Introduction

Although academic medical centers in the United States present an intrinsic value to our society today, the future viability of these centers is in question. The threat to academic practices is a fallout from the national debate on health care reform. Academic centers compete with private hospitals for managed care contracts, but the mission of the academic centers is different. Research and the education of medical students and residents are two areas of the academic mission that are paramount for progress, but they also increase the costs of care. Costs of the teaching and research programs are estimated to make clinical care at academic medical centers 30% to 40% more expensive than nonacademic hospitals. Teaching hospitals require $14.1 to $16.4 billion in indirect support for medical education to "level the playing field" so that they can compete financially with nonteaching institutions.[1]

Education and research are investments in the future of the United States and must be supported. Since the fruits of academic medical centers are shared by all, including managed care companies that use the educational and research products directly, the point can be made that the added costs associated with education and research also should be shared widely. Also, some believe that insurance companies should not be allowed to reap the benefits of the academic centers without helping to cover the costs. [2] Academic medical centers also must change to help control costs, to deliver highly technical care more efficiently, and to train primary care physicians to fill the roles that managed care needs.

Patient care is critical in order to fulfill the mission of any medical center. The clinical volumes that provide the material necessary to perform research and to educate medical students and residents are threatened with managed care. As costs increasingly determine the coverage choices made by health care plans, the higher costs of academic centers become a serious impediment to their use. Clinical income, the largest single source of funding for academic centers, accounted for 32.7% of the total operating income for the medical schools in 1992 compared with 7% in 1991. Less income from patient care directly threatens the financial stability of academic centers.

Heretofore, the debate on health care reform has focused on controlling short-term costs rather than improving the quality and reducing long-term costs through "innovation." Many believe that advances in modern technology always increase the costs of medical care. Successful reform must foster medical advances that will improve the quality of care while controlling or reducing costs.[3] Continued developments in information systems and outcome measurements, as well as an understanding of which treatments are effective and on what populations, are essential to appropriate technical advancement and cost control. The progression of biomedical research historically has been a fairly reproducible process. Initially, a disease such as cancer is treated by radical surgery. With more research, conservative operative procedures are defined that are equally efficacious. This era of intervention is followed by the discovery of effective medical therapy, which subsequently may be followed by preventive measures, eg, the development of vaccines for high-risk individuals. It is a mistake to halt the scientific process in an intermediate step without investing in the next phase of scientific discovery.

Surgical Care, Staging, and Adjuvant Therapy for Melanoma

In this progression of biomedical research, melanoma surgical care currently is undergoing a change toward more conservative operations. Ten years ago, treatment of the primary melanoma involved wide local excisions with 5.0-cm margins, whereas currently a more conservative 2.0 cm is used.[4] The surgical treatment of the regional nodal basin has been controversial at best, with prospective randomized trials either unable to demonstrate a survival benefit,[5] or displaying a survival benefit in only a limited subgroup of the total population.[6] In 1992, Morton et al[7] described a technique to map the cutaneous lymphatic flow from the primary site to the first node in the basin that drains the primary. This first node, called the sentinel node, has been shown in numerous trials to reflect the histology of the remainder of the nodal basin. The experience with this technique at our institution is outlined in this issue.[8]

The emerging technologies of cutaneous lymphatic mapping and sentinel node biopsy promise to revolutionize melanoma surgical care. These techniques provide full nodal staging information from a node biopsy rather than from a complete regional node dissection. These "selective lymphadenectomies" can often be performed under local anesthesia on an outpatient basis, thereby decreasing the costs of care and the morbidity of the procedure for the patient. In addition, nodal staging is becoming increasingly important; two adjuvant interferon trials show efficacy with extended survival in melanoma patients who are at a high risk for recurrence.[9,10] However, only those with nodal disease have benefitted from the adjuvant interferon therapy. Lymphatic mapping technology will allow the selective approach to adjuvant therapy in patients with stage III disease, instead of a "shotgun" approach (treating all stage I, II, and III patients) that is used in many other adjuvant settings. This is the only sensible strategy in this era of cost containment.

What has been the financial investment in this new technology? An estimated $250,000 has been invested to date in research on animal models and initial human trials, and the National Cancer Institute has recently funded a multicenter study of cutaneous lymphatic mapping whose goals are twofold: to ascertain whether the technique can be incorporated widely and to examine survival benefit that may be gained with this surgical strategy.[11] To date, financial investment in this innovation has been minimal.

Outcome Measurements for Melanoma Surgical Care

Health care reform considerations place a major emphasis on cost measurements for individual surgical procedures. In reform discussions, the quality of care measurements have been overshadowed by financial considerations. In a study recently completed at our center, a cost analysis was performed on the new lymphatic mapping procedure in melanoma patients in an attempt to measure the effect of this surgical technique on lowering costs of care while maintaining quality. From July 1993 to August 1994, 69 consecutive patients registered at the Cutaneous Oncology Clinic at our center were entered into a cost:quality outcome study. They were separated into three treatment groups: nodal staging was achieved in group 1 by elective lymph node dissections, in group 2 by the lymphatic mapping and sentinel node biopsy techniques under general anesthesia, and in group 3 by mapping techniques under local anesthesia. Complete lymph node dissections were performed in the sentinel node groups (groups 2 and 3) when the sentinel node was positive, and the costs of the additional surgery were entered into the analysis. Costs of care included all hospital and professional charges. Clinical outcome was measured by the ability to obtain complete nodal staging information for further clinical adjuvant trial entry with minimal morbidity.

Cost:Quality Study of 69 Melanoma Patients Grouped by Nodal Staging Technique*

<table>
<thead>
<tr>
<th>Group**</th>
<th>Number</th>
<th>Costs</th>
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<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>$10,033</td>
<td>30%</td>
</tr>
<tr>
<td>2</td>
<td>46</td>
<td>$10,650</td>
<td>5%</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>$5,096</td>
<td>5%</td>
</tr>
</tbody>
</table>

* From July 1993 to August 1994 at Moffitt Cancer Center. ** Nodal staging was achieved in group 1 by elective lymph node dissection, in group 2 by lymphatic mapping and sentinel node biopsy under general anesthesia, and in group 3 by mapping techniques under local anesthesia.
were $10,650 and $5,096, respectively (Table). Significant differences in the cost of care were noted when group 3 was compared with either group 1 or group 2 (P < 0.05). In 56 patients who underwent lymphatic mapping and selective lymphadenectomy as their initial surgical therapy, only one patient has recurred in a nodal basin after a negative sentinel node biopsy (false negative=1.7%), which suggests that the histology of the sentinel node reflects the histology of the remainder of the nodal basin. Morbidity was significantly lower in groups 2 and 3, with an earlier return to work or normal activity in the patients treated with the new technology. Ultimately, this surgical strategy would achieve the benefit of entering patients on adjuvant therapies or trials earlier in their clinical course. In addition, an annual savings in health care costs of $132 million from this surgical strategy alone would be realized, based on 32,000 new cases of melanoma each year in the United States.[12] >

By identifying all stage III patients (with nodal disease), only those with a proven survival benefit from interferon are exposed to the expense and toxicity of the drug. Assuming that the one-year cost of interferon is $10,000, that there are 24,000 new melanoma cases greater than 1.0 mm in thickness in which nodal metastases is possible, and that only 20% of these will have positive nodes, the total savings per year on drug costs alone is estimated to be $192 million.

Conclusions

This study illustrates that by incorporating the new lymphatic mapping techniques, complications and costs in the care of the patient with melanoma can be reduced without compromising the quality of care. This benefit has been achieved without sacrificing important nodal staging data that form the criteria for entry into effective adjuvant programs. Adjuvant therapies are offered on a selective basis to only those patients who may benefit. The estimated savings to our health care system will be approximately $324 million per year, and the morbidity from surgical procedures and drug toxicity will be reduced throughout the entire melanoma population. The cost savings in this example is achieved with a minimal initial financial investment in the scientific process and without a compromise in the quality of care. In other areas, however, the initial investment probably will need to be greater in order to define the optimal clinical approach. The investments must continue to be made.

References

11. Multicenter Selective Lymphadenectomy Trial (MSLT). National Cancer Institute Grant No. P01 CA29605-12.