mortality; the characteristics of the additional cancers detected differed both from those detected by routine screening and from interval cancers.² A randomised trial would be required to quantify the benefit of double reading definitively, but the size of the sample required to detect a significant difference would be prohibitively large.

Until now, little has been known about film reading practices in the NHS breast screening programme. We carried out a postal questionnaire survey of breast screening units in Britain in April 1995 and found that film reading and recall practices vary widely among units.³ Altogether 83% of units reported that they double read all or some of their screening films, and overall about three quarters of screening films in Britain were being double read by either two radiologists or a radiologist and a non-radiologist clinician or radiographer. The basis for decisions to recall women was inconsistent both among and within units, with some units using more than one method, including recall if recommended by only one reader, recall by consensus between both readers, and arbitration by a third reader. We also found wide variations in staffing and workload among units; in some places reading practices are dictated by a shortage of staff and inability to fill radiologist posts.

Given that double reading is widespread in the NHS breast screening programme, steps should be taken to ensure that the greatest possible benefit is derived from it in the light of our finding that there is currently little uniformity in reading practice in Britain. Although Brown and colleagues studied the first screening round in their unit, their findings provide the best evidence to date of the superiority of one method of double reading over others. Any extension to the breast screening programme, however, will have implications for staffing, training, and resources.

JANE WELLS

Senior registrar in public health medicine

Department of Public Health Medicine,
Buckinghamshire Health Authority,
Aylesbury HP19 3DP

JULIE COOKE

Consultant radiologist

Jarvis Breast Screening Centre,
Guildford GU1 1LJ

1 Brown J, Bryan S, Warren R. Mammography screening: an incremental cost effectiveness analysis of double versus single reading of mammograms. *BMJ* 1996;312:809-12. (30 March.)

2 Warren RML, Duffy SW. Comparison of single and double reading of mammograms, and change in effectiveness with experience. *Br J Radiol* 1995;68:958-62.

3 Wells J, Cooke J. Film reading practice of breast screening units. *Breast* (in press).

Endothelium dependent arterial dilatation in non-insulin dependent diabetes

Authors' finding is not new

EDITOR,—In 1992 we published a study showing that endothelium dependent and endothelium independent vasodilatation was impaired in 29 patients with non-insulin dependent diabetes compared with 21 controls matched for age and sex.¹ The vasodilator responses to acetylcholine and glyceryl trinitrate were impaired, as was arterial compliance, which was studied by waveform analysis.² We were unable to show differences between the two groups in the responses of forearm blood flow during reactive hyperaemia.¹

Jonathan Goodfellow and colleagues report similar work but used different methods to assess endothelium dependent and endothelium independent vascular responses in non-insulin dependent diabetic patients and controls.³ The

main features of this study were the low statistical power, the failure to perform the vascular measurements blind, and the use of indirect and less accurate methods of assessing endothelial and smooth muscle function.

Blood flow, vessel diameter, and distensibility are extremely difficult to measure with Doppler methods when blood flow is changing rapidly, as occurs during the hyperaemic response. In addition, most of the increases in blood flow after arterial occlusion occur during the first 20 seconds. In 12 volunteers the mean (95% confidence interval) forearm blood flow was 4.9 (3.2 to 6.5) ml/100 ml/min at baseline; the peak after release of the cuff was 30.4 (21.2 to 39.6) ml/100 ml/min, and the value 60 seconds after release of the cuff was 9.6 (6.9 to 12.3) ml/100 ml/min. Measurements performed at 60 seconds would clearly be too late for assessing acute hyperaemic responses.

Blood pressure in the finger measured by photoplethysmography cannot be assumed to be the same as pressure measured in the brachial artery. A direct measurement of blood pressure at the site of arterial dilatation is clearly required. In addition, the method of distensibility used by the authors assumes that the brachial artery is linearly elastic and that the percentage distension is the same at all pressures. This is not the case. Sublingual glyceryl trinitrate produces venodilatation, reflex tachycardia, and hypotension as well as arteriolar dilatation.

Changes in blood flow and vessel diameter therefore cannot be simply related to direct effects of the nitrate on arterial smooth muscle. This and the strong possibility of a type II statistical error may help to explain why the authors, unlike other investigators,⁴ failed to show impaired non-endothelium dependent vasodilatation in diabetic patients.

It is important that, when authors publish work, they undertake a comprehensive review of the literature and identify similar studies that have been performed. They should then refer to such studies and not give the impression that their observations are original.

G DENNIS JOHNSTON

Reader in clinical pharmacology

Department of Therapeutics and Pharmacology,
Queen's University of Belfast,
Belfast BT9 7BL

AILISH M NUGENT

Registrar in general medicine

RANDAL J HAYES

Professor of medicine

Department of Medicine,
Belfast City Hospital Trust,
Belfast BT9 7AB

GARY E MCVEIGH

Assistant professor of medicine

Department of Medicine,
University of Minnesota,
Box 741,
420 Delaware Street SE,
Minneapolis, MN 55455,
USA

1 McVeigh GE, Brennan GM, Johnston GD, McDermott BJ, McGrath LT, Henry WR, *et al*. Impaired endothelium-dependent and independent vasodilation in patients with type 2 (non-insulin-dependent) diabetes mellitus. *Diabetologia* 1992;35:771-6.

2 McVeigh GE, Brennan GM, Hayes JR, Cohn J, Finkelstein S, Johnston GD. Vascular abnormalities in non-insulin dependent diabetes mellitus identified by arterial waveform analysis. *Am J Med* 1993;95:424-30.

3 Goodfellow J, Ramsey MW, Luddington LA, Jones CJH, Coates PA, Dunstan F, *et al*. Endothelium and inelastic arteries: an early marker of vascular dysfunction in non-insulin dependent diabetes. *BMJ* 1996;312:744-5. (23 March.)

4 McVeigh GE, Brennan GM, Hayes JR, Johnston GD. Primary nitrate tolerance in diabetes mellitus. *Diabetologia* 1994;37:115-7.

Authors' reply

EDITOR,—We cited G Dennis Johnston and colleagues' work in our original manuscript, but we were asked to resubmit the paper as a short

report and so had to shorten it. We were of course aware of Johnston and colleagues' studies of non-insulin dependent diabetic patients (some with microalbuminuria). Whereas in our non-invasive study we measured flow related dilatation of a large artery, they used venous occlusion plethysmography to show a reduction in the responses of forearm blood flow to intra-arterial acetylcholine and glyceryl trinitrate¹ and waveform analysis of intra-arterial brachial artery pressure to infer a reduction in compliance of the vascular bed.²

Their criticisms of our work seem to be based on a misconception of our method.³ Our method addressed changes not in hyperaemic flow but in consequent flow mediated dilatation of the upstream brachial artery (which is maximal 45-120 seconds after release of the cuff); several workers have shown this to be mediated by nitrogen oxide and endothelium dependent. The increase in flow through the brachial artery during hand hyperaemia after release of an occluding cuff at the wrist can be used as the signal for this purpose because it is the same whether or not flow mediated dilatation of the brachial artery occurs (endothelial dysfunction in the microvessels seems to be compensated for by an increase in metabolic signal in reactive hyperaemia).

Ultrasonographic tracking of the vessel wall provides a reproducible, direct, beat to beat measure of the diameter of the brachial artery (resolution about 3 µm)³ and is an improvement on the ultrasonographic technique used in the first reported studies of this approach by Celermajer *et al* (resolution about 150 µm).⁴ It is quite different from venous occlusion plethysmography (which introduces different considerations). We used finger photoplethysmography not to provide a surrogate for the pressure waveform in the brachial artery but to measure blood pressure, pulse pressure, and heart rate.³ Our finding that the increase in the diameter of the brachial artery induced by glyceryl trinitrate was not impaired in the diabetic subjects neither supports nor conflicts with Johnston and colleagues' observations relating to the quite different variable of nitrate induced (and thus endothelium independent) increase in flow as assessed by venous occlusion plethysmography.

We believe that our data justify our conclusions.

JONATHAN GOODFELLOW

Research fellow

MARK W RAMSEY

Lecturer

CHRISTOPHER J H JONES

Lecturer

MALCOLM J LEWIS

Professor

DAVID R OWENS

Senior lecturer

ANDREW H HENDERSON

Professor

Cardiovascular Sciences Research Group and Diabetes
Research Unit,
University of Wales College of Medicine,
Cardiff CF4 4XN

1 McVeigh GE, Brennan GM, Johnston GD, McDermott BJ, McGrath LT, Henry WR, *et al*. Impaired endothelium-dependent and independent vasodilation in patients with type 2 (non-insulin-dependent) diabetes mellitus. *Diabetologia* 1992;35:771-6.

2 McVeigh GE, Brennan GM, Hayes JR, Cohn J, Finkelstein S, Johnston D. Vascular abnormalities in non-insulin-dependent diabetes mellitus identified by arterial waveform analysis. *Am J Med* 1993;95:424-30.

3 Ramsey MW, Goodfellow J, Jones CJH, Luddington LA, Lewis MJ, Henderson AH. Endothelial control of arterial distensibility is impaired in chronic heart failure. *Circulation* 1995;92:3212-9.

4 Celermajer DS, Sorenson KE, Gooch VM, Spiegelhalter DJ, Miller OJ, Sullivan ID, *et al*. Non-invasive detection of "endothelial dysfunction" in children and adults at risk of atherosclerosis. *Lancet* 1992;340:1111-5.