The Performance of Endarterectomy for Disease of the Extracranial Arteries of the Head

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SUMMARY Data from the National Hospital Discharge Survey, the Veterans Administration Hospitals and Armed Forces Hospitals were reviewed to estimate the number of endarterectomies of extracranial vessels of head and neck performed in the United States. The number increased from around 15,000 in 1971 to around 85,000 in 1982. An estimated 2.8% of those operated in non-federal hospitals were discharged dead.

IT IS IMPORTANT TO KNOW the number of endarterectomies performed for disease of the extracranial arteries supplying the brain, to realistically assess the significance of the controversy concerning the indications for the procedure. For this communication, data from the National Hospital Discharge Survey, the Veterans Administration hospitals and the Departments of Army, Air Force and Navy were reviewed and the number of procedures were estimated for each year from 1971 through 1982. Some remarks will be made on the possible implications of the steady increase from 15,000 endarterectomies in 1971 to more than 85,000 in 1982.

Methods

Several sources of data were used in an attempt to get an estimate of the total number of endarterectomies of extracranial vessels of head and neck performed in the United States. The National Hospital Discharge Survey was used to estimate those patients operated on in short-stay hospitals, exclusive of military and Veterans Administration hospitals, located in the fifty states and the District of Columbia. Estimates of procedures done in the Veterans Administration hospitals were obtained from their Biometrics Division,1 in Army hospitals from their Patient Administration Division,2 of Air Force hospitals from the Biometrics Division,3 and of Navy hospitals from the Naval Medical Data Services.4 Except for the Veterans Administration hospitals, deaths were based on the status at discharge. For the Veterans Administration hospitals, all deaths occurring within 30 days of the procedure were included. Information concerning public health service and other hospitals was not obtained.

National Hospital Discharge Survey

The National Hospital Discharge Survey is a survey of patients discharged from short-stay hospitals, exclusive of military and Veterans Administration hospitals, located in the 50 states and the District of Columbia. Short-stay hospitals are defined as having six beds or more and an average length of stay less than 30 days. The universe of the survey consists of 6,965 short-stay hospitals contained in the 1963 Master Facility Inventory of Hospitals and Institutions. New hospitals were sampled for inclusion in the survey in 1972, 1975, 1977, and 1979. For example, in the 1980 survey 420 of these hospitals were sampled providing approximately 224,000 abstracts of medical records. All hospitals with 1,000 beds or more in the universe of short-stay hospitals were selected with certainty. All hospitals with fewer than 1,000 were stratified, the primary strata being 24 size by region classes. Within each of these 24 primary strata, the allocation of the hospitals was made through a controlled selected technique so that hospitals in the sample would be properly distributed with regard to type of ownership and geographic division. Sample hospitals were drawn with probabilities ranging from certainty for the largest hospitals to 1 in 40 for the smallest hospitals.

Subsamples of discharges were selected within the sample hospitals using the daily listing sheet of discharges as a sampling frame. These discharges were selected by random technique, usually on the basis of the terminal digit(s) of the patient’s medical record number, a number assigned when the patient was admitted to the hospital. The within hospital sampling ratio for selected sample discharges varied inversely with the probability of selection of the hospitals.

Statistics produced by the National Hospital Discharge Survey are derived by a complex estimating procedure. The basic unit of estimation is the sample inpatient discharge abstract. The estimating procedure used to produce essentially unbiased national estimates in the National Hospital Discharge Survey has three
principle components: inflation by reciprocals of the probabilities of sample selection, adjustment for non-response, and a ratio adjustment to fixed totals. These components of estimation are described in Appendix I of two earlier publications.3,4

Because the estimates from this survey are based on a sample rather than the entire universe, they were subject to sampling variability. The standard error is primarily a measure of the variability that is attributed to using a value obtained from a sample as an estimate of a population value. The relative standard error is obtained by dividing the standard error by the estimate. The resulting value is multiplied by 100 which expresses the standard error as a percentage of the estimate. The relative standard error ranged from 16.5% in 1971 to 11.1% in 1982.

For the purposes of this study, the appropriate code from the International Classification of Disease was determined for endarterectomy for vessels of head and neck. For the years 1971 through 1978 the code 26.1 from the Eighth Revision International Classification of Diseases, Adapted for Use in the United States (ICDA-8)5 was used and for the years 1979 through 1982 the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)6 code 38.12 was used.

Federal Hospitals

The Biometrics Division of the Veterans Administration was contacted. They did have actual counts on the ICDA-8 code 26.1 for the years beginning October 1, 1971, 1977, and 1979.1 For the years beginning October 1, 1980 and 1981, the ICD-9-CM code 38.1 was used but the second digit was not used and, therefore, the procedures were for all endarterectomies not just for those of extracranial vessels.

The statistics of endarterectomies performed in the Armed Forces hospitals were obtained by direct contact with the Departments of Army,2 Air Force,3 and Navy.4 For the calendar years 1971 through 1979 the ICDA-8 code 26.1 was used (all endarterectomies of head and neck and base of brain) and for the years 1980 through 1982 the International Classification of Procedures in Medicine (ICPM) code 538.1 was used (all endarterectomies except coronary).

Results

The number of endarterectomies of the head and neck has increased steadily during the 12-hour period 1971 through 1982 (table 1). From an estimated 15,000 such procedures in non-federal hospitals in 1971, this procedure was performed approximately 82,000 times in non-federal hospitals in 1982 and around 3,000 times in federal facilities. This represents a 4.7-fold increase in non-federal hospitals and about a 2.9-fold increase in Army, Navy, Air Force and Veterans Administration hospitals.

Data for the largest population represented here, the civilian population, were obtained from a survey in which estimates of events less than 10,000 are considered unreliable. For this reason, for each year the estimates of patients who had undergone endarterectomies and were discharged dead are not presented in Table 1. However, the percent of patients who had this procedure and were discharged dead was fairly consistent for each of the 12 years under study, and averaged 2.8% of all endarterectomy discharges. This appears to be slightly higher than the percent of deaths in federal hospitals.

Discussion

The increase of procedures from approximately 15,000 in 1971 to approximately 85,000 in 1982 is difficult to understand in light of the lack of objective, double-blind prospective controlled studies to demonstrate that endarterectomy is clearly advantageous to medical therapy. This 467% increase must be based on the opinion of the surgeons that the procedure is of considerable value. One can neither refute nor support this concept on the basis of available data. Dr. Jack Whisnant, in his recent review of the decline of stroke,1 estimated that there were probably only approximately 35,000 patients each year who would have appropriate symptomatic angiographic lesions. If his calculations are correct, even if surgery were appropriate for each of these 35,000 cases, there still would be 50,000 procedures for indications that are not generally accepted. Thus, it is possible that between 1,000 and 1,800 patients die following a surgical procedure that many physicians might not have agreed was indicated. In addition, as most reports indicate that

<table>
<thead>
<tr>
<th>Year</th>
<th>National Hospital Discharge Survey (Estimated to Nearest 1000)</th>
<th>Army and Air Force (% Navy)</th>
<th>VAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>15,000</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>1972</td>
<td>16,000</td>
<td>186</td>
<td></td>
</tr>
<tr>
<td>1973</td>
<td>22,000</td>
<td>211</td>
<td></td>
</tr>
<tr>
<td>1974</td>
<td>23,000</td>
<td>282</td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>34,000</td>
<td>246 (359)</td>
<td></td>
</tr>
<tr>
<td>1976</td>
<td>34,000</td>
<td>370 (530)</td>
<td></td>
</tr>
<tr>
<td>1977</td>
<td>41,000</td>
<td>381 (339)</td>
<td></td>
</tr>
<tr>
<td>1978</td>
<td>42,000</td>
<td>387 (559)</td>
<td>2,077</td>
</tr>
<tr>
<td>1979</td>
<td>54,000</td>
<td>503 (654)</td>
<td>2,037</td>
</tr>
<tr>
<td>1980</td>
<td>55,000</td>
<td>772</td>
<td>2,076</td>
</tr>
<tr>
<td>1981</td>
<td>73,000</td>
<td>800</td>
<td>3,070</td>
</tr>
<tr>
<td>1982</td>
<td>82,000</td>
<td>854</td>
<td>3,424</td>
</tr>
</tbody>
</table>

Boxed areas include other endarterectomies than those for vessels of head and neck.
stroke occurs from one to five times as often as death following endarterectomy,\textsuperscript{8-14} an additional 1,000 to 9,000 persons in this group may have had a stroke. This would result in a combined mortality and morbidity of 2,000 to 10,800. These data are quite sobering and certainly should not be dismissed lightly.

**References**

2. Patient Administration Division, Department of the Army, Office of the Surgeon General: Personal communication with Lloyd A. Schlaeppey, Colonel, MSC, Chief, Patient Administration Division, Washington, D.C., November, 1983
4. Naval Medical Services Center, Health Care Operations, Naval Medical Command, Department of the Navy: Statistics on Endarterectomies, Personal communication with J.J. Quinn, Commodore, Deputy Commander for Health Care Operations, and A. Lewis, Washington, D.C., December, 1983

10. Millikan CH: Treatment of occlusive cerebrovascular disease. In: Cerebrovascular Survey Report for Joint Council Subcommittee on Cerebrovascular Disease, National Institute of Neurological and Communicative Disorders and Stroke and National Heart and Lung Institute, 244, 1980

**The Practice of Carotid Endarterectomy In A Large Metropolitan Area**

**THOMAS BROTT, M.D., AND KAREN THALINGER, M.D.**

**SUMMARY** All carotid endarterectomies performed in the greater Cincinnati metropolitan area during 1980 were reviewed. For the 431 procedures performed in 16 hospitals, the operative stroke rate was 8.6% (37 of 431), and the operative mortality rate was 2.8% (12 of 431). The combined morbidity and mortality was 9.5% (41 of 431). Fifty percent of the procedures were done for asymptomatic carotid disease (216 of 431). The stroke rate was 5.6% for the asymptomatic patients and 11.6% for the symptomatic patients (difference significant, \( p < 0.05 \)). Neurosurgeons and vascular surgeons had similar surgical morbidity. All of the operative strokes involved the hemisphere ipsilateral to the endarterectomy. Fifty-seven percent of the operative strokes (21 of 37) occurred after a neurologically intact interval lasting hours to days. Four occurred following combined endarterectomy-coronary bypass surgery, and one was an intracerebral hemorrhage. The other late strokes (17) occurred without evidence for cardiac embolus or hemorrhage, consistent with a thrombogenic-emboliclogenic operative site, and raising the question of need for adjunctive perioperative medical therapy.

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**CAROTID ENDARTERECTOMY** has become a common mode of therapy in the setting of internal carotid artery stenosis and ipsilateral TIA. The procedure is also performed by some for carotid stenosis and prior ipsilateral cerebral infarction, for asymptomatic carotid stenosis, and occasionally for vertebrobasilar insufficiency. Justifications for the procedure hinge on the comparisons of the surgical morbidity and mortality to the reported natural history in those treated medically, and in those untreated. Recent surgical literature would indicate a perioperative stroke rate of less than 3% in major centers.\textsuperscript{1-2} However, Easton and Sherman reported a considerably higher combined stroke and death rate in the community hospital setting (21.1% of 228 endarterectomies).\textsuperscript{4} Their report was recently updated by Modi et al, and a combined neurologic deficit-death rate was 8.9%, still higher than that reported from major teaching centers.\textsuperscript{5} The present study
The performance of endarterectomy for disease of the extracranial arteries of the head.
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