis of the usual allocation system and therefore require the use of alternative methods for cost allocation to each service (ie, cost center).

Cost Data Acquisition

Labor and fixed costs were readily available from our accounting system