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Low blood pressure in psychiatric inpatients

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SUMMARY Blood pressure recordings in 116 female psychiatric inpatients were analysed. Sixty-nine women had schizophrenia, the remainder a variety of psychiatric conditions. All had been in hospital continuously for more than one year, the average for 19 years continuously. An average of seven recordings of blood pressure per patient had been made during that time. The latest of these compared well with measurements made independently using a sphygmomanometer free from observer bias. On admission to hospital the blood pressure of these patients was close to that of two normal populations. Thereafter it failed to rise at the normal rate and after an average of 19 years, in the women having measurements made by special sphygmomanometer, systolic pressure was 28 mmHg lower than controls of the same age while diastolic pressure was 12·8 mmHg lower. Lower than control blood pressure was apparent in schizophrenic and non-schizophrenic women and in women taking no drugs, phenothiazines, and other drugs. Weight loss is an unlikely explanation: the mean weight of these women was 61·5 kg compared with 64·1 kg in a local control population of the same age. Some factor related to prolonged isolation in hospital seems more important.

Arterial pressure is known to be lower than normal in patients with schizophrenia[1 2] but it is not known if this results from the disease, from its treatment by drugs, or from prolonged residence in hospital.[3 4] We report here an attempt to resolve the matter by analysis of blood pressure measurements in patients with schizophrenia and other psychiatric disorders and a comparison with two control populations.

Methods

One hundred and twenty-six female patients from four wards at Gartnavel Royal Hospital were studied during 1977. Ten of uncertain diagnosis were excluded. Primary diagnoses in the remaining 116 were: schizophrenia (69), affective psychosis (25), alcohol psychosis (seven), neurosis (four), mental deficiency (four), epilepsy (four), and organic psychosis (three). All had been in hospital continuously for more than one year, 37 per cent for more than 20 years, 13 per cent for more than 30 years. The average duration of continuous inpatient care was 19 years. Schizophrenics tended to be younger than other patients, to enter hospital earlier, to stay longer, and to be discharged and readmitted less often (Table 1).

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All records of blood pressure were extracted from the notes yielding an average of 7·1 recordings per patient over the 19 year period. We could not validate earlier measurements of arterial pressure except by comparison with later measurements. The following comparisons were made. (a) The last routine recording of blood pressure by any phy-

Table 1 *Clinical data*

	Schizophrenics	*Non-schizophrenics*
Number	69	47
Age (y) (mean and range)	55·2 (23–80)	61·9 (28–88)
Age at first admission (y)		
< 34	44 (64%)	8 (17%)
35–44	13 (19%)	14 (30%)
45–54	9 (13%)	13 (28%)
55+	3 (4%)	12 (26%)
Duration of continuous residence in hospital (y)		
< 5	6 (9%)	12 (26%)
5–14	18 (26%)	19 (40%)
15–29	31 (45%)	15 (32%)
30+	14 (20%)	1 (2%)
Number of admissions		
1–2	49 (71%)	30 (64%)
3–5	16 (23%)	9 (19%)
6+	4 (6%)	8 (17%)

sician, except the authors, was noted; 60 per cent of these were between 1976 and 1977, 97 per cent between 1974 and 1977. (b) During 1977, while not aware of recording (a), GM made a further measurement in the same patients using a conventional sphygmomanometer. (c) In 1978, GM again measured blood pressure in 45 of the 116 patients randomly selected. (d) Simultaneously, with measurement (c), RSL recorded blood pressure in the patient's opposite arm, using a special sphygmomanometer.[5] Phase V was taken for diastolic pressure in (b), (c), and (d). Results were compared with general populations from London[6 7] and Glasgow.[8] We do not know if earlier recordings of diastolic pressure in our patients were phase IV or phase V. Phase IV was used in London controls,[6] phase V in Glasgow controls,[7] but a change in the form of recording diastolic pressure could not have produced a difference of pressure as large as that between patients and controls, and no such ambiguity affects the recording of systolic blood pressure where the changes were more pronounced. Using the tables of Pickering[7] we have also expressed individual blood pressure measurements as a deviation from the value expected in a normal woman of the same age.

Results

Blood pressure recordings made simultaneously by GM and RSL agreed well. It is unlikely for this reason that observer bias contributes much to the changes described below as the method used by RSL is relatively free from such bias.[5]

The rise of blood pressure with age in the two control populations was similar (Fig. 2). Both sets of observations have been reported.[6 8] At the time of first admission to the ward, blood pressure in patients was similar to that in controls of the same age (Fig. 2), but if patients of either group remained in hospital, arterial pressure rose at a slower than normal rate. Fig. 3 shows this, comparing the first and last measurements in 23 schizophrenic women in hospital continuously for more than 25 years. Arterial pressure on admission was slightly higher than in controls, but after 30 years it was lower. Another method of illustrating the point, one which allows for admission of patients of different ages, is to express systolic and diastolic pressures as their deviation from the value expected in a normal individual (see Methods). It can be seen in Fig. 4 that deviation for systolic and diastolic pressure was close to zero at the time of admission, but that both decreased progressively and significantly with increasing duration in hospital. Further evidence that this was not a consequence of observer bias is the

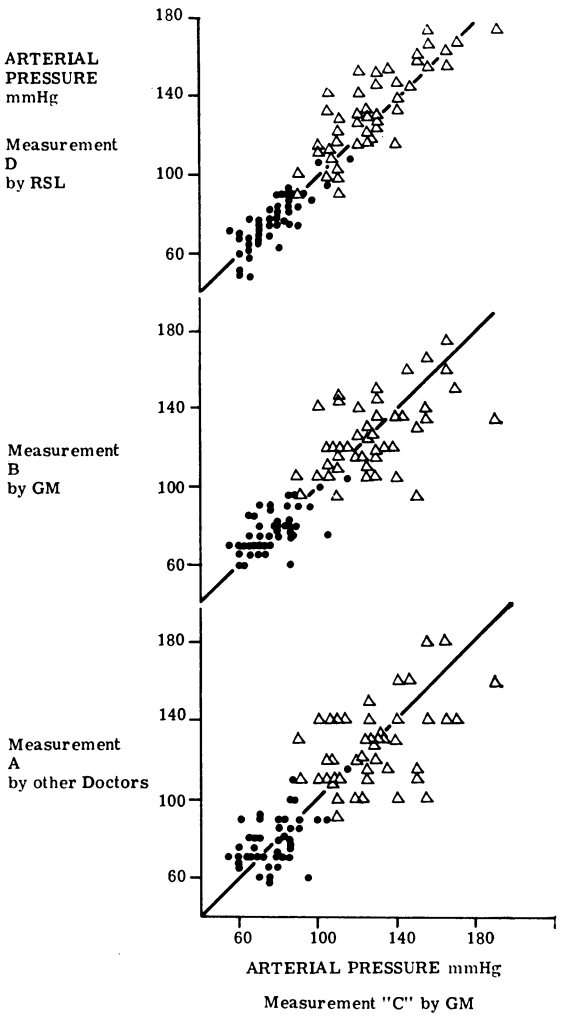

Fig. 1 Upper panel. *Simultaneous measurements of blood pressure in opposite arms using a conventional sphygmomanometer (GM) and a special sphygmomanometer (RSL). The line is a 45° slope. Systolic pressure was 3·4 mmHg higher on average with the second method, but diastolic pressure was 1·6 mmHg lower. Neither difference was significant (paired t for systolic = 1·8, for diastolic = 1·2). Correlation coefficient for systolic pressure r = 0·84, p < 0·001. For diastolic pressure r = 0·84, p < 0·001.* Middle panel: *two measurements made by GM one year apart; systolic r = 0·53, diastolic r = 0·63 (both p < 0·001).* Lower panel: *Measurement made by GM and another physician at routine medical examination more than one year earlier; systolic r = 0·47, diastolic r = 0·49 (both p < 0·001).*

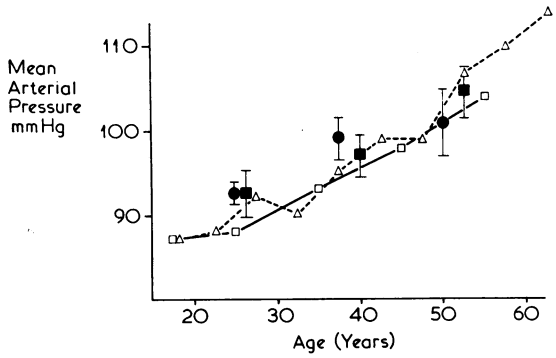

Fig. 2 *Relation of age and mean arterial pressure (diastolic plus ⅓ systolic pressure) in general populations from Glasgow [□—□],[8] and London [△ – – –△].[6] The solid circles are for age groups of schizophrenic woman at first admission to the ward, the solid squares for non-schizophrenic women, also at first admission. Bars represent 1 SEM.*

similar deviation of pressure in the 45 women having measurements made by special sphygmomanometer. Deviation of systolic and diastolic pressures were −28·4 mmHg and −12·8 mmHg, respectively, 19·2 years after admission to the ward.

All except six patients were receiving drugs in 1977, but there was little to suggest that drugs had lowered blood pressure. Negative deviation for systolic and diastolic pressures was apparent and similar in women receiving no drugs and in women having phenothiazines or other major tranquillisers (Table 2).

Blood pressure correlates positively with body weight in a general population[7] and a possible explanation of our finding was that patients had lost weight while in hospital. In fact, body weight was little different in our patients (61·5 ±SD 12·2 kg, age 56·8 years) as compared with female controls from the Glasgow area (64·1 ±11·4 kg, age 55–59 n=369).[9] The regression of weight and arterial pressure is not steep[7] and thus a weight difference this small is unlikely to explain the difference in arterial pressure.

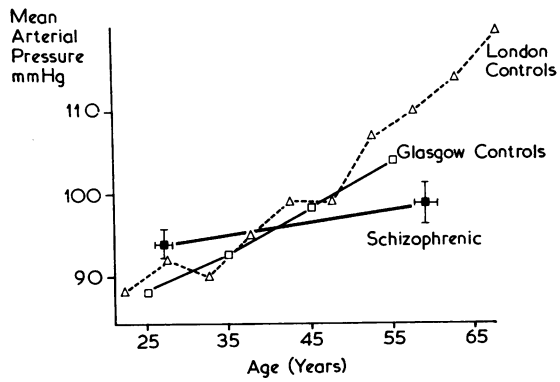

Fig. 3 *Mean arterial pressure for Glasgow and London controls are as in Fig. 2. The additional data are first and last measurements of pressure in 23 schizophrenic women remaining continuously in hospital for more than 25 years. Bars ±1 SEM.*

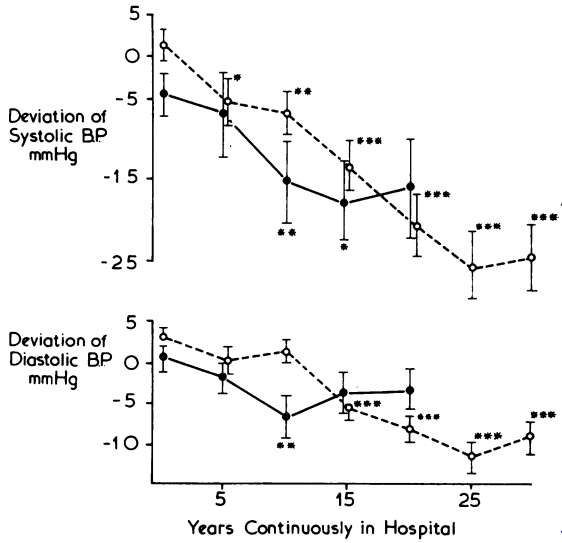

Fig. 4 *Deviation of systolic blood pressure (upper panel) and diastolic blood pressure as related to duration from first admission to the ward. Open circles and dotted lines are for schizophrenic women. Closed circles and continuous lines for non-schizophrenic women. Where more than one measurement was made in an individual during any five year period, the mean of those measurements was used in calculating the average deviation for the group. Bars=1 SEM. Significance was assessed by paired t test comparing values at particular intervals with initial value.*
*$p<0.05$, **$p<0.01$, ***$p<0.001$.*

Discussion

We have confirmed the finding of low blood pressure in schizophrenia[1 2] and other psychiatric states.[3 10] Blood pressure, however, was not reduced

in our patients at the time of admission to the ward. Nor was low blood pressure found in a study of psychiatric outpatients.[7] Together these observations suggest that subnormal arterial pressure develops after admission to hospital and that it is not a feature of one psychiatric disorder. Serial measurements in the same patients show that blood pressure does not fall, but that it fails to rise in the normal manner. The longer a patient remains in hospital, the lower arterial pressure becomes relative to normal.

We can exclude some, but not all, forms of bias and artefact. For reasons already given, observer bias in measurement of blood pressure is an unlikely source of error. Weight loss and the taking of drugs with hypotensive effect seem equally unlikely. We cannot, on the other hand, exclude a process of selection in which patients with higher than average arterial pressure are more likely to die than members of the general population with the same arterial pressure. But against such an effect, stroke and cardiovascular disease are among the least common causes of excess mortality in psychiatric inpatients, excluding those with organic brain disease.[11] Nor can we exclude the possibility that psychiatric inpatients with higher than average blood pressure are more likely to be discharged from hospital than those with lower arterial pressure. Against this, patients discharged and then readmitted have a deviation of arterial pressure which is insignificantly different from patients remaining in hospital continuously.

We have not identified the cause of subnormal pressure in our patients. It is well known that blood pressure tends to fall when repeated measurements are made over days or weeks, particularly in patients who are admitted to hospital.[7 12] An effect of this sort could explain the early fall of arterial pressure but it is unlikely to persist for long enough to be the whole explanation. Serial measurements in a general population over a prolonged period show the expected rise of pressure.[13]

Blood pressure rises at different rates in different societies. Those with the slowest rate of rise tend to be primitive and isolated and to have a diet high in potassium, but low in calories and sodium. The relative importance of these and other factors as determinants of the rise of arterial pressure is not agreed.[7 9 14–16] Investigation of the matter is obviously important because the risks of vascular disease relate so closely to increased arterial pressure. Our study may be relevant here in that within Western society there are individuals with a slower rise of arterial pressure. It does not, of course, follow that the same factor is at work in psychiatric inpatients and primitive societies.

Our evidence suggests that the rise of pressure is retarded by some factor related to long residence in hospital, but we cannot say much more than this. For example, we have no information on dietary intake or urinary excretion of electrolytes in our patients. Potassium is unlikely to have been as high, or sodium to have been as low as in a primitive society. Isolation itself could be important. Main and Masterton[17] have since shown that blood pressure is lowest in patients from wards where freedom is least and isolation greatest, but it does not necessarily follow that isolation reduces blood pressure since patients with lower blood pressure may need more isolation.

The effect of isolation on blood pressure has been studied in animals: mice reared in isolation develop hypertension when transferred to an overcrowded environment,[18] isolation reduces the rate of rise of pressure in rats with genetic hypertension[19]; but in other circumstances in the rat, short-term isolation can raise blood pressure.[20]

We conclude that blood pressure rises at a slower than normal rate in psychiatric inpatients, that bias in the measurement of arterial pressure, drugs, and

Table 2 *Deviation of blood pressure in relation to drug treatment during 1977*

Treatment	*No. of patients*	*Duration in hospital (y)*	*Deviation of systolic BP mmHg*		*Deviation of diastolic BP mmHg*	
			Observed	*Expected*	*Observed*	*Expected*
Nil	6	19	−27	−18	−7	−5
Oral phenothiazines	59	20	−22	−22	−8	−6
Other oral major tranquillisers	18	21	−22	−23	−10	−6
Depot major tranquillisers	34	21	−16	−23	−5	−6
Antidepressants	29	18	−24	−18	−8	−5

"Expected" values for deviation of arterial pressure are the average values for the whole group at the times given in the second column. Thus, six untreated patients were studied 19 years after admission. The average deviation expected for the whole group at this time would be −18 mmHg. It can be seen that there are no major differences between the five groups. Systolic deviation tends to be lowest in the six untreated patients. Some patients received more than one drug, but multiple regression analysis[17] suggested that this did not influence arterial pressure.

weight loss are not the explanation, and that an unidentified factor related to prolonged residence in hospital may be.

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