

Papers and Originals

Psychiatric Sequelae of Subarachnoid Haemorrhage

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This study is a report on the psychological and psychiatric morbidity of 261 cases of subarachnoid haemorrhage treated at Atkinson Morley's Hospital between January 1958 and June 1964. During this period approximately 2,750 patients with subarachnoid haemorrhage were admitted, in about 1,300 of whom aneurysms were demonstrated. Many of the latter were included in a trial of surgical versus nonsurgical treatment in patients with ruptured cerebral artery aneurysms, the organization and early results of which were described by McKissock, Richardson, and Walsh (1960). The background to the trial was that, although surgery of various types had been used for many years, there was no clear knowledge of the natural history of patients with ruptured aneurysms, so that the surgical results reported were possibly due to selection of cases already out of danger from rebleeding (McKissock and Walsh, 1956; Norlen and Barnum, 1953).

The trial was designed to allocate cases suitable for surgery randomly to operative or conservative treatment after stratification by site of aneurysm, blood pressure, age, clinical condition, and elapse of time since the haemorrhage. Sex was not originally used as a stratification factor, but it was realized later (McKissock, Richardson, and Walsh, 1962) that it was of great importance in middle cerebral aneurysms, as women fared worse with surgery than did men.

Conservative treatment in this trial means six weeks' rest in bed, with any necessary medical measures, including hypotensives, followed by gradual mobilization. Surgical treatment is of three main types: common carotid ligation (C.C.L.); direct attack on the aneurysm (D.A.); and proximal occlusion of the vessel from which the aneurysm arises, used only for anterior communicating aneurysm in this series. The operations used in the cases considered in the comparisons are described later.

The results of the trial of surgery so far have been published by McKissock, Richardson, and Walsh (1960, 1962, 1965); they indicate that surgery is of definite benefit in posterior communicating (P.C.) aneurysms and in men with middle cerebral (M.C.) aneurysms. No significant differences between operative and conservative treatment have been shown for women with M.C. aneurysms or for patients with anterior communicating (A.C.) aneurysms.

The risk of rebleeding from a ruptured cerebral artery aneurysm is greatest in the first few days, and is quite small after two weeks. Surgery to be of real value must therefore be used in the early stages.

There are many scattered references to various psychiatric complications in the literature, but no comprehensive study has been found. All who work in this field are aware that in a certain number of cases marked personality and intellectual deterioration may occur, and that anxiety and depression are

not uncommon late results. Walton (1956) in his well-known book on subarachnoid haemorrhage said that mental symptoms proved to be an important cause of disability in his series of patients, both from organic brain damage and from anxiety symptoms; and commented that such sequelae had received little attention in the literature.

Present Study

Material

Follow-up has been made of 261 patients with proved subarachnoid haemorrhage. All were seen between December 1963 and June 1965. Selection was made without knowledge of their clinical state; but some patients with an aneurysm in a certain site were chosen in order to bring the groups up to approximately equal size. There was no other special selection.

The follow-up period varied between six years and six months: it was more than three years in 145, between three years and 18 months in 43, and less than 18 months in 73. In only 11 was the follow-up period less than one year; two of these were at six months, and none was at less than six months.

The age of the patients varied from 19 to 67 years: 6% were under 30 years, 25% were from 30 to 44, 50% were from 45 to 59, and 20% 60 or more.

Of the 261 patients seen seven had multiple aneurysms and 30 had no aneurysms. None was believed to have had a primary intracerebral haematoma, nor had any had a head injury. None of the patients had been on M.A.O. inhibitor drugs at the time of haemorrhage, so far as is known. The remaining 224 had single aneurysms, 81 anterior communicating (A.C.), 72 posterior communicating (P.C.), and 71 middle cerebral (M.C.) aneurysms. Fifteen of those with single aneurysms were for technical reasons regarded as unsuitable for the trial or had an operation in order to evacuate a life-threatening haematoma. These and the seven patients with multiple aneurysms are not considered further here.

When the study was carried out all cases with A.C. aneurysms and women with M.C. aneurysms were still in the trial if they fulfilled the criteria, but those with P.C. aneurysms and men with M.C. aneurysms had been out of the trial, and therefore treated operatively, since 1959 and 1961 respectively. To increase the size of the groups under comparison all cases in the two latter categories have been included in the "trial comparisons" if they fulfilled the original trial criteria—even if they were admitted after the trial had been abandoned—and surgery recognized as the treatment of choice. Such cases are described as suitable for trial in this paper. Of the 224 patients with single aneurysms 163 were actually in the trial and a further 46 were suitable for trial (but all were treated surgically). There are consequently 209 patients who may be used to provide valid comparisons of the incidence of psychiatric and other sequelae—in 125 operatively and 84 non-operatively

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treated cases. Table I shows the sex and treatment distribution. Of the 30 cases with no aneurysm 14 were men and 16 women.

In order to check the validity of the comparisons between the 125 operatively treated and 84 conservatively treated cases a series of χ^2 estimations was made on the incidence of the

TABLE I.—Material for Trial Comparisons (209 Cases)

	A.C.		M.C.		P.C.		Totals
	M	F	M	F	M	F	
Op. ..	16	18	18	21	18	34	125
Cons. ..	25	17	10	19	3	10	84
Totals ..	41	35	28	40	21	44	209
	76		68		65		

following 11 pretreatment factors in the two groups: sex; age; side of aneurysm; coma following the haemorrhage; level of consciousness on admission (alert or not alert); the incidence and severity of lateralizing neurological signs; blood pressure on admission (above 160/90 or not); incidence of haematomata and of cerebral arterial spasm on angiography; history of previous subarachnoid haemorrhage; and the results of carotid compression before angiography. No significant differences emerged, either between these two groups or in the distribution of the factors between operative and conservative subgroups for each type of aneurysm separately. They may therefore be justifiably compared for the results of treatment.

Table II shows the type of operation used in the cases compared for the trial.

TABLE II.—Operation Used in 125 Operatively Treated Cases (Trial and Suitable-for-trial Cases Only)

	A.C.		M.C.		P.C.		Totals
	M	F	M	F	M	F	
C.C.L. ..	5	9	2	0	16	32	64
D.A. ..	3	5	16	21	2	2	49
Proximal occlusion	8	4	0	0	0	0	12
Totals ..	16	18	18	21	18	34	125
	34		39		52		

C.C.L. = Common carotid ligation. D.A. = Direct attack on aneurysm after craniotomy, with clipping or gauze wrapping of aneurysm. Proximal occlusion = Of the supplying vessel.

Methods

Of the 261 cases 260 were seen by me, all but eight in their own homes.¹ In 242 cases another informant was also seen, usually the spouse or other close relative.

Each interview lasted between one and a half and two hours, and consisted of an initial informal period with the patient, followed by history-taking and then by questions from a check list. Simple clinical tests of memory, grasp, and comprehension were used. Lastly, the Benton visual retention test and the Inglis paired-associate-learning test were given in most cases. The patient then laid down, and the relative was interviewed separately. The patient was finally examined physically, and blood pressure was measured at the beginning and end of the examination, the lower reading being accepted. Minor lateralizing neurological signs were carefully looked for as presumptive evidence of brain damage.

In addition to interview material letters from the patient in answer to earlier routine follow-up inquiries were studied, and in many cases letters from the patient's general practitioner were also available. A few general practitioners were seen personally—mainly in rural districts. With regard to patients

¹ One case is included on the basis of detailed letters from the patient and his wife, and of a report from Wing Commander A. W. Black, R.A.F., who examined him, and to whom I am indebted. (The patient was rated unimpaired in all respects.)

who had had hospital psychiatric treatment the hospitals concerned were contacted, notes being forthcoming in most cases.

At the end of the interview ratings were made on four scales—physical disability, psychiatric symptoms, personality impairment, and intellectual impairment. These are described in the Appendix, and all were made within a few minutes of the end of the interview. (In some cases where other hospital notes were studied later the rating for psychiatric symptoms was changed.) Unfortunately no rating was made on overall mental disability at that time, but during analysis of the results it was realized that such a rating was necessary. As many patients were rated as impaired on more than one of the scales, a false impression could be gained by mentally summing the scores arithmetically. Rating scales of this type are not entirely suitable for such summing, as no truly mathematical relationships can be assumed. A five-point scale of overall mental disability was therefore constructed, the original notes were scrutinized again, and each patient was rated on the scale (see Appendix for details). This procedure has the advantage that more valid comparisons can be made on overall disability and, most importantly, each patient is being considered only once in the comparisons. It is obvious that these last ratings were made after the results were already clear, but every attempt was made to avoid bias.

Results

1. Overall Mental Disability

With the use of the five-point scale as a measure of overall mental disability (see Appendix), Table III shows the results in the 209 aneurysm cases used in the trial comparisons. Comparable figures for the 30 cases with no demonstrated aneurysm are also given.

TABLE III.—Results in 209 Aneurysm Cases (Trial Comparisons) and 30 No-aneurysm Cases. Overall Mental Disability

	Absent	Mild	Mod.	Severe	V. Severe	Totals
P.C. ..	33 (51)	15 (23)	11 (17)	6 (9)	0 (0)	65 (100)
M.C. ..	26 (38)	14 (21)	12 (17)	11 (16)	5 (7)	68 (99)
A.C. ..	35 (46)	22 (29)	14 (18)	3 (4)	2 (3)	76 (100)
All an. ..	94 (45)	51 (24)	37 (18)	20 (10)	7 (3)	209 (100)
No an. ..	19 (63)	8 (27)	2 (7)	1 (3)	0 (0)	30 (100)

Percentages in parentheses.

Comparing all those with aneurysms with those without, and simplifying the results into absent/mild and moderate/severe/very severe, we find that morbidity is significantly greater in those with aneurysms ($\chi^2=5.593$ with 1 degree of freedom, $P<0.02$).

Those with M.C. aneurysms do worse than those with A.C. or P.C. aneurysms. Again simplifying Table III as above, and considering only the aneurysm cases, then $\chi^2=5.345$, $P<0.1$ with 2 degrees of freedom, not quite reaching conventional levels of significance. If, however, M.C. aneurysms are compared with the others as a whole, then $\chi^2=5.320$, $P<0.05$ with one degree of freedom.

The distribution of central nervous system signs at follow-up is shown in Table IV, but the findings on admission are omitted to save space.

TABLE IV.—C.N.S. Signs at Follow-up

	Absent	Mild	Mod.	Severe	Totals
P.C. ..	40 (62)	12 (18)	6 (9)	7 (11)	65 (100)
M.C. ..	27 (39)	22 (32)	7 (10)	12 (18)	68 (99)
A.C. ..	49 (64)	20 (26)	3 (4)	4 (5)	76 (99)
All an. ..	116 (55)	54 (26)	16 (8)	23 (11)	209 (100)
No an. ..	24 (80)	5 (17)	1 (3)	0 (0)	30 (100)

In patients with aneurysms the neurological signs at follow-up were significantly more frequent and severe than on admission ($\chi^2=6.30$, $P<0.02$, with one degree of freedom). In those without aneurysms the incidence of the neurological signs was almost exactly as on admission. The fact that no increase occurs in the signs of the no-aneurysm cases indicates that the ratings are probably reliable, as these latter patients have very low rebleed rates, and no possibility of postoperative complications. (The ratings of C.N.S. signs on admission are derived from surgical notes made by a number of people over several years, whereas the follow-up examinations were all made by me.)

There is a significant difference in the incidence of neurological signs at follow-up in the three main aneurysm groups, being greatest in those with M.C. and least in those with A.C. aneurysms. (When grouped as absent/mild and moderate/severe $\chi^2=8.407$ with 2 degrees of freedom, $P<0.025$.)

The fact that those with M.C. aneurysms have a higher incidence of signs is at least a partial—and probably a complete—explanation for their increased overall mental morbidity, demonstrated in Table III. Equally, those with no aneurysms have the fewest neurological signs and the lowest mental disability, while those with A.C. and P.C. aneurysms have intermediate positions in these respects. The evidence is not set

TABLE V.—M.C. Aneurysms in Trial Comparisons. Overall Mental Disability

	Absent	Mild	Mod.	Severe	V. Severe	Totals
(a) Women						
R Op. . .	4	3	2	0	1	10
R Cons. .	4	4	2	0	0	10
L Op. . .	1	2	2	4	2	11
L Cons. .	4	2	1	1	1	9
Totals	13 (32)	11 (27)	7 (17)	5 (12)	4 (10)	40
(b) Men						
R Op. . .	4	1	3	4	0	12
R Cons. .	2	1	1	2	0	6
L Op. . .	3	1	1	0	1	6
L Cons. .	4	0	0	0	0	4
Totals	13 (46)	3 (11)	5 (18)	6 (21)	1 (4)	28

out fully in this paper, but, as would be expected, both personality and intellectual impairment are clearly associated with brain damage, of which neurological signs are unequivocal evidence. Psychiatric symptoms of anxiety and depression are not infrequent in those without neurological signs, but those with brain damage have a greater tendency to such symptoms than those without.

There were no significant differences between the overall mental disability of the operatively and the conservatively treated groups, between men and women, nor between those with right-sided as opposed to left-sided aneurysms. A.C. aneurysms are essentially midline structures, although they may damage one side of the brain more than the other on rupture; they are therefore not included in this comparison.

Although when the trial material is considered as a whole there are no sizable differences between operative and conservative groups, between men and women, or between right- and left-sided aneurysms, this is not so when those with M.C. aneurysms are considered separately. Patients with M.C. aneurysms do worse overall than those with other aneurysms (Table III), and it can be seen from Table V that this is entirely because of the worse results with surgery in this group. The difference is most pro-

nounced in the case of women with left-sided aneurysms, but men with right-sided aneurysms also fare worse with surgery than with conservative treatment.

Table V (a)—that is, for women with M.C. aneurysm—has been analysed using Cochran's criterion, testing for the difference in mental disability when grouped as absent/mild and moderate/severe/very severe, and correcting for the differences between right- and left-sided lesions. The test is two-tailed, and the result is between the 7% and 8% levels of significance ($t=1.778$), not quite reaching conventional levels.

Table VI shows M.C. aneurysm cases of both sexes, divided by type of treatment for added clarity.

TABLE VI.—M.C. Aneurysms in Trial Comparisons. Operative versus Conservative Treatment

	Absent	Mild	Mod.	Severe	V. Severe	Totals
Op. . .	12 (31)	7 (18)	8 (21)	8 (21)	4 (10)	39 (101)
Cons. . .	14 (48)	7 (24)	4 (14)	3 (10)	1 (3)	29 (99)
Totals . .	26 (38)	14 (21)	12 (17)	11 (16)	5 (7)	68 (99)

Combining the results into two categories of absent/mild and moderate/severe/very severe, the latter contains 52% of the operative and only 27% of the conservative groups. The use of χ^2 test shows the difference to be significant at the 5% level. ($\chi^2=3.892$, $P<0.05$ with one degree of freedom.)

Comparable separate tables for A.C. and P.C. aneurysm groups are not given, but in fact those treated by surgery have a lower overall mental disability than the conservatively treated patients. The differences are not significant. They are, however, marked enough to even out the operative versus conservative comparisons when all aneurysms are considered together.

2. Using Separate Rating Scales

The results so far have been set out with the use of only the rating of overall mental disability. As was explained earlier, each patient was originally rated on four scales, each of four points, for personality impairment, psychiatric symptoms, intellectual impairment, and physical disability (see Appendix). These are set out as histograms in Figs. 1 and 2. It must be remembered that in the overall mental disability ratings psychiatric symptoms were given relatively less weight, as in

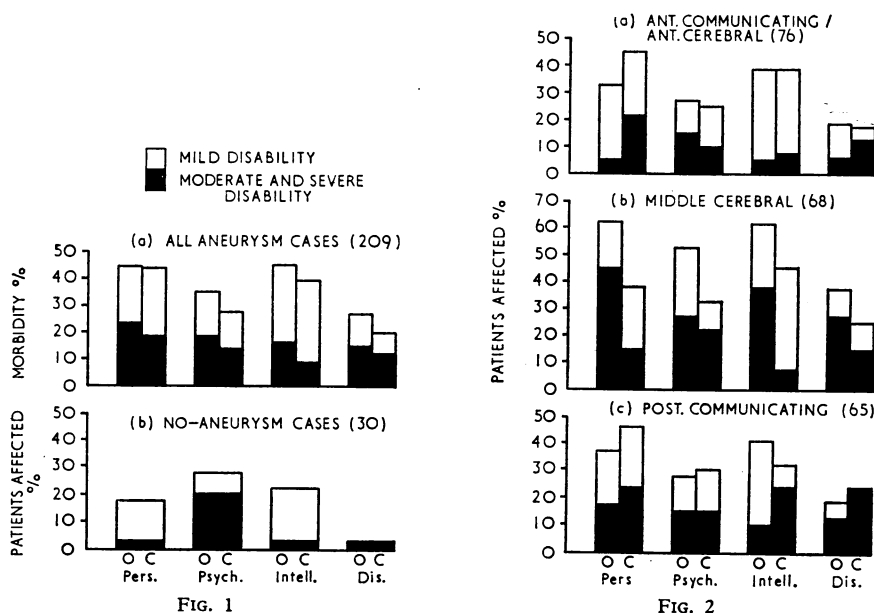


FIG. 1.—All aneurysm cases in trial comparisons. O—Operated cases. C—Conservative. Pers.—Personality impairment. Psych.—Psychiatric symptoms. Intell.—Intellectual impairment. Dis.—Physical disability. FIG. 2.—Comparison of major aneurysm groups.

many cases they are transient, whereas personality and intellectual impairment are permanent. The histographic method, with four point-rating scales, makes differences between groups more apparent than did the overall rating method, but there are no major inconsistencies. The rating scales were also assessed statistically, using *t* tests, and the results of these will be mentioned where applicable. Fig. 1 shows that the aneurysm cases are more severely affected than those with no aneurysm, and also shows that in the latter group there is very little personality impairment, intellectual impairment, or physical disability rated as moderate or severe. One man, the only no-aneurysm case with C.N.S. signs rated moderately severe at follow-up, is responsible for the 3% shown in each of those categories. Patients with no aneurysms have, however, a similar incidence of psychiatric symptoms to patients with aneurysms. Seven of the 30 patients without aneurysms had clinically significant anxiety or anxiety/depressive states at the time of their haemorrhage, but only two out of seven are rated here as being worse than before the stroke. (This aspect will be dealt with in greater detail in a later publication.)

The columns representing the aneurysm cases in Fig. 1 show a slight worsening in the operative groups, which did not appear in the ratings of overall mental morbidity, but the differences are not significant.

Fig. 2 shows the results in the three main aneurysm groups, from which it can be seen that in the P.C. and A.C. cases those treated operatively do somewhat better than the others, but the differences are not significant. M.C. cases do considerably worse with surgery, however, particularly where moderate damage and severe damage are concerned. Using *t* tests, and considering the sexes and side of aneurysm separately (although the histograms do not show them separately), the significant differences are as follows: for personality impairment in women with left-sided aneurysms, operative cases do significantly worse than conservative cases at the 1% level ($t=2.9$, $n=17$, $P<0.01$); for intellectual symptoms in the same cases the difference is significant at the 2% level ($t=2.8$, $n=17$, $P<0.02$). None of the other differences reach conventional levels of significance.

3. "Improved Personality"

Details of the nature of the personality and intellectual impairment, and of the psychiatric symptoms, will be reported elsewhere, but there are some points which may suitably be mentioned here.

Depressive and anxiety states occurred in patients with and without brain damage, and in this study those with brain damage are rated as depressed even if there is no evidence of depressive illness, and if in my opinion the mood change was distinctive enough. In this way a number of those rated as having mild psychiatric symptoms showed a picture of shallow depression, easily lifted, in a setting of personality and intellectual impairment.

The personality changes which occurred were mainly those commonly recognized in brain damage, but 13 patients were regarded as having improved personalities. (They were rated unimpaired in the results already discussed.) Eight of the 13 had an A.C., four had a P.C., and one had an M.C. aneurysm. This description of "improved" depended essentially on the account of the patient's spouse, which was available in each case. Such a patient was typically described as being more pleasant to live with, a nicer person, less sarcastic and irritable, less tense and anxious, less fussy and overmeticulous, and often as more affectionate and tolerant. Two of the patients showed minor forgetfulness, but in none was there any loss of drive, any falling off in work ability, or any untoward development. None had experienced any depressive or anxiety symptoms, and most were aware of increased well-being subjectively. In seven cases there were no abnormal C.N.S. signs, and in six there

were mild or moderate signs. There were no differences between operative and conservative groups in these cases. The previous personality of these patients was described in each case in such terms as "cold," "tense," "sarcastic and irritable," "unreasonably houseproud," or "timid and worrying." Naturally there were a good many patients in whom similar changes were associated with unfavourable changes, and who are therefore not described as having improved.

4. Epilepsy

In the whole case material of 261 patients there were 22 who had had epileptic disturbances. These all had either an M.C. aneurysm (17 cases out of 71, or 24%) or a P.C. aneurysm (five cases out of 72, or 7%). The overall incidence of epilepsy in those with single aneurysms was therefore 22 out of 224 cases, or approximately 10%. The epilepsy was easy to control in all except four patients, and in most there were only a few fits.

There are no significant differences between the operative and conservative groups, but epilepsy is significantly more common in men than in women ($\chi^2=8.556$, $P<0.01$ with one degree of freedom) and with M.C. aneurysm than with P.C. aneurysm ($\chi^2=5.685$, $P<0.025$ with 1 degree of freedom). None of the other differences is significant.

Epilepsy was in all but six cases associated with some abnormal neurological signs, mostly moderately severe or severe, and some other mental disability was present in all but five cases. Fourteen of the 19 patients with epilepsy had had a haematoma demonstrated by angiography—an incidence of 74%. Overall 40% of all patients with M.C. and P.C. aneurysms had haematomata.

Discussion

Subarachnoid haemorrhage from ruptured cerebral artery aneurysm is not uncommon, having been estimated at 6 per 100,000 of population in the area served by Atkinson Morley's Hospital (Crawford and Sarner, 1965). Among patients reaching hospital alive the subsequent mortality depends on various factors—particularly clinical condition, level of consciousness, site of aneurysm, age, blood pressure, and others—(McKissock *et al.*, 1960, 1962, 1965; Richardson, Jane, and Payne, 1964; Richardson, Jane, and Yashon, 1966). In this study the operative and conservative groups were shown to be comparable for the factors named, as well as for various others. The mortality after admission to hospital is high; in the studies mentioned the six-month survival rates of operatively and conservatively treated cases combined were approximately: P.C. aneurysms 69%, M.C. aneurysms 72%, and A.C. aneurysms 58%.

This study shows that the psychiatric morbidity of the survivors is also high. Only 45% of those in the trial comparisons were considered to be unimpaired and 24% as mildly affected. Eighteen per cent. were moderately, 10% severely, and 3% very severely damaged—these last being demented and inaccessible. M.C. aneurysm is associated with a significantly higher morbidity than either of the other main aneurysm types, and most of the serious mental disability was associated with neurological evidence of brain damage. Depressive and anxiety states, sometimes very severe, were quite commonly found in the absence of such damage, however. Those patients with no demonstrable aneurysm had a lower morbidity than the others, a finding which was clearly associated with a lower incidence of brain damage.

Depressive states did not show a more definite relationship to physical disability or to intellectual and personality impairment than they did to brain damage generally—that is, depression did not seem to be mainly a reaction to disability, although in many cases such an element was present. This aspect will be considered in more detail in a later publication.

The findings of 13 patients with improved personalities was unexpected, and seems to represent an effect of leucotomy. This is supported by the fact that most of the patients had A.C. aneurysms, which tend to damage the frontal lobes particularly. Vascular spasm, associated with subarachnoid haemorrhage from aneurysms at any site, may lead to patchy infarction anywhere in the brain, so that five cases that did not have A.C. aneurysms could still have had some frontal-lobe infarction.

The purely psychological reaction to a serious illness may lead a patient to reconsider his ways, change his attitudes to other people, etc., and this may have played a part. However, the nature of the changes and association with A.C. aneurysms make it more likely that this is indeed a leucotomy effect. Similar findings have been made by Logue *et al.* (1967, to be published).

The most important practical finding is that patients with M.C. aneurysms did worse with operative treatment than when treated conservatively. This was most noticeable in women, but it also occurred in men. Men, however, have a better chance of survival with surgery, and it is probable that their increased morbidity is because some of those more severely damaged, who might otherwise have died, have been saved by surgery; and the findings here do not affect the policy of operating in these patients. In women, on the other hand, there is no increased survival rate with surgery, and it is probable that the cause lies in the morphological and neuropathological differences in M.C. aneurysms in women (Crompton, 1962). These aneurysms are more difficult to treat, and the added brain damage due to surgical exposure of the aneurysm is presumably responsible for the worse results after operation.

However, since the period during which many of the cases in this study were treated there has been a change in the preferred timing of operation, with a consequent improvement in mortality figures. These results have not yet been fully assessed or published, but it is our intention to follow up an adequate sample of women with M.C. aneurysms treated by operation on the fourth to sixth days, to see whether or not there has been a consequent lessening of psychiatric morbidity.

It is understandable that left-sided aneurysms should do worse with surgery, as is the case with women here, when the dominant hemisphere is involved. It is not clear why in men right-sided aneurysms should lead to a higher morbidity. Inspection of the original findings does not suggest a markedly different pattern of disability, although there is an overall tendency in M.C. aneurysms for right-sided lesions to be associated with a greater incidence of psychiatric symptoms and left-sided aneurysms with more intellectual impairment, and for there to be an equal incidence of personality impairment with right- and left-sided lesions.

The incidence of epilepsy, 10%, along with its distribution, is very similar to that found by Rose and Sarner (1965), who studied a larger material from the same neurosurgical department. There is a full discussion of the subject in their paper.

Employment status has not been considered separately as a measure of recovery, although always taken into account. Men in some occupations, mainly in large organizations, seemed often to be accepted by the management and carried by their workmates even when clearly incapable of full work. This was found in the case of a senior managerial executive who continued to draw full salary although suffering from marked intellectual and personality impairment; but it was much commoner in lower employment levels. Self-employed people doing skilled or professional work seemed to suffer more from any given level of disability. Other patients were found who had retired or had changed their work, on medical grounds, unnecessarily—often because of exaggerated fears of exertion. The whole matter is closely linked with economic conditions and attitudes towards the handicapped, so that one would expect differences between various countries and various periods.

Appendix 1

Overall Mental Disability.—This is a five-point rating scale. Most weight is placed on permanent changes; transient anxiety and depression, even if severe, are considered to be less important than intellectual and personality damage.

Absent or Minimal Disability.—Includes those with only minor memory impairment (forgetfulness), and those with transient anxiety/depressive states not seeking or requiring treatment.

Mild Disability.—Comprises those with intellectual impairment which allows adequate functioning in nonintellectual occupations, those in whom personality change is not sufficient to lead to deterioration in family or other relationships, and those with depression or anxiety states responding to treatment—either as inpatients or as outpatients.

Moderate Disability.—Includes those with definite impairment of work status unless completely unskilled; deterioration in personal relationships and subjective well-being; severe and prolonged depression not responding fully to inpatient treatment even in the absence of other changes.

Severe Disability.—In this section are included those with personality and intellectual impairment, or both, severe enough to lead to unemployment or a pronounced fall in employment status; marked deterioration in family relationships and subjective well-being, or both; and severe prolonged depression not responding fully to inpatient treatment, in conjunction with otherwise moderate intellectual and personality damage. This category contains patients who are largely incapable of independent life and need institutional care or the protection of a tolerant family.

Very Severe Disability.—Includes those who are grossly demented, inaccessible, bedfast, and often grossly dysphasic. Two such cases were being nursed at home, the others were in institutions.

Appendix 2: Rating Scales of Impairment and Disability

Each patient was initially rated on a four-point scale of impairment or disability (absent, slight, moderate, severe) on each of the following:

Personality Impairment.—In this rating the opinion of the other informants was regarded as most important. On the whole the changes were those commonly recognized as “organic personality change,” with loss of drive and vitality, irritability, easily provoked anxiety, dependence, emotional lability, etc.

Psychiatric Symptoms.—These were almost entirely depressive states and anxiety symptoms, often together. Both lasting and limited illnesses are included, but symptoms restricted to the first three months of convalescence are excluded. In patients whose symptoms had cleared up before the follow-up examination it was sometimes difficult to assess severity, but most of these rated as severe cases had had inpatient or prolonged outpatient treatment; most rated moderate had had outpatient treatment. However, several of those rated moderate, and who were also brain-damaged, had not had psychiatric treatment. In patients with pre-existing anxiety or depressive states, only a worsening is counted in the ratings. Epileptic syndromes are not included.

Intellectual Impairment.—In this rating the results of the Benton visual retention test and the Inglis paired associates test are ignored. The rating is based on accounts given by the patient and other informants, the results of simple clinical tests (orientation, digit span, remembering a name and address, simple calculations, serial seven subtraction, knowledge of current affairs, etc.), and the general impression made; at the same time taking into account the patient's background and presumed previous intelligence. The rating of severe is equivalent to frank dementia; mild rating to some impairment of

recent memory and higher intellectual abilities, but compatible with no loss of employment status except in professional, executive, and similar occupations. Moderate impairment falls between the two above, and is usually associated with a drop in employment status.

Physical Disability.—This excludes purely ocular disabilities, and refers mainly to the consequences of weakness or other disturbances of the limbs. Those with C.N.S. signs are not included unless there is frank disability—which depends mainly on the severity of the signs and the nature of the patient's work.

Summary

Some results of a psychiatric study of 261 cases of subarachnoid haemorrhage are presented, dealing especially with comparisons between operative and conservative treatment of 209 patients with single aneurysms of the posterior communicating (P.C.), middle cerebral (M.C.), and anterior communicating (A.C.) arteries. The background and trial organization are briefly described.

Psychiatric morbidity is high. Of those with aneurysms in the trial comparisons 45% were regarded as unimpaired or nearly so; 24% were mildly, 18% moderately, 10% severely, and 3% very severely affected. Patients with no demonstrable aneurysms (30) had lower morbidity rates.

Most of the psychiatric and psychological morbidity is due to brain damage, but anxiety and depressive states also occur in the absence of such damage, and may be very severe.

Patients with M.C. aneurysms have a significantly higher morbidity with surgical than with conservative treatment, especially women with left-sided lesions. Possible reasons for this are mentioned. Patients with aneurysms at other sites do slightly but not significantly better with surgery.

A group of 13 patients with apparently improved personalities is described. This improvement is regarded as a leucotomy effect.

The incidence of epilepsy is 10% overall in patients with single aneurysms. No case of epilepsy occurred in those with A.C. aneurysms or with no demonstrable aneurysm. The rate was 24% in those with M.C. and 7% in those with P.C. aneurysms. There was no difference between operative and conservative treatment in this respect.

Several tables have had to be omitted to save space. Details will be sent on request.

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REFERENCES

- Crawford, M. D., and Sarner, M. (1965). *Lancet*, 2, 1254.
 Crompton, M. R. (1962). *Ibid.*, 2, 421.
 Logue, V., Durward, M., Pratt, R. T. C., Piercy, M., and Nixon, W. B. L. (1967). *Brit. J. Psychiat.* In press.
 McKissock, W., Richardson, A., and Walsh, L. (1960). *Lancet*, 1, 1203.
 ——— (1962). *Ibid.*, 2, 417.
 ——— (1965). *Ibid.*, 1, 873.
 ——— and Walsh, L. (1956). *Brit. med. J.*, 2, 559.
 Norlen, G., and Barnum, H. S. (1953). *J. Neurosurg.*, 10, 634.
 Richardson, A. E., Jane, J. A., and Payne, P. M. (1964). *Ibid.*, 21, 266.
 ——— Yashon, D. (1966). *Arch. Neurol. (Chic.)*, 14, 172.
 Rose, F. C., and Sarner, M. (1965). *Brit. med. J.*, 1, 18.
 Walton, J. N. (1956). *Subarachnoid Haemorrhage*. Edinburgh.

Psychiatric Aspects of Pernicious Anaemia: A Prospective Controlled Investigation

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Though a wide spectrum of psychiatric symptoms has been attributed to vitamin-B₁₂ deficiency, the factors which predispose individuals to this form of illness rather than to haematological or neurological manifestations remain unknown. The frequency of mental symptoms in pernicious anaemia has not been established. Inquiries based on the retrospective analysis of general hospital case records have reported mental symptoms in only 2 to 4% of patients (Young, 1932; Cox, 1962), whereas in selected patients with chronic neurological disabilities the incidence of such symptoms has been as high as 60% (McAlpine, 1929; Holmes, 1956). No investigations to date have been carried out prospectively on unselected patients with pernicious anaemia admitted to general hospitals, and none have controlled the non-specific effects of physical illness and fatigue on the mental states of patients. Despite these uncertainties, interest in the psychiatric symptoms of pernicious

anaemia has been renewed and routine screening tests to detect latent pernicious anaemia have been advocated for all psychiatric patients (Strachan and Henderson, 1965; Hunter and Matthews, 1965).

The present investigations were carried out, firstly, to determine the incidence of psychiatric symptoms in patients with pernicious anaemia and, secondly, to evaluate the importance of vitamin-B₁₂ deficiency in their development. The method used was a comparison of the psychiatric symptoms in patients with pernicious anaemia and in a control series of patients with other types of anaemia, both groups being matched for age, sex, and haemoglobin level. It was predicted that if vitamin-B₁₂ deficiency caused mental symptoms, their incidence would be higher in the pernicious anaemia group and their remission would not occur until after treatment with vitamin B₁₂.

Selection of Patients

Pernicious Anaemia.—Patients with suspected pernicious anaemia were seen through the co-operation of physicians and

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