Predicting the Stroke Patient’s Ability to Live Independently

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SUMMARY The objective of this paper is to identify those variables that best predict a stroke patient’s ability to live independently following his/her discharge from medical rehabilitation. The paper draws heavily on a formal research model grounded in independent living (IL) theory. Independent living is defined and operationalized as (1) the patient’s ability to live in a nonrestrictive environment and (2) the patient’s ability to live productively — not only in terms of gainful employment but also in terms of other contributions to community and family life. The main data source for the study is an extensive computer file of 84 stroke patients discharged from 8 medical rehabilitation centers. The multivariate statistical analysis indicates that 56 to 80 percent of the variance in a patient’s ability to live independently can be explained or predicted mainly by the patient’s marital status, age, Barthel score, communication impairments, and the ability to get into a motor vehicle. The paper concludes by discussing the implications of the findings for medical rehabilitation and public policy.

THE MEDICAL TREATMENT OF STROKE has often been colored by a sense of “therapeutic nihilism” — the view that sustained intervention has little value, especially for the older stroke patient with multiple medical problems.1 2 This nihilism has been challenged by a variety of studies documenting the impact of rehabilitation therapy on stroke patients.3 4 12

Many of these studies have demonstrated that functional gains made during the course of medical rehabilitation are maintained following discharge. However, Feigenson, a leader in the field of stroke rehabilitation, has argued in the editorial pages of this journal that consideration of functional gain is not enough and that more consideration must be given to the patient’s “quality of life” following medical rehabilitation.4 But as Feigenson is quick to point out, “‘quality of life’ . . . is exceedingly difficult to define or measure in a meaningful and objective fashion.”5 He goes on to suggest several factors that may be indicative of a patient’s quality of life, including the patient’s activity patterns in the home, at work or in school; and a patient’s leisure time activities both in and away from home.1

Incorporating quality of life factors such as these into outcome-related research is also consistent with the independent living movement, a movement that seeks a better quality of life for persons with disabilities. Historically, the movement has focused on younger working age disabled adults as the primary candidates for independent living. The movement’s philosophy has not been readily extended to older persons such as stroke patients who are often faced with many of the same functional limitations characteristic of younger disabled persons.

A central thesis in the independent living movement is that the quality of life is significantly affected by environmental factors such as the availability of in-home care, accessible housing, and accessible transportation, to name three leading examples from the movement’s budding literature.13 27 This point of view represents a marked departure from more traditional rehabilitation interventions which have concentrated on individual deficits in the form of functional limitations, medical complications, and various personality characteristics that might compromise outcomes. In short, the independent living movement argues that environmental deficits are as important as individual deficits in determining post hospital outcomes and quality of life.

This paper seeks to demonstrate how quality of life factors can be incorporated into an evaluation of stroke outcomes. Quality of life is operationalized by considering the living arrangements and activity patterns of stroke patients following their discharge from medical rehabilitation. Multivariate analysis is used to evaluate the relative contribution of individual and environmental deficits in explaining the variance in the quality of life for stroke patients discharged from medical rehabilitation.

Data Source and Study Group Characteristics

The main data source for the present study was an exhaustive computer file of 84 stroke patients discharged from 8 comprehensive medical rehabilitation centers. The data file was drawn from a larger survey of 307 former medical rehabilitation patients representing a variety of disabling conditions. The survey was completed by the Urban Institute in 1975 as part of the Comprehensive Needs Study authorized by the Rehabilitation Act of 1973. Survey participants were interviewed approximately 2 years following discharge. All 307 participants were chosen on the basis of eight selection criteria applied to 2,681 medical records. To be selected, a patient had, among other things, to have been admitted to the rehabilitation facility for the first time and to have been an inpatient for at least 14 days. The 84 patients selected for this study were those who

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had a primary diagnosis of a stroke based on diagnostic codes and other diagnostic information in the medical record.26

Altogether, six instruments were used to collect data on the study group, including medical record review forms, a mailed questionnaire, and an interview questionnaire used to conduct personal interviews with survey participants. From these six sources, 27 computer cards of data were collected on each survey participant. A special computer file of 84 stroke patients was created for purposes of this study.

Some knowledge of the characteristics of the study group is needed in order to determine the extent to which the findings of the study can be generalized to other groups of stroke patients. Frequency distributions indicated that:

- 52% were male; 48% were female
- 64% were 60 or more years old
- 37% had a Barthel score of 60 or less
- 60% were married
- 85% were living in the community
- 24% were nonwhite
- 60% had at least a high school education
- 89% were not gainfully employed
- 64% were 60 or more years old
- 52% were male; 48% were female

While these characteristics are similar to the characteristics of most stroke patients included in studies cited earlier, those in the study group tended to be somewhat younger than those included in other studies such as the National Survey of Stroke conducted in the mid 1970's.28

Research Model

To help analyze the data in a systematic fashion, a formal research model was developed specifying the various individual and environmental variables considered most relevant to a stroke patient's independent living status following discharge from medical rehabilitation. The research model drew heavily on an analysis of independent living as a social movement.17, 18, 20

Independent living status or outcomes were hypothesized to be a function of four sets of variables: (1) Socio-demographic characteristics, (2) Disability related variables, (3) Environmental barriers, and (4) an Interface variable to reflect the role of assistive devices (e.g., wheelchairs) needed to bridge the gap between functional limitations and environmental barriers. The model can be expressed more succinctly as follows:

$$O = f (S, D, E, I)$$

The variables associated with each factor are summarized in chart 1.

Dependent Variables

The dependent variables were a set of outcome measures used to reflect the stroke patient's quality of life as determined by (1) the restrictiveness of a person's living arrangement, (2) a person's level of "productivity," and (3) a person's overall level of independence based on a weighted average of his/her living arrangement and productivity scores. Productivity in this case was not limited to gainful employment but included other contributions to community and family life as well.

The selection of these outcome measures was based on a variety of theoretical considerations as well as the relevance of these outcome measures to policy and independent living issues. Being able to live in the least restrictive environment has been an avowed goal of many public programs ranging from community mental health to subsidized home health care. Policy makers have expressed a preference for less structured residential settings, in part, as a way of containing costs associated with health and human service programs. Similar observations apply to productivity as an outcome measure. While the ability to secure gainful employment has always been a focal issue in human service programs, policy makers have come to realize that homemaking and community volunteer activities contribute significantly to societal well-being.

The concepts of living arrangement and productivity are also consonant with values espoused by the independent living movement. Deinstitutionalization and the ability to live in the least restrictive environment has been virtually synonymous with the independent living movement. Moreover, the independent living movement has affirmed the importance of employment but has sought to expand the concept of productivity beyond its usual focus on gainful work to include a wide variety of contributions to family and community life.

Finally, we can look to the law (P.L. 95-602) itself which defines independent living services as those "that will enhance the ability of a handicapped individual to live independently and function within his family and community, and, if appropriate, secure and maintain employment." The goals implicit in this definition are those suggested by the outcome measures used here — the ability to live in a less restrictive environment and the ability to be a productive member of society. Both outcomes may be viewed as significant indicators of a person's quality of life.

Each of the seven living arrangement outcomes and each of the 12 productivity outcomes identified in the data set were weighted on a 10-point scale with a value of "10" assigned to the best outcome. The living arrangement outcomes were based on where and with whom a person lived. The productivity outcomes were based on the extent of a person's participation in gainful employment, school or training activities, formal organizations, homemaking, and leisure time activities. Thus each productivity outcome represented participation in a unique combination of activities and levels of involvement.

The weightings of living arrangement and productivity outcomes were completed by 32 members of an interdisciplinary panel consisting of providers, consumers, policy makers, and administrators concerned with independent living issues. The exact methodology used in the study to develop independent living
outcome measures has been described elsewhere by DeJong and Hughes. 29

Independent Variables

The various socio-demographic and disability-related variables are fairly straightforward and need no further explanation except for the Barthel score which was based on the Granger-modified Barthel Index. 30 The Barthel Index measures a person's ability to be independent in activities of daily living and was used here as an indicator of the severity of a person's disability.

The environmental variables require some explanation. The various environmental variables selected from the Urban Institute data file were designed to reflect the key environmental issues in the independent living movement to date. For purposes of this study, six environmental variables were considered in depth to determine their impact on independent living outcomes: (1) attendant care as measured by the presence or absence of needed in-home assistance; (2) housing as determined by the presence of absence of architectural barriers in and about the home; (3) transportation barriers as measured by the accessibility of public or private transportation; (4) work disincentives as determined by whether persons would lose or had lost benefits when becoming gainfully employed; (5) person's assumption of the patient role as measured by the length of initial and subsequent hospitalizations, and the degree of medical supervision; and (6) services received/needed as determined by the number of health and human services received and number of service needs remaining current.

The "interface" variable was measured by whether the respondent reported he or she had any "unmet equipment needs," i.e., assistive devices.

In addition, two other independent variables were considered because of their zero-order correlations with the outcome variables. The first of these variables was whether or not a person had moved to a more barrier-free living environment in order to accommodate the demands of their disability. The second variable was one of the component variables used to create the transportation barriers variable, namely, whether or not a person had any problems getting into an automobile. Neither of these variables had been considered in the original research model except to the extent to which they related to the housing and transportation variables respectively.

Multivariate Analysis

Stepwise multiple regression analysis was the principal multivariate technique used in the study. Multiple regression analysis is a method used to examine the relationship between an outcome variable and two or more independent variables. The purpose of the multiple regression analysis here is two-fold: (1) to determine which independent variables best explained patient outcomes and (2) to determine what proportion of the variance in patient outcomes can be explained by the independent variables, both individually and collectively. The independent variables considered in the regression analyses were those listed in chart 1.

The results of the multiple regression analysis will be presented for each of the three outcome variables: (1) living arrangement outcomes, (2) productivity outcomes, and (3) overall independent living (IL) outcomes. In addition to presenting the results of the multiple regression analysis for the study group as a whole (n = 84), regression results will also be presented for two subgroups, men (n = 44) and women (n = 40). To facilitate an understanding of the results, a table is presented summarizing the last meaningful step in each of the regressions.

Results

Predictors of Living Arrangement Outcomes

Four variables explained 59.9% of the variance in living arrangement outcomes for those in the study group (table 1).

By far, the most important predictor of living arrangement outcomes was marital status (1 = married; 0 = not married). Being married enhanced the chances that a person would be living in a less restrictive environment. Even if marital status had been the last variable stepped into the equation, it still would have accounted for 23.2% of the variance in outcome.

CHART 1 Research Model Summarized

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<thead>
<tr>
<th>Outcome variables</th>
<th>Independent variables*</th>
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<td>Socio-demographic variables</td>
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<td>Living arrangement</td>
<td>Age</td>
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<td>Productivity</td>
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*Because of their zero-order correlations with the outcome variables, 2 other variables — (1) whether or not a person had moved to a more barrier-free environment and (2) whether or not a person was able to get into a vehicle — were considered in the analysis although not included in the original research model.
While marital status is widely viewed as a demographic characteristic, it could also be viewed as an environmental variable if we consider the spouse as a source of in-home care. The absence of such a caregiver (i.e., not married) may force an individual to choose a more restrictive living arrangement but one which guarantees a minimum of personal care or in-home support. This observation is supported by comparing the regression results for men and women separately (tables 2 and 3). This comparison indicates that after all other variables had been taken into account, a person’s marital status was more important for men than for women (unique variance: 37.7 percent for men; 20.6 percent for women). The result stands to reason: men are more likely to have caregiving spouses than women owing to the traditional caregiving roles expected of women in our society especially for the age groups represented in the study sample. These findings are corroborated by the gerontological literature which indicates that the availability of a female spouse caregiver can significantly alter the chances of institutionalization among older persons.31-33

A person’s Barthel score was the second most important predictor of living arrangement status for both men and women but especially for women. In fact, for women, just two variables — a person’s marital status and Barthel score — explained 62.4 percent of the variance in living arrangement outcomes.

Whether or not a person had moved in order to live in a more barrier-free environment was also a predictor of residential status but not in the expected direction. Independent living theory argues that barrier-free living is necessary in fostering a more independent lifestyle. Thus, the regression coefficient was expected to be positive when the result was negative. One explanation for this finding was that stroke patients sometimes make a trade-off between a more barrier-free setting and a more independent living arrangement. In other words, persons are sometimes willing to sacrifice independence in living arrangement in order to be able to get around better. To test this thesis further, another variable, the number of barriers in a person’s home, was substituted in the regression analysis for the variable determining whether a person had moved to get around better. The home barriers variable also proved to be a positive predictor of outcome, although its relationship with the outcome variable was not quite as strong.

The number of services received from various non-medical human service organizations was a positive predictor for the group as a whole (and for men) but not for women.

Another difference between men and women in the study group was the role of current equipment needs. Men who needed assistive devices, but for whom such needs were unmet, had better outcomes than those without unmet needs. Again independent living theory would suggest the opposite relationship: those with unmet needs would have a less independent lifestyle. One explanation that has been corroborated by other need assessment studies24 is that those who seek to maintain a more independent lifestyle are more likely to encounter unmet needs not encountered by those who become resigned to their functional limitations and accept a more dependent living arrangement.

Medical rehabilitation length of stay was a predictor for women but not for men. However, the direction of the relationship was opposite to what had been expected. Independent living theory has maintained that prolonged length of stay can socialize patients into the sick role and thus compromise their ability to be independent. The expected relationship, then, was negative when the result was positive, indicating that women with longer lengths of stay had better outcomes.
Predictors of Productivity Outcomes

Four independent variables explained 56.1 percent of the variance in productivity outcomes among those in the study group (table 4). Whether a person had any problems getting into an automobile proved to be the most important predictor of a person's ability to lead a productive lifestyle. In an automobile-oriented society, such a result should not be too surprising. Without the availability of an accessible automobile, persons are much more likely to remain homebound and refrain from participating in activities commonly associated with a productive lifestyle. The zero-order correlation between a person's ability to get into a vehicle and a person's ability to live productively was 0.630. Thus, by itself, a person's ability to get into a vehicle explained nearly 40 percent of variance in outcome.

The regression results indicate that age was an important predictor of productivity, especially for men (table 5). Patients in the study group were in various stages of transition from active employment to full retirement, a transition that is highly correlated with age. Since women in this age group were less likely to have participated in the labor force on a regular basis, they were less likely to experience the kind of transition more characteristic of men in this age group. Thus age did not prove to be a predictor of productivity for women (table 6).

A patient's Barthel score predicted outcome for both men and women but especially women. For men, the number of communication problems a person had, was a more important predictor of outcome than the degree of functional limitation as measured by the Barthel Index. Once the number of communication problems was stepped into the regression equation for men, the partial correlation between a person's Barthel score and outcome score was reduced considerably. Thus, the communication problems variable obscured what the Barthel variable might have contributed if a person's communication problems had not been considered in the model.

The presence of unmet in-home needs was a predictor for the group as a whole but was not a predictor when men and women were considered separately. No reason could be found for this finding.

Men who faced work disincentives were less likely to be productive. The work disincentives variable was not a predictor for women.

The level of education helped to predict outcomes for women but not for men when ordinarily one would expect level of education to affect both sexes.

Predictors of Overall IL Outcome

Five independent variables explained 62.1 percent of the variance in overall IL outcomes among those in the study group (table 7).

Generally speaking, the strongest predictors of living arrangement and productivity outcomes were also predictors of overall IL outcomes. In the regressions that were run separately for men and women, a couple of variables were stronger predictors when the living arrangement and productivity outcomes were combined than when they were considered individually. In the case of men (table 8), problems getting into a vehicle was a stronger predictor of overall IL outcomes than as a predictor of productivity outcomes. In the case of women (table 9), the Barthel score was a stronger predictor of overall IL outcomes than a predictor of either living arrangement or productivity outcomes.

Discussion

Interaction Effects

One of the more vexing problems in the regression analyses was the interaction between the severity of a

| Table 4 Regression Results for Productivity Outcomes, All Stroke (n = 84) |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Independent variable | Regression coefficient | t-Test | Unique variance* |
| Prob. get in vehicle | -2.361 | -4.29$ | .102 |
| Age | -0.074 | -3.67§ | .075 |
| Barthel score | 0.028 | 2.82‡ | .044 |
| Unmet in-home needs | -0.975 | -2.07† | .024 |
| Regression constant | 7.192 | |
| R2 | 0.561 | df = 4&79 |
| R | 0.749 | F = 25.28 |
| sdr = 2.118 | p < .001 |

| Table 5 Regression Results for Productivity Outcomes, Male Stroke (n = 44) |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Independent variable | Regression coefficient | t-Test | Unique variance* |
| Age | -0.124 | -4.76§ | .193 |
| Prob. get in vehicle | -2.631 | -3.98§ | .135 |
| Communication probs. | -0.506 | -2.99‡ | .076 |
| Work disincentive | -1.431 | -2.22† | .042 |
| Regression constant | 13.545 | |
| R2 | 0.668 | df = 4&39 |
| R | 0.817 | F = 19.58 |
| sdr = 1.957 | p < .001 |

| Table 6 Regression Results for Productivity Outcomes, Female Stroke (n = 40) |
|--------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Independent variable | Regression coefficient | t-Test | Unique variance* |
| Prob. get in vehicle | -2.204 | -2.77‡ | .087 |
| Barthel score | 0.043 | 3.27§ | .122 |
| Education | 0.248 | 2.57‡ | .075 |
| Regression constant | 1.255 | |
| R2 | 0.591 | df = 3&36 |
| R | 0.769 | F = 17.34 |
| sdr = 2.011 | p < .001 |

*The increase in $R^2$ attributable to a variable had it been the last variable stepped into the equation.

†p ≤ .05.
‡p ≤ .01.
§p ≤ .001.
sdr = standard deviation of residuals.
person’s disability (as measured by the Barthel score) and the limitations of a person’s environment. As would be expected, those with more functional limitations were also more likely to encounter environmental barriers. Except for the unique variance contributed by each variable, it was sometimes difficult to determine in the regression analyses how much of the variance in outcome should be attributed to functional losses and how much should be attributed to environmental factors.

The interaction between personal and environmental limitations was observed in the interaction between a patient’s Barthel score and whether a patient had any problems getting into a vehicle, a transportation barrier. As observed in the analysis of productivity outcomes, the vehicle problems variable had the higher zero-order correlation with the dependent variable and thus was stepped in first. But because the Barthel score and the vehicle problems variable were moderately correlated with each other \((r = -.467)\), the vehicle problems variable concealed what the Barthel score might have contributed had vehicle problems not been considered. And similarly, as observed in the analysis of overall IL outcomes for women, the Barthel score had the higher zero-order correlation with the dependent variable and thus was stepped in first. But because the Barthel score and the vehicle problems variable were also moderately correlated \((r = -.418)\), the Barthel score eliminated the vehicle problems variable from the equation even though the vehicle problems variable had the second highest zero-order correlation with the dependent variable.

These interactions resulted from the fact that problems associated with getting into a vehicle could, in part, be attributed to barriers that were inherently environmental in nature, and, in part, to limitations that were largely personal in nature. Thus, the vehicle problems variable and the Barthel score overlapped as sources of explained variance. The only way to determine how much of the problem was truly environmental was to observe the amount of unique variance explained by the vehicle problems variable after the Barthel score had been stepped into the equation.

**Implications**

**For Medical Rehabilitation**

The central role of the spouse in fostering independent living outcomes highlights the need to make the spouse an integral part of the post-stroke rehabilitation process. The spouse must continue to be viewed as the main source of in-home care for the stroke patient with functional limitations. Moreover, it would appear that supplementing the caregiving role of the spouse may at times be necessary if the spouse can no longer fulfill such a role and if institutionalization appears probable.

The high correlation between outcomes and having problems getting into a vehicle suggests a strategic point of intervention for physical therapy. While the accessibility of an automobile may present some important limitations, it would appear that small gains made by the patient in getting into a vehicle may significantly alter outcomes. Physical therapy’s interventions cannot be limited to activities within the walls of a rehabilitation center but must extend to various forms of outdoor mobility, especially the automobile.

**For Public Policy**

The implications of the findings extend to the policy making arena in several ways.

First, public policy also needs to take into account the significant caregiving functions of the spouse and to identify those points at which caregiving is threatened or made vulnerable due to illness, death or other
factors affecting the well-being of the spouse. As suggested above, supplementary in-home care, publicly subsidized or otherwise, would appear appropriate.

Second, barriers present in the form of inaccessible private transportation must be overcome if stroke patients are to lead productive and independent lives. However, the regression results do not offer specific suggestions as to how such barriers can be overcome.

And third, housing must be more accessible to prevent persons from having to move into more restrictive living arrangements when accessible housing is not available.

Conclusions

The results of the regression analyses indicate that a research model based on independent living theory can contribute significantly to our understanding of stroke outcomes. Although the results were not always in the expected direction, the regression model used here was able to explain roughly 65 percent of the variance in outcomes.

Very few independent variables were needed to explain most of the variance in outcome. In the case of women stroke patients, for example, only 2 variables were needed to explain 62.4 percent of the variance in living arrangement outcomes; only 3 variables were needed to explain 65.8 percent of the variance in productivity outcomes; and only 3 variables were needed to explain 67.5 percent of the variance in overall IL outcomes.

The central question in this article has been the role of environmental variables relative to individual limitations in furthering the stroke patient’s quality of life following discharge. The regression analyses indicated that several variables, which are environmental or contain a significant environmental component, did affect the independent living status of the stroke patient. The most important of these were the patient’s (1) marital status, (2) home barriers, and (3) problems in getting into a private vehicle. While these variables can enhance our understanding of stroke outcomes, individual limitations such as functional deficits still loom large as predictors.

The distinction between personal limitations and environmental barriers did not always hold up in the regression analyses. The results indicate a significant degree of interaction between individual and environmental limitations. These results suggest that our understanding of stroke outcomes are enhanced when we consider the dynamic character of individual, medical, and environmental factors and its affect on patient well-being.

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Interpretation of Results of Compression Ophthalmodynamometry

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SUMMARY Retinal artery pressure measurements were correlated with angiograms in 100 patients who underwent these studies for presumed carotid artery occlusive disease. Using 90% stenosis as the level of stenosis required to produce a hemodynamically significant obstruction to flow, we found a false-positive rate of 10% and a false-negative rate of 28%. We conclude that ophthalmodynamometry remains an effective screening tool. Asymmetric retinal artery pressure measurements indicate the high probability of a high-grade stenosis or occlusion of one artery, but negative measurements do not exclude the presence of significant carotid occlusive disease. In this study no patient with the combination of a significantly altered retinal artery pressure and a carotid bruit had an angiogram showing stenosis of 49% or less.

Th omas AND PETROHELOS1 were the first to call attention to the importance of measuring retinal artery pressures in patients with occlusion of the internal carotid artery. They found definite lowering of the ipsilateral retinal artery pressure in 7 of 8 patients with carotid artery lesions and in 8 of 11 similar patients described in the literature. They concluded that the finding of equal retinal artery pressures does not exclude impairment of the internal carotid artery blood flow, but if other reasons for inequality are excluded, unilateral lowering of the retinal artery pressure is strongly suggestive of occlusion in the internal carotid artery. The method of measurement of retinal artery pressures has been well described elsewhere by Hollenhorst2 and by Smith.3 Kearns4 has reviewed the ophthalmic findings in carotid artery disease and has concluded that a unilateral, significantly low retinal artery pressure indicates stenosis of 90% or more and that the pressure is often 50% or less (diastolic and systolic) of the pressure of the normal eye.

However, a significant number of patients with chronic stenosis of the internal carotid artery, even to the point of occlusion, will have equal retinal artery pressures in the two eyes, as a result of the development of collateral circulation to the eye. Kearns4 observed that normal or equal retinal artery pressures do not rule out stenosis or even occlusion of the internal carotid artery. In other words, occlusive disease, equal retinal artery pressures would be considered a false-negative finding. In the absence of carotid occlusive disease, asymmetric pressures would be considered a false-positive finding. The possibility that false-positive findings may occur in a number of patients requires further elucidation. The literature contains only a few reports of abnormal retinal artery pressures with normal carotid arteries.5-7 It is useful to know the incidence of false-positive findings in patients because all signs and symptoms of carotid occlusive disease are important in making diagnostic and therapeutic considerations. Thus, we undertook an evaluation of retinal artery pressures to identify the incidence of false-positive readings in a group of 100 patients who underwent carotid angiography solely for the evaluation of carotid artery occlusive disease. The retinal artery pressures were correlated with other neuro-ophthalmic and neurovascular findings and with the status of the carotid circulation.

Material and Methods

All carotid angiographic reports for the year 1979 at the Mayo Clinic were reviewed. One hundred one patients were selected with the use of random selection procedures who met all of the following criteria: (1) carotid angiograms were obtained because of the presence of chronic carotid occlusive disease alone; (2) bilateral retinal artery pressures with systolic and diastolic values were obtained before angiography; (3) the patients had not had carotid endarterectomy or another...
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