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PROGNOSIS AND SURVIVAL IN THE AFTERMATH OF HEMIPLEGIA

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There are two stages of recovery from a stroke—the fight for life at the onset, and then the struggle to overcome the effects of residual paralysis. Progress in emergency treatment in the first stage has been influenced by the criteria of differential diagnosis and immediate prognosis defined by Aring and Merritt (1935), Millikan and Moersch (1953), and Rankin (1957), and a basis for the assessment of new methods of treatment has been provided by Millikan *et al.* (1958), Fisher (1958), Carter (1960), and Marshall and Shaw (1960) for anticoagulant therapy, and by Rob and Wheeler (1957), de Bakey *et al.* (1959), and Edwards *et al.* (1960) for the application of vascular surgery. There is no comparable background of precise knowledge about the prospects for recovery or the expectation of life in the second stage, the aftermath of a stroke. Prognosis in this stage is seldom distinguished separately, survival is rarely mentioned, and the value of rehabilitation is difficult to assess because the results that have been reported differ so widely in criteria of case-selection and standards of assessment (Wright and Millikan, 1958; Lee *et al.*, 1958).

In this paper we present some further information about factors influencing prognosis and survival in the stage of functional recovery from hemiplegia, extending to a larger series our experience with a small group reported some years ago (Adams and McComb, 1953).

The Series

The patients were a group of 736 hemiplegics admitted to the geriatric wards of the Belfast City Hospital between 1948 and 1956 and followed up as out-patients, by home visits, or through their family doctors. The date and cause of death were sometimes difficult to ascertain, and survival times were estimated to the nearest month or to an arbitrary date—April 30, 1959, when the last visits were made. Twenty-six patients (4%) were untraced, a proportion unlikely to affect the statistical analysis relating to the remaining 710 (314 men and 396 women).

Most of these patients were transferred from general medical wards or admitted from their homes in the third or fourth week after a stroke, to avoid moving them in the critical fortnight after onset, when most deaths directly attributable to haemorrhage or infarction occur (Aring and Merritt, 1935). Patients who recover quickly from minor lesions are rarely transferred to us, and, because these rapid recoveries from transient paresis and

many early deaths were excluded, the series does not represent the ordinary run of cerebrovascular accidents admitted to general hospitals. It does, however, represent a relatively unselected group of the hard-hit survivors of strokes equivalent to approximately 25% of all cerebrovascular accidents admitted each year to the two largest hospitals in the area. These are accepted without reserve in the belief that no patient who survives the onset of a stroke should be denied an attempt at rehabilitation in the early weeks. It is seldom possible at this stage to foretell what spontaneous mental and physical improvement may be expected in the months ahead.

We have had to ignore the cause of the stroke in the analysis of results because we lacked data to make accurate retrospective diagnoses in many patients, and because the significance of vascular insufficiency in the carotid-vertebral-basilar system was not properly appreciated in the early years of the review. The predominant lesion was cerebral infarction from thrombosis or embolism; the incidence of haemorrhage was unknown. Accurate diagnosis of the underlying lesion is most necessary at the onset of a stroke to make the best use of life-saving measures and to prevent recurrence in some instances, but it is usually less important than the degree of disability later on.

Patients were given a regime of physical retraining adapted to individual needs and continued as long as there was any sign of improvement, if necessary for several months of in-patient and out-patient care (Adams, 1960). The average duration of in-patient treatment for patients of both sexes who recovered was seven weeks.

As patients were discharged home, died, or were transferred to long-stay wards, the following data were compiled in a card index: age on admission, sex, date of onset, duration of paralysis before admission to the unit, blood-pressure, side of brain affected, and an arbitrary grade of recovery. At annual review, a short progress note was made on survivors, or the date and cause of death were noted.

Classification

Patients were classified into three groups:

1. *Recovered*:—Those who responded to treatment.
(a) Grade I: Those who became fully independent, with normal intellect, some use of the affected hand, and ability

to walk with confidence. (b) Grade II: Patients who became able to walk, but were handicapped by a useless arm and needed help with dressing and toilet; some had impaired intellect but none were incontinent.

2. *Long-stay*: Those who failed to improve appreciably after at least three months of intensive treatment, becoming chairfast or bedfast and incapable of walking alone. They were usually confused and incontinent.

3. *Died*: Those who died within two months of onset, before the likely response to treatment could be assessed.

Results

Table I shows the proportions of men and women in each group. There was no significant* difference between them in group distribution, and four-fifths of

TABLE I.—*Prognosis of Hemiplegia in 710 Patients Who Survived the Initial Shock of a Stroke*

Result Group	Males	Females	Total
Recovered	45.2	40.2	42.3
Long-stay	38.2	38.6	38.5
Died under 2 months ..	16.6	21.2	19.2
Total	100 (314)	100 (396)	100 (710)

$$\chi^2 = 3.05, \text{ D.F.} = 2, 0.30 > P > 0.20.$$

Note:—(1) In this and other tables the figures are percentages of the numbers in parentheses. (2) χ^2 is based on absolute numbers.

those who withstood the onset of a stroke survived the next two months, but their chance of being able to move about and look after themselves was only slightly better than that of being permanently incapacitated (42.3% compared with 38.5%).

There were no significant differences between men and women in the grade of recovery. Grade I comprised 42.3% of the men who recovered and 45.3% of the women, and Grade II 57.7% of the men and 54.7% of the women who recovered.

Age Distribution.—There were no age differences between men and women within the three groups (Tables II and III); but, as might be expected, age does affect the outcome of a stroke, and from Table III it

TABLE II.—*Age on Admission and Fate of 710 Hemiplegic Patients who Survived the Initial Stage of Cerebral Shock*

Age on Admission in Years	Recovered		Long-stay		Died under 2 Months	
	Males	Females	Males	Females	Males	Females
<60	20.4	23.9	10.0	15.7	3.8	4.8
60–	9.9	17.0	12.5	12.4	7.7	10.7
65–	21.1	18.9	17.5	15.0	15.4	15.5
70–	20.4	18.2	24.2	19.6	23.1	33.3
75–	18.3	12.6	18.3	18.3	23.1	14.3
80+	9.9	9.4	17.5	19.0	26.9	21.4
Total ..	100 (142)	100 (159)	100 (120)	100 (153)	100 (52)	100 (84)
χ^2 ..	5.20		2.63		3.32	
D.F. ..	5		5		4	
P ..	0.30–0.50		0.70–0.80		0.50–0.70	

Comparison of age distribution among the three result groups:
Males: $\chi^2 = 19.80$; D.F. = 10; $0.05 > P > 0.02$.
Females: $\chi^2 = 29.80$; D.F. = 10; $P < 0.001$.

may be seen that the average ages of men and women who died (73.8 and 72.5 years respectively) were greater than the average ages of those who became chronic invalids (70.8 and 70.3 years), who in turn were older than the recovered group (67.7 and 65.7 years), and these differences between result groups were significant. However, age does not preclude a good recovery from a stroke; indeed, those who were classified grade I were on average older than grade II patients, though this difference was not technically significant (Table IV).

*Significance implying a probability of a result arising by chance of less than 0.05.

Duration of Paralysis Before Admission.—The earlier physical retraining begins after a stroke the better the result. Table V shows that of the men who recovered 73.9% were admitted less than a month after onset (compared with 55.8% of those who became long-stay invalids), with corresponding figures for the women of 76.1 and 49.0%.

Side of Brain Involved.—In the recovered group of patients (Table VI) there were higher proportions of men and women with lesions of the left cerebral hemisphere (62.7% and 58.5% respectively) than were found in either the long-stay group or among those who died. This difference was significant only for the men. For both sexes there was little difference in the proportions of left and right cerebral lesions in long-stay patients, but there were rather more right cerebral lesions among those who died within two months.

TABLE III.—*Comparison of Average Age and Arterial Pressures Among the Three Result Groups*

Variable	Sex	Recovered		Long-stay		Died under 2 Months	
		Mean	S.E.	Mean	S.E.	Mean	S.E.
Age in years	M	67.7	0.88	70.8	0.80	73.8	1.02
	F	65.7	0.85	70.3	0.81	72.5	0.93
Systolic B.P. (mm. Hg)	M	179.1	3.31	183.0	3.05	173.0	5.29
	F	198.3	3.04	192.2	3.12	178.7	3.98
Diastolic B.P. (mm. Hg)	M	101.4	1.87	103.8	1.94	102.5	3.54
	F	108.5	1.45	109.2	1.99	100.4	2.52

TABLE IV.—*Comparison of Average Age and Arterial Pressures Between Grades of Recovery*

Sex	Grade	No. of Patients	Age in Years		Systolic B.P. (mm. Hg)		Diastolic B.P. (mm. Hg)	
			Mean	S.E.	Mean	S.E.	Mean	S.E.
Males	I	60	69.5	1.34	177.1	5.11	100.0	2.88
	II	82	66.4	1.15	180.6	4.53	102.4	2.61
Females	I	72	67.1	1.23	196.5	4.54	109.0	2.17
	II	87	64.5	1.20	199.8	4.10	108.1	1.89

TABLE V.—*Duration of Paralysis Before Admission*

Duration of Paralysis before Admission (Months)	Recovered		Long-stay	
	Males	Females	Males	Females
0–	73.9	76.1	55.8	49.0
1–	21.8	18.9	23.3	28.1
12–	2.1	2.5	7.5	7.2
24–	1.4	0.6	3.3	3.9
36–	0.7	0.6	4.2	2.6
48+	—	1.3	5.8	9.2
Total ..	100 (142)	100 (159)	100 (120)	100 (153)
χ^2 ..	5.88		2.89	
D.F. ..	4		6	
P ..	0.20–0.30		0.80–0.90	

Comparison of duration distribution between recovered and long-stay patients:

Males: $\chi^2 = 20.77$; D.F. = 5; $P < 0.001$.
Females: $\chi^2 = 39.94$; D.F. = 6; $P < 0.001$.

TABLE VI.—*Side of Brain Affected*

Side of Brain Affected	Recovered		Long-stay		Died under 2 Months	
	Males	Females	Males	Females	Males	Females
Left ..	62.7	58.5	45.8	49.7	44.2	44.0
Right ..	35.2	40.9	47.5	42.5	50.0	52.4
Both ..	2.1	0.6	6.7	7.8	5.8	3.6
Total ..	100 (142)	100 (159)	100 (120)	100 (153)	100 (52)	100 (84)
χ^2 ..	0.83*		0.71		0.02*	
D.F. ..	1		2		1	
P ..	0.30–0.50		0.70–0.80		0.80–0.90	

Comparison of side affected among the result groups:

Males: $\chi^2 = 7.40$; D.F. = 2; $0.05 > P > 0.02$.

Females: $\chi^2 = 3.76$; D.F. = 2; $0.20 > P > 0.10$.

* Omitting both sides affected because of small numbers.

Blood-pressure

Blood-pressure usually rises with the onset of a cerebrovascular accident, falling gradually to its normal value for the individual in the early weeks of convalescence. Most patients were transferred to us in or after this period, and the pressure recorded in the card index for each patient was the highest resting pressure in convalescence. Routine readings were made each week in the rehabilitation wards, but over the years they were made by different members of staff, and only one reading was available for some of the patients who died, so that the analysis of blood-pressures is not strictly comparable with other studies in which standard criteria were used for such records.

An analysis of variance of the data† showed that there was no material difference between the average systolic and diastolic pressures of patients of either sex who recovered or became long-stay invalids, but arterial pressure in those who died within two months tended to be lower than in those in the other two groups, the difference being statistically significant only for women. The average values of both systolic and diastolic pressures in these hemiplegic patients were higher throughout than those in several samples of healthy old people in the general population (Hamilton *et al.*, 1954; Miall and Oldham, 1955; Anderson and Cowan, 1959a, and 1959b), and our results show, as do theirs, that men have lower pressures on average than women (Table III). Average blood-pressure levels did not differ between grades of recovery. Systolic and diastolic pressures of men were rather lower than those of women, but there was no significant difference between the pressures of grade I and grade II recoveries for either sex.

Prognosis for Life

The main object of this survey was to compare the survival of recovered and long-stay patients. We had acquired a discouraging impression that patients who failed to respond to treatment were apt to outlive those who got back on their feet and returned to active life.

Because of certain differences, described earlier, between the recovered and long-stay groups, and between men and women in the series, survival rates have been compared for each sex for patients of similar age, for those with the same side of the brain affected, and for those admitted within a month of their strokes. Because some patients were still alive at the chosen final date, survival was assessed by means of life-tables (Berkson and Gage, 1950). These are most easily presented as graphs (Figs. 1-3), and, although the validity of the following conclusions may not always be self-evident in each graph, they are borne out by comparison of the tabulated data in each instance.

1. Men and women who recovered lived longer than those who became long-stay patients. This was true of each age-group. It is reassuring to find that physical retraining has been worth while. The mistaken impression which prompted this part of the inquiry probably arose from seeing the same faces in the same beds in so many corners of the long-stay wards on routine rounds over many years, whereas patients who recovered were seen only at intervals of months or years.

†An analysis of variance was made of age and of systolic and diastolic blood-pressure for each sex in each of the three groups, and the authors will forward the statistical data to anyone who is especially interested.

2. Women survived somewhat longer than men of the same age and result groups. This is no more than we expect of the weaker sex, and the only factor in the inquiry that might have influenced this finding, other than the more resilient constitutions of elderly women, was their higher average blood-pressure.

3. It appeared from the numbers available that these conclusions were not affected by the side of the brain involved (Fig. 2) or the duration of paralysis (Fig. 3).

4. Moreover, the same differences in the survival curves between recovered and long-stay patients persisted in the analysis of all combinations of subgroups of age, sex, side of brain involved, and duration of paralysis. But the validity of this particular analysis was limited because the numbers of patients in some subgroups were small.

FIG. 1.—Survival curves—age on admission. — recovered. --- long stay. In each figure the number of patients in the group is given in parentheses.

FIG. 2.—Survival curves—side of brain affected. — recovered. --- long stay.

Owing to small numbers of patients still surviving at the tails of many of these curves, average survival for the whole series could not be estimated. However, it was possible to assess the half-way mark with reasonable accuracy—that is, the number of years after a stroke which half of a given group might expect to live (or, conversely, the number of years which would be exceeded by less than half of a group). Medians drawn

FIG. 3.—Survival curves of patients who were admitted within a month of stroke. — recovered. ---- long stay.

at this point for each sex below 65 years of age, between 65 and 75, and over 75 years show that "group half-survival" declined with age as might be expected, and, as before, that recovered patients outlived the long-stay invalids and the women outlived the men (Table VII). It seemed from this that 50% of the patients of either sex who recovered from their strokes survived at least six years if aged less than 65 at the onset, or about three and a half years if men, or four years if women, over that age.

TABLE VII.—Comparison of Normal Life Expectation with "Half-survival" after Hemiplegia

Sex		Recovered Patients. Age-group in Years			Long-stay Patients. Age-group in Years		
		<65	65-75	75+	<65	65-75	75+
Males	Normal average expectation (yrs)	19.3	9.7	5.8	16.6	9.4	5.6
	"Half-survival" figure (yrs)	6.2	3.4	3.2	3.2	2.4	1.8
Females	Normal average expectation (yrs)	20.9	11.0	6.2	19.0	10.4	6.0
	"Half-survival" figure (yrs)	6.6	4.8	3.4	4.1	3.3	1.8

Total number of patients in each group is shown in Fig. 1.

Cause of Death

It was often difficult to obtain reliable information about the cause of death in patients who had died after discharge from hospital. Cerebral thrombosis or haemorrhage may be recorded as the primary cause of death although the stroke may have happened some years before, without recurrence, and death may in fact have followed a terminal pneumonia, coronary or pulmonary infarction, or congestive heart failure.

Of 306 patients in whom the cause of death was traced, 32% appeared to have had a further fatal cerebrovascular accident, 34% died from respiratory disease (mainly terminal bronchopneumonia in bedfast chronic invalids), 18% had coronary thromboses or congestive heart failure, and 16% died from other causes.

Discussion

Compared with other studies of the results of rehabilitation in hemiplegia reported in recent years, the 42% recovery rate in this series might seem at first glance to be a poor result. Dinken (1947), Lowman (1948), Rusk (1950, 1956), and Benton and Rusk (1956) restored independent self-care and the ability to walk unaided to more than 90% of groups of 50 or more hemiplegic patients. Rusk observed that appropriate selection will ensure this high level of success in an average of six to eight weeks of retraining, and that 30% of the patients can return to work. Lee *et al.* (1958) gave a detailed analysis of 230 hemiplegics from the Bellevue Hospital Medical Center, New York. Although 84.5% were said to have improved their ability to walk, and 88.1% improved or regained independent self-care, only 65.7% were described as discharged home "active" and 23.9% home under "medical care." The authors comment that differences in the results reported from various centres may sometimes be related to inadequate home-care services which prejudice the discharge from hospital of patients who have regained independence.

Baumoe *et al.* (1954) found that of 250 patients with cerebrovascular accidents admitted to a hospital for chronic diseases in various stages of disability, 75% ultimately were able to walk with or without the use of some apparatus, and Mahoney *et al.* (1955) restored safe and independent self-care and walking to 81.8% of their first series of 122 hemiplegics, but to only 71.9% of a second group of 70 patients. Lindgren (1958), in a detailed study and follow-up of 65 patients with verified occlusion of internal carotid or middle cerebral arteries, restored self-care and independence to 60% of them, 26% being able to return to work. 75 to 90% of hemiplegic patients are said to recover sufficient voluntary power in the leg to stand and walk (Twitchell, 1957); this is supported by Rankin (1957), who observes that 80% of those who survive a stroke (or nearly 90% of those without bilateral signs) show useful recovery of function.

In contrast with these favourable reports, only 42% of our earlier series of 174 hemiplegics recovered ability to walk and attend to personal needs (Adams and McComb, 1953), and this is confirmed by the present review. Droller (1953), in a follow-up of 275 hemiplegics of vascular origin in Leeds, was able to discharge only 30% of them home, 25% within 12 months, and a further 5% after more prolonged treatment in long-stay wards.

These less successful recovery rates must be due to the higher average ages of Droller's patients and ours, and to the less rigid criteria of selection applied to our admissions. Droller's recovered patients averaged 69.9 years of age, and ours 66.7 years, compared, for example, with 55.7 years in the series reviewed by Lee *et al.* The latter believe that age is an important factor in recovery because 92 of their 96 patients under 55 returned home, but only 24 out of 34 over 65 were able to do so.

Benton and Rusk (1956) excluded patients with a progressive lesion, with intractable renal disease, coronary insufficiency, or heart failure, or with "involvement of cerebral cortical tissue to such an extent as to preclude adequate mentation and retention." The series of Lee *et al.* from the Bellevue Center were those who were thought likely to respond to rehabilitation—"the cream of the crop." Our patients were not chosen so critically. We believe that treatment should persist

as long as there is evidence of improvement, however slight, and we excluded only those patients who could not walk or had advanced senile mental changes prior to the stroke, and those referred with inflexible contractures or in terminal illness. More rigid selection may ensure that time and effort are not wasted on patients who cannot respond to treatment, but it is also apt to deny others a chance to make the most of a delayed recovery. The rewards of resolute treatment over many months in apparently hopeless invalids may be as great in hemiplegia as those expected in some other protracted neurological disorders.

A man aged 60 survived a severe left cerebral haemorrhage with aphasia, flaccid paralysis, and hemianaesthesia. He remained retarded, incontinent, and apathetic, with persistent paralysis for 22 weeks before his mental state began to improve and voluntary movement reappeared in the leg. Incontinence cleared and he returned home, walking with a calliper, after a further 10 weeks. His hemiplegic hand and arm remained useless, but at review two years later he was still active and relatively independent.

A woman aged 73 was admitted to hospital in coma with a left hemiplegia and a heavily blood-stained cerebrospinal fluid. She was not expected to survive, and a month later consciousness was still clouded, with apathy, retarded comprehension, incontinence, and dysphasia. The arm was flaccid and paralysed, although movement was returning to the hemiplegic leg. She was still in this state on transfer for rehabilitation in the sixth week after onset. By the 11th week she had regained normal use of the leg and partial use of hand and arm, but was still incontinent and inattentive, so that she needed constant supervision though able to walk and to get in and out of bed or a chair unaided. Mental improvement progressed until by the 22nd week she was fully independent, able to use the hemiplegic hand in dressing, and dry by day though still occasionally incontinent at night. She returned home to relatives after 33 weeks in hospital.

Three patients with embolic infarction from rheumatic heart disease needed $2\frac{1}{2}$, $3\frac{1}{2}$, and $4\frac{1}{2}$ years respectively to regain the use of the fingers of their hemiplegic hands. They were women, and in each the recovery of a useful hand was a tribute to their constancy and persistence with self-aided exercises to keep the joints flexible while awaiting the return of voluntary movement.

Gowers (1888) described the need to reassure the patient of "the slow recovery that time will bring." The essentials in treatment seem to be effective supervision and training in self-aided exercises to prevent contractures, so that the patient will have a useful limb if and when voluntary power returns, and an environment which will encourage the patient to make the best use of this functional recovery, if he has the grit to do so.

Involvement of the dominant hemisphere is usually regarded as an adverse factor in prognosis of strokes because it is difficult to communicate with the aphasic patient. The predominance of left cerebral lesions among patients in this series who recovered was unexpected. The difference in the proportions of left- and right-sided lesions was significant only for the men, but the same trend was evident in the women. This finding needs to be confirmed from other sources, and meanwhile only tentative suggestions can be offered to explain our results.

A right-handed person who has a stroke and loses the use of his right arm and leg may be driven to redouble his efforts to regain the use of them because he cannot make good with the unpractised left side. With the left side paralysed, he may ignore it not only because it is

easier to use the dominant right limbs but because bizarre disturbances of body image and adverse mental reactions often occur with lesions of the non-dominant hemisphere. This would explain the better outcome of left cerebral lesions, but it implies that the extent of recovery rests with the patient. It occurred to us that, if this were true, it must have applied equally to patients in the years prior to the more intensive physical retraining that hemiplegic patients are now given, and therefore the distribution between the two sides should have been the same in the old chronic-ward invalids as it is in the long-stay patients now—that is, about equal numbers of left and right. However, a search showed that of 28 hemiplegics inherited 12 years ago from the old chronic wards, no less than 79% had left cerebral lesions, confirming the belief that there was a predominance of right hemiplegias in chronic hospital wards (Wright and Millikan, 1958). For some reason this trend has changed, because although only one of these original invalids is now alive, only 56% of 32 long-stay hemiplegics with us now have left cerebral lesions. This compares favourably with experience over the whole series—that is, about equal numbers of left and right.

We believe that modern management of hemiplegia must have some bearing on this. Knapp (1959) drew attention to the problems of rehabilitation arising in non-dominant-hemisphere lesions from defects in visuo-motor, temporal, and spatial relationships, and in judgment and abstract generalizations. These may cause more difficulty than loss of speech, but, given time and resolute retraining, they may be more successfully overcome. In the past, hemiplegics were often denied both of these essentials, which might explain why so many victims of left cerebral lesions fell by the wayside. Perhaps the right-handed patient who loses the use of the right arm and leg is driven to greater efforts, not so much to regain the use of his hemiplegic side, but to compensate for lack of it by more determined use of the unpractised left. In this he would be helped greatly by modern methods of occupational therapy and physiotherapy.

There are few references to the expectation of life for patients who survive the immediate effects of a stroke. Tennent and Harman (1949), reviewing prognosis in a series of 105 patients with cerebrovascular lesions, observed that, unless seriously compromised by the sequelae of their disease, survivors seem to live out their expected life-span. However, Lindgren (1958) found that one-third of his 65 patients died in less than two years (although only 18 of them were aged over 50), and Pincock (1957) followed up 101 patients with cerebral thrombosis after discharge from hospital and 55 (54%) had died within seven years, cardiac disease being the predominant cause. He observed, as we have, that patients who regained good functional capacity tended to maintain it.

The lack of accurate knowledge of the natural history of cerebrovascular disease prompted a review of the meagre information available and a follow-up of 251 patients by Marshall and Shaw (1959) from the National Hospital for Nervous Diseases. Embolic infarcts were excluded from their series, and no attempt was made to distinguish between transient ischaemic episodes and accident resulting in a permanent neurological deficit. The follow-up period varied from four to nine years, and in this time 63% of the 160 males and 53% of the 91 women had died (119 of the combined 149 deaths occurring within five years). The authors discuss

prognosis for life in relation to the initial diagnosis and note that thrombosis in a hemisphere carries a prognosis as bad as, or worse than, thrombosis of the brain-stem, and that the death-rate in patients (especially men) with diffuse cerebrovascular disease is very high. Lee *et al.*, who reviewed their series between 1947 and 1956, found that 29.1% of active patients discharged home had died, compared with 41.8% of those discharged under medical care, but the distribution of these deaths over the years was not given.

Although we were unable to estimate an average expectation of life for the series, the half-survival figures described earlier could be compared with normal average life expectation within the same age ranges (less than 65 years of age, 65 to 75, and over 75 years) compiled from life-tables (Registrar-General for Northern Ireland, 1957). For each man and woman the expectation of life was estimated at his or her age from the life-tables, and the sum of these figures for each age-group was divided by the number of patients to give a normal average for that group.

In Table VII the normal and hemiplegic half-survival figures are compared, and it is obvious that the expectation of life after a stroke is greatly foreshortened. Even if the normal average expectation of life is halved, it still exceeds the half-survival-mark figures in every hemiplegic group except the recovered men over 75 years of age.

We believe, with Marshall and Shaw, that the death-rate in diffuse cerebrovascular disease is exceptionally high, and it is a prominent cause of the chronic incapacity of many long-stay patients, who, owing to progressive cerebral degeneration, remain apathetic, inattentive, and incontinent until terminal illness overtakes them, usually within two years. The prognosis for younger patients is little better; of 34 patients in this series who had embolic hemiplegia from rheumatic heart disease, only one survived the review period. None of these patients had anticoagulant therapy, and the prognosis for this type of hemiplegia may alter considerably with this treatment in the future (Carter, 1960).

Summary

Prognosis and survival has been studied in a series of 736 patients with hemiplegia of vascular origin who were accepted for rehabilitation two weeks or more after the onset of their strokes.

They were classified in three groups—those who recovered (within two arbitrary grades), those who failed to respond to treatment and became chronic invalids, and those who died within two months of onset. 81% of the patients survived these two months, but their chance of being able to get about and look after themselves was little better than that of becoming relatively helpless invalids.

Older patients were more likely to be permanently incapacitated, but age in itself did not preclude a good recovery nor, contrary to the general belief, did a lesion of the dominant hemisphere. Recoveries included a significantly greater proportion of men with dominant-hemisphere lesions and the same trend was evident amongst the women.

Blood-pressure in these patients were higher on average than those in samples of old people in the general population, and the blood-pressure of the women were higher than those of the men.

The earlier physical retraining began the better, and, if successful, the recovered patient had an even chance of maintaining a relatively active life for at least six years if under 65 years of age at the onset, or for three and a half years as a man and four years as a woman over that age.

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