Vascular Society of Great Britain and Ireland

The following abstracts are from the papers presented to the 41st Vascular Society Annual Scientific Meeting of the Vascular Society of Great Britain and Ireland, held in Edinburgh, UK on 22–24th November 2006. The President of the Society, Mr John Wolfe was in the Chair. The BJS Prize was won by Mr MJ Bown, and the Founder's Prize was won by Mr GS McMahon. Both winners were from the University of Leicester, Leicester, UK. Abstracts from papers presented at the prize sessions are published in the print edition of BJS (vol 94: issue 2, February 2007).

The abstracts should be cited as in the following example:
Stewart AHR, Eyers PS, Earnshaw JJ. Systemic antibiotics prevent graft and wound infection in peripheral bypass surgery; a systematic review and meta-analysis. *Br J Surg* 2007; **94**(Suppl1): 4.

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Cathepsins and the activation of MMPs in the wall of abdominal aortic aneurysms (AAAs)

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Objective: Cathepsins are potent cysteine proteases that can degrade elastin in the aortic wall. They can activate other proteases such as MMPs contributing to aneurysm formation and expansion. The aim of this study was to determine the protein expression and activity of cathepsins and their inhibitors in AAA and aortic occlusive disease (AOD). We also examined their relationship with matrix metalloproteinase-9 activity.
Method: Aortic wall was obtained from patients with AAA ($n = 82$), and AOD ($n = 13$). The protein expression and activity of cathepsins B, H, K, L and S, and cystatins A, B, and C were measured by ELISA and specific fluorogenic substrates. MMP-9 activity was measured by bioimmunoassay.
Results: AAA wall had lower cystatin C levels ($P = 0{\cdot}03$) and higher levels of cathepsin H protein ($P = 0{\cdot}007$) compared with AOD. The activity of cathepsins B, H, L, and S was significantly greater in AAA than AOD. In AAA wall, MMP-9 activity was positively correlated with cathepsin L activity (Pearson $r = 0{\cdot}42$, $P < 0{\cdot}0001$) and negatively correlated with cystatin C levels (Pearson $r = -0{\cdot}75$, $P < 0{\cdot}0001$).
Conclusion: There is evidence of an imbalance between the activity of cysteine proteases and cystatin C in the aneurysmal wall. There is also evidence of a relationship between both cystatin C and cathepsin L, and activation of a major matrix-remodelling enzyme, MMP-9.

Abdominal aortic aneurysms and circulating endothelial progenitor cells

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Objective: Endothelial progenitor cells (EPCs) are circulating stem cells mobilised in response to vascular injury. They home to sites of injury where they re-endothelialise vessels or contribute to angiogenesis by forming new blood vessels. Angiogenesis is implicated in the development and rupture of AAA, stimulated by ischaemia and vascular endothelial growth factor (VEGF), both potent mobilisers of EPCs. This study tested the hypothesis that circulating EPCs are increased in patients with AAA.
Method: Peripheral blood mononuclear cells were isolated from patients with AAA ($n = 25$) and age-matched controls ($n = 18$). Flow cytometry was used to identify EPCs using progenitor cell markers CD34+ and CD133+. Endothelial differentiation potential was tested by culturing CD133+ cells and determining expression of the endothelial cell markers, von Willebrand Factor (vWF) and vascular endothelial cell adhesion molecule (VE-cadherin) using immunofluorescence. In addition, circulating pro-angiogenic cytokines VEGF, MMP-9, MCP-1 and G-CSF were measured using ELISA.
Results: CD34+/CD133+ cells (% total events) were higher in the AAA group compared to controls (2·4% *versus* 1·3%, $P = 0{\cdot}008$). Following culture these cells expressed endothelial markers vWF and VE-cadherin. Circulating VEGF was higher in the AAA group (33 pg/ml *versus* 18 pg/ml, $P = 0{\cdot}002$), with no significant differences in MMP-9 ($P = 0{\cdot}25$) and MCP-1 ($P = 0{\cdot}14$). G-CSF was higher in the controls (9·7 pg/ml *versus* 6·8 pg/ml, $P = 0{\cdot}03$).
Conclusion: These data suggest that EPCs are mobilised in patients with AAA, perhaps due to a systemic rise in certain pro-angiogenic factors. It remains to be determined whether EPCs contribute to AAA growth or repair, but they may provide a future therapeutic target.

Identification of biomarkers associated with expansion and rupture of abdominal aortic aneurysms by proteomic analysis

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Objective: Only approximately half of large abdominal aortic aneurysm (AAA) would have ruptured, if they were left unoperated, but even small AAA rupture occasionally. A more nuanced indication for surgery would be relevant. The aim of this study was to identify potential biomarkers associated with AAA rupture.
Method: Serum and abdominal aortic wall material from 12 cases of ruptured AAA and 12 cases of asymptomatic AAA were used. Asymptomatic cases had undergone surveillance in the Viborg Aneurysm Screening Study, and were referred to surgery because of expansion to above 5 cm in maximal diameter. Mean annual expansion rate was calculated. Samples were analysed for protein composition by two-dimensional gel electrophoresis. Image analysis was used to detect protein spots, which were significantly regulated at least 1·5-fold in ruptured AAA samples compared with asymptomatic AAA. Significantly associated spots were excised for attempted identification by mass spectrometry. Wilcoxon's rank sum test and Spearman's correlation analysis were used for statistical analyses.
Results: Seven proteins were differentially regulated by at least 1·5-fold in wall material from patients with ruptured AAA compared with asymptomatic AAA. Three proteins have been identified: two down-regulated, vitronectin and gamma-fibrinogen, and one up-regulated, peroxiredoxin-2. Gamma-fibrinogen in serum correlated with AAA expansion rate (Spearman's $r = 0{\cdot}649$).

Conclusion: The proteomic composition of wall material differs from patients with ruptured and asymptomatic AAA. The identified proteins suggest that the changes in AAA wall are due to inflammation, oxidative stress, and destruction and weakening of extracellular matrix.

Serum markers of brain injury to assess sub-clinical morbidity of CEA and CAS: no difference detected

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Objective: To follow S-100ß, neuron-specific enolase (NSE), and glial fibrillary acidic protein (GFAP) – markers of cellular brain injury – in patients undergoing carotid endarterectomy (CEA) and carotid artery stenting (CAS).
Method: Fifty-two patients with internal carotid artery (ICA) stenosis were recruited. Twenty-four patients underwent CAS, and 28 underwent CEA. Transcranial Doppler was performed, recording middle cerebral artery (MCA) velocity and high intensity transient signals (HITS) on the operated side. Serum was drawn pre-operatively, post-declamp/embolic protection device (EPD) retrieval, and 6, 12, 24 and 48 hours postoperatively, then assayed using commercial equipment.
Results: Fifty-two procedures were performed successfully. CEA was associated with a greater change in mean ipsilateral MCA velocity ($-25{\cdot}5\%$ *versus* $+2{\cdot}7\%$, $P < 0{\cdot}0001$), and CAS with greater numbers of HITS (mean 239 *versus* 42, $P = 0{\cdot}028$), despite routine use of an EPD. S-100ß levels rose non-significantly in both groups, while NSE levels declined. S-100ß and NSE rose significantly ($P < 0{\cdot}05$) in those patients with a postoperative neurological deficit (CEA = 3, CAS = 1). GFAP concentrations remained unchanged in all patients.
Conclusion: Patients who did not have a postoperative neurological deficit had no significant changes in S-100ß, NSE or GFAP, irrespective of treatment group. The observed protein changes may represent only a transient impairment of the blood-brain barrier. Transcranial Doppler findings suggest that the cause of postoperative neurological deficits may be increased peri-operative hypoperfusion or embolisation, or a combination. Studies to determine the nature of HITS during CAS, the effect of different cerebral protection devices, and the significance of these observations are recommended.

Is arterial stiffness a good predictor of systemic vascular disease in claudicants?

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Objective: Aortic pulse wave velocity (PWV), the current gold standard measure of stiffness, is an independent predictor of all-cause cardiovascular mortality. Patients suffering with peripheral vascular disease (PVD) are at a higher risk of cardiovascular events compared to age-matched healthy controls. We therefore hypothesised that PWV should be higher in PVD patients than in age-matched healthy controls, and be related to ankle brachial pressure index (ABPI).
Method: We studied 47 (mean age $71 \pm 7{\cdot}1$) patients, 15 women and 32 men having claudication diagnosed on history and confirmed with ankle brachial pressure index (mean ABPI $0{\cdot}56 \pm 0{\cdot}24$) and 97 age-matched controls (mean age $71 \pm 7{\cdot}1$), 30 women and 67 men. Supine blood pressure, heart rate and aortic and brachial PWV were derived using sequential carotid/femoral waveform recordings and the transit time calculated of the R wave of a simultaneously recorded ECG as a reference frame (SphygmoCor).
Results: Mean ± SD aortic PWV in those with PVD was significantly higher compared with healthy age-matched controls ($12{\cdot}1$ m/s $\pm 4{\cdot}2$ *versus* $9{\cdot}5$ m/s $\pm 1{\cdot}8$, $P < 0{\cdot}001$). The corresponding values for brachial PWV were $8{\cdot}6$ m/s $\pm 1{\cdot}9$ and $8{\cdot}2$ m/s $\pm 1{\cdot}2$, $P = 0{\cdot}3$. The difference in aortic PWV persisted after correction for age, gender, blood pressure and smoking status. Amongst the claudicants no relationship was seen between ABPI and PWV.
Conclusion: The increased aortic stiffness provides a possible explanation for the increased cardiovascular events seen in PVD patients.

Can objective assessment of functional capacity predict length of critical care or hospital stay in abdominal aortic aneurysm (AAA) surgery?

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Objective: Prediction of peri-operative risk for patients undergoing AAA surgery remains challenging. Pre-operative functional capacity may help predict risk. Anaerobic threshold (AT) and clinical evaluation of metabolic equivalents (METs) provide objective and subjective assessments of functional capacity, respectively. Our aim was to determine if a correlation existed between these two predictors of functional capacity and length of critical care/hospital stay.
Method: We made a prospective, blinded, ongoing observational study of 48 patients with AAAs attending our vascular pre-assessment clinic. Clinical evaluation of METs (by a consultant vascular anaesthetist) was followed by measurement of AT using cardiopulmonary exercise (CPX) testing. Patients subsequently underwent open or endovascular (EVAR) aneurysm repair.
Results: Twenty-seven patients underwent open repair and 21 EVAR. Median critical care/hospital stay was 4/10 and 1/3 days for open and EVAR groups, respectively. Mean AT ($10{\cdot}43$ *versus* $12{\cdot}01$ ml/min/kg) and mean predicted METs score ($5{\cdot}1$ *versus* $4{\cdot}3$) were similar for both open and EVAR groups, respectively. There was no significant correlation between length of critical care or hospital stay and measured AT or METs score for either group. There was a significant correlation between measured AT and predicted METs score ($r = 0{\cdot}4$, $P < 0{\cdot}01$).
Conclusion: These interim results suggest that thorough clinical pre-operative assessment may be as accurate in prediction of functional capacity as CPX testing. Despite this, neither measurement appears to accurately predict length of critical care or hospital stay following open aneurysm repair or EVAR. These results confirm the ongoing challenge clinicians face with peri-operative risk prediction in vascular surgery.

Endothelin-1 promotes proliferation and angiogenesis via the ETB receptor

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Objective: Endothelin-1 (ET-1) has potent vasoconstrictor and mitogenic properties. We have previously demonstrated ET-1 expression around areas of neovascularisation in critically ischaemic human skeletal muscle. This study aims to investigate the angiogenic role of ET-1 and the ET-1 receptor (ETR) subtypes, ETAR and ETBR, on human microvascular endothelial cells (HMEC-1).
Method: Cell proliferation-HMEC-1 were incubated in low-serum ($0{\cdot}5\%$) conditions with varying ET-1 concentrations. After 24 hours the cells were harvested and counted in a haemocytometer. The impact of selective blockade of the ETR was assessed by the addition of either bosentan (both ETAR and ETBR antagonists), BQ788 (ETBR antagonist), BQ123 (ETAR antagonist) and IRL-1620 (ETBR agonist). To perform *in vitro* angiogenesis assays, morphometric capillary tube formation was measured by culturing HMEC-1 on growth factor reduced matrigel. Vessel growth was investigated using rat aortic ring assay.
Results: ET-1 enhances *in vitro* proliferation of HMEC-1 in a dose-dependent manner ($P < 0{\cdot}001$). Bosentan alone attenuates HMEC-1 proliferation to below control levels ($P < 0{\cdot}015$) and had a dose-dependent inhibitory effect on ET-1 proliferation ($P < 0{\cdot}03$). The attenuation of proliferation appears to be a property of the ETBR ($P < 0{\cdot}001$). ET-1 significantly enhanced angiogenesis ($P < 0{\cdot}02$), whilst BQ788 suppressed endogenous angiogenesis ($P < 0{\cdot}04$). BQ123 had no effect. BQ788 and IRL-1620 attenuated and enhanced ET-1-mediated angiogenesis, respectively (both $P < 0{\cdot}05$).
Conclusion: The data suggest that ET-1 may be an important autocrine growth factor in stimulating angiogenesis, mediated by ETBR, unlike ET-l's effect on vasomotor tone, which is known to be ETAR-dependent. This

may benefit patients with peripheral vascular disease, where selective ETAR antagonism might promote vasodilatation while preserving angiogenesis.

Decreased cellular telomere content is observed locally and systemically in abdominal aortic aneurysms

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Objective: Accumulation of DNA damage with decreased cellular telomere content is associated with increased cardiovascular risk. Critically low telomere content induces inappropriate gene expression and resistance to mitosis. Despite the high incidence of abdominal aortic aneurysms (AAA) in the elderly, there is little knowledge of AAA telomere content. This study addressed the relationship between AAA and telomeric content both locally and systemically.
Method: Infrarenal aortic biopsies were obtained from the normal aorta (n-A) of organ donors ($n = 18$) and electively repaired AAA ($n = 18$); mean age n-A = 64 ± 4·7, AAA = 65 ± 3·4, $P = 0·201$. Matched blood samples were taken from 12 normal and 11 AAA patients. Cellular telomere content (T) of biopsy and blood samples were quantified using quantitative real-time PCR and expressed relative to the single copy gene (S) – acidic ribosomal phosphoprotein. Analysis used *t*-tests, Pearson's correlation and Fischer's exact test ($P < 0·05$).
Results: Comparing biopsies, telomere content was significantly lower in AAA (AAA = 1·4 ± 0·4, n-A = 2·3 ± 0·6, $P < 0·0001$). Comparing blood samples, telomere content was also significantly lower in AAA (AAA = 0·8 ± 0·2, n-A = 1·3 ± 0·4, $P = 0·007$). The correlation for telomere content between paired biopsy and blood samples was high (AAA $r = 0·739$, $P = 0·036$; n-A $r = 0·738$, $P = 0·037$). Within this model, taking a cut-off of 1·05 (T/S) the positive predictive value for an AAA was 0·77, sensitivity = 0·9, specificity = 0·75.
Conclusion: A localised and systemic reduction in telomere content was observed in AAA patients compared with age-matched normal controls. The significant correlation between biopsy and blood levels supports a systemic process. These data present a pathway for aneurysm pathogenesis related to DNA damage rather than gene mutations.

Effect of anaesthetic method on cerebrovascular reactivity (CVR) in the early period following carotid endarterectomy (CEA): a transcranial Doppler (TCD) study

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Objective: It is believed that cerebral autoregulation is impaired when CEA is performed under general anaesthesia (GA) but preserved by local anaesthesia (LA). However, the effect of anaesthetic type on CVR immediately postoperatively is unknown (impairment might promote hyperperfusion syndrome). Further, although previous studies show that impaired CVR improves within 5–180 days of CEA, the timing of this change is unknown. This study assesses early changes in CVR after CEA.
Method: CVR to CO_2 was assessed < 24 h pre-CEA (GA $n = 14$, LA $n = 18$) and 24–48 h post-surgery. Ipsilateral mean middle cerebral artery velocity (MCAV) was measured (TCD) with simultaneous end-tidal CO_2 recording during normocapnia, hypercapnia and hypocapnia. CVR was calculated as percentage change in MCAV/kPa change in end-tidal CO_2.
Results: LA and GA groups were matched for baseline characteristics including the incidence of unilateral and bilateral carotid disease. For all patients there was no difference between median [IQR] pre- and postoperative CVR (%kPa-1): 15·87 [11·88–21·32] *versus* 16·67 [13·73–20·51], $P = 0·654$. Similarly, change in CVR (ΔCVR) postoperatively was no different between LA and GA patients: 1·10 [−0·90–3·39] *versus* −0·59 [−6·23–3·28], $P = 0·156$. CVR improved significantly in six patients (2 GA, 4 LA) with impaired pre-operative CVR (< 11·5%kPa-1) by 48 h: 8·64 [3·04–10·66] *versus* 13·19 [10·98–20·99], $P = 0·028$ with a greater ΔCVR compared to other patients: 3·14 [2·15–15·55] *versus* −0·26 [−4·27–1·87], $P = 0·006$.
Conclusion: These results show that post-CEA CVR is unaffected by anaesthetic type and that the anticipated improvement in CVR in patients in whom it is impaired pre-operatively occurs within 24–48 h.

Peak wall stress and matrix metalloproteinases in abdominal aortic aneurysms; is there an association?

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Objective: Matrix metalloproteinase (MMP)-8 and 9 levels are elevated at sites of AAA rupture. AAA finite element analysis (FEA) identifies the site of peak wall stress (PWS), which correlates with site of rupture. We aimed to compare levels of MMP-2, 8 and 9, and their inhibitors TIMP-1 and 2, at sites of PWS and arteriotomy.
Method: 3D reconstruction of AAA CT scans was performed in patients scheduled for elective AAA repair, which were analysed with FEA software (Ansys 7·1) to identify site and value of PWS. AAA wall samples were taken from the site of PWS and the arteriotomy, snap frozen and analysed for total and active MMP-2, 8 and 9 and TIMP-1 and 2 using ELISA. Statistical analysis was with SPSS 11·5, using the paired *t*-test.
Results: Twenty-one patients (median age 74 years, IQR 71-77), were recruited with a median AAA diameter of 5·8 (IQR 5·5–6·3) cm, and median PWS 0·92 (IQR 0·75–1·08) MPa.

		PWS site	Arteriotomy site	*P* value
MMP-2	Active	3·96 (0·7)	2·3 (0·4)	0·11
	Total	24·2 (5·3)	20·8 (4·6)	0·43
MMP-8	Active	10·3 (3·8)	6·5 (1·9)	0·34
	Total	29·6 (6·9)	21·2 (5·4)	0·08
MMP-9	Active	4·7 (3·7)	0·8 (0·2)	0·29
	Total	19·5 (10·7)	9·1 (1·7)	0·35
TIMP-1	Total	460 (80·8)	292 (51)	0·07
TIMP-2	Total	23·6 (3·7)	16·1 (2·2)	0·08

Conclusion: Geometric variation in PWS may stimulate the accelerated proteolysis (elevated MMP-8) that precipitates AAA rupture and the elevation in TIMP-1 and 2 may represent an attempt to contain this process.

The inhibitory effect of carbon monoxide-releasing molecule (CORM-3) on thrombin-interferon-induced neuro-inflammation is potentiated by blockade of PI3-K and partially by ERK pathway

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Objective: In recent years, CORM-3 has been used to investigate the anti-inflammatory activities of CO gas but very little is known about the mechanism/s behind such effect. Recent studies have shown the involvement of mitogen-activated protein kinase (MAPK) pathways: P38, JNK, ERK and PI3-K in the brain tissue response to inflammation and ischaemia. In this study, we examined the interactions of CORM-3 with MAPK pathways in modulating thrombin-interferon-γ induced inflammation in BV-2 cells.
Method: BV-2 microglia were treated with P38 inhibitor SB203580 (10 μM), JNK inhibitor SP600125 (25 μM), ERK inhibitor PD98059 (25 μM) and PI3-K inhibitor LY294002 (25 μM) in serum-free medium for 1 h. Then cells were exposed for 24 h to complete medium containing thrombin (10 u/ml) plus IFN-γ (10 ng/ml) and CORM-3 (75 μM). At the end of the incubation period, the anti-inflammatory action was evaluated by assessing the effect on nitric oxide production and tumour necrosis factor-α (TNF-α) release.
Results: CORM-3 (10–75 μM) did not show any cytotoxicity and dose-dependently reduced thrombin-interferon-induced inflammation in BV-2 microglia. PI3-K inhibition augmented CORM-3 anti-inflammatory activity as evidenced by a significant reduction ($P < 0·05$) (one-way ANOVA/Bonferroni) in NO production and TNF-α release, while P38 and JNK inhibition did

not have a significant effect. On the other hand, ERK inhibition selectively augmented the CORM-3 effect on TNF-α release but not NO production.
Conclusion: CORM-3 can modulate neuroinflammation through a distinct mechanism that can be favourably augmented by the existing neuromodulatory agents which increases our ability to ameliorate the inflammatory response in various neurological disorders including stroke.

Omega-3 fish oil improves walking distance in patients with peripheral arterial disease (PAD)

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Objective: Fish oil (omega-3 PUFAs) reduces the risk of cardiovascular disease and re-infarction. Inflammation plays an important role in atherosclerosis and fish oil has anti-inflammatory properties. Fish oil has been shown to improve carotid plaque morphology, but not in all subjects. We postulated a genetic influence on response related to TNF-α production. We attempted to show that fish oil supplementation would improve clinical outcome in patients with PAD and that their response would be related to genotype.
Method: Men aged ≥ 45 years had dietary supplementation of 6 g/day MaxEPA for 12 weeks. Subjects with diabetes, uncontrolled hypertension, chronic inflammatory conditions or malignancy were excluded from the trial. Blood samples and clinical measurements were taken pre and post-supplementation. Walking distance was assessed on a treadmill, supervised.
Results: In the group of 64 males we demonstrated a mean increase in total walking distance of 85 m, 160·6 ± 21·8 m before fish oil *versus* 245·8 ± 34·9 m after fish oil ($P \leq 0{\cdot}01$). The ABPI increased, before fish oil 0·5985 ± 0·0169, after fish oil 0·776 ± 0·02994 ($P < 0{\cdot}001$). Increase in walking distance was dependent on genotypes for the pro-inflammatory genes TNF-α and IL-1ß and anti-inflammatory gene IL-10, but not for lymphotoxin-α of IL-6 genes. No genotypes examined affected ABPI.
Conclusion: Fish oil improves walking distance and ABPI in patients with PAD. The outcome for walking distance appears to be dependent on certain genotypes and this can be used to direct therapy to patients that are most likely to benefit.

Systemic antibiotics prevent graft and wound infection in peripheral bypass surgery; a systematic review and meta-analysis

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Objective: To assess the effect of prophylactic measures in preventing infection in patients undergoing peripheral arterial reconstruction.
Method: Randomized controlled trials of interventions intended to reduce or eliminate infection in peripheral arterial surgery were sought using the search strategy described by the Cochrane Review Group on Peripheral Vascular Diseases. The methodological quality of relevant studies was assessed, and wound infection and early graft infection data extracted. Meta-analyses were performed using RevMan 4·2·7 software.
Results: Thirty-four randomized controlled trials were included comprising 22 trials of prophylactic systemic antibiotics, three of rifampicin-bonded grafts, three of pre-operative skin antisepsis, two of vacuum wound drainage, two of minimally invasive *in situ* techniques, and individual trials of intra-operative glove change and wound closure techniques. Prophylactic systemic antibiotics reduced the risk of wound infection (RR fixed 0·25, 95% c.i. 0·17, 0·38) and early graft infection in a fixed effects model (RR fixed 0·31, 95% c.i. 0·11, 0·85, $P = 0{\cdot}02$). Antibiotic prophylaxis for greater than 24 h appears to be of no added benefit (RR fixed 1·28, 95% c.i. 0·82, 1·98). Rifampicin bonding to Dacron grafts did not reduce graft infection at either 1 month (RR fixed 0·63, 95% c.i. 0·27, 1·49) or 2 years (RR fixed 1·05, 95% c.i. 0·46, 2·40). Vacuum groin wound drainage (RR fixed 0·96 95% c.i. 0·50, 1·86) and pre-operative bathing or shower regimen with antiseptic agents (RR 0·97, 95% c.i. 0·70, 1·36) have neither a detrimental or beneficial effect.
Conclusion: Prophylactic systemic antibiotics should be given for all peripheral arterial reconstructions.

Ankle brachial pressure index correlates with platelet activity in patients with peripheral arterial disease

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Objective: Ankle brachial pressure index (ABPI) is an independent predictor of subsequent cardiovascular events. Similarly, platelet activation has been shown to be increased in patients with peripheral vascular disease (PAD) and have been implicated in the pathogenesis of acute thrombotic events. We aimed to assess the relationship between ABPI and platelet activation.
Method: ABPI was assessed in 204 patients with PAD. Platelet function was assessed by: (1) flowcytometric P-selectin expression and fibrinogen binding (both without and with ADP stimulation *ex vivo*) and (2) rapid platelet function assay (RPFA), using the agonists arachidonic acid (AA) and thrombin receptor activation (TRAP).
Results: The median ABPI was 0·54 (0·16–1·0). All patients were on aspirin and statin therapy. A significant inverse correlation (Spearman's test) existed between ABPI and ADP-stimulated P-selectin expression ($r = -0{\cdot}228$, $P = 0{\cdot}003$) and ABPI and TRAP ($r = -0{\cdot}179$, $P = 0{\cdot}04$). Platelets of patients with ABPI < 0·6 have a significantly higher ADP-stimulated P-selectin expression (median 41·3%, [0·65–76·10]) in comparison to those with ABPI > 0·6 (median 34·7%, [0·74–63·1]), $P = 0{\cdot}001$. Fibrinogen binding correlated with AA-induced platelet aggregation ($r = 0{\cdot}218$, $P < 0{\cdot}007$), but neither of these markers correlated with ABPI.
Conclusion: This is the first study to assess the relationship between platelet activation (flow cytometry and aggregation) with ABPI. Our results have shown that patients with more severe peripheral artery disease have increased platelet activation, suggesting the need for more potent antiplatelet therapy in these patients.

The effects of supervised exercise training on skeletal muscle oxygen metabolism in claudicants

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Objective: Supervised exercise is an effective treatment for intermittent claudication, although its mechanism of action remains unclear. Exercise may induce adaptive changes in local calf muscle oxygen metabolism rather than any increase in limb blood flow. This study used near-infrared spectroscopy to seek evidence of improved oxygen utilisation by exercising calf muscle following supervised exercise training in claudicants.
Method: Twenty-nine claudicants were recruited to a 3-month supervised exercise programme, following a control period of exercise advice alone. Changes in maximum walking distance (MWD) and quality of life were recorded. A spectrophotometer was used to monitor changes in oxygen saturation and in oxyhaemoglobin concentration in subjects' gastrocnemius muscle following both treadmill exercise and a period of thigh cuff-induced ischaemia-hyperaemia (a measure of oxyhaemoglobin influx independent of metabolic demand). Data are expressed as a median with inter-quartile range.
Results: MWD improved by 107% after exercise training ($P < 0{\cdot}01$). Peak exercise oxygen de-saturation was similar before and after training (24·4[11·5] *versus* 22·5[9·7]; $P = 0{\cdot}178$). Training improved the rate of oxyhaemoglobin recovery following fixed workload exercise by 14% ($P < 0{\cdot}03$), indicating an increase in oxidative capacity. In contrast, the rate of oxyhaemoglobin recovery in the hyperaemic phase following thigh cuff-induced ischaemia did not increase after training ($P = 0{\cdot}474$), suggesting no increase in local muscle perfusion.
Conclusion: This study confirms that supervised exercise is an effective treatment for claudication and is associated with increased oxidative capacity in calf muscle during recovery from exercise. This increase in oxidative capacity is likely to result from improved local oxygen metabolism rather than increased limb blood flow.

Validation of a new, non-invasive automated peripheral arterial disease assessment device based on discrete near infrared spectroscopy

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Objective: We validated a new near infrared spectroscopy-based device (PoDX), which utilises both pulsatile arterial blood volume and skin colour changes in the foot using a simple functional test, for the assessment of peripheral arterial disease (PAD).
Method: Twenty-four diabetic and 40 non-diabetic patients and seven age-matched orthopaedic controls, were studied (141 legs). All underwent resting ankle brachial pressure index (rABPI) and duplex ultrasound angiography (DUA – assessed by modified Rutherford score) by a vascular technologist. Results were compared with DUA as the gold standard.
Results: In diabetics significant correlations between rABPI and DUA score ($r = -0{\cdot}81$, $n = 60$, $P < 0{\cdot}01$), PoDX and DUA ($r = -0{\cdot}68$, $n = 61$, $P < 0{\cdot}01$) and PoDX and rABPI ($r = 0{\cdot}65$, $n = 60$, $P < 0{\cdot}01$) were found. In non-diabetics similar significant correlations between rABPI and DUA ($r = -0{\cdot}79$, $n = 94$, $P < 0{\cdot}01$), PoDX and DUA ($r = -0{\cdot}70$, $n = 94$, $P < 0{\cdot}01$) and PoDX and rABPI ($r = 0{\cdot}72$, $n = 94$, $P < 0{\cdot}01$) were found. ROC curve analysis revealed in diabetics rABPI and PoDX sensitivity and specificity of 80% and 93%, and 83% and 71%, respectively. Non-diabetics showed rABPI and PoDX sensitivity and specificity of 89% and 87%, and 90% and 78%, respectively.
Conclusion: These interim results confirm PoDX gives good PAD discrimination in non-diabetics and diabetics. Furthermore, it appears to offer a graded index of disease severity. PoDX may be a useful primary care automatic screening method which does not have the skilled operator requirements and subjectivity issues associated with ABPI.

Management of meningococcal septicaemia and purpura fulminans – a multidisciplinary approach

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Objective: To assess surgical interventions in children with purpura fulminans complicating meningococcal disease (MD).
Method: All admissions to PICU between 1994 to 2004 with a diagnosis of MD were identified using a prospectively collected departmental database. Those who required surgical intervention during their acute admission had their case notes reviewed.
Results: Eight hundred and fifty patients were identified, of which 411 (48%) were classified as having severe disease (Glasgow Meningococcal Septicaemia Prognostic Score [GMSPS] > 8). Fifty-two (13%) were referred to surgeons because of vascular complications and these case notes were reviewed. The median predicted mortality of this group determined by the Paediatric Risk of Mortality (PRISM) score was 76% (range 2–100). Observed mortality was 10/52 (19%) with six deaths prior to any intervention being performed. 14/52 (27%) survived with limb loss. 7/52 (13%) had compartment syndrome requiring fasciotomy and 9/52 (17%) had skin infarctions. Of the amputations, 9/14 (64%) were bilateral BKA (two of whom also lost a forearm). Of the remainder (5), two lost a lower leg and three lost a forearm.
Conclusion: This large study from a tertiary referral centre suggests a multidisciplinary approach and close collaboration between paediatric and surgical specialties optimised treatment and outcome of these patients in the acute phase of MD. Survival in this study was dramatically better than predicted so that significantly more children are left with the devastating complications of MD requiring amputation and skin grafting. Close collaboration of surgeons and paediatricians is essential to improve long-term morbidity.

The significance of 6 weeks scan in infra-inguinal vein bypass graft surveillance

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Objective: Duplex surveillance of infra-inguinal vein grafts is associated with significant utilisation of resources. We sought to assess if the natural history of vein graft stenosis can be determined by the findings of the first postoperative duplex scan.
Method: Patients who underwent infra-inguinal vein graft bypass from January 2000-December 2005 were enrolled into a duplex surveillance program. Grafts were categorised into those with no significant lesion, mild stenoses, intermediate stenoses and critically stenosed grafts based on duplex findings at the first scan. Disease progression, intervention rates and graft patency were compared.
Results: Three hundred and sixty-four infra-inguinal vein grafts in 352 patients were followed-up for a median duration of 23 months (range: 2–60). Two hundred and thirty-six grafts (64·8%) did not have significant stenosis at 6 weeks. These grafts had a 40-month cumulative patency rate of 82% and limb salvage rate of 93%. One hundred and twenty-eight grafts (35·2%) presented with stenosis at 6 weeks, of which 29 were critical stenoses, 57 were intermediate stenoses and 42 grafts had mild lesions. Of the 29 critical stenoses, 15 were repaired, 11 occluded, and three did not change. Thirty-two intermediate lesions progressed to critical stenosis, nine occluded, two were repaired and 14 did not change or improved. Sixteen grafts with mild stenosis progressed to a higher degree of stenosis, four occluded, and 22 did not change or improved. No significant difference was observed in graft patency and limb salvage rates between grafts that had their stenotic lesions repaired and grafts with no significant stenosis. Untreated critical vein graft stenoses had significantly lower patency and limb salvage rates ($P < 0{\cdot}001$ and $P < 0{\cdot}01$, respectively).
Conclusion: An early postoperative duplex scan can predict the natural history of vein graft lesions and may be used to determine the frequency and duration of follow-up.

The impact of endovascular aneurysm repair on vascular training

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Objective: Surgical training in the United Kingdom is undergoing major changes, with endovascular aneurysm repair (EVAR) being a realistic alternative to open repair of abdominal aortic aneurysms (AAA). The aim of this study is to examine the effects of EVAR on vascular training.
Method: Retrospective analysis of a prospectively collected computerised database between the period of 1991 and 2001.
Results: The total arterial workload has been relatively constant over 10 years, with an average of 60 elective open AAA repair per year (range between 45 to 81), of which an average of 27 elective cases (range between 2 to 37) per year were operated on by trainees with consultant supervision. Since 2001, our institution has seen a dramatic decrease in open infrarenal aortic aneurysm surgery with an expansion in EVAR. The percentage of open repairs has steadily declined from 100% in 1991, to 91% in 1995, to 62% in 2002, and 34% in 2005. In the first 6 months of 2006, out of a total of 54 elective infrarenal aortic aneurysms, only three cases were repaired with open surgery.
Conclusion: With trainees performing a decreasing number of elective open procedures, this expanding endovascular trend has serious potential consequences for vascular training in open aortic surgery. Conversely, the necessity for training in EVAR is essential. There are very few endovascular training posts in the United Kingdom and this issue needs to be addressed urgently.

A modular aorto-uni-iliac endovascular stent graft provides surgeons with a method for rapid exclusion of acute symptomatic and ruptured abdominal aortic aneurysms

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Objective: Endovascular repair (EVAR) of acute symptomatic and ruptured abdominal aortic aneurysm (rAAA) can be difficult without a large stock of suitable graft sizes. We report a prospective European multicentre study of a modular aorto-uni-iliac stent graft.

Methods: Seven centres, with elective EVAR experience, participated in the study. Sixty-five patients were enrolled from September 2002 to April 2005. Some 45 patients had rAAA and 20 were acutely symptomatic. Their median age was 74 (69–80·3) years and 49 (75%) were men. From a choice of four body and four limb sizes, stent grafts were deployed under local or general anaesthesia.
Results: The endovascular delivery system was introduced and the aneurysm excluded from the circulation in a median of 40 (30–60) min from the first incision. The median operative duration was 150 (120–190) min, blood loss 300 ml (200–800) and 175 ml (140–220) contrast was used. Thirty-three (51%) operations were performed by a vascular surgeon alone and 32 (49%) by a team of vascular surgeon and interventional radiologist. There were a total of four (6%) peri-operative interventions, endovascular ($n = 1$), open ($n = 2$) and thrombectomy ($n = 1$). There were two Type I endoleaks, both requiring intervention and six Type II endoleaks (no intervention). The overall peri-operative mortality was 31%. Two patients died after EVAR for an acute symptomatic aneurysm and 18 following rAAA.
Conclusions: Aorto-uni-iliac stent grafts provide rapid exclusion of rAAA. Suitably trained surgeons can do the operation without a radiologist's support. The mortality rate from rAAA treated with EVAR remains high.

Can fenestrated endovascular repair (F-EVAR) of juxtarenal aortic aneurysms be justified?

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Objective: To evaluate the safety and mid-term outcome of F-EVAR.
Method: Between February 2003 and July 2006, 40 patients (median age 73 years; range 53–85) underwent primary (36) or secondary (4) F-EVAR of a juxtarenal aortic aneurysm (JAA). All were fit for open surgery (ASA I/II 12; III 25; IV 3). Median aneurysm diameter was 69 mm (55–100 mm). Customised fenestrated Zenith (Cook) stent grafts were employed in all cases, incorporating between one and four (median 3) fenestrations to preserve flow into renal (68), superior mesenteric (31) and/or coeliac (2) arteries. Seventy-two target vessels (TV) were stented (56 bare, 16 covered).
Results: Aneurysms were successfully isolated in all cases with preservation of all TV. One accessory renal vessel was lost. One patient died after 5 days (myocardial infarction) and one after 3 months (multi-organ failure secondary to athero-embolism). One patient has refused follow-up. The remaining 37 patients have been followed for a median of 20 months (1–42 months). All aneurysms are stable or shrinking. There have been no late ruptures, conversions to open repair or graft-related endoleaks. Five patients have required secondary intervention (superior mesenteric angioplasty – one, iliac angioplasty – one, cuff extension – one, limb extension – two). Two target vessels have occluded without clinical sequelae for a primary TV patency of 98%. There have been three late deaths (malignant disease – two, pancreatitis – one).
Conclusion: F-EVAR enables successful treatment of JAA with low risk of early and late complications and represents a viable alternative to high-risk open surgery.

Endovascular, not open repair, should be used in the fittest patients: the application of fitness scoring to EVAR trial patients

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Objective: To determine: whether a validated fitness score can be applied to discriminate between patients considered fit (EVAR trial 1) or unfit (EVAR trial 2) for open abdominal aortic aneurysm repair; and whether fitter patients benefit from having open rather than endovascular repair in EVAR trial 1.
Method: Various published validated fitness scores were considered and the Customised Probability Index (CPI) was selected with a modified version applied to all patients entered into EVAR trials 1 and 2. Propensity analysis was performed to test whether CPI components could predict entry into either trial. Tests of interaction between CPI scores and randomized group (logistic and Cox regression models) were used to investigate the combined effect of fitness and type of AAA repair on elective 30-day operative mortality and 4-year survival.
Results: Propensity analysis showed that all components of the CPI were significant predictors of allocation into the EVAR 1 or EVAR 2 trials. Scores were calculated for all patients (range − 25 to 43) with a mean (SD) CPI score of 3·6 (9·3) for 1252 EVAR 1 patients and 10·0 (11·3) for 404 EVAR 2 patients; the t-test P-value for difference between trials, $P < 0{\cdot}0001$. EVAR 1 patients were classified into three groups of good fitness ($n = 579$, mean CPI − 4·2), moderate fitness ($n = 331$, mean CPI 5·7) and poor fitness ($n = 338$, mean CPI 15·1) with missing scores for four patients. Although 30-day operative mortality favoured EVAR only in the good fitness group (1·0% EVAR, 4·1% open repair; odds ratio 0·24, 95% c.i. 0·07–0·87), the test of interaction across all fitness scores was not significant, $P = 0{\cdot}363$. For longer-term mortality, there was no convincing benefit for either treatment across the spectrum of fitness scores, test of interaction $P = 0{\cdot}281$.
Conclusion: Use of the CPI showed a clear discrimination of fitness between EVAR trials 1 and 2 with all components strongly predicting entry into either of the trials. The benefit of EVAR *versus* open repair was greatest in the fittest patients. There is no evidence for the hypothesis that the fittest patients benefit from open rather than endovascular surgery.

Duplex ultrasound scanning is reliable in the detection of endoleak following endovascular aneurysm repair

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Objective: Endovascular aneurysm repair (EVAR) is becoming increasingly popular and has been shown to produce lesser mortality rates than open aneurysm repair. However, long-term follow-up is necessary and the expense of repeated scans may limit the availability of this technique. Duplex ultrasound scanning is much cheaper than computed tomography (CT) and can be useful in the detection of complications such as endoleak. This study investigated the use of duplex ultrasound scanning (DUSS) in the routine follow-up of patients following EVAR.
Method: Imaging was reviewed for 310 consecutive patients undergoing EVAR at a single centre. There were 244 paired concurrent DUSS and CT scans which were used for further analysis. These modalities were compared with respect to sensitivity, specificity, positive and negative predictive values and level of agreement (using Kappa statistics) using CT as the gold standard.
Results: DUSS proved to be highly specific in the detection of endoleak (90%); however, the sensitivity compared with CT was poor (34%). Positive predictive values ranged from 33–100% but negative predictive values were more reliable with values of 99–100%. No high-risk leaks requiring intervention were missed on DUSS.
Conclusion: Although DUSS is not as sensitive as CT scanning in the detection of endoleak, no leaks requiring intervention were missed on DUSS in this study. DUSS is much cheaper than CT and avoids high doses of radiation. DUSS is a valuable resource for follow-up after EVAR and can reduce the need for repeated CT scans and the cost which this entails.

VBHOM: a data economic model for predicting outcome after abdominal aortic aneurysm (AAA) repair

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Objective: Vascular surgical audit requires robust validated tools that compensate for case mix. Complex models increase the likelihood of missing or incomplete data. VBHOM (Vascular Biochemistry and Haematology Outcome Models) uses a minimum dataset to model outcome. This study aimed to test a VBHOM model on a patient cohort undergoing open elective and emergency AAA repair.
Method: A binary logistic regression model of risk of in-hospital mortality was built from the 2002–2004 submissions to the National Vascular Database (NVD) using all records ($n = 2718$). The subset of NVD data items used

were urea, sodium, potassium, haemoglobin, white cell count, gender, age and mode of admission. The model was applied prospectively, using the Hosmer-Lemeshow methodology, to a test set of abdominal aortic aneurysm data, which were not part of the original training set used to develop the model.

Results: The validation set contained 331 patients (elective AAA = 212; ruptured AAA = 119). Outcome following elective and ruptured AAA repair could be described accurately using the same model. The overall mean predicted risk of mortality was 13·9%, predicting 46 deaths. Actual number of deaths was 57 ($\chi^2 = 8{\cdot}98$, 10 d.f., $P = 0{\cdot}534$; no evidence of lack of fit). The model also demonstrated good discrimination (c-index = 0·833).

Conclusion: The VBHOM approach has the advantage of using simple, objective clinical data that are easy and feasible to collect routinely. The VBHOM data items potentially allow the surgeon to predict risk in an individual patient before surgery.

Knee-length graduated compression stockings for thromboprophylaxis in air travellers: a meta-analysis

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Objective: The objective of this meta-analysis was to systematically review the randomized controlled trials that have evaluated the efficacy of knee-length graduated compression stockings for thromboprophylaxis in air travellers.

Method: After electronic database search the randomized controlled trials on passengers of long haul flights were selected according to specific criteria and were analysed to generate summative data.

Results: Nine randomized controlled trials studying participants using class I knee-length stockings were analysed. Forty-six of 1261 (3·64%) participants randomized to a control group developed DVT, compared with two of 1237 (0·16%) in the knee-length stockings group. The weighted risk difference was −0·034 indicating the absolute difference in the incidence of DVT in favour of knee-length stockings 3·4% (95% c.i., 2·3%–4·5%; z = 6·05, $P < 0{\cdot}001$). Therefore, the number needed to treat with knee-length stockings to avoid one case of DVT was 29·4. However, there was significant heterogeneity among different trials ($\chi^2 = 32{\cdot}5$, d.f. = 8, $P < 0{\cdot}001$). The relative risk for DVT in high-risk participants was 0·08 (95% c.i.0·02–0·34, $\chi^2 = 0{\cdot}60$, d.f. = 1, z = 3·42, $P < 0{\cdot}0006$) and for low/medium-risk participants was 0·14 (95% c.i. 0·03–0·79, $\chi^2 = 0{\cdot}08$, d.f. = 2, z = 2·23, $P < 0{\cdot}03$).

Conclusion: Class I knee-length stockings are effective for thromboprophylaxis in air travellers at low, medium and high risk for DVT. The use of knee-length stockings should form a major part of air traveller's education to lower the burden of DVT. The results of this meta-analysis can be used to advise travellers on their risk of DVT and preventative strategies.

Quantitative measurement of superficial venous surgery using continuous ambulatory venous pressure measurement (CAVPM)

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Objective: To quantitatively measure the pressure-reducing effect of conventional superficial venous surgery on ambulatory venous pressure in patients with superficial, perforator and deep venous reflux, using a new technique of continuous ambulatory venous pressure monitoring.

Method: Fifty-one limbs of 48 patients with chronic venous insufficiency and 15 normal controls were studied. Duplex ultrasound scanning was performed to classify limbs into four groups; 'no reflux' (controls), superficial reflux (As2–5; 'S'), superficial with perforator reflux (As2–5, Ap17, 18; 'S&P') and any reflux with deep reflux (Ad11–16; 'S/P&D'). Postoperative duplex scans were performed to ensure surgical efficacy. Continuous pressure monitoring was performed during exercise, before and after (6–12 weeks) superficial venous surgery and the variables, mean walking pressure (MWP) and ambulatory pressure deviation (APD – a measure of pressure amplitude), were calculated. Data were analysed using Kruskal-Wallis tests and Mann-Whitney tests.

Results: Pre-operative MWP and APD were significantly different between all CEAP anatomical reflux groups ($P < 0{\cdot}001$). Postoperatively, significant differences in MWP were detectable only between the deep reflux group and other groups ($P = 0{\cdot}026$). Postoperative APD remained significantly different between reflux groups with the exception of the controls and the superficial reflux group. The median difference in MWP in the 'S', 'S&P', and 'S/P&D' groups were 14·9, 22·0 and 21·8 mmHg, respectively. APD reduction was not different between groups following surgery.

Conclusion: CAVPM offers reliable and objective measurements of the pressure-reducing effect of superficial venous surgery. Comparisons between the conventional surgery and other procedures for treating venous reflux may help to compare the therapeutic benefits of different treatments.

Endovenous laser ablation of the short saphenous vein and veins around the popliteal fossa

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Objective: Open ligation of the saphenopopliteal junction (SPJ) can be technically difficult and may have a high recurrence rate. Endovenous laser ablation (EVLA) is attractive as the junction is directly visualised using ultrasound and ablated, with little pain or scarring. Concerns have been raised regarding sural nerve damage from thermal ablation, especially when entering the vein in the lower third of the leg. We examined this area with regard to safety and effectiveness.

Method: Eighty-one consecutive patients underwent EVLA to veins around the popliteal fossa. The short saphenous vein (SSV) was entered in the lower third of the calf. The SSV, as well as the Giacomini vein, and perforating branches were ablated (ELVes 980 nm, 50–60 J/cm). Patients were reviewed with ultrasound examination immediately and at six weeks.

Results: The technical success rate was 99%. In one patient the SSV recanalised at 6 weeks, although the SPJ remained closed. Sixty-four patients had EVLA to the SSV and SPJ alone, 15 patients had a Giacomini vein which was ablated and two patients underwent ablation of the SSV and other perforating branches in the lower leg. Ultrasound visualisation of the sural nerve was possible in most cases. The sural nerve was clinically detected to be damaged in two patients.

Conclusion: Concerns regarding damage to the sural nerve during EVLA of the SSV throughout its length are unfounded. This is a safe and effective method of treating SPJ and SSV reflux. Other venous tributaries can be effectively treated at the same sitting.

Mid-term results of foam sclerotherapy for symptomatic and complicated varicose veins

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Objective: A consecutive cohort of patients who had foam sclerotherapy were followed-up at 6 months with a venous duplex scan and clinical assessment to assess the mid-term results.

Method: A total of 51 patients (52 legs) were assessed. Their median age was 64 years (range 36–84). There were 34 legs with primary and 18 with recurrent varicose veins, with a range of clinical severities (CEAP Class 2–14, Class 3–4, Class 4–15, Class 5–10, Class 6–9). Forty-five legs were treated in one foam session, seven required two. A median of 10 ml (range 2–22) of 3% STD foam was employed.

Results: At 6 months, 37/52 (71%) target truncal veins remained occluded with no flow on duplex, nine (17%) were partially occluded with minimal flow and six (12%) were patent and incompetent. In 47 legs (90%) treatment had achieved its objectives (no ulcer recurrence, abolished symptoms or achieved successful cosmetic result). There was no difference in success rates between the different clinical severities: complete or partial occlusion rates were 16/18 (89%) for CEAP 2–3 legs and 30/34 (88%) for CEAP 4–6.

Conclusion: Foam sclerotherapy was safe and effective in the mid term, with high patient satisfaction. For most this was achieved with a single treatment.

Improved transcapillary filtration rate in varicose vein patients treated with surgical treatment as compared to conservative treatment

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Objective: Persistent oedema of the leg due to chronic venous insufficiency (CVI) may decrease oxygenation of the tissues, thereby worsening local ulceration. Impairment of transcapillary filtration is implicated as a possible factor in the development of oedema in patients with CVI due to varicose veins (VV). The aim of this study was to evaluate the capillary filtration rate in patients with chronic venous insufficiency of the lower limbs due to VV.
Method: Seventy-five patients were recruited to the study. Twenty-three had normal limbs, 40 had varicose veins and were managed by conservative treatment, and 12 had varicose veins and had undergone varicose vein surgery. Blood flow studies including arterial inflow, venous outflow, maximum venous capacity and capillary filtration rates, were performed on these patients using opto-electronic photoplethysmography.
Results: There was no significant difference in the arterial inflow ($P = 0{\cdot}189$), venous outflow ($P = 0{\cdot}874$) and maximum venous capacity ($P = 0{\cdot}94$) among the three groups. The values for capillary filtration rate were significantly increased ($P < 0{\cdot}05$) in patients with venous insufficiency who did not have surgical correction of their superficial venous system. (Mann-Whitney *U* Test).
Conclusion: The results demonstrated that those patients with varicose veins who did not have corrective surgery for their venous system had an increased capillary filtration rate. This impairment of capillary filtration mechanism in the lower limbs of patients with CVI may have direct impact on the development of local oedema and subsequent venous ulceration. Corrective surgery for CVI improves capillary filtration rate, reduces pitting oedema and consequently leads to healing of venous ulcers.

Randomized trial of PTFE patch insertion for the treatment of recurrent varicose veins

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Objective: The aim of this study was to assess the use of a PTFE patch in the treatment of recurrent varicose veins.
Method: Thirty-one patients (40 legs) with recurrent saphenofemoral junction incompetence were randomized to redo saphenofemoral ligation and great saphenous vein stripping with or without the insertion of a PTFE patch. Patients underwent assessment pre-operatively and at 6 weeks, 1 year and 2 years postoperatively with clinical examination, duplex imaging and completion of the Aberdeen Varicose Vein Symptom Severity Score (AVVSSS).
Results: A total of 26 patients (31 legs) attended for assessment at 6 weeks, 25 patients (30 legs) at 1 year and so far 20 patients (22 legs) at 2 years. At 6 weeks, six legs (19%) had an area of numbness; all but one had resolved by 1 year. Four legs (13%) developed groin infections which required antibiotics, two developed groin haematomas and four developed seromas, all of which resolved spontaneously. The overall complication rate was 35% (11 legs), with no statistically significant difference between the groups. One of 16 legs without a patch and four of 15 legs with a patch developed neovascularisation on duplex by 2 years postoperatively, two of which directly resulted in clinical recurrence ($P > 0{\cdot}05$). There was an improvement in patients' AVVSSS 2 years postoperatively ($P < 0{\cdot}0001$), similar in both groups.
Conclusion: In this study, insertion of a PTFE patch did not affect the rate of peri-operative complications, but nor did it appear to protect against neovascularisation.

A prolonged mortality benefit from screening for abdominal aortic aneurysm: 7-year follow-up of the MASS trial

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Objective: Mid-term trial-based estimates of mortality benefit and cost-effectiveness for abdominal aortic aneurysm (AAA) screening are reported.
Method: The Multicentre Aneurysm Screening Study, comprising 67,770 men randomized to invitation to screening or not, was analysed at a mean of 7 years follow-up. Benefits in terms of AAA-related and all-cause mortality were estimated alongside cost-effectiveness.
Results: The relative risk reduction for AAA-related mortality in the group invited to screening was 47% (95% c.i. 32% to 58%). In terms of all-cause mortality, the observed risk reduction was 4% (95% c.i. 0% to 7%). The rupture rate in men initially screened normal has remained low at 0·54 ruptures per 10,000 person-years (95% c.i. 0·25 to 1·02). Cost-effectiveness was estimated at £12, 500 per life-year gained (95% c.i. £8, 000 to £25, 700) at 7 years of follow-up based on AAA mortality, and £4, 900 per life-year gained (95% c.i. infinite) based on all-cause mortality. Costs were inflated to the 2004–5 financial year and discounted at 3·5% per annum. Life-years were adjusted for non-AAA mortality, and were also discounted at 3·5% per annum.
Conclusion: These results from a large, pragmatic randomized trial show that the early mortality benefit is maintained in the mid term and that the cost-effectiveness of screening becomes more favourable over time. At £12, 500 per life-year gained, the cost-effectiveness of AAA screening in men is well below commonly accepted thresholds for interventions, and compares favourably with other screening programmes already in place in the UK.

The long-term prognosis of patients with small abdominal aortic aneurysm following surgery or surveillance: 12-year final follow-up of patients enrolled in the UK Small Aneurysm Trial

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Objective: Two randomized trials have shown no survival benefit associated with a policy of early open surgical repair compared to surveillance in patients with small abdominal aortic aneurysm. However, at 8 years of follow-up there was a hint of an emerging survival benefit for early surgery.
Method: We did a 12-year follow-up for mortality and aneurysm repair, of the 1090 patients enrolled into the UK Small Aneurysm Trial between 1991 and 1995. Patients with aneurysms 4·0 to 5·5 cm in diameter were randomized either to early elective open surgery or ultrasound surveillance until the aneurysm diameter exceeded 5·5 cm, the aneurysm grew rapidly or there were symptoms referable to the aneurysm.
Results: By the end of November 2005, 714 patients (66%) had died, 929 (85%) had undergone aneurysm repair, 150 (14%) had died without aneurysm repair and 11 (1%) remained alive without aneurysm repair. After 12 years, mortality in the surgery and surveillance groups was 64% and 67%, respectively, unadjusted hazard ratio 0·90 (95% c.i. 0·77 to 1·04), $P = 0{\cdot}139$. Thirty-day operative mortality (including emergency repairs) was similar in the surgery and surveillance groups, 5·5% and 7·2%, respectively, $P = 0{\cdot}28$. A policy of early surgery cost 17% more than a policy of delayed surgery following a period of surveillance, with a mean difference of £1326 (95% c.i. 960 to 1692). The death rate observed in small aneurysm patients was about twice that in the age-sex-matched population, differences being greater for women than men.
Conclusion: There was no late survival benefit for a policy of early elective open surgery of small abdominal aortic aneurysms, although the majority of patients in the surveillance group (76%) eventually underwent aneurysm repair. Despite this, a policy of early aneurysm repair still cost more than a policy of surveillance for small aneurysms.

Pre-operative simvastatin reduces MMP-9 in the wall of abdominal aortic aneurysms: a randomized trial

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Objective: The primary purpose of these studies was to investigate whether simvastatin reduced the activity of MMP-9 in the wall of abdominal aortic aneurysms (AAA). Secondary outcomes included MMP-2 activity and interleukin-6 (IL-6) secretion.
Method: Patients with large AAA were randomized to receive a 3-week course of either pre-operative simvastatin (40 mg) or placebo and the concentration of MMP-2 and MMP-9 in the aortic wall was assessed in a surgical biopsy. Aortic explant cultures (human AAA wall 48 h, $n = 8$) were used to investigate the effect of simvastatin (0 to 3 microM) on tissue levels of MMP-2 and MMP-9 and IL-6 secretion *in vitro*.

Results: From 32 eligible patients, 21 were randomized, 10 to simvastatin and 11 to placebo. Simvastatin reduced the amount of MMP-9 in the aneurysm wall by 40% (from $1{\cdot}75 \pm 0{\cdot}74$ to $1{\cdot}01 \pm 0{\cdot}38$ a.u.), $P = 0{\cdot}015$, but there were no significant changes in either MMP-2 or IL-6. In contrast, *in vitro* simvastatin reduced the secretion of IL-6 from aortic explants by 35%, ANOVA $P = 0{\cdot}043$, but had little effect on the metalloprotease activity of human explants.
Conclusion: Pre-operative treatment with simvastatin reduced the MMP-9 activity in AAA wall. Since simvastatin did not alter the MMP-9 content of aneurysm wall *in vitro*, the probable beneficial effect of MMP-9 attenuation observed *in vivo* is likely to be attributable to active metabolites of simvastatin.

Statins suppress elastolytic activity in the wall of human abdominal aortic aneurysms (AAAs)

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Objective: Elastolytic activity is an important mechanism in aneurysm formation and expansion. Statins are lipid-lowering agents which reduce the expression of elastolytic enzymes in aortic explants and the macrophages. The expansion of experimental aneurysms has been reduced by statin treatment. The aim of this study was to examine the effect of statin treatment on the activity of cathepsins and matrix metalloproteinase-9 in the AAA wall.
Method: Aortic wall biopsies were taken from patients during AAA repair ($n = 82$). Only 21 patients were on statin treatment before surgery. The activity of cathepsins B, H, K, L, S, and MMP-9 were measured in extracts of AAA wall using quantitative assays. Activity was standardised against the total soluble protein concentrations.
Results: The statin-treated cohort had almost two-fold lower cathepsin H activity compared with patients not taking statins (controls, $P = 0{\cdot}015$). Cathepsin L activity was three-fold lower in the statin-treated cohort compared with controls ($P = 0{\cdot}02$). There was a two-fold reduction in MMP-9 activity in the statin-treated cohort compared with controls ($P < 0{\cdot}0001$). There was also reduction in the activity of cathepsin B, K and S activity in the statin-treated cohort, but these did not reach statistical significance.
Conclusion: Statins decrease the activity of elastolytic enzymes that are known to degrade the extracellular matrix. They may have a role in reducing the expansion of AAA.

Long-term follow-up of patients with large abdominal aortic aneurysms turned down for intervention

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Objective: The EVAR-2 trial did not show improved survival of stent grafting over no intervention. Further research into the natural history of large AAAs is therefore required.
Method: A prospective database was maintained of all patients with AAAs $\geq 5{\cdot}5$ cm turned down for elective open aneurysm repair from 1989 to 1999, prior to the introduction of an endovascular programme. Demographic details were collected on all patients, copies of death certificates were obtained from the Office of National Statistics, local in-hospital patient records, and general practitioner records. Results of post mortem examinations were also obtained. Aneurysms were stratified according to their size at presentation (5·5–5·9 cm and $\geq 6{\cdot}0$ cm), and the reasons for no intervention were documented.
Results: One hundred and six patients met the criteria with a mean age at presentation of 78·4 years with a male to female ratio of 68 : 38. A review of these patients in April 2006 found five patients to be alive with a mean follow-up of 117 months. The 101 patients who died had a mean follow-up of 25·8 months. Fifty-five AAAs ruptured at a mean of 23·2 months. Twenty-three patients had AAAs measuring 5·5–5·9 cm, all were dead with a mean follow-up of 37·2 months, of which 11 ruptured at a mean of 38·9 months. Eighty-three patients had AAAs measuring $\geq 6{\cdot}0$ cm with a mean age of 77·9 years, 44 of these ruptured at a mean of 16·1 months.
Conclusion: A significant proportion of large AAAs do not rupture with the patient eventually dying from other causes.

Dr. Foster and the (in)accuracy of abdominal aortic aneurysm (AAA) surgery mortality rates

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Objective: To determine the accuracy of the Dr. Foster database with respect to mortality rates for AAA surgery in a single institution, and to assess the implications for individual surgeons in published league tables.
Method: The Dr. Foster (DF) database was interrogated over a 12-month period (July 2004 to July 2005). All AAA operations from our institution were identified, along with relevant clinical data. Comparison was made with the vascular surgeons' own database (VOD) over the same period.
Results: One hundred and thirty-seven AAA repairs were performed by five vascular surgeons according to the VOD (76 elective, 32 emergency no rupture and 29 ruptured). The DF database only identified 118 (86%). Of the 19 patients missing, 12 (63%) were emergencies. Of these, eight (66·6%) were ruptures. The overall mortality rates for the two databases were: elective: DF 4%, VOD 2·6%; emergency: DF 26%, VOD 28%; ruptured: DF 38%, VOD 45%. Thirty-five patients on the DF database were incorrectly coded by consultant (30%). Combined with the missing data, this led to marked differences between the two databases in individual surgeons' mortality rates of between 2 and 17%.
Conclusion: Major flaws exist in the coding of AAA repairs in the DF database, particularly for non-elective cases. This leads to inaccuracies in mortality rates published in league tables. These errors are particularly magnified when applied to individual surgeons. Calls for the publication of individual surgeons' results should be resisted until a more robust and validated system such as the National Vascular Database is used.

An external polyester sheath increases the oxygen gradient around porcine saphenous vein grafts

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Objective: External polyester sheaths reduce both intimal and medial wall thickening in porcine vein grafts and increase the number of microvessels within the space between sheath and graft (neoadventitia). It was suggested that the sheath promotes angiogenesis thus enhancing oxygenation of the graft. To test this hypothesis, the oxygen gradient within porcine saphenous vein graft walls following placement of an external polyester sheath was measured.
Method: Bilateral saphenous vein–common carotid artery interposition grafting was performed in Large White pigs ($n = 6$ per time course) with external placement of a polyester sheath on one side, the contralateral side remaining unsheathed as a control. Grafts were left in situ for 1, 2 and 4 weeks. Prior to explantation, oxygen tension within the graft walls was measured using an oxygen needle microelectrode. Immunohistochemistry was performed to evaluate microvessel development.
Results: The number of microvessels within the neoadventitia of sheathed grafts was greater than in the adventitia of control grafts. At all three time points, oxygen tension within the neoadventitia of sheathed grafts (1 week – 224 ± 56; 2 weeks – 230 ± 77; 4 weeks – 246 ± 54 mmHg) was significantly greater than at the surface of control grafts (144 ± 16; 138 ± 23; 165 ± 8 mmHg) (mean ± SEM; $P < 0{\cdot}05$).
Conclusion: External polyester sheaths promote microvessel formation within the neoadventitia of porcine vein grafts which augments oxygenation of the graft wall. These data demonstrate hypoxic stress as being potentially a key factor in the progression of vein graft thickening and therefore of vein graft failure.

Does clopidogrel reduce major adverse cardiac events in patients undergoing non-cardiac vascular surgery?

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Objective: To study the influence of clopidogrel on major adverse cardiac events (MACE) in patients undergoing non-cardiac vascular surgery. Antiplatelet agents are commonly withdrawn prior to surgery due to concerns over bleeding risk, yet there are some retrospective data suggesting that while

patients on antiplatelet agents do have higher rates of bleeding, overall prognosis is improved.
Method: We performed a prospective observational study on non-cardiac vascular surgery patients. Baseline clinical parameters were systematically collected and in-hospital MACE were recorded on post-op days one to three. MACE was defined as a rise in cardiac troponin T $\geq 0{\cdot}06$ or definite new ECG changes suggestive of ischaemia. Data were assessed using χ^2 for non-parametric data and *t*-testing for the Eagle score.
Results: Seventy-five patients were included in the study. Twenty-seven (36%) had peripheral arterial bypass surgery, 24 (32%) endovascular repair, 13 (17%) carotid endarterectomy and 11 (15%) had open aneurysm repair. Fourteen (19%) of the total were taking clopidogrel. The mean Eagle risk score was $1{\cdot}22 + 0{\cdot}93$ *versus* $0{\cdot}92 + 0{\cdot}75$ in the non-clopidogrel and clopidogrel group, respectively. There was no significant difference among Eagle risk score between the two groups. Thirteen (21%) of 61 patients not taking clopidogrel experienced MACE *versus* 0 in those taking clopidogrel ($P = 0{\cdot}03$). There were no significant differences in the proportion of patients taking statins or beta-blockers between the two groups.
Conclusion: Our study suggests that clopidogrel reduces major adverse cardiac events in patients undergoing non-cardiac vascular surgery even in higher-risk patients. Other medications, in particular beta-blockers, did not appear to influence the outcome.

Outcomes in tertiary upper limb vascular access for haemodialysis

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Objective: Patients in whom conventional haemodialysis arteriovenous fistulas have failed present a significant clinical challenge. This study compares outcomes in patients undergoing secondary upper limb access surgery; either basilic vein transposition (BVT) or insertion of a prosthetic access graft (AG).
Method: We identified all patients undergoing either BVT or insertion of an upper limb AG for haemodialysis, between 1 Jan 2000 and 31 December 2005. Median follow-up was 20·8 months (i.q.r. 9·9–36·9). Successful use for dialysis, primary patency, secondary patency and patient survival were assessed.
Results: Two hundred and fifty-three patients underwent 319 procedures. There were 103 BVT and 216 AG. Median age was 64·3 years (i.q.r. 50·4–74·5 years). The groups were well matched for age, sex, and diabetes. There was no difference in primary or secondary patency between the two procedures. Significantly fewer BVTs were successfully used for dialysis; 73·8% BVT compared to 89·4% AG ($P = 0{\cdot}001$, χ^2). One and two-year survival of vascular access from time of first use was 68·2% and 62·3% for BVT and 57·2% and 41·4% for AG ($P = 0{\cdot}014$ log rank). Patients who had BVT ($n = 64$) or both procedures ($n = 37$) had a significantly higher survival ($P = 0{\cdot}0005$ log rank) than those who only underwent insertion of AG ($n = 152$).
Conclusion: Higher AG rates reflect the urgency of surgery in many patients. BVTs are more difficult to establish, but if useable provide more durable access. In patients who do not need to start dialysis immediately, BVT is the secondary access procedure of choice.

Weekly simulator training improves technical competency

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Objective: To assess the value of weekly in-house technical skills training of junior surgical trainees on a synthetic carotid bench model.
Method: Ten junior SHOs were recruited (group A) and underwent a weekly skills training program over a 3-month period. Pre and post-training technical skills assessments were performed. Ten senior (post-MRCS) SHOs (group B) and ten senior SpRs (group C) acted as controls. Technical skills were assessed using validated generic and procedure-specific rating scales for both live and video assessment. The endarterectomy specimen was assessed using an end-product rating scale.
Results: Group A performed significantly worse than their senior counterparts on initial assessment ($P < 0{\cdot}0001$ Mann-Whitney *U* test). However, post-training there was no significant difference between group A and group B. Group C were significantly better than both A and B ($P < 0{\cdot}003$). End-product analysis showed significant improvement from initial to final session (session 6) ($P < 0{\cdot}001$) and the learning curve plateaued after four sessions. There were no significant differences in the score in live and blinded video assessment. There was no correlation between trainees' self-assessment and that of the trainers ($P =$ ns, Spearman's rank correlation) either pre or post-training. Trainees consistently overestimated their ability. Trainers' inter-observer reliability was high for all three rating scales (Kronenbachs $\alpha = 0{\cdot}8$).
Conclusion: Junior trainees showed significant improvement following limited training and achieved the same level of competence as more experienced trainees. In-house training is a useful adjunct in competency-based training.

Virtual reality simulation objectively differentiates level of carotid artery stent experience

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Objective: Though endovascular treatment of carotid disease is rapidly gaining acceptance, technical proficiency is paramount to ensure patient safety. Virtual reality (VR) simulation has been proposed as a means to objectively assess technical performance. The aim of this study was to validate assessment parameters and subsequently define benchmark levels of endovascular skill, to be achieved prior to operating on patients.
Method: Forty-five endovascular interventionalists (> 100 cases), though with varying experience in carotid artery stenting (CAS), were recruited: group A (0 procedures, $n = 12$), group B (1–20, $n = 12$), group C (21–50, $n = 10$) and group D (> 50, $n = 11$). All subjects performed a simulated right internal CAS procedure, assessed by metrics recorded objectively and instantly by the simulator (VIST). Participants also rated the realism and training potential of the simulator on a scale from one (poor) to five (excellent).
Results: There were significant differences across groups A-D for total time (medians 20·5 *versus* 24 *versus* 19 *versus* 16 minutes, $P = 0{\cdot}002$) and fluoroscopic time (12·5 *versus* 13 *versus* 10 *versus* 7 minutes, $P < 0{\cdot}001$) respectively. Total errors committed did not achieve statistical significance ($P = 0{\cdot}209$). Participants rated the simulator highly (median 4) in terms of realism and training potential.
Conclusion: The use of quantitative metrics on a realistic VR simulation model differentiates between levels of CAS experience, and can enable inexperienced practitioners to train to expert benchmark levels (group D) prior to operating on patients. In terms of error scores, differential weightings may enable the derivation of expert benchmark values for these metrics.

Longitudinal comparative study of transverse *versus* vertical groin incision for femoral artery exposure in arterial reconstructive surgery

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Objective: Vertical groin incisions (VGI) have been used to access femoral vessels and studies have reported associated wound complications. The aim of this study is to compare VGI with transverse groin incision (TGI) for femoral artery access.
Method: From 1999–2005 169 patients with 252 groin dissections for various vascular arterial reconstructive surgeries were studied. Composite-primary endpoints were early graft occlusion, superficial or deep groin wound infection, haematoma, seroma, serous ooze, and wound dehiscence. Secondary endpoints were length of hospital stay, minor and major amputation.
Results: There were 128 TGI (50·8%) and 124 VGI (49·2%). The male : female ratio was 2 : 1. Mean age was 70·5 years. Incisions were for aortobifemoral bypass (14), embolectomy (8), EVAR (32), fem-fem crossover (78), and femoral-distal bypasses (122). Age or risk factor profile was not statistically different between the groups. Seroma developed in 5·5% ($n = 7$) TGI and 13·7% ($n = 17$) VGI ($P = 0{\cdot}0129$, 95% c.i. 0·0091–0·1592). Infection rate was 3·9% ($n = 5$) with TGI compared to 16·1% ($n = 20$) in VGI ($P = 0{\cdot}0006$, 95% c.i. 0·0489–0·2002). A non-significant rise in haematoma

development was noted in VGI (7·3%) compared to TGI (4·7%), $P = 0·1943$. VGI had a significantly higher rate of major amputation, 10·5% ($n = 13$) compared to 1·6% ($n = 2$) in TGI ($P = 0·0341$, 95% c.i. 0·0311–0·1565). Significantly higher graft failure rates were observed in VGI 7·3% ($n = 18$) compared to 3·65% ($n = 9$) in TGI ($P = 0·0374$, 95% c.i. −00075–0·0824).
Conclusion: Compared to VGI, TGI has a lower propensity to disruption of lymphatic vessels and is associated with less wound complications, higher patency rates and lower amputation rates without compromising vessel exposure.

The effects of increasing obesity on vascular surgery

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Objective: The aim of this study was to determine whether vascular patients are becoming progressively more obese and whether morbid obesity affects outcomes from vascular surgery.
Method: Data for the index vascular procedures of infra-inguinal bypass, carotid endarterectomy and abdominal aortic aneurysm repair were prospectively collected in a computer database from 1996–2006. Patient build was stratified into cachectic, normal and morbidly obese (BMI > 35). The data were analysed with respect to operation duration, length of stay, complication rate and mortality. Results were adjusted for potential confounding variables, including mode of admission, cardiac history, renal function and smoking.
Results: One thousand three hundred and seventeen patients were recruited. Build was recorded in 1119 cases. The incidence of morbid obesity increased from 1·3% to 9% over 10 years. The operation duration was longer for morbidly obese subjects compared with normals (mean of 180 *versus* 154 min; $P < 0·006$) and infection rates were greater (25% *versus* 31%; $P < 0·001$). These differences were predominantly attributable to the abdominal aortic aneurysm subgroup. There were no significant differences in other complications, graft failure, length of stay or mortality.
Conclusion: Vascular patients are becoming progressively more obese. Procedures performed on morbidly obese subjects take longer and these patients have higher rates of infectious complications. This did not translate into poorer final outcomes in this study, although significant differences might emerge from a larger sample.

Wall thickening and its relation to local haemodynamic parameters in femoral bypass grafts

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Objective: To examine the relationship between haemodynamic parameters and the prospective development of wall thickening in autologous saphenous vein bypass grafts.
Method: A clinical cohort of 33 patients undergoing femoropopliteal bypass grafts were recruited and each had initial MRI scanning within 2 weeks of surgery. All patients also had baseline haemodynamic measurements recorded with duplex ultrasound (flow) and tonometry (pressure) as input conditions for computational fluid dynamics (CFD) modelling. The combined 3D geometrical structure (from MRI) and haemodynamics data of the bypass grafts were suitable for analysis in five cases. The grafts were sequentially examined by ultrasound at 3-month intervals to give measurements of wall thickness and lumen diameter. Computer-derived haemodynamic parameters were analysed *versus* complete sets of ultrasound wall thickness measures 6–12 months after surgery.
Results: There was an inverse relationship between mean wall shear stress (WSS) and graft wall thickness (median R-value −0·37) and WSS and lumen diameter (median R-value −0·41). When all graft data were pooled, the relationship between graft WSS and graft thickness displayed a marked threshold effect for shear stress lower than 1 N/m^2 (WSS < 1 *versus* WSS > = 1·0, [$P < 0·005$]). Regions of increased wall thickness may progress with time leading to focal stenoses and graft failure.
Conclusion: The analysis of graft haemodynamics using CFD simulations allows the mapping of sites with low wall shear stress which predicts the subsequent development of vein graft wall thickening. This has not previously been prospectively demonstrated *in vivo* and has implications for the understanding and prevention of graft failure.

Descriptive study comparing Hospital Episode Statistics with The Vascular Society of Great Britain & Ireland's National Vascular Database

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On behalf of the Audit and Research Committee of The Vascular Society

Objective: To compare patient volume and outcomes in vascular surgery between an administrative dataset (Hospital Episode Statistics) and a clinical database (National Vascular Database).
Method: A descriptive study set in NHS hospital trusts in England. Patients undergoing either repair of abdominal aortic aneurysm, carotid endarterectomy or infra-inguinal bypass over a 3-year period between 1 April 2001 and 31 March 2004. Main outcome measures were: volume of cases by age, sex, year and procedure and in-hospital mortality by procedure for both datasets.
Results: There were 32,242 admissions with a mention of the three selected vascular procedures within the administrative dataset compared to 8,462 within the clinical database. For NHS trusts common to both datasets, there were twice as many procedures (16,923) recorded within the administrative dataset compared to the clinical database. Patient characteristics were similar across both databases. Further analysis limiting the administrative data to records attributed to consultants known to contribute to the clinical database showed much closer agreement with only 11% more repairs of abdominal aortic aneurysm recorded within the administrative dataset compared to the National Vascular Database. Mortality rates in HES for non-ruptured and ruptured aneurysms, respectively, were 9% and 45·1% for non-NVD contributors and 7·4% and 43·2% for NVD contributors, and 6·8% and 40·4% in the NVD. Mortality rates for the other index procedures will be presented.
Conclusion: If the National Vascular Database is to become a credible source of information on activity and outcomes for vascular surgery, there is a clear need to increase the number of contributing surgeons and to increase the completeness of data submitted. Further analysis at individual record level is needed to identify other reasons for discrepancies which could help to enhance data quality, both within Hospital Episode Statistics and within the National Vascular Database. The methods are clearly applicable to other clinical databases.

The acute blue finger

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Objective: The acute blue finger is a rare problem. Management includes anticoagulation and investigation for cardiac or upper limb embolisation. However, these investigations may be normal. We wished to assess a series of patients, their management and outcome.
Method: The acute blue finger was defined as a patient who presented with sudden onset blue discolouration of a finger within the previous 72 hours. All patients had normal radial and ulnar pulses.
Results: Twenty-two patients were reviewed (median age 55 (range 19–88)), 15 were female. Additional symptoms included ache (2), pain (8), altered sensation (9), coldness (6), or swelling (5). Nine patients were smokers (mean 25 pack years) and six had cardiovascular risk factors. Five had an underlying cause; two had symptoms compatible with Raynaud's disease, one of whom had previously diagnosed mild CREST syndrome, one patient had signs (later confirmed on MRA) of arterial thoracic outlet syndrome and two had polycythemia (Hb > 17 g/dl). Otherwise all laboratory investigations were normal. Upper limb duplex, echocardiogram and 24-hour cardiac tapes were normal in all cases. Median duration of symptoms was 12 days (range 1 day to 3 months). Median follow-up was 19 months. Three patients had recurrent symptoms in the finger. No patient suffered tissue loss and none had stroke or arterial embolisation.
Conclusion: The acute blue finger is a benign condition not suggestive of arterial embolisation. Tissue loss was not seen. Cardiac investigations may not be indicated.

Cardiopulmonary exercise testing: a reproducible, safe and objective method of assessing pre-operative fitness

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Objective: Cardiopulmonary exercise testing (CPX) objectively assesses fitness through measurement of anaerobic threshold (AT). Little evidence exists about the validity of a repeated test. Our aim was to determine whether a training/familiarisation effect exists through repeated testing.
Method: A prospective, observational pilot study involving 16 patients with abdominal aortic aneurysms under surveillance (maximum diameter < 5·5 cm). CPX testing was performed four times over a 6-week period in weeks one, two, three and six, respectively. Testing was performed at the same time of day to eliminate confounding factors.
Results: Statistical analysis was performed using SPSSv13. Significance was assumed at the $P < 0{\cdot}05$ level. Data were assessed for normality before analysis. The results of tests 1 and 3 were compared to analyse if a training effect occurred. Tests 3 and 4 were then compared to analyse if a training effect was lost (using two-tailed paired Student's *t*-test). The results showed that there was no significant change in anaerobic threshold between test 1 and 3 (mean AT 12·63 ml/min/kg *versus* 12·52 ml/min/kg), or tests 3 and 4 (mean AT 12·52 ml/min/kg *versus* 12·04 ml/min/kg). No serious adverse events occurred during CPX.
Conclusion: A training effect does not exist for the patient population studied. Anaerobic threshold is highly reproducible making it a good objective measure of cardiopulmonary function. It is a safe, well-tolerated, non-invasive test, which could be incorporated into routine pre-assessment of patients undergoing major vascular surgery.

Cardiopulmonary exercise testing as a risk assessment tool for aortic surgery

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Objective: Aortic surgery carries a significant risk and measuring anaerobic threshold using cardiopulmonary exercise testing (CPX testing), has been shown to be an accurate predictor of postoperative cardiopulmonary morbidity in previous studies. In our institution CPX testing has been used since December 2001 to aid decision making for patients with aortic aneurysm. This paper presents an audit of the results to date, which demonstrate the role of CPX testing in the decision-making process.
Method: All patients with aortic aneurysms of an operable size have a CPX test, consisting of a graded exercise test on a cycle ergometer, during which 12-lead ECG and gas exchange is measured. Oxygen consumption at anaerobic threshold (AT) is determined. Following the criteria determined by previous studies, patients with an AT less than 11 ml/kg/min and a history or ECG evidence of ischaemic heart disease, are considered as high-risk, and all others as normal-risk. In general, normal-risk patients are offered open repair, whilst high-risk patients are considered for endovascular stenting if suitable, open repair (accepting a higher risk) or leaving the aneurysm in situ.
Results: Fifty-seven of 154 patients tested were high-risk. Of these, 37 were operated on with a 16·2% mortality, compared to 3·6% in the normal-risk group. Twenty high-risk patients have not had open repair, all had an AT less than 8·5; eight out of 20 have died to date.
Conclusion: CPX testing can accurately identify patients at increased risk of aneurysm surgery, and in whom alternative treatments may be appropriate.

False lumen thrombosis and remodelling after stenting of acute and chronic Type B aortic dissection

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Objective: This study compares false lumen outcome in stents performed early for complications of acute Type B dissection with chronic dissections. Achieving false lumen (FL) thrombosis may be important to prevent late aortic dilatation and rupture.
Method: Prospective 6-year data collection from consecutive patients undergoing thoracic stenting of complicated Type B dissection. 'Acute' presentation was defined as less than 3 months from first symptoms. Follow-up was by 6-monthly CT scan (median 13 months, range 0–60).
Results: Thoracic stents were performed in 44 patients; 20 'acute' (median FL diameter 28 mm [10–34], 15 M:5 F, median 71 years) and 24 'chronic' (median FL diameter 39 mm [8–80], 18 M:6 F, median 67 years). The primary entry tears (1 arch, 21 isthmus and 22 descending thoracic) were successfully excluded using a median of one stent 'acute' (range 1–4) *versus* three stents 'chronic' (range 1–6). Technical success and 30-day mortality were 95% *versus* 94%, and 5·0% *versus* 12·5%, respectively. The late FL expansion rate was 5% 'acute' *versus* 21% 'chronic'. The median diameter change was − 1 mm *versus* + 7 mm. Re-intervention was required in 5% *versus* 21% of patients.
Conclusion: Thoracic false lumen remodelling (thrombosis and collapse) was more frequent after successful exclusion of the primary entry tear in acute complicated Type B dissection. Persistent thoracic false lumen flow was associated with persistent aortic expansion and a high rate of patients requiring re-intervention. These findings support the concept of early intervention for acute Type B dissection; however, larger numbers are needed to show a survival benefit.

The prognostic value of raised pre-operative cardiac Troponin I in vascular surgery – a case series

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Objective: Vascular surgery is associated with a substantial risk of cardiovascular events and death. Cardiac Troponin I (cTnI) is a contractile protein that is a highly sensitive and specific marker of myocardial necrosis. This case series examines the clinical course of ten patients who had an asymptomatic pre-operative elevation in cTnI and underwent a vascular surgical procedure.
Method: A prospective, 2-year observational single-centre cohort study of all patients undergoing a vascular procedure with an expected cardiac event rate of > 5% (major amputation, aortic procedures, distal bypass surgery) recruited patients who had no clinical or ECG evidence of myocardial ischaemia. Pre-operative cTnI was performed and a level of > 0·02 ng/ml determined as positive. Postoperative screening for cardiac events (daily clinical assessment, serial ECGs and cTnI measurement) at postoperative days two, five and 30 was performed.
Results: Two hundred and thirteen patients were recruited, of whom 11 (5·2%) had an asymptomatic raised cTnI. Eight of the ten patients in whom the pre-operative cTnI was not known prior to surgery, or in whom a procedure could not be delayed, proceeded with the operation, and two patients had surgery deferred. Four (40%) patients suffered a postoperative cardiac event (defined by WHO criteria) and three died. Two patients died within 30 days secondary to sepsis and one patient developed acute renal failure.
Conclusion: The outcome in this case series was poor with death in 50% of those taken to theatre and cardiac events in 40%. An elevated pre-operative cTnI in an otherwise asymptomatic patient identifies a very high-risk group of patients.

Vascular training – is dual accreditation or collaboration the future?

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Objective: The advent of endovascular procedures has revolutionised the management of vascular diseases. This study documents the transformation from open surgery to combined surgery with endovascular intervention.
Method: An analysis of prospectively collected audit data from June 2000 to May 2006 on three conditions: carotid occlusive disease, elective infrarenal abdominal aortic aneurysms and thoraco-abdominal aortic disease.
Results: In 2000, carotid occlusive disease was the sole domain of surgeons, but by 2005 combined procedures were performed in 29% of cases. From 2000-2005 there was a rise in endovascular procedures which became the treatment

modality of choice for elective infrarenal abdominal aortic aneurysms. In 2000, endovascular intervention represented only 3% of cases, compared with 83% in 2005. A similar trend was seen in thoraco-abdominal aortic interventions. In 2000, 88% of cases were performed by surgeons alone, by 2006 this practice had reversed and 88% of cases were jointly undertaken by surgeons and radiologists. Over the last 5 years many cases previously performed solely by surgeons are now being undertaken as joint procedures. This trend was significant in all three conditions studied. In 2000, surgeons operated on 95% of cases alone; by 2006 this figure had decreased to 51%. It was felt that neither the surgeon nor the radiologist would have been able to perform the vast majority of cases alone.

Conclusion: Rather than hope to become skilled to a high level in both surgical and interventional skills, trainees should have experience of both, and aim to collaborate and share skills to offer the best possible patient care.