GOS Geelong Osteoporosis Study

Barwon Health

DEAKIN UNIVERSITY

Cardiovascular and All-Cause Mortality Risk in Men with Impaired Fasting Glucose and Diabetes

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INTRODUCTION

Diabetes is a chronic disease with multiple microvascular and macrovascular complications that can increase mortality risk. Morbidity and mortality associated with diabetes is expected to rise in the coming years and is predicted to be one of the top ten leading causes of death in high-, middle-, and low-income countries[1]. Previous studies have found increased risk of mortality for people with diabetes[2,3]. People with elevated fasting plasma glucose are said to have impaired fasting glucose (IFG). Individuals with IFG have been reported to be at increased risk of cardiovascular disease[4]. However, it is not clear if they are also at a higher risk of early mortality.

OBJECTIVES

This study aimed to determine the mortality risk for men with normoglycaemia, IFG and diabetes.

METHOD

Participants (n=1170, aged ≥20yr) were from the Geelong Osteoporosis Study. IFG was categorised as fasting plasma glucose 5.6-6.9mmol/L. Diabetes was identified if fasting plasma glucose ≥7.0 mmol/L, by self-report and/or use of antihyperglycaemic medication. Participants were followed from baseline to date of death or 14/07/2017. Mortality data was obtained using data linkage from the national deaths index. Height and weight were used to calculate body mass index, fat and lean mass were obtained using Dual-energy X-ray Absorptiometry. Self-report questionnaires were used to determine physical activity levels, smoking status, and medication use. A Cancer Council Victoria food[5] frequency questionnaire was used to determine alcohol consumption. Cox proportional hazards models were used to investigate mortality risk across the three glycaemia groups, adjusted for potential confounders.

Project has been approved by Barwon Health HREC (project 00/56).

Results

Table 1: Descriptive characteristics for men with normoglycaemia, impaired fasting glucose (IFG), and diabetes. BMI= body mass index, FPG= fasting plasma glucose

	All (n=1170)	Normoglycaemia (n=790)	IFG (n=256)	Diabetes (n=124)	p value
Age (yr): median (Q₁-Q₃)	61.7 (44.7-75.5)	57.0 (41.2-74.6)	67.7 (53.0-76.8)	70.3 (61.1-75.5)	<0.001
Weight (kg): mean±SD	82.9±14.4	81.2±13.9	86.9±15.3	85.7±14.3	<0.001
Height (cm): mean±SD	174.4±7.3	174.7±7.4	174.1±7.1	172.5±6.9	0.006
BMI (kg/m²): mean±SD	27.2±4.2	26.6±4.0	28.6±4.3	28.8±4.6	<0.001
Waist circumference (cm): mean±SD	98.3±11.3	96.1±10.4	102.3±11.7	103.6±12.0	<0.001
Hip circumference (cm): mean±SD	101.1±8.9	99.8±8.4	103.6±9.0	104.7±9.5	<0.001
Systolic blood pressure (mmHg): mean±SD	137.4±17.7	135.4±17.0	141.3±17.8	142.9±20.0	<0.001
Diastolic blood pressure (mmHg): mean±SD	85.6±12.4	84.9±11.2	87.7±14.6	85.4±14.6	0.011
Fat mass (kg): mean±SD	22.0±8.3	20.8±8.0	24.6±8.4	24.4±8.4	<0.001
Lean mass (kg): mean±SD	57.2±7.4	57.4±7.4	58.6±7.4	57.6±7.2	0.102
Smoking: n(%)	148 (12.7)	108 (13.7)	27 (10.6)	13 (10.5)	0.371
High alcohol consumption: n(%)	254 (22.28)	169 (21.8)	66 (26.7)	19 (16.2)	0.068
Low physical activity: n(%)	309 (26.4)	180 (22.8)	84 (32.8)	45 (36.3)	<0.001
FPG (mmol/L): mean±SD	5.4±1.1	4.9±0.5	6.0±0.3	7.7±2.1	<0.001
Aspirin use: n(%)	227 (19.4)	129 (16.3)	58 (22.7)	40 (32.3)	<0.001
Antihypertensive use: n(%)	410 (35.0)	208 (26.3)	113 (44.1)	89 (71.8)	<0.001
Cardiovascular related medication use: n(%)	542 (46.3)	295 (37.3)	145 (56.6)	102 (82.3)	<0.001
Total Time at risk (person-years)	10.73	10.96	10.67	9.35	-
Mortality: n(%)	338 (28.9)	195 (24.7)	83 (32.4)	60 (48.4)	<0.001

Over 12548.73 total years of follow-up a total of 338 deaths occurred. A greater proportion were seen in the diabetes group, then IFG and finally normoglycaemia (Table 1).

Men with diabetes were on average older, had higher measures of adiposity, blood pressure, and fasting plasma glucose, and were less physically active. People with IFG appeared to have intermediate values for these characteristics (Table 1).
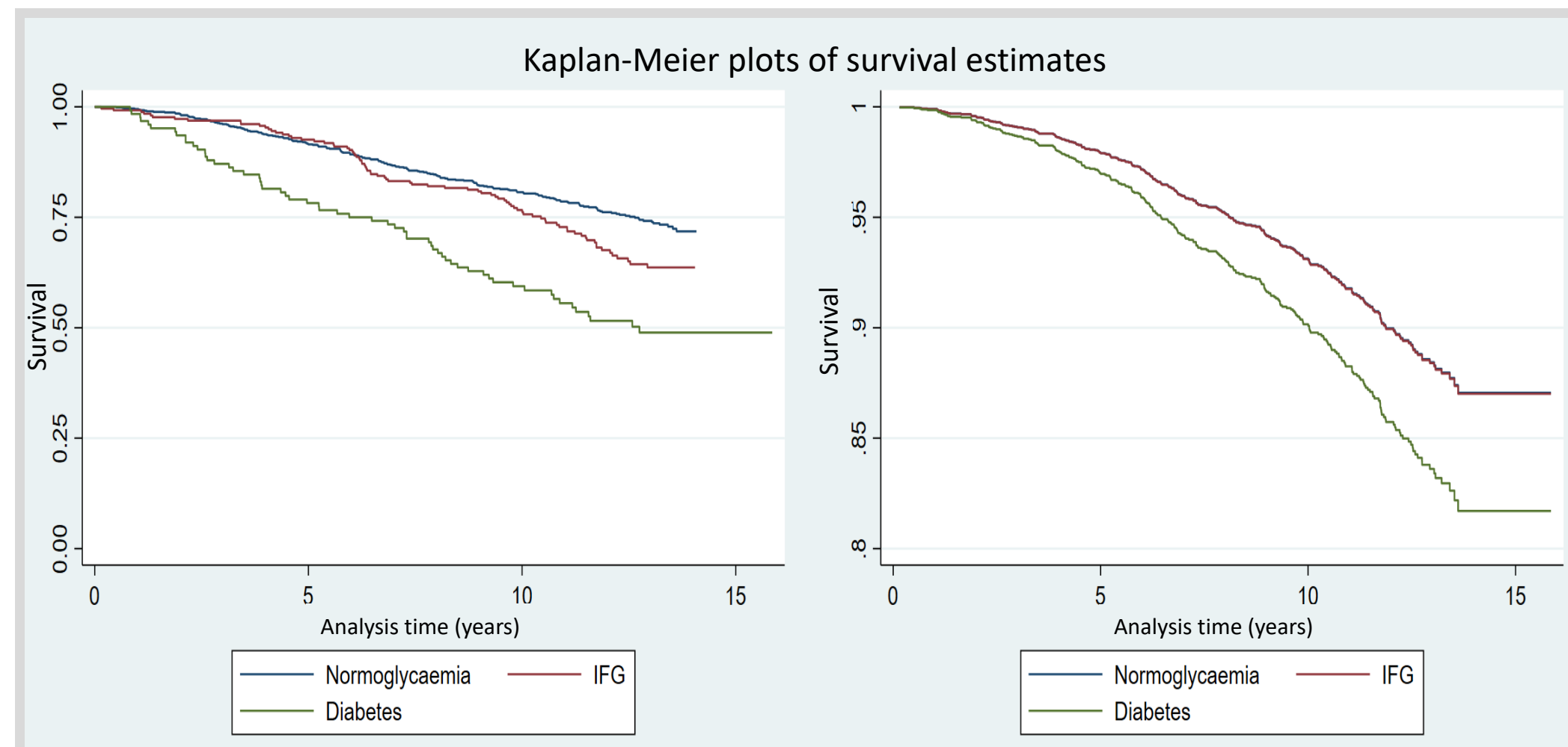

Figure 1: Kaplan-Meier plots of survival estimates of normoglycaemia, impaired fasting glucose (IFG), and diabetes for all cause mortality. Left shows unadjusted model, right is adjusted by age, systolic blood pressure, and physical activity.

After adjustment all-cause mortality risk was statistically significantly higher in those with diabetes, but not in IFG (Table 2). Neither diabetes or IFG had higher mortality risk when cardiovascular events were flagged as primary cause of death. Whereas diabetes was significantly associated mortality risk when cardiovascular event were flagged as primary or secondary cause of death (Table 2).

Table 2: Mortality risk for IFG and diabetes for various causes of death. Shows adjusted and unadjusted models

Glycaemia status	HR unadjusted (95% CI)	p value	HR adjusted (95% CI)	p value
All-cause mortality				
Normoglycaemia	Referent	-	Referent*	-
IFG*	1.36 (1.05-1.76)	0.019	0.98 (0.74-1.30)	0.885
Diabetes*	2.38 (1.78-3.17)	<0.001	1.40 (1.01-1.93)	0.042
Cardiovascular events as primary cause of death				
Normoglycaemia	Referent	-	Referent**	-
IFG*	1.36 (0.90-2.05)	0.149	0.96 (0.63-1.45)	0.837
Diabetes*	2.26 (1.40-3.63)	0.001	1.33 (0.83-2.15)	0.239
Cardiovascular events as primary or secondary cause of death				
Normoglycaemia	Referent	-	Referent***	-
IFG*	1.09 (0.77-1.55)	0.614	0.90 (0.61-1.31)	0.574
Diabetes*	2.45 (1.71-3.52)	<0.001	1.69 (1.15-2.50)	0.008

* Adjusted by age, systolic blood pressure, and physical activity
** Adjusted by age and physical activity
*** Adjusted by age, systolic blood pressure, and physical activity

Medication use was higher in individuals with diabetes compared to the other groups (Table 1). Use of antihypertensives was able to significantly attenuate the risk of cardiovascular mortality listed as primary or secondary cause of death (HR 1.44, 95% CI 0.97-2.13, p=0.067). Other medications reduced the risk, but it remained significant, similar trends were seen in the IFG group.

DISCUSSION

This study found individuals with diabetes had higher risk of mortality, other studies have indeed reported similar results[2,3]. However it is still unclear whether people with IFG are at greater risk of mortality. Previous studies have come to conflicting conclusions leading to confusion of whether having IFG increases mortality risk[2,4,7]. This study found that individuals with IFG were not at greater risk of all cause or cardiovascular related mortality.

Use of antihypertensives have been shown to be effective in preventing cardiovascular complications in people with diabetes[6], thus reducing risk of mortality as was seen in this study.

CONCLUSION

Mortality risk was elevated for men with diabetes, but not for men with IFG. This highlights the need for prevention strategies targeted at those with IFG to prevent progression to diabetes to reduce premature mortality associated with diabetes. Medication use may be able to attenuate cardiovascular mortality, but only antihypertensives applied a significant change.

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