Long term impact of retinal screening upon significant diabetes related visual impairment in the working age population

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Abstract

Background: Diabetic retinopathy has long been regarded as the commonest preventable cause of blindness in the working age population. Consistent annual screening for treatable retinopathy would be expected to decrease the incidence of new blindness.

Methods: We collated the causes of blindness for a 5 year period between 2001- 2005 for the 16 – 64 year age group in a district which had operated systematic retinal screening in diabetes since 1986.

Results: Diabetic retinopathy was found to be the second commonest cause of blindness, with optic atrophy being the commonest cause in Newcastle District. This differs from national data showing diabetic retinopathy to be the commonest cause. Diabetic retinopathy was also the second commonest cause of partial sightedness registrations with stroke being the commonest cause. Overall, stroke disease accounted for 16.2 % and diabetes for 15.4 % of registrations. The annual incidence of blindness was 0.22 per 1000 with diabetes and partial sightedness was 0.43 per 1000 with diabetes.

Conclusions: Systematic annual screening for retinopathy demotes diabetes from being the commonest cause of blindness in the working age population.

Keywords: Diabetic retinopathy, blindness, retinal screening, maculopathy, proliferative retinopathy

Abbreviations: PS partial sightedness, UKPDS United Kingdom Prospective Diabetes Study

Introduction

Diabetic retinopathy has long been recognised as the commonest cause of blindness in the working age population (1-5). A recent report showed that all three leading causes of blindness - age related macular degeneration, diabetic retinopathy and glaucoma - to be increasing (6). Loss of vision at any age is catastrophic, but in the working age range has particularly devastating personal, family and societal consequences. Given that the commonest underlying reason for diabetes related visual loss aged 16-64 years is proliferative retinopathy, and that therapy for this is almost completely effective if given at an early stage it would be expected that screening should markedly decrease rates of blindness in this age range (7). However, the most recent figures for England and Wales suggest that there has been little change since 1990 (8) and this could relate to incomplete screening coverage over this period (9) Visual impairment due to diabetes does not become symptomatic until proliferative retinopathy or macular disease have become advanced, and an effective annual screening programme would be expected to identify treatable retinopathy at a preventable stage. The retinal screening programme Newcastle District commenced in 1986 and has achieved near comprehensive population coverage since 1996 (11). The St Vincent Declaration set out a target of reduction in new blindness due to diabetes by one third. Our aim was to determine the prevalence of significant visual impairment related to diabetes and other causes in the 16- 64 years age group of this district between 2001 and 2005.

Methodology

The Newcastle Diabetes Centre provides retinal screening for Newcastle district (population 270000) using two static retinal cameras for patients attending for specialist care and patients whose diabetes is managed in the community. The programme commenced in 1986 using a mobile unit (10), and achieved coverage of all people registered as having diabetes by 1998, when screening became deliverable from a central Diabetes Centre. Since then, annual population coverage in Newcastle District has been consistently over 80%. The original Polaroid photography was replaced by digital retinal imaging in 2000. Screening is performed by trained retinal screeners who measure visual acuity, instill tropicamide eye drops, carry out retinal photography, assess the images and explain the findings to each individual patient. Quality assurance is continuously monitored (11). Ungradeable images were defined as those in which the second order of arterioles were unclear or in which less than 75% of the retina was visible, and patients with ungradeable images (5.0% of all screened) were referred for ophthalmological examination in view of the previous observation of a high rate of sight threatening retinopathy in this group (12). The standards used over the period reported in this paper originally contributed to the current UK nationally agreed standards (13).

The Newcastle Ophthalmology Department deals with all ophthalmological referrals from Newcastle as well as the surrounding districts.

In the UK certifiable blindness is defined as:

1. Visual acuity of less than 3/60 with a full visual field.
2. Visual acuity better than 3/60 but below 6/60 with a very restricted visual field

Partial sightedness is defined as:

1. Visual acuity of 3/60 to 6/60 with a full field of vision.
2. Visual acuity of up to 6/24 with a moderate restriction of field of vision or with opacities in the media or aphakia
3. Visual acuity of 6/18 or better with a gross visual field defect as with hemianopia, retinitis pigmentosa or glaucoma.

All patients aged 16-64 registered with blindness or partial sightedness during the period January 2001 to December 2005, were identified from the records of the Royal National Institute for the Blind Liaison Office. This office, situated in the Newcastle Ophthalmology Department, has maintained records of all those registered visually impaired since 1998, and the completeness of collection of this information on people with diabetes has been verified by cross-checking of visual acuity data in the clinical diabetes records (14). Details of type and duration of diabetes**,** and other medical conditions was obtained from Diabetes clinical records. Information on type of retinopathy & treatment was collated from the Ophthalmology Department clinical records. Only those patients with a Newcastle District postal code were identified included to allow calculation of rates of visual loss in a defined population.

Results

A total of 130 registrations were recorded over the 5 year period. Blindness accounted for 56 of these registrations. Seven patients with diabetic retinopathy were registered blind and 13 registered partially sighted. Optic atrophy was the commonest cause of blindness (10 patients), with diabetic retinopathy being the second commonest cause. Of the 74 patients registered partially sighted, stroke was the

commonest cause (16 patients), with diabetic retinopathy being the second commonest cause (13 patients) (Table 1).

When all registrations were combined together, stroke was the commonest cause for any registration (21 patients) with diabetes being the second commonest cause (20 patients). Other causes were optic atrophy (18), hereditary retinal disorders (9), macular degeneration (12), glaucoma (12), myopic degeneration (10), cataract (6), neurodegenerative disorder (5), neoplasia (2) and uveitis (2). Amongst people with type 1 diabetes (n=5) there was 2 registered blind and 3 partially sighted. Amongst people with type 2 diabetes (n=15) there were 5 registered blind and 10 partially sighted. Mean age of registration in all patients was 55 years for blindness and 52 years for partial sightedness. A lag period between 3 to 5.5 years was noted between referral and registration. All patients underwent laser therapy within a few months of referral to ophthalmology service. In type 1 diabetes the primary reason for registration was proliferative retinopathy (3 patients) and maculopathy (2 patients). In comparison, in type 2 diabetes proliferative retinopathy accounted for 6 patients and macular oedema 9 patients. The similar overall prevalence of proliferative retinopathy to macular disease in the age group studied may reflect the considerably better response of the former to laser therapy (additional refs A & B).

The annual incidence of blindness in Newcastle district in the working age population was calculated knowing the population aged 15- 64 years for Newcastle District (172,653 from 2001 Census) and the age specific prevalence of diabetes in the UK (3.5 %) (18). Of the population at risk of visual loss from diabetes (6,043), 7 patients became blind during the 5 year period. Hence the annual incidence of blindness was 0.22 per 1000 with diabetes. 13 patients were registered partially sighted, equivalent to an annual incidence of 0.43 per 1000 with diabetes.

Discussion

After 15-20 years of screening for treatable diabetic retinopathy, diabetes was found to be no longer the commonest cause of blindness in the working age population. In Newcastle District over the 5 year period from 2001- 2005, the commonest cause of blindness registration for this age group was optic atrophy. Diabetic retinopathy was the second commonest cause. The commonest cause for partial sightedness was stroke disease, with diabetes again being second commonest. When all registrations were considered together, stroke disease remained the commonest cause and diabetes was the second commonest cause. A low annual registration rate was noted for blindness and partial sightedness (0.22 and 0.45 per 1000 patients per year with diabetes respectively). Although these data are based on the voluntary blind registration process, the completeness of this information was verified by cross-checking of visual acuity data with the clinical diabetes records in the Newcastle Diabetes Centre.

The best comparable data for the 16-64 year age group are from UK national data on blindness registrations relating to 1900 and 1999-2000 (5; 8). In 1990, diabetes was by far the leading cause of blindness and this had not changed in 1999-2000. Our observations on Newcastle are very different, with blindness due to diabetes accounting for only 12.1 % of registrations. Over the same period, rates of new blindness due to glaucoma fell, and rates were similar for 1999-2000 for the UK and 2000-2005 for Newcastle. As rates of optic atrophy were observed to be fairly constant and would not be expected to change over this period, the ratio of blindness due to diabetes or due to optic atrophy is of interest. The England and Wales national

data show ratios of 1.3:1 (11.9: 9.4) and 1.7: 1 (17.7: 10.1) in 1990 and 1999-2000 respectively, suggesting no major change in blindness due to diabetes over the 10 year period. However, in Newcastle District the ratio was found to be 0.78:1 (12.1:15.5). The fall in incidence of blindness associated with a systematic retinal screening programme which we have observed is consistent with a previous report ref 2. programme (2).

A low registration rate was noted for blindness and partial sightedness namely 0.22 and 0.45 per year per 1000 patients with diabetes respectively. There are no previous reports of incidence in working age population to compare with the present results and the median age of blindness registration in working age population has not previously been reported. However, in Newcastle, in 1985, there were at least 6 patients < 25 years of age registered blind. Based on the current data, median age of registration in this age group is 53 years.

The factors contributing to the fall in incidence of new significant visual impairment must be considered. Both better treatment of diabetes and effective screening coupled with appropriate laser treatment could impact upon the data. Better blood glucose and blood pressure control can delay the rate of progression of diabetic retinopathy (UKPDS) with both onset and progression to sight threatening retinopathy being decreased (DCCT) (15; 16). However, comparative data show no major differences in HbA1c and blood pressure in national data compared with our own (17) and there is no reason to suggest that differences in clinical management of diabetes could account for the greater fall in rates of diabetic blindness in Newcastle. On the other hand, retinal screening in Newcastle has been carried out year-on-year with good population coverage and quality assurance (ref 11). Population coverage with retinal screening has been limited in the UK as a whole (ref 9). Retinal screening in

coordinated partnership with timely application of laser therapy is likely to be a more potent factor underlying the lower rates of visual impairment observed in this study.

It is notable that stroke disease accounted for such high partial sightedness registration rates. All cases were all due to significant field defects leading to visual disability and reflect a changing attitude to partial sightness registration. With the recent UK change in details required for registration of blindness or partial sightedness it has become easier to register this category based on field defects (8).

In summary, diabetes is no longer the commonest cause of preventable blindness and partial sightedness in working age population in a district which has had a long established comprehensive screening and treatment programme for all people with diabetes. There has been a major change in age of onset of blindness due to diabetes. This report demonstrates that the visual preservation objectives of the St.Vincent's Declaration are achievable.

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Table 1: Causes of blindness and partial sightedness registrations

	No. of Blind	% of blind	No. of PS	% PS	Total Registered	% Registered
Optic Atrophy	10	17.9	8	10.8	18	13.8
Diabetic retinopathy	7	12.5	13	17.6	20	15.4
Hereditary retinal disorders	7	12.5	2	2.7	9	6.9
Cerebrovascular Disease	5	9	16	21.6	21	16.2
Macular Degeneration	5	9	7	9.5	12	9.2
Glaucoma	3	5.4	9	12.2	12	9.2
Myopic Degeneration	3	5.4	7	9.5	10	7.7
Cataract	3	5.4	3	4.1	6	4.6
Neurodegenerative Disorder	4	7.1	1	1.4	5	3.8
Corneal scarring	3	5.4	2	2.7	5	3.8
Neoplasia	1	1.8	1	1.4	2	1.5
Uveitis	1	1.8	1	1.4	2	1.5
Ambylopia with corneal scarring in the other eye	1	1.8			1	0.8
Ambylopia with epiretinal membrane in the other eye			1	1.4	1	0.8
Vigabatrin macular toxicity	1	1.8			1	0.8
Quinine toxicity	1	1.8			1	0.8
Macular scarring	1	1.8	1	1.4	2	1.5
Retinal necrosis syndrome			1	1.4	1	0.8
Hypertensive retinopathy			1	1.4	1	0.8
Total	56	100	74	100	130	100

Table 2: Characteristics of diabetes patients registered blind or partially sighted

	Patients (number)	**Sex (M/F)**	**Mean age (years)**	**Duration of diabetes (years)**	**Referral to registration (years)**
Type 1 diabetes Blind	2	1 F 1M	56.5	51	4
Type 1 diabetes PS	3	2F 1M	50.6	22 (21- 23)	5 (3-7)
All type 1	5	5			
Type 2 diabetes PS	10	8F 2M	53.6	10.5 (0-15)	3 (0-5)
Type 2 diabetes blind	5	3F 2M	66.25	12 (3- 19)	5.5 (3- 8)
All type 2	15	15			