Chronic Kidney Disease and Obesity in Ireland: Comparison of Self-Reported Coronary Artery Disease in Population Study with Clinic Attendees

Abstract:

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Abstract

Obesity is a growing issue in Ireland. The link between obesity, CKD and CAD has not previously been described in the Irish population. The prevalence of obesity and CKD was compared across 3 groups: population based estimates with self-reported CAD, population based estimates without self-reported CAD (SLAN-07) and a random selection of cardiology outpatients with CAD. The SLˆ N-07 is a representative survey of 1207 randomly selected participants e45 years. Validated methods measured parameters including waist circumference, blood pressure and markers of renal function specifically glomerular filtration rate (eGFR) and albumin: creatinine ratio. The Cardiology clinic surveyed a random selection of 126 participants e45 years with CAD. Similar parameters were measured using the validated methods utilised in SLˆ N-07 study. Prevalence of obesity and renal disease was significantly higher in both CAD groups. At population level, risk factors were modelled using logistic regression to compare odds of participants with self-reported CAD with those without. Age, hypertension, obesity, elevated waist circumference, renal disease and diabetes are significantly associated with existing CAD. Obesity and CKD are more frequent in patients with CAD. Routine evaluation is essential to facilitate more intensive management of these risk factors.

Introduction

Cardiovascular disease is the leading cause of death in Ireland, at higher than average rates for the European Union[2,3]. The triad of obesity, glucose intolerance and hypertension is well described. Obesity has emerged as the most significant health threat of this century and has evolved globally through complex changes in lifestyle, diet and transportation. The prevalence of obesity in Ireland has been recently described in the National Adult Nutritional Survey and estimates 26%of men and 21% of women described as obese and 44% of men and 31% of women were overweight[4]. Obesity and CKD are thought to interact in the pathogenesis and progression of premature atherosclerotic disease[5]. Chronic kidney disease (CKD) is a known independent risk factor for cardiovascular disease, however often excluded in initial riskstratification[6,7]. Irish primary care physicians, cardiologists and hospital physicians practice high risk prevention strategies for existing sufferers of cardiovascular disease. However routine assessment of central obesity and renal function in all high risk patients is not practised. For the first time, we present a representative population based sample of Irish adults of middle age showing the association of obesity with CKD in Ireland without reported cardiovascular disease. To further investigate the association of obesity and CKD was estimated sample of participants attending a hospital based cardiology service. Comparison of the groups showed similar prevalence of CKD and obesity in participants with CAD.

Methods

The study is divided into two distinct parts. Firstly SLˆ N-07, a population based cross-sectional study in the Republic of Ireland was conducted in 2007. The Irish population based random sample used all residential, non-commercial addresses in the Republic of Ireland as its sampling frame from â The Irish GeoDirectoryâ compiled by the Irish Postal service. Non-institutionalized adults aged 18 years and older were recruited using multi-stage sampling with a known probability of selection for each dwelling; we have described sampling methods in more detail elsewhere[8]. 10,364 participants (62% of those invited to participate) completed a detailed health and lifestyle questionnaire. A 25% random subgroup of the study participants who were 45 years or older were selected by inviting all such participants within randomly selecting clusters to further undergo a comprehensive physical examination and basic laboratory testing. 1,207 individuals of 45 years and over participated in the physical examination and laboratory tested subgroup of SLAN-07, with a response rate of 66% of participants, with 179 participants unable to participate and 613 participants declining to participate. Using the validated health and lifestyle SLAN questionnaire, self-reported history of CAD, smoking and current medications were recorded. Based on this, participants were categorised into two groups according to individual reporting of CAD. Standard operating procedures have been described for physical measurements including body mass index, waist circumference, blood pressure[8] and biochemical analysis measured albumin to creatinine ratio, non fasting random serum cholesterol. A single serum creatinine was used to calculate the estimated glomerular filtration rate[9].

The second study was a cardiology clinic based study conducted in 2009. In a cardiology outpatient clinic 126 patients with clinically diagnosed CAD were randomly selected using non identifying case note numbers. Again, identical variables to those collected in the SLˆ N 2007 study were measured using the same validated methods. Creatinine measurements for SLAN 2007 were performed using the kinetic Jaffe method based on the Abbott Architect methodology by Biomnis, a commercial laboratory in Dublin, Ireland. The cardiology clinic bloods including serum creatinine were performed in a local hospital laboratory in Cork also using the kinetic Jaffe method using the Abbott architect. Creatinine measurements were IDMS (Isotope Dilution Mass Spectrometry) traceable. Obesity was defined as a Body Mass Index>30kg/m†. Elevated waist circumference was defined as greater than 94cm for males and 80cm for females. CKD was defined as an eGFR less than 60mL/min/1.73m†or eGFR greater than 60ml/min/1.73m† with evidence of renal damage, indicated by an albumin / creatinine ratio greater than 30mg/g. Three CKD categories are presented in this study, exclusively low eGFR (<60mL/min/1.73m†), low eGFR oral buminuria and a low eGFR and albuminuria (>30mg/g). Statistical analysis of estimates in each of the three subgroups was compared using a chi squared test. Logistic regression model was only used for the population sample (SLAN-07) comparing the odds of reported cardiovascular disease with those without by the significant covariates. Data was analysed using STATA version 11(Timberlake). The study was approved by Research Ethics Committee of the Cork Teaching Hospitals.

Results

The prevalence of cardiovascular risk factors across the three samples is demonstrated in Table 1. The cardiology outpatient cohort was older with a male predominance. In the SLˆ N-07 study, 59 participants (4.9%) reported CAD. Self-reported CAD cases in SLˆ N-07 gave similar estimates of general and central obesity and all 3 categories of CKD as cardiology clinic participants. The prevalence of older age, obesity, eGFR <60ml/min/1.73m† and albuminuria were found to be significantly higher in both groups with CAD.

At the level of the Irish population, using logistic regression to model risk factors independently, the odds of participants with CAD were compared to those without CAD and non adjusted and adjusted odds ratios are shown in Table 2. Age, hypertension, BMI >30kg/m2,elevated waist circumference, diabetes mellitus and the 3 categories of CKD, (low eGFR, low eGFR or albuminuria, low eGFR and albuminuria) were initially included independently in a univariate model. Participants with reduced eGFR and also albuminuria showed the strongest association with self reported CAD. All covariates were then incorporated in a stepwise manner in multivariate logistic model. Raised cholesterol and diabetes mellitus were excluded due to non-significance. Models included only one measure of obesity due to collinearity. Only age, hypertension, BMI>30kg/m2 or elevated waist circumference remain significant in a fully adjusted logistic model. The effect of CKD on cardiovascular disease was no longer significant.

Discussion

One quarter of the Irish population is estimated to be obese according to the most recent national survey.[4] This study confirmed the higher prevalence of obesity in participants with CAD. This is consistent with previous studies which have also demonstrated that a BMI>30kg/m† is an independent risk factor for a major adverse coronary event[11]. The multiple pathogenic effects of obesity on the cardiovascular system are well documented with studies reporting both direct and indirect mechanisms. Many of the deleterious effects of obesity are mediated through a host of other cardiovascular risk factors including hypertension, glucose intolerance and hypercholesterolaemia[12].Therefore, participants with obesity are likely to require aggressive therapeutic targeting of hypertension, smoking cessation, glucose intolerance and lipids. At present in Ireland, there are very few centres offering a combined multi-disciplinary approach to managing existing morbid obesity. However real change at population level as recommended by the national obesity strategy aims to use a multifaceted approach to implement significant change at population level.

CKD is well recognised as an independent risk factor for CAD, and the prevalence of significant CKD in the Irish population has recently been estimated at 11.2% of participants of 45 years and over[13]. The relationship between CKD and CAD is complex, both disease entities potentially implicated in the progression of the other. CAD participants have worse renal function but in addition many studies have shown that patients with CKD at the time of a major cardiac event are more likely to experience a poorer outcome[14]. This study clearly demonstrates that there is a higher level of CKD in patients with CAD. The demonstration of this association is consistent with previous studies showing that declining eGFR is associated with increased risk of cardiovascular events[14]. Serum creatinine and albuminuria were only measured on one occasion. Both of these variables are prone to fluctuations and may not necessarily reflect a true decline in renal function, however all participants studied were community dwelling or stable outpatient attendees making acute deterioration less likely. The combination of reduced GFR and the presence of low grade albuminuria are strongly associated with CAD in this population. In addition, although self reported medical status is highly useful and cost effective in large population based surveys, this methodology tends to underestimate prevalence. Patients under 45 years were not included in this study reflecting the growing risk of CAD and CKD with increasing age. Further studies are necessary to investigate the association between CAD and CKD in a younger population.

This study further emphasises the importance of population based surveys to ascertain prevalence estimates of obesity and CKD. Only participants over 45 years were studied so extrapolation of findings to the younger population is not possible. The cross sectional study design results in difficulty in showing a temporal association with risk factors and outcome however obesity is difficult to treat, often develops slowly and from a young age and is likely to be longstanding. CKD and obesity are associated with age, and CKD estimates are likely to be higher in this subset of the Irish population. The importance of CKD and obesity in the development of CAD cannot be proven in this study but confirms the significant prevalence of both in existing cases. It highlights the importance of acknowledging the significance of CKD, albuminuria and both general and central obesity in patients with CAD. Central obesity or albuminuria are not routinely or regularly monitored in cardiology clinics nor in cardiovascular assessment in primary care.

Awareness among physicians and patients of the potential benefits in managing obesity and CKD aggressively is essential. We suggest a coordinated team approach involving cardiologists, primary care physicians and the allied services including dieticians in the care of these patients as part of a secondary prevention strategy. Body mass index and renal function are strongly associated with the development and progression of CAD. Ensuring that all patients with CAD are screened and have subsequent access to the necessary services is essential to optimise outcomes in CAD.

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