

Referrals for coronary angiography in a high risk population

Frank Kee

Abstract

Objectives—To examine variations in referral for coronary angiography within Northern Ireland and relate these to local death rates from coronary artery disease (ICD rubrics 410-414).

Design—A descriptive retrospective analysis of aggregate hospital activity data for 1979-88 and corresponding mortality rates in the local population.

Setting—Two regional referral hospitals and 26 local district council areas.

Patients—5173 patients aged 35-74 years with an underlying diagnosis of ischaemic heart disease, whose records contained complete information on their age, sex, and home address.

Main measures—Age-standardised angiography rates and corresponding standardised death rates derived from the registrar general's reports.

Results—Among the 26 constituent district council areas there was significant heterogeneity in the angiography rates, ranging from 62 to 335/100 000 in men and from 7 to 62/100 000 in women (likelihood ratio statistic 856 and 359 respectively). There was no significant association between these angiography rates and the local death rates from ischaemic heart disease.

Conclusion—The results suggest a non-uniform threshold for referral for angiography.

Implications—Clinicians need to examine the appropriate indications for referral for invasive investigation.

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Introduction

In the past 30 years many advances in coronary care have been pioneered in Northern Ireland. Although resources are rightly channelled into continued primary prevention programmes, a strategically focused approach that combines prevention with appropriate intervention will probably deliver maximum health gain.^{1,2} Therefore it is important for cardiological and surgical services to be balanced in the most efficient manner.³ In the United States there continues to be debate about the appropriate indications for coronary angiography,⁴ but physicians' attitudes towards the diagnosis and treatment of coronary heart disease seem to be more conservative in the United Kingdom.⁵ Over the past 10 years the number of invasive cardiological assessments performed has

grown substantially,⁶ but there is scant information on how geographical variations in mortality relate to variations in referrals for angiography and revascularisation.

Although Northern Ireland has the highest death rate from ischaemic heart disease in the United Kingdom, there is significant heterogeneity in mortality throughout the province. Geographical variations in mortality have been used widely as proxies for disease prevalence.⁷ Indeed, data from the regional heart study indicate a strong correlation between mortality and prevalence of coronary heart disease. It has been estimated that for a 10% variation in mortality there is a 15.6% difference in morbidity.⁸

The objective of this study was to describe the variations in referrals for coronary angiography and relate these to the mortality from coronary heart disease in the 26 constituent district council areas of Northern Ireland.

Methods

Northern Ireland has only two centres for invasive cardiological assessment, at the Royal Victoria and the Belfast City hospitals. These hospitals are situated only 1.6 km (1 mile) apart in Belfast, and they receive referrals for invasive assessment from all over the province. Data on all patients (aged 35-74 years) undergoing coronary angiography (Office of Population Censuses and Surveys IV) (OPCS IV) code K63: "contrast radiology of the heart") who had an underlying diagnosis of ischaemic heart disease (ICD 410-414) were obtained from the Hospital Activity Analysis files submitted by the two hospitals to the Department of Health and Social Services. The age, sex, and district council of residence was abstracted for each patient, and the number of procedures was aggregated for the 10 years between 1979 and 1988. The population structure of the 26 district council areas varies, some of the coastal regions having relatively larger "retirement" communities. Directly age-standardised angiography rates were derived for each district council area for all patients aged 35-74 years, with the Northern Ireland population as the standard. These rates were then compared with the standardised death rates for ischaemic heart disease (ICD 410-414) for the same areas.

Because of the range in population size of the district councils (for example, Belfast, the largest, has 295 223 residents and Moyle, the smallest has 14 252), Poisson regression was used to test whether significant heterogeneity existed in the angiography rates. The death

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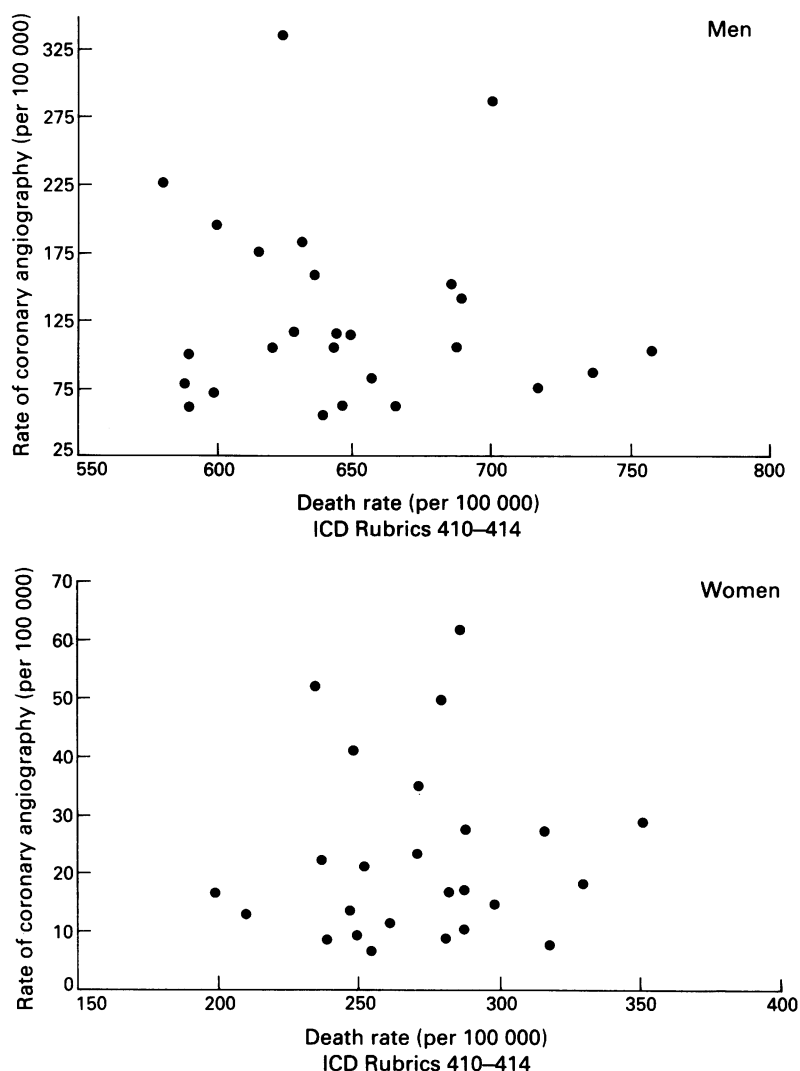


Fig 1 Relation between age-standardised death rate and angiography rates for 26 district council areas in Northern Ireland, 1979-88

rates and rates of angiography were compared with Spearman's correlation test to compare ranks. The analysis was carried out with EGRET software.

Results

During 1979-88 the Hospital Activity Analysis files had records of 7662 patients undergoing angiography, of whom 5173 had been given an underlying diagnosis of ischaemic heart disease. For these 5173 records, the patient's district council of residence was known. There was no information available for the complete study period on the number of records in

which the patient's address was unknown, but in recent years this has been less than 5%. Thus this analysis is based on the 5173 records in which the patient's age, sex, and address were known. Although there was no direct way to validate the completeness of the Hospital Activity Analysis files, there was no reason to suppose that records of residents of any specific district council would have been more or less likely to have gone uncoded.

The primary result of this study is a description of the relation between the average annual age-standardised angiography rates and death rates for the 26 district council areas in the province (summarised in figure 1). There was a greater than fivefold variation in the referral rates among men (55-335/100 000) and an eightfold range among women (7-62/100 000). Among men only one of the five districts with the highest angiography rates was among the top five with the highest death rates, and this pattern was also observed for women; conversely only one district among the five with the lowest angiography rates appeared among the five with the lowest death rates (table). The variation in angiography rates among district councils was highly significant, the likelihood ratio statistics in the Poisson regression model being 856 and 359 for men and women respectively, after fitting separately a term for age ($p < 0.001$, $df = 25$).

The correlation coefficients between the angiography rates and death rates for these 26 district council areas were -0.07 (SE 0.2, $p > 0.05$) and 0.09 (SE 0.2, $p > 0.05$) for men and women respectively. Of note is the absence of any significant association between death rates and angiography rates for either men or women.

Among the district councils there was a positive (though not significant) association between the death rates of men and women (correlation coefficient 0.29, SE 0.19, $p > 0.05$), but the rates of angiography for men and women were highly correlated (coefficient 0.84, SE 0.11, $p < 0.001$). Figure 2 illustrates this pattern of association.

Discussion

This study showed that there is very little relation between angiography rates and mortality from coronary heart disease among the 26 district councils in Northern Ireland. The province is host to one of the World Health Organisation's projects on monitoring trends and determinants in cardiovascular disease (MONICA) and from the project data it is known that area mortality within the province is a relatively good proxy for incidence of infarction. Given a uniform threshold for referral, areas with high death rates might be expected to have correspondingly high rates of angiography. The absence of such an association could have several explanations.

It might be argued that those areas with the highest angiography rates also had the populations which received relatively more cardiac surgery. This would tend to reduce the death rate for some people, thus rather than local

Districts ranking highest and lowest for angiography and death rates from coronary causes, 1979-88

Rank	Men		Women	
	Rate of referral	Death rate	Rate of referral	Death rate
1	Carrickfergus	Derry	Newtownabbey	Larne
2	Newtownabbey	Cookstown	Belfast	Derry
3	Belfast	Coleraine	Carrickfergus	Ballymoney
4	Fermanagh	Newtownabbey	Lisburn	Craigavon
5	Lisburn	Omagh	Fermanagh	Dungannon
22	Castlereagh	Castlereagh	Moyle	Coleraine
23	Limavady	North Down	Banbridge	Ards
24	Ballymena	Ballymoney	Coleraine	Belfast
25	Ballymoney	Magherafelt	Ballymoney	Castlereagh
26	Moyle	Belfast	Limavady	North Down

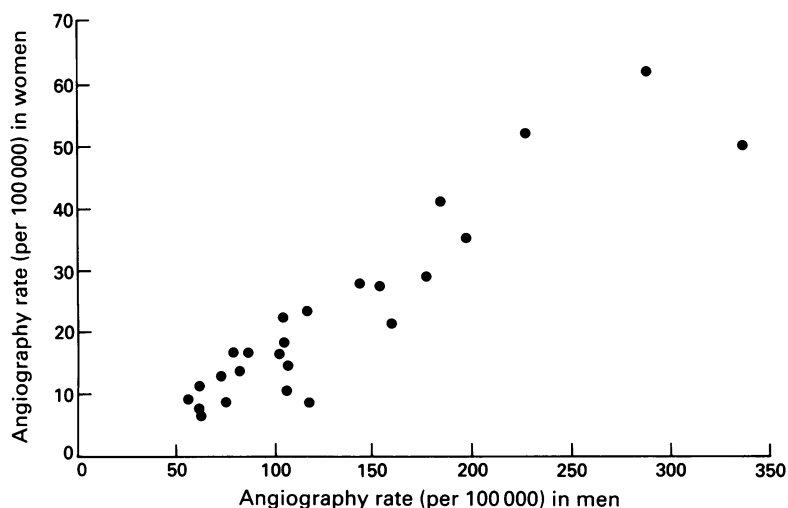


Fig 2 Relation between age-standardised angiography rates in men and women in 26 district council areas in Northern Ireland, 1979-88

mortality from heart disease being an indication for population need for angiography, it might represent the effect of referrals for angiography. Whether this effect could be so large as to explain the absence of a relation that might have been expected if local death rates were considered reasonable proxies for prevalence of disease is extremely unlikely. Despite the high death rate from ischaemic heart disease in Northern Ireland the rate of coronary artery bypass surgery during the study period averaged about 145 procedures per million⁹ (less than a third of the current recommended levels of provision). The annual total of deaths from coronary heart disease in the province outnumbered bypass procedures by nearly 10-fold over the period. In fact, the potential for cardiac surgery to lower mortality is relatively modest. The cumulative survival figures for medical and surgical therapy were 79% and 82% respectively at 10 years in the coronary artery surgery study¹⁰ and 67% versus 71% (at 12 years) in the European coronary surgery study.¹ In other words, in these randomised controlled trials surgery ultimately made a life or death difference for less than five of every 100 patients.

Another explanation for the lack of association between death rates and rates of angiography may warrant consideration. If out of hospital mortality from ischaemic heart disease varied significantly between district councils then, despite a comparable incidence of disease, some areas may have a smaller pool of patients eligible for referral. There is little direct evidence for comment on this hypothesis. The only local study of its kind compared incidence and mortality in Ballymena and Omagh district council areas and found a 13% lower mortality in Ballymena, which, unlike Omagh, had access to mobile coronary care.¹¹ However, in the present study the average annual referral rates in Omagh were more than twice those for the population of Ballymena (142 v 62 in men and 28 v 12 in women). This argument is also hard to sustain in light of the much stronger

association between men and women for angiography rates than for death rates among the district council areas.

Referrals for coronary angiography can be made either directly by general practitioners (predominantly in the greater Belfast areas) to cardiologists in one of the two "regional" centres or through physicians and cardiologists practising at peripheral hospitals. An alternative and more likely explanation for the patterns observed would be that there is a non-uniform threshold for referral for angiography. From reports predominantly from the United States it seems that differences in referral patterns for angiography can result in certain patient groups having greater access to revascularisation.¹²⁻¹⁷ In Scotland there are major differences in the rates of angiography in neighbouring health boards, with rates tending to be higher in boards with angiographic facilities and in areas of low material deprivation.^{16, 17} Clearly then, under-referral may create inequitable provision of revascularisation services especially if cardiac surgery contracts are established with an eye to existing waiting list statistics.

For all of the district council areas studied the ratio of male to female death rates was less than the corresponding ratio for angiography. Across the province as a whole these ratios were 2.5:1 and 5:1 respectively. This may reflect some relative under-referral of women and, if so, would concur with other studies.¹³⁻¹⁵ The results from these studies have not been entirely consistent, however. One study showed that among patients undergoing angiography women had significantly lower rates of severe stenoses and that after adjustment for this the rates of angiography in men and women were comparable.¹⁵ Another study reported that despite women having more severe symptoms and greater functional disability men were twice as likely to have an invasive investigation.¹³ A more detailed appraisal of case mix and severity would be required to confirm whether this was the case in Northern Ireland. In the largest study in the United States the authors remind us that it is difficult to distinguish underuse by women from overuse by men.¹⁴ In view of the relative lack of consensus on the ability to predict those patients likely to experience adverse events,^{18, 19} local clinicians may do well to examine (perhaps through medical audit²⁰) their own thresholds for referral for angiography to ensure that scarce revascularisation resources are being distributed to maximum benefit in the community.

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