

ORGANIC BASIS OF CONFUSIONAL STATES IN THE ELDERLY

BY

F. J. FLINT, D.M., M.R.C.P.

Physician, City General Hospital, Fir Vale Infirmary,
and Nether Edge Hospital, Sheffield

AND

SHELAGH M. RICHARDS, M.B., Ch.B., D.C.H.

Resident Medical Officer, Royal Infirmary, Sheffield; late
Senior House Officer, City General Hospital and
Fir Vale Infirmary, Sheffield

Mental confusion is a relatively common feature of illness in old people. The consequent domestic upheaval and the ensuing medical, nursing, and social problems are well known. This review of the aetiological factors of confusion in 242 elderly confused patients is designed to call attention to the high incidence of organic disease both in the brain and elsewhere in the body. It will be shown that "senile dementia" is not necessarily synonymous with either cerebral arteriosclerosis or "senility."

Clinical Material and Method of Investigation

The 242 patients under review were admitted between April 1, 1954, and March 31, 1955, to a general medical unit at Fir Vale Infirmary, Sheffield, which is a hospital for the elderly chronic sick. Each patient was over 60, mentally confused on admission to hospital, and ambulant until the onset of the illness necessitating admission. Any patient who had been bedfast at home for longer than three months, who had suffered from long-standing dementia, or who became confused only after admission to hospital has been excluded.

A full clinical examination included estimation of the blood pressure, examination of the urine, recording of the temperature, and assessment of the patient's mental state. Appropriate investigations were carried out when indicated; that is, lumbar puncture in cases of cerebral thrombosis or haemorrhage; radiography of the chest in cases of respiratory disease; electrocardiography in cases of myocardial infarction; a blood count and, if necessary, other haematological studies in cases of anaemia; and estimation of the blood urea in cases of uraemia. Reasonably comprehensive data were therefore available for assessing the causes of mental confusion.

TABLE I.—Age Distribution of Patients Over 60 with Mental Confusion on Admission

	Males					Females					Total
	60-	70-	80-	90-	All Ages	60-	70-	80-	90-	All Ages	
No. of patients	18	82	34	1	135	8	57	38	4	107	242
Deaths	14	58	30	0	102	7	47	25	3	82	184
Necropsies	7	13	3	0	23	6	14	4	0	24	47
Discharged	4	20	4	0	28	1	5	3	1	10	38
Still in hospital	0	4	0	1	5	0	5	10	0	15	20
Recovered—ambulant and rational	4	18	3	1	26	0	4	5	1	10	36

Of the 242 patients in the series, 135 were male and 107 female; total admissions during the same period were 330 males and 244 females. The age distribution in relation to death and recovery (assessed three months after the last patient was admitted to the series) is shown in Table I.

Aetiology of Mental Confusion

The diseases which were thought to have caused mental confusion are described below and summarized in Table II. Owing to the frequency of multiple aetiological factors, some cases have been included in more than one section.

TABLE II.—Aetiology of Confusional States

	Sex			Deaths	Survivors	
	M	F	Total		Rational and Ambulant	Not Recovered
Cerebral diseases	46	36	82	67	8	7
Heart failure	28	25	53	40	9	4
Pulmonary diseases	35	11	46	34	10	2
Uraemia	21	5	26	24	2	0
Anaemia	6	5	11	7	3	1
Hepatic failure	2	2	4	4	0	0
Avitaminosis	4	1	5	3	2	0
Endocrine disorders	3	5	8	8	0	0
Drugs	3	0	3	1	2	0
Miscellaneous infections	1	3	4	3	1	0
Cancer	6	3	9	8	0	1
Injuries	1	7	8	7	1	0
Dissecting aneurysm	1	0	1	1	0	0
Unknown	23	31	54	36	5	13

In 188 of the 242 cases mental confusion was attributed to an organic lesion, which in 118 cases was extracerebral; in the remaining 54 cases no specific cause was elicited, but in many of these cases the data were incomplete—that is, necropsy was not performed.

Cerebral Diseases.—Cerebral infarction was the commonest cerebral lesion, occurring in 66 of the 82 cases in the cerebral group (Table III). In 28 cases there was evidence only of an old infarct; because of hemiplegia or

TABLE III.—"Cerebral" Diseases

	Males	Females	Total	Deaths
Cerebral infarction:				
Recent	20	18	38	32
Old	18	10	28	20
Cerebral haemorrhage	4	3	7	6
Parkinsonism	2	3	5	5
Cerebral tumour	2	1	3	3
General paralysis of insane	0	1	1	1

other neurological signs it was difficult to ascertain how many of these cases also had a fresh infarct. In 38 cases there was evidence of a recent infarct which was complicated in 17 by hemiplegia, but in most of the other 21 cases no focal signs were elicited. The observation was made that cerebral infarction, especially the massive type, is often associated with an increase of protein in the cerebrospinal fluid; hence the diagnostic value of lumbar puncture in doubtful cases. In two cases of post-infarction epilepsy the confusional state was attributed to the post-ictal state; further episodes of confusion were prevented by the use of anticonvulsant drugs. Cerebral haemorrhage was comparatively rare; there were only seven cases in the series. In five cases the haemorrhage was intracerebral and associated with hypertension; in one it was subarachnoid and due to rupture of an aneurysm; in the other patient, who was an alcoholic, it was subdural and caused by injury. A primary cerebral tumour was encountered in one case, and cerebral metastases from carcinoma of the lung in a further two cases.

TABLE IV.—Heart Failure

	Males	Females	Total	Deaths
Ischaemic heart disease—total	12	7	19	14
Recent coronary thrombosis	6	2	8	6
Hypertensive heart disease	5	2	7	6
Aortic stenosis	2	7	9	7
Mitral	0	1	1	1
Cor pulmonale	5	0	5	3
Severe anaemia	0	3	3	2
Pulmonary embolism	0	1	1	1
Aetiology unknown	4	4	8	6

Heart Failure.—In 39 cases there was frank congestive failure; the remainder had varying degrees of left heart failure (Table IV). In two cases of ischaemic heart disease there was associated myxoedema.

Respiratory Diseases (Table V).—Ten patients with bronchitis and one with lobar pneumonia also had heart

failure. In the two cases of pulmonary tuberculosis the disease was shown at necropsy to be widely disseminated throughout the body except in the meninges.

TABLE V.—*Respiratory Diseases*

	Males	Females	Total	Deaths
Lobar pneumonia ..	6	3	9	6
Bronchopneumonia; bronchitis ..	26	7	33	24
Tuberculosis (active) ..	2	0	2	2
Pulmonary embolism ..	1	1	2	2

Uraemia.—Twenty-six patients were frankly uraemic (Table VI). In 15 of the 21 men prostatic hypertrophy was the basic cause; these men were admitted because of mental symptoms, but all had chronic urinary retention complicated by infection. Most of the patients were unfit for sur-

TABLE VI.—*Uraemia*

	Males	Females	Total	Deaths
Prostatic hypertrophy ..	15	0	15	13
Permanent suprapubic cystostomy ..	2	0	2	2
Chronic nephritis ..	4	5	9	9

gery, but the only two survivors had prostatectomies. In 11 cases uraemia was due either to chronic glomerulonephritis or to exacerbation of chronic pyelonephritis, including two cases of permanent suprapubic cystostomy. In several cases the uraemic state was associated with gross sodium and water depletion. In this survey the blood urea was estimated only if there were signs of uraemia or urinary tract disease.

Anaemia (Table VII).—Mental confusion was attributed to anaemia only if the haemoglobin was 40% or less. In other cases it is possible that a moderate degree of anaemia

TABLE VII.—*Anaemia*

	Males	Females	Total	Deaths
Pernicious anaemia ..	2	2	4	2
Iron deficiency ..	1	2	3	2
Gastro-intestinal haemorrhage ..	2	1	3	1
Erythraemic myelosis ..	1	0	1	1

was responsible, but these cases are not included. The three cases of gastro-intestinal haemorrhage included one of rectal carcinoma and two of benign gastric ulcer.

Hepatic Failure.—The four cases consisted of one case of portal cirrhosis, two cases of biliary cirrhosis, and one case of secondary carcinoma from the gall-bladder.

Avitaminosis.—Each of the five patients in this group had signs of frank scurvy, but the mental confusion was attributed to deficiency of the B complex. One patient, a man aged 60, having lived in a garret for six weeks and eaten nothing but bread and water, was admitted to hospital with severe encephalopathy; there were signs of bulbar palsy, ataxia, bilateral extensor plantar response, severe mental confusion, massive ecchymoses, and dehydration with nitrogen retention (non-protein nitrogen 94 mg. per 100 ml.). He was fed by oesophageal tube for 10 days and made a complete recovery, the blood N.P.N. falling to 39 mg. per 100 ml.

Diabetes Mellitus.—In the four diabetic patients mental confusion was attributed to associated cerebral arteriosclerosis.

Thyroid Disorders.—Two of the three patients with myxoedema also had severe heart failure; all three died. The one patient with thyrotoxicosis also suffered from multiple and recurrent pulmonary infarcts, which eventually killed her.

Miscellaneous Conditions.—These conditions included drug intoxication (promethazine hydrochloride, which was administered for urticaria caused by penicillin, carbon monoxide, and a barbiturate), gangrene, erysipelas, cellulitis,

dissecting aneurysm of the aorta, cancer, and various injuries. The relationship of injury to mental confusion was indirect except in three cases of head injury.

Aetiology Unknown.—In 54 cases no organic cause for the confusional state was elicited, but none of the 36 fatal cases was examined at necropsy. Undetected cerebral degeneration was probably the factor in many of these cases.

Prognosis and Treatment

The mortality rate for this group of confused patients was 76%, in contrast to a rate of 50% for patients of similar age and sex distribution admitted during the same period who were rational on admission; the figures for discharge from hospital in the two groups were 16% and 38% respectively.

In the management of a patient with acute confusion, a thorough search should be made for an extracerebral cause, always bearing in mind the possibility of multiple factors; this is often difficult clinically. Owing to diminished functional reserve, cardiac, respiratory, or renal failure can be precipitated by a comparatively trivial infection. Unfortunately the complication of mental confusion often denotes an advanced metabolic disturbance. In the treatment of the patient, the dangers of sedation should always be borne in mind. Great care should be taken, first, to combat infections with the appropriate antibiotic; secondly, to correct electrolyte and fluid imbalance, preferably by simple measures; and, thirdly, to ensure an adequate intake of calories and vitamins. Dehydration is the most elusive disorder. For the patient who is drowsy and confused, an adequate intake of fluid and salt can be ensured only by means of an intragastric drip; intravenous administration should be avoided.

The outlook is by no means hopeless if the appropriate treatment is instituted before the complications of confusion and prolonged sedation develop. The mortality rate in the present series was unduly high; because of a long waiting-list, neglect at home, or the terminal state of their disease many patients showed signs of advanced deterioration and many died within a few days of admission to hospital.

Enthusiasm to resuscitate the patient should, however, be tempered by the realization that in many cases the illness is but the inevitable end to a long life.

Discussion

A degenerative disorder of the brain is undoubtedly the commonest aetiological factor in the organic dementias of the elderly. Although atrophy of the brain in old age is not always vascular in origin, cerebral infarction is the commonest lesion. In the present series extracerebral factors were equally important; they were predominant in 118 out of 242 cases. Kay and Roth (1955) showed that extracerebral disease is important even in the more severe forms of dementia encountered in a mental hospital.

Cerebral Infarction

In the absence of hemiplegia or other focal signs the diagnosis of cerebral thrombosis may be difficult; indeed, an acute confusional state may be the only clinical manifestation. If the infarct is large enough to cause confusion the protein content of the cerebrospinal fluid is usually raised. There is no doubt that unsuspected infarction is a common cause of acute confusional states, for the unexpected finding at necropsy of old infarcts which are often multiple is of common occurrence. Therefore the incidence of cerebral infarction in the present series was probably higher than the figures suggest.

The mechanism whereby an infarct gives rise to mental or neurological changes is not always a necrotic process. A haemorrhagic infarct causes a good deal of oedematous swelling of the surrounding tissues, with consequent pressure on more remote areas. The "space-occupying effect" may indeed be so marked that it causes irreparable damage to the brain stem by a process of herniation of the uncus

through the opening of the tentorium cerebelli. Destruction of brain cells is irreversible, so any improvement in the mental or neurological state following infarction is probably attributable to recovery of brain cells in which function has been only temporarily impaired by compression, oedema, or ischaemia. Another possible explanation for the confusional state is epilepsy. This may result from infarction involving the cerebral cortex, both in the acute phase and subsequently. Thus in some cases recurrent bouts of mental confusion are due to the post-ictal confusional state. For patients with recurrent "blackouts" or short bouts of confusion it is always worth while to try the effect of an anticonvulsant drug.

Diseases of the Heart and Lungs

The association of mental confusion with heart failure is well known. The confusion is usually attributed to an inadequate supply of arterial blood caused by reduced cardiac output. In coronary thrombosis there is also the factor of shock; in cor pulmonale the factors of cerebral oedema, hypoxia, hypercapnia, and acidosis prevail. In the obstructive forms of respiratory infection, which usually occur in patients with a poor respiratory reserve, hypoxia and hypercapnia are again the important factors, but in lobar pneumonia the associated toxæmia or septicaemia is predominant. In elderly patients several factors may operate together, and even though comparatively trivial in themselves can combine to produce marked mental changes. Renal failure and fluid and electrolyte imbalance are commonly associated.

In the elderly patient both bronchitis and pneumonic consolidation may be difficult to detect clinically. When ventilation is diminished, the classical signs are often absent.

Biochemical Disturbances

In old age the brain is unusually susceptible to chemical disturbances, especially anoxia. Cerebral anoxia may be due to a variety of different causes; these include respiratory obstruction, heart failure, and anaemia, which reduce the supply of oxygen to the brain, and many toxic disturbances such as septicaemia, uraemia, hepatic failure, electrolyte disturbances, and extrinsic poisons, which interfere with cellular oxidation.

Uraemia as a cause of mental confusion is undoubtedly more frequent than is apparent from this survey, for the blood urea was estimated only in patients exhibiting signs of uraemia or of urinary tract disease. Pre-renal uraemia is a common complication of many diseases, particularly in elderly people who are living alone or without adequate help. In a subsequent survey, undertaken in the same medical unit, A. Allibone (personal communication) has shown that in 30% of all patients over the age of 60 the blood urea exceeded 50 mg. per 100 ml.; in patients with respiratory infections or heart failure it was not uncommon to find levels of over 100 mg. per 100 ml. Moreover, nitrogen retention is only one aspect of renal failure. Grave disturbances of water, sodium, potassium, and acid-base balance may be quite disproportionate to the level of the blood urea; they result not only from impaired function of the kidney but also from an unbalanced intake (Bull, 1955).

The clinical manifestations of cerebral anoxia caused by severe anaemia in the elderly are well known, but only 11 cases were encountered in the present series. Experience of other cases, however, has shown that mental confusion and other complications such as heart failure are encountered in a higher proportion of patients with pernicious anaemia than of those with other forms of anaemia of comparable severity. There is evidence that vitamin B₁₂ is essential not only for haemopoiesis and nutrition of the central nervous system, including the brain, but also for other body tissues (Samson, Swisher, Christian and Engel, 1952; *Lancet*, 1954). It is therefore possible that mental confusion or heart failure in pernicious anaemia is related not only to the effects of a low haemoglobin level but also to the biological need for

the vitamin in the cells of the heart and brain. In pernicious anaemia recovery does not always immediately follow an improvement in the haemoglobin level brought about by blood transfusion, as in some other forms of anaemia, and may not be complete for several months.

The mental disorder due to vitamin-B deficiency is well known, but is probably rare in this country.

Liver failure is a rare but interesting cause of mental confusion. In cases of hepato-cellular failure alone and in cases of cirrhosis with large porto-caval shunts, ammonia and other nitrogenous substances accumulate in the systemic circulation; these may be responsible for bizarre mental and neurological disturbances (Sherlock, 1955; Phear, Sherlock, and Summerskill, 1955).

The dementia of myxoedema is well known, but it was surprisingly rare in this series. The function of all the endocrine glands is impaired in the elderly, but the relative importance of this factor in the processes of ageing is as yet unknown.

Summary

The aetiological factors of mental confusion in a group of 242 elderly patients admitted to a general medical unit of a geriatric hospital are described and discussed. In 188 cases confusion was attributed to a known organic disease, which in 118 cases was predominantly extracerebral.

REFERENCES

- Bull, G. M. (1955). *Lancet*, 1, 731, 777.
 Kay, D. W. K., and Roth, M. (1955). *Ibid.*, 2, 740.
Lancet, 1954, 1, 865.
 Phear, E. A., Sherlock, S., and Summerskill, W. H. J. (1955). *Lancet*, 1, 836.
 Samson, D. C., Swisher, S. N., Christian, R. M., and Engel, G. L. (1952). *A.M.A. Arch. Intern. Med.*, 90, 4.
 Sherlock, S. (1955). *British Medical Journal*, 1, 1383.

CHRONIC BRONCHITIS

N.A.P.T. SYMPOSIUM

[FROM A SPECIAL CORRESPONDENT]

With tuberculosis on the wane in Britain, the National Association for the Prevention of Tuberculosis took powers a short time ago to extend its coverage to diseases of the chest and heart in general. An example of this new policy was a symposium on "Chronic Bronchitis" which the association held at B.M.A. House on December 12 under the chairmanship of Dr. J. L. LIVINGSTONE.

A Baffling Disease

In spite of the importance of chronic bronchitis to the community, said Dr. NEVILLE OSWALD, who opened the discussion, there remained much to learn about its aetiology. We were still at a very preliminary stage, and only now beginning to realize, from morbidity and other surveys, its general incidence and distribution. Advances had been made in the bacteriology and pathology, but there was much still to understand about the role of viruses and the mechanisms of mucus formation. Clinical studies had shown that those who might be helped by specific antibiotic therapy were the patients with purulent sputum, who formed 20-40% of the total. These might need admitting to hospital for a number of reasons: during an acute exacerbation; for assessment with a view to organizing future management; or for long-term accommodation on a permanent or semi-permanent basis—and here the use of sanatoria must be considered and developed.

Air Pollution and Infection

Dr. P. J. LAWTHORP said that although it was probable that atmospheric pollution played a definite part in the causation of chronic bronchitis no survey had yet demonstrated any direct relationship. There were two types of pollution—the acute insult of a smog which might produce