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- Morgane PJ, Austin-LaFrance R, Bronzino J, Tonkiss J, Diaz-Cintra S, Cintra L, et al. Prenatal malnutrition and development of the brain. *Neurosci Biobehav Rev* 1993;17:91-128.
- Osofsky HJ. Relationships between nutrition during pregnancy and subsequent infant and child development. *Obstet Gynecol Surv* 1975;30:227-41.
- Winick M, Rosso P, Brasel JA. Malnutrition and cellular growth in the brain: existence of critical periods. In: *Lipids, malnutrition and the developing brain*. New York: Associated Scientific Publishers, 1972:199-206.
- Morgane PJ, Austin-LaFrance R, Bronzino JD, Tonkiss J, Galler JR. Malnutrition and the developing nervous system. In: Isaacson R, Jensen K, eds. *The vulnerable brain and environmental risks*. Vol 1. *Malnutrition and hazard assessment*. New York: Plenum Press, 1992:3-44.
- Dobbing J. Vulnerable periods in brain growth and somatic growth. In: Roberts DF, Thomson AM, eds. *The biology of human fetal growth*. London: Taylor and Francis, 1976:137-47.
- Winick M, Noble A. Cellular response in rats during malnutrition of various ages. *J Nutr* 1966;89:300-6.
- Smart JL. Early life malnutrition and later learning ability: a critical analysis. In: Oliverio A, ed. *Genetics, environment and intelligence*. Amsterdam: Elsevier/North Holland Biomedical Press, 1977:215-35.
- Gorman KS, Pollitt E. Relationship between weight and body proportionality at birth, growth during the first year of life and cognitive development at 36, 48, and 60 months. *Infant Behavior and Development* 1992;15:279-96.
- Davies PA, Stewart AL. Low-birth-weight infants: neurological sequelae and later intelligence. *Br Med Bull* 1975;31:85-91.
- Villar J, Smeriglio V, Martorell R, Brown CH, Klein RE. Heterogeneous growth and mental development of intrauterine growth-retarded infants during the first 3 years of life. *Pediatrics* 1984;74:783-91.
- Rabbitt P, Donlan C, Bent N, McInnes L, Abson V. The University of Manchester age and cognitive performance research centre and north-east age research longitudinal programmes, 1982 to 1997. *Zeitschrift für Gerontologie* 1993;26:176-83.
- Horn JL, Cattell RB. Age differences in fluid and crystallized intelligence. *Acta Psychol (Amst)* 1967;26:107-29.
- Foulds GA, Raven IC. Normal changes in the mental abilities of adults as age advances. *Journal of Mental Sciences* 1948;94:133-42.
- Rabbitt P. Applied cognitive gerontology: some problems, methodologies and data. *Applied Cognitive Psychology* 1990;4:225-46.
- Rabbitt P. Does it all go together when it goes? The nineteenth Bartlett memorial lecture. *Q J Exp Psychol (A)* 1993;46:385-434.
- Barker DJP, ed. *Fetal and infant origins of adult disease*. London: BMA Publishing, 1992.
- Barker DJP. *Mothers, babies, and disease in later life*. London: BMJ Publishing, 1994.
- Barker DJP, Bull AR, Osmond C, Simmonds SJ. Fetal and placental size and the risk of hypertension in adult life. *BMJ* 1990;301:259-62.
- Barker DJP, Osmond C, Winter PD, Simmonds SJ, Margetts B. Weight in infancy and death from ischaemic heart disease. *Lancet* 1989;iii:577-80.
- Osmond C, Barker DJP, Winter PD, Fall CHD, Simmonds SJ. Early growth and death from cardiovascular disease in women. *BMJ* 1993;307:1519-24.
- Cooke RWI, Lucas A, Yudkin PLN, Pryse-Davies J. Head circumference as an index of brain weight in the fetus and newborn. *Early Hum Dev* 1977;1/2:145-9.
- Nelson KB, Deutschberger J. Head size at one year as a predictor of four-year IQ. *Dev Med Child Neurol* 1970;12:487-95.
- Kline J, Stein Z, Susser M. *Conception to birth—epidemiology of prenatal development*. New York: Oxford University Press, 1976.
- Fancourt R, Campbell S, Harvey D, Norman AP. Follow-up study of small-for-dates babies. *BMJ* 1976;ii:1435-7.
- Warshaw JB. Intrauterine growth retardation: adaptation or pathology? *Pediatrics* 1985;6:998-9.
- Scherjon SA. *The brain-sparing effect*. Amsterdam: University of Amsterdam, 1993.(PhD thesis.)
- Campbell S, Thoms A. Ultrasound measurement of the fetal head to abdomen circumference ratio in the assessment of growth retardation. *Br J Obstet Gynaecol* 1977;84:165-74.
- Stein Z, Susser M. The Dutch famine, 1944-1945, and the reproductive process. I. Effects on six indices at birth. *Paediatric Research* 1975;9:70-6.
- Stein Z, Susser M, Saenger G, Marolla F. *Famine and human development: the Dutch hunger winter of 1944/45*. Oxford: Oxford University Press, 1975.
- Berk LE. *Child development*. Boston: Allyn and Bacon, 1991.
- Cravioto J, DeLicardie E. Environment and nutrition deprivation in children with learning difficulties. In: Cruickshank W, Hallahan D, eds. *Perceptual and learning disabilities in children*. Vol 2. *Research and theory*. Littleton, MA: Publishing Sciences Group, 1975:3-102.
- Holland CA, Rabbitt P. The course and causes of cognitive change with advancing age. *Reviews in Clinical Gerontology* 1991;1:81-96.

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Perioperative myocardial infarction in peripheral vascular surgery

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The commonest major complication in patients undergoing peripheral vascular surgery is perioperative myocardial infarction.¹ No study in Britain has prospectively assessed this risk, but a recent retrospective study found an incidence of 6.3% in patients undergoing aortic surgery.² We report the incidence of perioperative myocardial infarction in our unit, which is a regional centre for peripheral vascular surgery.

Patients, methods, and results

We studied consecutive patients undergoing peripheral vascular surgery after excluding those who were undergoing surgery for trauma, venous surgery, and minor procedures. Patients thought to be at high risk of perioperative myocardial infarction were referred to a cardiologist for further preoperative assessment. Concentrations of creatinine kinase MB isoenzymes were measured (by Imx STAT) for the first three days after surgery, and electrocardiograms were recorded on admission, on discharge from hospital, and at doctors' discretion. Because the concentration of creatinine kinase MB isoenzyme may be raised by skeletal muscle ischaemia, myocardial infarction was diagnosed only when a raised total creatinine kinase concentration was associated with an MB subunit concentration of >10 ng/ml and a ratio of MB

subunit to total creatinine kinase of ≥5%. Cardiac death was defined as death unequivocally related to myocardial infarction, heart failure, or arrhythmia. The primary end points of our study were myocardial infarction or cardiac death within 30 days of surgery. We performed statistical analysis with the χ^2 test or, when appropriate, Fisher's exact test.

The 191 patients included in our study (128 men, median age 65, and 63 women, median age 70) underwent 204 operations, of which 100 were elective procedures, 70 were urgent (requiring surgery within the same hospital admission), and 34 were emergency (requiring surgery within 24 hours). Ninety one of the operations were carried out for critical ischaemia, 32 were aortic procedures, and 120 patients (of the 182 in whom data were available) had preoperative evidence of ischaemic heart disease.

The overall incidence of perioperative myocardial infarction and cardiac death was 7.3%—6% for those undergoing elective or urgent procedures and 12% for those undergoing emergency surgery. Table 1 gives details of the six myocardial infarctions and eight cardiac deaths that occurred. Four of the non-fatal infarctions were clinically silent. Two patients had surgery performed under regional anaesthesia (amputation and brachial embolectomy), while the rest had a general anaesthetic. Three patients were submitted to necropsy, which showed subendocardial infarction in two patients and transmural infarction (probably preceding surgery) in the other. The factors associated with perioperative myocardial infarction were age over 70 ($\chi^2=4.642$, $P=0.03$), sex ($\chi^2=3.989$, $P=.05$), perioperative shock (Fisher's exact test $\chi^2=6.949$, $P=0.05$), and angina (Fisher's exact test $\chi^2=7.317$, $P=0.008$).

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Table 1—Details of patients undergoing peripheral vascular surgery who sustained perioperative myocardial infarction

		Infarction		
Patient's age	Operation (class)	Time*	Associated signs	Risk factors†
Non-fatal infarction				
64	Carotid (elective)	1	Angina, electrocardiographic changes	High blood pressure, ischaemic heart disease
78	Femoropopliteal (elective)	1	Silent (electrocardiographic signs of bundle branch block)	Ischaemic heart disease, smoker, age
65	Ileofemoral graft and operative sympathectomy (urgent)	0	Silent (electrocardiographic signs of bundle branch block)	Ischaemic heart disease, cerebrovascular accident, diabetes
69	Below knee amputation (urgent)	2	Silent	High blood pressure, diabetes
81	Below knee amputation (urgent)	0	Silent	Ischaemic heart disease, high blood pressure, cerebrovascular accident, age
66	Abdominal aortic aneurysm repair (emergency)	0	Angina, electrocardiographic changes, bradycardia	Perioperative shock, ischaemic heart disease, smoker
Fatal infarction				
65	Abdominal aortic aneurysm repair (elective)	2	Left ventricular failure, subendocardial myocardial infarction on necropsy	Ischaemic heart disease, high blood pressure, cerebrovascular accident
63	Abdominal aortic aneurysm repair (elective)	11	Left ventricular failure, electrocardiographic changes	Ischaemic heart disease, high blood pressure, perioperative shock
73	Femoral-femoral crossover (elective)	4	Left ventricular failure, subendocardial myocardial infarction on necropsy	Ischaemic heart disease, high blood pressure, age, smoker
71	Ileofemoral graft and operative sympathectomy (urgent)	4	Angina, electrocardiographic changes	Ischaemic heart disease, high blood pressure, cerebrovascular accident, age
90	Below knee amputation (urgent)	13	Left ventricular failure	Ischaemic heart disease, high blood pressure, age
72	Abdominal aortic aneurysm repair (emergency)	3	Left ventricular failure, electrocardiographic changes	Ischaemic heart disease, perioperative shock, smoker, age
75	Abdominal aortic aneurysm repair (emergency)	0	Cardiogenic shock	Ischaemic heart disease, perioperative shock, age
89	Brachial embolectomy (emergency)	0	Cardiac arrest, transmural myocardial infarction on necropsy	Ischaemic heart disease, smoker, age

*No of days after peripheral vascular surgery.

†Age >70 years; high blood pressure; previous transient ischaemic attack or cerebrovascular accident; diabetes; current smoker; perioperative shock; ischaemic heart disease (angina, previous myocardial infarction, or abnormal electrocardiographic results).

Comment

This is the first prospective study in Britain to assess the incidence of perioperative myocardial infarction in patients undergoing peripheral vascular surgery. Infarction is clinically silent in about 30% of patients,³ as we found, and is fatal in 50%.⁴ Perioperative cardiac events were not restricted to patients obviously at high risk: myocardial infarctions occurred in patients undergoing elective non-aortic surgery as well as in those undergoing repair of ruptured aortic aneurysm. We found angina to be a strong predictor of risk, but previous myocardial infarction was not. Reviews have confirmed age, diabetes, and heart failure at operation as the only consistent predictors of risk,⁵ but larger studies with better design might shed more light on this.

We found an overall rate of perioperative myocardial infarction of 7.3%, which remained substantial at 6% if

we excluded patients undergoing emergency surgery. This implies that further attempts at risk stratification are justified. We urgently require studies to ascertain the best methods of preoperative stratification in order to minimise the risks of vascular surgery.

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- 1 Mamode N, Cobbe SM, Pollock JG. Infarcts after surgery. *BMJ* 1995;310:1215-6.
- 2 Kalra M, Charlesworth D, Morris JA, Al-Khaffaf H. Myocardial infarction after reconstruction of the abdominal aorta. *Br J Surg* 1993;80:28-3.
- 3 Taylor LM, Yeager RA, Moneta GL, McConnell DB, Porter JM. The incidence of perioperative myocardial infarction in general vascular surgery. *J Vasc Surg* 1991;15:52-61.
- 4 Mangano DT. Perioperative cardiac morbidity. *Anaesthesiology* 1990;72:153-84.
- 5 Wong T, Detsky AS. Preoperative cardiac risk assessment for patients having peripheral vascular surgery. *Ann Intern Med* 1992;116:743-53.

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Risk factors for sudden infant death syndrome: further change in 1992-3

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We described the change in risk factors for sudden infant death syndrome in three East Anglian health districts in 1992, one year after a campaign to reduce the risk of cot death.¹ Fewer babies slept on their fronts, though most new born babies were still put on their sides, not their backs; mothers were more aware of overheating; the incidence of smoking did not change, though more mothers claimed that no one smoked near the baby; and breast feeding rates were similar. We noticed that in the first quarter of 1992 32% of babies slept on their backs compared with 47% in the fourth quarter ($P<0.03$). This suggested a further change with time, and as the advice was receding into the past we

reviewed infant care in December 1993, two years after the campaign, to see if the change continued.

Subjects, methods, and results

The data for 1992 were collected by questionnaires sent to randomly selected mothers of babies born normally at term in Cambridge, Huntingdon, or Bury St Edmunds after the campaign and when their baby was 6 months old. About equal numbers of babies were chosen from each month and hospital, and about 90% of mothers responded. Similar questionnaires were also sent to mothers of 6 month old babies born in December 1993, two years after the television campaign. They were enrolled from the same districts. Of 615 questionnaires posted, 524 (85%) were suitable for analysis.

Mothers in the two datasets had similar maternal age, parity, and education. There was a slight social class difference. Regression analysis showed that these factors did not significantly affect the baby's sleeping position. χ^2 Tests and t tests were used to analyse the data. The results are shown in table 1.