

### What is already known on this topic

Involving health service users in the NHS is recommended in UK government policy

Involving users in mental health services is generally seen as worthwhile, but the effects of involving users have not been thoroughly evaluated, and few attempts to draw evaluations together have been made

### What this study adds

The few comparative studies of users' involvement that have been published indicate that involving users as employees, trainers, or researchers has no negative effect on services and may be of benefit

the United States and were confined to a case management model. Government policy in the United Kingdom strongly supports the development of involving users in the delivery and evaluation of mental health services. Little evidence exists on the effectiveness of such programmes, and more formal evaluations are needed.

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## Assessment of neurocognitive impairment after off-pump and on-pump techniques for coronary artery bypass graft surgery: prospective randomised controlled trial

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### Abstract

**Objective** To assess neurocognitive impairment after the off-pump and on-pump techniques for coronary artery bypass graft surgery in patients with triple vessel disease.

**Design** Randomised controlled trial.

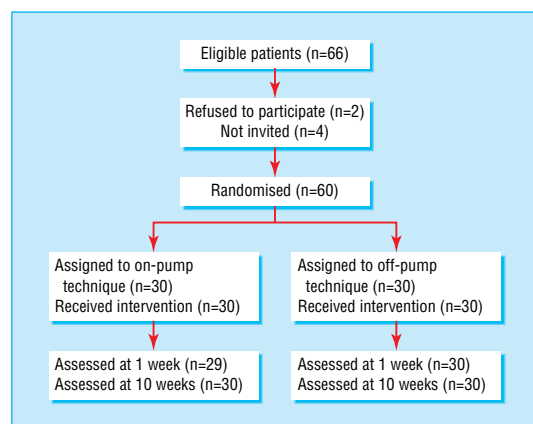
**Setting** University Hospital of Wales, Cardiff.

**Participants** 60 patients undergoing coronary artery bypass graft surgery for triple vessel disease prospectively randomised to the off-pump or on-pump technique.

**Main outcome measures** Change in scores in nine standard neuropsychometric tests administered preoperatively and at 1 and 10 weeks postoperatively.

**Results** The on-pump group showed a significantly greater deterioration in scores for two and three tests at 1 week and 10 weeks postoperatively, respectively, than the off-pump group. The on-pump group also showed a significantly higher incidence of major deterioration in one of the tests both 1 week and 10 weeks postoperatively. The incidence of neurocognitive impairment at 1 week postoperatively was 27% (8 out of 30) in the off-pump group and 63% (19 out of 30) in the on-pump group ( $P=0.004$ ); and at 10 weeks postoperatively was 10% (3 out of 30) in the off-pump group and 40% (12 out of 30) in the on-pump group ( $P=0.017$ ).

**Conclusion** Off-pump coronary artery bypass graft surgery results in less neurocognitive impairment than the on-pump technique.



Flow of participants through trial

## Introduction

Neurological injury is an important complication after coronary artery bypass graft surgery. It comprises two types.<sup>1</sup> Type 1 injury includes stroke, transient ischaemic attack, and coma (incidence 3 to 6%). Type 2 injury is more subtle and includes impairment of cognitive function. These are defects associated with attention, concentration, short term memory, fine motor function, and speed of mental and motor responses. The incidence of neurocognitive impairment after cardiac surgery varies from 20% to 80%.<sup>2-5</sup> These defects are not always transient, and longitudinal assessment studies have shown a major impairment at 5 years<sup>6,7</sup>; impairment immediately after surgery has been shown to correlate with long term impairment.<sup>7</sup> Recent work has focused on the role of cardiopulmonary bypass in neurocognitive impairment, but the literature is inconclusive.<sup>5,8-10</sup>

We aimed to assess the impact of the on-pump and off-pump techniques on neurocognitive impairment in patients undergoing coronary artery bypass graft surgery for triple vessel disease. In recent years coronary artery bypass graft surgery without using cardiopulmonary bypass (off-pump technique) has been shown to be a reliable and reproducible technique, and both short and medium term results have been favourable.<sup>11,12</sup>

## Methods

### Patient selection

We enrolled 60 patients undergoing urgent or elective coronary artery bypass graft surgery for triple vessel disease between May and October 2001 (figure). We excluded patients with a greater than 50% carotid artery stenosis, recent myocardial infarction (within one month), previous transient ischaemic attack or cerebrovascular attack, previous psychiatric illness, renal failure, or those who needed emergency operation, reoperation, or combined valvular surgery.

The anaesthetic technique was standardised and all patients received the same medication. The operations were performed by one surgeon (VZ). The surgical technique was standardised, the left internal mammary artery being attached to the left anterior descending artery, and vein grafts to the other coronary arteries as appropriate in all patients. In both groups the top end anastomoses were constructed with the help of a side biting clamp. The only difference between the two

groups was the use of cardiopulmonary bypass. Cardiomyotomy suction was not used in the on-pump group. In both groups the cell saver was used.

### Neuropsychometric assessment and primary outcome variable

We carried out nine neuropsychometric tests to assess the patients both preoperatively and at 1 week and 10 weeks postoperatively. The battery of tests included the core tests according to the recommendations of the statement of consensus on assessment of neurobehavioural outcomes after cardiac surgery.<sup>13</sup> We estimated the premorbid full scale IQ by using the national adult reading test.<sup>14</sup>

The primary outcome variable was the change in scores at 10 weeks from preoperative levels. We considered a patient to have major deterioration in a particular test if the score deteriorated by 1 SD of the baseline score of all patients.<sup>15</sup> We considered a patient to have neurocognitive impairment if there was a major deterioration in two or more tests.<sup>15</sup>

## Results

Both groups were similar for age, sex, angina class, left ventricle function, and extent of coronary artery disease, and they had a similar number of grafts. Neither group had any deaths, major neurological complications, or perioperative myocardial infarctions (based on electrocardiographic evidence only). Intubation time and length of hospital stay were shorter in the off-pump group than in the on-pump group but did not reach significance. Significantly fewer patients in the off-pump group required blood transfusion. Both groups had similar baseline scores for the neuropsychometric tests and full scale IQ.

One patient in the on-pump group was not tested 1 week postoperatively because of tiredness and loss of motivation. All patients were tested 10 weeks postoperatively. At 1 week postoperatively the on-pump group showed a significantly greater deterioration in scores in the grooved pegboard test using the non-dominant hand and the digit symbol substitution test than the off-pump group. At 10 weeks postoperatively the on-pump group showed a significantly greater deterioration in part B of the trail making test, the grooved pegboard test using the dominant hand, and the digit symbol substitution test.

One week postoperatively two patients (7%) in the off-pump group and 14 patients (48%) in the on-pump group showed a deterioration of 1 SD or more in the grooved pegboard test using the non-dominant hand ( $P=0.001$ ; table). Ten weeks postoperatively no patient in the off-pump group and six patients (20%) in the on-pump group showed a deterioration of 1 SD or more in the grooved pegboard test using the dominant hand ( $P=0.03$ ).

Patients were considered to have neurocognitive impairment if they showed a deterioration of 1 SD or more in two or more tests. One week postoperatively eight patients (27%) in the off-pump group and 19 (66%) in the on-pump group ( $P=0.004$ ) had neurocognitive impairment. Ten weeks postoperatively three patients (10%) in the off-pump group and 12 (40%) in the on-pump group ( $P=0.017$ ) had neurocognitive impairment.

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Percentage of patients in each group who had deterioration  $\geq 1$  standard deviation in individual tests at 1 week and 10 weeks postoperatively

Test	1 week postoperatively				10 weeks postoperatively			
	Off-pump (n=30)	On-pump (n=29)	Difference		Off-pump (n=30)	On-pump (n=30)	Difference	
			%	95% CI			%	95% CI
Rey auditory verbal learning test	13.3	34.5	21.2	(-0.7 to 41.0)	10.0	23.3	13.3	(-6.1 to 32.1)
Part A of trail making test	26.7	44.8	18.2	(-6.0 to 39.8)	6.7	16.7	10.0	(-7.4 to 27.6)
Part B of trail making test	23.3	44.8	21.5	(-2.6 to 42.6)	10.0	30.0	20.0	(-0.5 to 39.0)
Grooved pegboard test using dominant hand	13.3	31.0	17.7	(-3.7 to 37.6)	0	20.0	20.0	(4.5 to 37.3)*
Grooved pegboard test using non-dominant hand	6.7	48.3	41.6	(19.3 to 59.6)*	3.3	16.7	13.3	(-2.9 to 30.5)
Digit symbol substitution test	6.7	24.1	17.5	(-1.4 to 36.1)	3.3	13.3	10.0	(-5.6 to 26.6)
Digit span forward test	10.0	27.6	17.6	(-2.7 to 36.9)	0	10.0	10.0	(-3.1 to 25.6)
Digit span backward test	6.7	20.7	14.0	(-4.2 to 32.4)	0	0	0	(-11.4 to 11.4)
Controlled oral word association test	6.7	27.6	20.9	(1.4 to 39.7)*	3.3	10.0	6.7	(-8.2 to 22.5)

\*Excludes 0.

## Discussion

The incidence of neurocognitive impairment after coronary artery bypass graft surgery varies noticeably between studies.<sup>2-4 15</sup> This is because of variations in the tests used, the time points of assessment, the definition of impairment, and the statistical methods used for comparing groups.<sup>15</sup>

We found significantly less neurocognitive impairment 1 week and 10 weeks after off-pump coronary artery bypass graft surgery for patients with triple vessel disease. Previous studies have shown equivocal results. One prospective randomised study found increased concentrations of S100 protein, a marker of neurological injury, in the on-pump group, but no difference in neurocognitive impairment.<sup>10</sup> The definition of neurocognitive impairment was, however, unclear. More than 60% of patients recruited in that study had single or double vessel disease. Another study found a higher concentration of serum S100 protein, a higher number of high intensive transient signals picked up by transcranial Doppler, and an increased incidence of neurocognitive impairment in the on-pump than off-pump group.<sup>8</sup> This was a randomised study including 40 patients. The neuropsychological assessment was limited to the preoperative period and 1 week postoperatively, and the tests used did not conform to the consensus statement.<sup>13</sup> In one randomised controlled trial, neurocognitive outcome was assessed in 281 patients, using 10 neuropsychometric tests.<sup>5</sup> Improved cognitive outcomes were found in the off-pump group at 3 months, but the effects were limited and became negligible at 12 months. A significant proportion of the patients in this study had single and double vessel disease, and anaesthetic management differed between the groups.

### Strengths of study

Our study had several strengths: we included 91% of eligible patients, operations were performed by one surgeon, and we standardised anaesthetic and surgical factors that might lead to cerebral injury. Both groups also underwent the same surgical procedure, and we included only patients with triple vessel disease. No cross over occurred. None of the patients in the off-pump group required conversion to on-pump surgery. Follow up was 100%. We are thus confident that cardiopulmonary bypass was the only major difference between our groups.

### Limitations of study

Although a single surgeon operating in a single hospital, with standardisation of the anaesthetic and surgical

## What is already known on this topic

Neurocognitive impairment after coronary artery bypass graft surgery occurs in a major proportion of patients

Cardiopulmonary bypass has been implicated, but the evidence is inconclusive

## What this study adds

Off-pump coronary artery bypass graft surgery results in less neurocognitive impairment than the on-pump technique

techniques allows reproducibility of findings, generalisability is affected. Our patients were assessed only at 1 week and 10 weeks postoperatively; future studies need to incorporate longer term follow up.

Cardiopulmonary bypass has been implicated in the pathogenesis of neurocognitive impairment. Various mechanisms are responsible, including hypoperfusion during cardiopulmonary bypass, venous hypertension due to manipulation of the heart during surgery, emboli originating from the cardiopulmonary bypass circuit and the ascending aorta, and systemic inflammatory response syndrome leading to cerebral swelling and an increase in the permeability of the blood-brain barrier.<sup>16-21</sup>

Neuropsychometric testing and the measurement of serum levels of biochemical markers (S100 $\beta$  and neurone specific enolase) are two ways of measuring neurological injury. Neuropsychometric tests assess specific domains of the brain, whereas the serum markers assess global injury. Two studies showed an association between neurocognitive impairment and S100 $\beta$  and neurone specific enolase levels.<sup>13 14</sup> Others have found no such association.<sup>10 22</sup> At present, comprehensive neuropsychometric tests need to be administered to assess neurocognitive impairment.

We found one notable difference between our patient population and those in other studies. The average IQ of our patients was 115, higher (107 and 108) than in other studies.<sup>9 19</sup> It is possible that the slightly higher incidence of neurocognitive impairment in our patients could be related to a higher pre-morbid IQ. One study found a higher composite neurocognitive score at baseline to be a significant predictor of change in the composite cognitive index.<sup>6</sup>

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## Application of Framingham risk estimates to ethnic minorities in United Kingdom and implications for primary prevention of heart disease in general practice: cross sectional population based study

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### Abstract

**Objective** To compare the 10 year risk of coronary heart disease (CHD), stroke, and combined cardiovascular disease (CVD) estimated from the Framingham equations.

**Design** Population based cross sectional survey.

**Setting** Nine general practices in south London.

**Population** 1386 men and women, age 40-59 years, with no history of CVD (475 white people, 447 south Asian people, and 464 people of African origin), and a subgroup of 1069 without known diabetes, left ventricular hypertrophy, peripheral vascular disease, renal impairment, or target organ damage.

**Main outcome measures** 10 year risk estimates.

**Results** People of African origin had the lowest 10 year risk estimate of CHD adjusted for age and sex (7.0%, 95% confidence interval 6.5 to 7.5) compared

with white people (8.8%, 8.2 to 9.5) and south Asians (9.2%, 8.6 to 9.9) and the highest estimated risk of stroke (1.7% (1.5 to 1.9), 1.4% (1.3 to 1.6), 1.6% (1.5 to 1.8), respectively). The estimate risk of combined CVD, however, was highest in south Asians (12.5%, 11.6 to 13.4) compared with white people (11.9%, 11.0 to 12.7) and people of African origin (10.5%, 9.7 to 11.2). In the subgroup of 1069, the probability that a risk of CHD  $\geq$  15% would identify risk of combined CVD  $\geq$  20% was 91% in white people and 81% in both south Asians and people of African origin. The use of thresholds for risk of CHD of 12% in south Asians and 10% in people of African origin would increase the probability of identifying those at risk to 100% and 97%, respectively.

**Conclusion** Primary care doctors should use a lower threshold of CHD risk when treating mild uncomplicated hypertension in people of African or south Asian origin.



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