

## ORIGINAL ARTICLE

## Diabetes in a high secure hospital

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**Aims:** To determine the prevalence of diabetes mellitus and its possible causes and to assess its control in a high secure hospital.

**Methods:** A cross sectional survey and a prospective cohort study were conducted. The cross sectional survey included 408 patients admitted under the Mental Health Act, and the prospective study included 22 patients with known diabetes followed up for 24 months. The outcome measures evaluated were drug treatment, status of microvascular and macrovascular complications, glycated haemoglobin, and body mass index.

**Results:** In the cross sectional survey, 35 out of 408 patients (8.6%; 95% confidence interval 5.9% to 11.3%) had known diabetes, and all of these had type 2 diabetes. Obesity, cigarette smoking, schizophrenia, and antipsychotic drug use were frequent, and weight gain was common after hospital admission. Glycaemic control was variable, and, although a majority of patients were above recommended treatment targets, control remained stable over the follow up period.

**Conclusions:** Type 2 diabetes was common in this hospital. Both its prevalence and the suboptimal glycaemic control in some patients probably relate to sedentary life, dietary factors, smoking, and perhaps widespread use of antipsychotic drugs. However, regular multidisciplinary input enabled most patients to maintain relatively stable glycaemic control, with good control of blood pressure and lipids, at levels similar to those seen in community and hospital diabetic clinics. Further modification of lifestyle risk factors is probably needed to reduce the prevalence and impact of diabetes in this patient group.

Diabetes mellitus is a chronic disease associated with serious long term complications. Diabetes is thought to affect approximately 3% of the UK population,<sup>1</sup> but consumes about 9% of the total national healthcare expenditure.<sup>2</sup> Type 2 diabetes poses a major public health problem, because of associated morbidity from microvascular and macrovascular disease and early mortality from cardiovascular disease. Once diagnosed, diabetes requires careful surveillance by health professionals trained in diabetes care, in order to achieve optimal metabolic control, to reduce associated cardiovascular risk factors, and to detect and treat complications.

An increased prevalence of impaired glucose tolerance or diabetes in patients with mental disorders was first suggested over 80 years ago.<sup>3–4</sup> Observations in the modern era also have supported an increased prevalence of type 2 diabetes in patients in psychiatric hospitals<sup>5–6</sup> and in those receiving medication with antipsychotic drugs (APDs).<sup>7</sup> Both the long term care environment and APDs may contribute to weight gain and an increased risk of developing diabetes, and in those with existing diabetes these factors may also result in deterioration of glycaemic control.<sup>8</sup> All of these problems can be exaggerated in secure hospitals where patients may be held for many years.

In view of the rapidly increasing prevalences of obesity and diabetes in the general population, therefore, and the increasing use of new APDs in psychiatry, some of which may have greater diabetogenic potential than older drugs, we investigated the prevalence and clinical characteristics of diabetes mellitus in one of the UK's largest secure hospitals. Most patients in this hospital are admitted for prolonged periods and receive APD medication. We also report our experiences of treating a cohort of diabetic patients in the hospital who were followed for up to two years. There are very few published data on diabetes mellitus in this neglected patient group.

## PATIENTS AND METHODS

The study was conducted at one of three regional high secure hospitals in the UK. The study was approved by the institutional ethics committee. Patients admitted to the hospital are compulsorily detained under the 1983 Mental Health Act as posing grave and immediate danger to others. At any time in the UK, there are approximately 1700 people in the three hospitals. Approximately 70% of these have significant mental illness (mostly schizophrenia) and 25% have psychopathic personality disorders. Some have intellectual impairment. The average length of stay in a high secure hospital is eight years, with 20% remaining for more than 15 years. Over 70% of patients are male, and 90% are under the age of 60 years.<sup>9</sup>

## Prospective cohort study

On admission to this secure hospital all patients with a known diagnosis of diabetes are referred to the health centre where they are seen by a visiting general practitioner. Psychiatric nursing and medical staff arrange opportunistic screening for diabetes as indicated by symptoms or risk factors such as family history. New cases of diabetes detected in this way are also referred to the health centre. As well as receiving a medical assessment, patients with diabetes are seen by a dietitian and a chiropodist and undergo eye screening for retinopathy. The general practitioner either manages the patient's diabetes alone or refers individual patients to a visiting consultant diabetologist. From September 1999 to September 2001 details were recorded of all patients referred with diabetes and seen by the diabetologist on at least two occasions. In addition to clinical details,

**Abbreviations:** APD, antipsychotic drug; BMI, body mass index; HbA1c, glycated haemoglobin; OHA, oral hypoglycaemic agent

management decisions and medical problems were recorded, and outcomes such as glycaemic control and body weight were measured.

### Prevalence study

Additionally, on one day in September 2001, the clinical characteristics and management details of all patients with diabetes mellitus in the hospital were studied. The point prevalence was estimated from the total hospital population at the time.

For both studies, glycated haemoglobin (HbA1c) was measured by a laboratory high pressure liquid chromatography method, which was aligned to that used in the diabetes control and complications trial.<sup>10</sup> Body mass index (BMI) was calculated as the patient's weight (kg) divided by the square of their height (m). BMI levels of 20.0–24.9 kg/m<sup>2</sup> were regarded as normal, 25.0–29.9 kg/m<sup>2</sup> as overweight, 30.0–34.9 kg/m<sup>2</sup> as grade 1 obesity, 35.0–39.9 kg/m<sup>2</sup> as grade 2 obesity, and >40 kg/m<sup>2</sup> as grade 3 obesity.<sup>11</sup>

## RESULTS

### Prospective cohort study

During the 24 months of the study, serial data were obtained from 22 (four female) patients with diabetes, all of whom had type 2 diabetes. Clinical details are shown in table 1. Out of the 22 patients, 18 had significant mental illness—mostly schizophrenia—and had received or were receiving a variety of APDs and other psychoactive medications. These included chlorpromazine, flupenthixol, clozapine, sulpiride, clopexol, trifluoperazine, amitriptyline, fluoxetine, lithium, and carbamazepine. Two of the four patients with personality disorders had also received APD medication. As expected, glycaemic control was variable, but on average did not deteriorate during the study. Similarly, BMI remained stable, with mean levels in the range indicating grade 1 obesity. Interventions by the diabetologist during the study period included the introduction of oral hypoglycaemic agents (OHAs) (n = 3), change of OHA doses (n = 4), introduction of insulin (n = 5), and addition of metformin to insulin

**Table 1** Characteristics of, and glycaemic control and complications in, 22 diabetic patients in a high secure hospital. Data are mean (SD), with the range in square brackets

Characteristics of patients	
Number of subjects	22
Number with mental illness	18
Number with a personality disorder	4
Age (years)	45 (12) [27–67]
Sex	18 (82%) male : 4 (18%) female
Duration of diabetes (years)	5.0 (4.6) [0.2–16.0]
Duration of follow up (years)	1.6 (0.5) [0.3–2.0]
Initial BMI (kg/m <sup>2</sup> )	33.3 (8.5) [22.0–60.0]
Follow up BMI (kg/m <sup>2</sup> )	33.2 (7.9) [24.0–55.0]
Glycaemic control	
Initial HbA1c (%)	8.5 (1.9) [5.5–13.6]
Follow up HbA1c (%)	8.3 (1.6) [5.6–12.0]
Complications (values are numbers of patients)	
Retinopathy	3
Neuropathy*	2
Proteinuria	2
Cerebrovascular disease	2
Coronary artery disease	3
Hypertension†	8
Hyperlipidaemia‡	12

\*Refers to symptomatic neuropathy.

†Patients receiving drug treatment for hypertension or hyperlipidaemia.

(n = 1). By the end of the follow up period, patients were receiving the following treatments: diet alone (n = 1), OHAs (n = 11), insulin (n = 5), insulin plus metformin (n = 4), and insulin plus gliclazide (n = 1). During the study, seven patients refused consultations or prescribed medications for short periods of time, but compliance with treatment was usually excellent. Two patients (9%) died suddenly from cardiovascular disease during the follow up period. Both of these patients smoked more than 20 cigarettes per day and one had renal impairment (creatinine level of 245 µmol/l).

### Prevalence study

The prevalence study in September 2001 revealed 35 diabetic patients (six of them (17%) female) in this hospital—all with type 2 diabetes. There were three Afro-Caribbean males, and the rest were white. The total hospital population on that day was 408 patients (11% female), giving a diabetes point prevalence of 8.6% (95% confidence interval 5.9% to 11.3%). In females the prevalence was 13.0% (95% confidence interval 7.9% to 18.1%), and in males it was 8.0% (95% confidence interval 6.6% to 9.4%). Details of these patients are shown in table 2. Treatment for diabetes was by diet alone (n = 5), OHA (n = 20), insulin (n = 5), insulin plus metformin (n = 4), or insulin plus gliclazide (n = 1). Many patients were receiving treatment for other conditions, including chronic obstructive pulmonary disease (n = 12), cardiac failure (n = 4), and hypothyroidism (n = 4). Over 90% were current smokers, and all of these smoked at least 20 cigarettes per day. Significant obesity was common (table 2), and in many cases hospital records suggested that considerable weight gain had occurred since admission to hospital.

**Table 2** The prevalence of diabetes in a high secure hospital. Details of 35 patients present in September 2001. Data are mean (SD), with the range in square brackets

Characteristics of patients	
Number of patients	35
Number with mental illness	27
Number with a personality disorder	8
Age (years)	48 (12) [range 28–78]
Sex	29 (83%) male : 6 (17%) female
Duration of diabetes (years)	4.7 (4.4) [0.2–16.0]
Duration of follow up (years)	1.6 (0.5) [0.3–2.0]
BMI (kg/m <sup>2</sup> )	31.9 (7.3) [19.0–55.0]
Clinical characteristics	
HbA1c (%)	7.9 (1.6) [5.6–12.0]
Cholesterol (mmol/l)	5.2 (1.2) [3.2–8.4]
Systolic blood pressure (mm Hg)	127 (16.6) [90–170]
Diastolic blood pressure (mm Hg)	76.6 (9.9) [50–102]
Obesity*	
Class 1	11, of which 3 female
Class 2	6, of which none female
Class 3	4, of which 3 female
Complications (values are numbers of patients)	
Retinopathy	3
Neuropathy†	2
Proteinuria	2
Cerebrovascular disease	2
Coronary artery disease	6
Hypertension‡	9
Hyperlipidaemia‡	16

\*See methods section for definition.

†Refers to symptomatic neuropathy.

‡Drug treatment for hypertension or hyperlipidaemia.

## DISCUSSION

This study found that type 2 diabetes was common in a relatively young population (90% of patients were below the age of 60 years). Although the confidence intervals were relatively wide, the prevalence of diabetes was higher than would be expected from the background prevalence of known diabetes,<sup>1</sup> and so the data highlight diabetes as a major health issue in this patient group. Interestingly, this prevalence is similar to that reported recently in a deprived multiethnic population in inner Manchester.<sup>12</sup> Previous studies in general hospitals in the UK found inpatient prevalence rates of known diabetes of around 8%–9% in Liverpool<sup>13</sup> and elsewhere.<sup>14</sup> However, the diabetic patients in this hospital all had type 2 diabetes, whereas in general hospitals, the community and prison environments in the same geographical region<sup>15–16</sup> there were significant numbers of patients with type 1 diabetes.

Schizophrenia was common in this population. An increased prevalence of diabetes has been reported in institutionalised psychiatric patients.<sup>5–6</sup> The environment in psychiatric hospitals probably promotes diabetes through risk factors such as diet, physical inactivity, obesity, and smoking.<sup>17</sup> Obesity and cigarette smoking were both particularly prevalent in this population, and despite dietary advice many diabetic patients had relatively high intakes of sugar and fat and low levels of physical activity. Data collected by the Schizophrenia Outcomes Research Team support the idea that people with schizophrenia are at increased risk of diabetes because of poor lifestyle and physical health.<sup>18</sup> It is possible that the origins of diabetes antedate hospitalisation, although hospital lifestyle and the widespread use of APDs may be additional factors. The diabetogenic effect of APDs has attracted interest with the introduction of new agents,<sup>7</sup> although it has been known for some years that chlorpromazine and haloperidol acutely impair insulin secretion.<sup>19–20</sup> The Schizophrenia Outcomes Research Trial implicated APDs as a cause of diabetes, but observed that diabetes was prevalent before the widespread use of new APDs.<sup>18</sup> Of the newer drugs, clozapine and olanzepine have been most consistently associated with the development of diabetes,<sup>21–22</sup> although our data do not allow us to comment on the possible contributions of individual drugs. Weight gain may be a significant mechanism causing diabetes in patients receiving newer APDs,<sup>21–23</sup> although ketosis and apparent insulin deficiency have also been described.<sup>24–25</sup>

Diabetes and its complications are important issues for long stay psychiatric patients. In this study, specialist multidisciplinary diabetes care led to the identification and appropriate treatment of diabetic complications, despite undeniable obstacles including questionable dietary compliance, physical inactivity, smoking, and obesity. Glycaemic control was variable, and, although most patients did not achieve HbA1c in the range 6.5%–7.5%, glycaemic control did not deteriorate over time. Similar glycaemic control through specialist care has been observed previously in a prison environment.<sup>15–16</sup> Although mean blood pressure and cholesterol levels were reasonably controlled, the study highlights the risk of cardiovascular disease as a major issue for many patients and points to a further need to promote the cessation of smoking in this population. Finally, among patients without diabetes on entry to the secure hospital environment, those with risk factors such as obesity are at the highest risk,

suggesting a need for awareness of diabetic symptoms and, arguably, annual screening. In secure hospitals and other long stay psychiatric institutions improved dietary choice and opportunities for physical activity would help to reduce the risk of type 2 diabetes.<sup>26–27</sup>

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