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SESSION 1

Anaesthetic implications for centralisation of vascular services

Dr Jane Eddleston, Manchester

Commissioning of Specialist Services is undergoing a considerable change. Each service will have a National Service Specification which will determine the standards, outcomes and interdependencies of each individual service, thereby delivering equity of service across England.

Vascular disease is one such service.

My presentation will cover the changes inherent in the new commissioning model and describe its likely implication for Vascular Surgical Services.
Training in Vascular Anaesthesia, the future

Dr D Nolan, RCoA, South Manchester

No abstract available..
Vascular Anaesthetic Training in the UK; The good, the bad and the ugly

Dr Kristy Wagstaff, Post-CCT Anaesthetic Registrar and VASGBI trainee committee member, Northern General Hospital, Sheffield

The last few years have seen significant changes for anaesthetic training within the UK. Shorter training programmes, EWTD reduction in working hours and a new curriculum serve to challenge the traditional delivery of training and heighten the worry that the inexperienced generic trainee may already be upon us.

Vascular anaesthesia has not escaped unscathed. The loss of vascular training as a core module has not been without impact. A recent survey of final year trainees highlighted that less than 30% felt competent to manage acute and emergency vascular cases out of hours with local supervision. As the 2010 curricula trainees come through, the situation is only likely to become worse.

Perhaps it is the case that at this point in time a shift in thought process and attitude is required to address such problems as much opportunity exists.

My own subspecialty training has been a mixture of luck and perseverance. As a 2007 curriculum trainee I was lucky to have the luxury of access to both core intermediate training and optional higher training modules. With perseverance (and encouragement) I managed to complete a pre-assessment fellowship, out of programme vascular anaesthetic research, 3-years of CPET training, 9-months of direct clinical exposure to vascular anaesthesia working from a home-made curriculum and became the society’s current trainee committee member. I believe that that access to such a path should not be an exception.

The Society is working hard in support of vascular anaesthetic training. The committee continues to interact with the college, motivated in the belief that vascular training has an essential place in core training, and to support the trainee travelling grant. The society also seeks to formalise and improve access to advanced training with the advent of educational standards and a fellowship network.

Education standards:
Providing advanced trainees and supervising clinicians with a structured training curriculum, the consultation document is available to view on the website.

Fellowship network:
Many thanks to all that have replied to the society’s email. It is hoped that a fellowship network with details of existing fellowships both in the UK and abroad will be accessible on the website in the near future. Further to this, future aspirations include the formation of a fellow’s network to foster learning and research collaborations.

Pre-CCT fellows:
Currently exist in number, both for competitive and informal entry, although it is increasingly unlikely that this will continue as the norm given the reduction in pre-CCT time available for subspecialty development. Current fellowships range from 6 to 12-months duration with content most frequently centred on direct clinical exposure or dedicated research fellowships. Some centres offer pre-assessment and CPET experience, either alone, or in combination.

Post-CCT fellows
Increasingly likely to become the norm, trainees and new CCT holders do not see these posts as an unwelcome evil. Many now seek further subspecialty training out of preference, some
for up to 24-months in duration. Such posts will only attract good candidates if constructed in a manner as to allow for continued professional development. It is important that institutions recognise that the needs of these individuals will not be akin to that of a trainee and that posts are protected from becoming simple service providers.

References;
Vascular Anaesthetic Society of Great Britain and Ireland;

Royal College of Anaesthetists;
Intermediate training curriculum - https://www.rcoa.ac.uk/CCT/AnnexC
Higher training curriculum - https://www.rcoa.ac.uk/CCT/AnnexD
Reducing respiratory complications after vascular surgery

Andrew Lumb, St James’s University Hospital, Leeds, UK

Post-operative pulmonary complications (PPCs) are common after major surgery. The term includes various clinical problems such as respiratory infections (need for antibiotics, CXR changes, raised WBC & symptoms), respiratory failure (increased FiO\textsubscript{2} requirement, ventilatory support), or atelectasis, pneumothorax or acute lung injury.

Pre-operative considerations. Assessment pre-operatively aims to identify patients who have a current chest infection whose surgery may be postponed, assess the severity and adequacy of treatment for existing respiratory disease so this may be optimised before surgery, and to predict the likelihood of a PPC occurring\textsuperscript{1,2} so that appropriate perioperative care can be planned (Table). All of these factors can be assessed from a simple history, examination and basic investigations; chest x-rays and lung function tests add little further predictive value.\textsuperscript{3}

Table - Factors predicting the development of PPCs after surgery from references 1 (red) and 2 (blue).

<table>
<thead>
<tr>
<th>Potential risk factor</th>
<th>Incidence of PPCs (%)</th>
<th>Relative risk or odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When present</td>
<td>When not present</td>
</tr>
<tr>
<td>Smoking</td>
<td>15 – 46</td>
<td>6 – 21</td>
</tr>
<tr>
<td>ASA class &gt;II</td>
<td>26</td>
<td>16</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;70 years</td>
<td>9 – 17</td>
<td>4 – 9</td>
</tr>
<tr>
<td>&gt; 80 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>COPD</td>
<td>6 – 26</td>
<td>2 – 8</td>
</tr>
<tr>
<td>Pre-op SpO\textsubscript{2}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91-95%</td>
<td>6.2</td>
<td>2.8</td>
</tr>
<tr>
<td>&lt;90%</td>
<td>3.4</td>
<td>1.3</td>
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<tr>
<td>Recent respiratory infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site of surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper abdominal</td>
<td>13 – 33</td>
<td></td>
</tr>
<tr>
<td>Lower abdominal</td>
<td>0 – 16</td>
<td></td>
</tr>
<tr>
<td>Thoracic</td>
<td>10 – 40</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.6 – 7</td>
<td></td>
</tr>
<tr>
<td>Surgery duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-3 hours</td>
<td>10 – 53</td>
<td>3 – 15</td>
</tr>
<tr>
<td>&gt; 3 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General anaesthesia</td>
<td>8 – 19</td>
<td>0 – 17</td>
</tr>
<tr>
<td>Emergency procedure</td>
<td></td>
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</tbody>
</table>

Anaesthesia. Avoidance of general anaesthesia (GA) wherever possible is the single most important technique for avoiding PPCs. Multiple studies and meta-analyses have failed to show large differences in overall mortality between regional anaesthesia (RA) and GA techniques, but have found significant differences in the incidence of PPCs. Furthermore, a recent cohort study of PPCs found that overall mortality in patients who develop a PPC was 19.5% compared with 0.5% in those who did not.\textsuperscript{1} When GA cannot be avoided then using
regional techniques for analgesia is also regarded as best practice. However, many questions remain about the role of RA in preventing PPCs, particularly in patients at high risk of RA complications such as those receiving anti-platelet drugs and heparin. When using GA in patients at risk of PPCs it is also important to recognize, prevent and treat intra-operative atelectasis as its presence at the end of surgery may pre-dispose to respiratory infection post-operatively.

**Peri-operative interventions.** Two strategies may help prevent PPCs:

1. Lung expansion manoeuvres include any or all of deep breathing exercises (taught and supervised by physiotherapists), intermittent positive pressure breathing (currently rarely used routinely) or incentive spirometry (most effective if taught pre-operatively, but patient can then use unaided). All these interventions are equally effective, and work better if the patients are encouraged by all staff to perform them regularly.

2. Smoking cessation. Smoking tobacco within a few hours of anaesthesia and surgery will have adverse effects from the effects of carboxyhaemoglobin and nicotine on oxygen supply and demand, particularly in the heart. Patients with ischaemic heart disease should therefore not be permitted to smoke within 12 hours of their surgery. Smoking also causes PPCs (see Table) and pre-operative cessation prevents these. Anaesthetists should therefore use the pre-operative assessment as a ‘teachable moment’ to emphasise to the patient the benefits of stopping smoking. The duration of cessation required to avoid PPCs is unknown - older studies of patients having cardiac surgery suggested that stopping for less than 8 weeks caused even more PPCs than continuing to smoke, but this view is now disputed and there are other studies of different types of surgery showing that any duration of pre-operative abstinence is beneficial.

2. Canet J et al. Anesthesiology 2010; 113
5. Warner DO. Anesthesiology 2006; 104:356–67
Haemostasis management in thoraco-abdominal aortic aneurysm (TAAA) repair

Dr Alastair F Nimmo, Consultant Anaesthetist, Royal Infirmary of Edinburgh

There have been advances in the endovascular and hybrid open/endovascular repair of complex aortic aneurysms in recent years. However, some aneurysms are not suitable for endovascular repair and the longer term results of endovascular repair of TAAAs remains uncertain. There remains an important role for open repair of TAAAs but this is very major procedure and is commonly associated with massive haemorrhage. Blood loss, a period of ischaemia of the abdominal organs, deliberate hypothermia and the effect of antiplatelet agents and heparin combine to severely impair haemostasis during surgery.

The severity and underlying cause(s) of impaired haemostasis can change rapidly during surgery and the results of laboratory investigations often come back too late to be of relevance. Point-of-care testing with thromboelastometry or thromboelastography permits rapid diagnosis and targeted treatment of the specific abnormalities. We have used thromboelastometry during TAAA surgery for the past 12 years and have developed a simple guideline on how to use the results to guide treatment in order to ensure satisfactory haemostasis by the end of surgery.

In most cases the earliest deficiency to become severe enough to significantly impair haemostasis is a low plasma fibrinogen concentration followed later, if bleeding continues, by thrombocytopenia and eventually, in some cases, a deficiency of other coagulation factors. We have just completed a randomised trial comparing fibrinogen administration with FFP administration during Extent 4 TAAA repair.

Most of our patients are taking aspirin at the time of TAAA surgery and this is continued perioperatively. Occasionally patients undergo surgery while taking clopidogrel – for example if they have coronary artery disease or a coronary stent and a history of aspirin intolerance. Overall, clopidogrel monotherapy is not necessarily associated with more bleeding during vascular surgery than aspirin monotherapy. However, there is a greater
variability between patients in the response to clopidogrel than to aspirin, with platelet function testing showing little or no platelet inhibition in some patients and very marked inhibition in others. We use preoperative platelet function testing to ensure that the patient is not a “hyper-responder” to clopidogrel and routinely omit the clopidogrel dose on the morning of surgery so that any platelets transfused during surgery will not be irreversibly inhibited by circulating active clopidogrel metabolite.

Further reading


Pre-operative assessment for abdominal aortic surgery

Dr Nick Wisely, Consultant Vascular Anaesthetist University Hospital of South Manchester and Honorary Senior Lecturer University of Manchester

Pre-operative Assessment

This talk will be based on the preoperative assessment clinic at Wythenshawe Hospital. It is a combined risk assessment, patient information and optimisation clinic. We see patients early in their care pathway usually before any decision has been taken about the mode of operation.

Historically the overall mortality following elective surgery for abdominal aortic aneurysms (AAA) in the UK (7.5%) has been poor in comparison with other similar countries (3.5%). The Vascular Society instituted a quality improvement program in 2009 to try to improve outcome. As part of this they recommended a pre-operative care bundle\(^1\) that includes a pre-operative risk assessment by a vascular anaesthetist and discussion at a multidisciplinary meeting. Now that a national screening program for AAAs has started there is urgency to increase standards of pre-assessment and to drive this initiative nationally.

Patient Understanding

There will be a wide range of background understanding about their diagnosis in patients presenting at the clinic and also a wide range of desire for further information but there are many excellent resources available on line\(^2\). Patients should have a clear idea of the treatment pathway ahead of them but also the expectations that we have of them with regard to smoking cessation, exercise and other ways that they can improve their outcome. Sometimes not operating will give the patient the longest and best quality life expectancy.

Risk Assessment

It is important to take a long-term view when trying to risk assess a patient for open AAA repair. The risk of aneurysm rupture also needs to be considered. The many scoring systems e.g. Revised Coronary Risk Index\(^3\) and Customised Probability model\(^4\) are useful and will be discussed. They mostly recognise the importance of the following conditions as risk predictors of increased mortality

- Ischaemic heart disease
- Congestive cardiac failure
- Renal insufficiency
- Diabetes mellitus
- Cerebrovascular disease
- Hypertension
- Chronic obstructive pulmonary disease

Other scoring systems are less useful preoperatively as they need intraoperative data e.g. VPOSSUM

Investigations

As part of the risk assessment process our patients perform basic spirometry and a symptom limited Cardiopulmonary Exercise Test (CPET) to provide fitness data. We look at the patient’s VO\(_2\) at anaerobic threshold, peak VO\(_2\), VE/VCO\(_2\) and ECG evidence of myocardial ischaemia. The data is useful in predicting both short and longer-term outcome and some of our published work will be discussed. Echocardiography at rest has limited utility as a risk
assessment tool although it will be useful to investigate valvular problems. Dynamic echocardiography is more useful at diagnosing ischaemic heart disease and may be a precursor to coronary angiography. Formal lung function may be needed to measure transfer factor.

**Optimising and Reducing Risk**

Every patient contact can be used for optimisation and a thorough checklist approach is useful.

**Antiplatelets**\(^5\) – Aspirin has antiplatelet and anti-inflammatory properties and reduces the risk or death and risk of non-fatal cardiovascular events. It is only associated with a small increase in postoperative bleeding.

**Statins**\(^6\) – Statins reduce cholesterol, are anti-inflammatory, anti-thrombotic, increase plaque stability and are vasodilators.

**β blockers**\(^7\) – Heart rate reduction is important to improve the \(\text{O}_2\) supply demand ratio. The reduce inflammation and improve plaque stability. Evidence suggests there is a role for them in high-risk patients although excessively low heart rates are associated with an increased mortality\(^8\).

**Coronary revascularisation**\(^9\) – CABG should be reserved for patients that warrant revascularisation in their own e.g. left main stem stenosis, 3 vessel disease, STEMI or unstable angina. Coronary artery stents are at high risk of thrombosing if surgery is carried out before they epithelialise or antiplatelets are stopped prematurely.

**Respiratory optimisation** – Many patients present with undiagnosed COPD and greatly benefit from quad inhaler therapy and smoking cessation. Incentive spirometry and perioperative physiotherapy are very important.

**Renal optimisation**\(^10\) – Poor renal function is a risk factor for poor outcome. It needs to be recognised preoperatively and strategies implemented to optimise outcome. These include holding ACE inhibitors and angiotensin antagonists, pre-operative fluid therapy and antioxidants.

**Exercise**\(^11\) – Aerobic conditioning can improve \(\text{pVO}_2\) by up to 30% over a 6 month period

**Diet and weight loss**\(^12\) – Although studies have shown that there is a survival advantage to being a little overweight.

**Summary**

Over the last few years we have already seen great improvements in outcome following open AAA surgery. Every patient with an aneurysm deserves to have a detailed risk assessment, medication review, exercise test and optimisation so if open surgery is decided upon then they stand the best chance of surviving the procedure and long into the future.
References

5. Collaborative meta-analysis of randomised trials of antiplatelet therapy for prevention of death, myocardial infarction, and stroke in high risk patients *BMJ* 2002; 32471-86
SESSION 3

Emerging trends in Endovascular Surgery

Mr Ferdinand Serracino-Inglott, Manchester

No abstract available
The structure of today’s presentation will broadly cover where I feel the focus of anaesthetic planning and assessment should lie in relation to “complex” endovascular procedures and some important aspects of perioperative management.

So what is complex EVAR? There is no standard definition, but patients who fall outside of the criteria for standard EVAR may be complex for a variety of reasons; for example those with juxta-renal, peri-renal and thoraco-abdominal aortic aneurysms may require bespoke stent grafts with fenestrations and branches to accommodate the aortic side branches. Hybrid procedures whereby native branches are occluded by a stent graft combined with a surgical bypass procedure have also become more common place in recent years, particularly for the management of descending thoracic aneurysms that involve the left subclavian artery. These are technically challenging and require detailed planning and consideration of all the surgical options not least an assessment of perioperative and long term risks associated with intervention. The anaesthetist is well placed to offer early advice on certain aspects of this risk assessment and to consider risk reduction strategies which can influence the MDT.

There is also a cohort of infra-renal AAA patients who due to “hostile” anatomy perhaps should also be classified as complex. Conventionally the anatomy of the proximal and distal landing zones as well as quality of the arterial access into the aneurysm is the issue addressed when planning an EVAR. Patients considered to be at very high surgical risk for open repair and who fall outside of the instructions for use (IFU) for standard EVAR may still have endovascular options, albeit with lower success rates both in the short and longer term due to endoleaks and higher future re-intervention. These cases may require the use of novel access routes (e.g. the carotid artery), iliac conduits, and brachial approaches to deploy a stent graft. The anaesthetist needs to be cognisant of this and be involved in the planning of such cases.

The recent AAAQIP has further strengthened our specialty’s pivotal position in preoperative assessment of patients with AAA. The decision to offer treatment and the mode of treatment will be influenced by our evaluation of the patient. It’s also a chance to consider medical optimisation. However whether or not medical optimisation affects perioperative outcomes in patients undergoing EVAR is not entirely clear. Evidence from the UK EVAR trials demonstrated that cardiovascular deaths in the 2 years after surgery were greater in the EVAR group; it is this that seems to account for the catch up in mortality between EVAR and open surgery. Patients in the EVAR II trial who underwent intervention also encountered a greater cardiovascular death rate than those who were managed conservatively. This perhaps strengthens the notion that medical optimisation is integral to the management of patients with aortic aneurysm. A rigorous approach may add further benefit to those offered intervention. Whether this interpretation can be applied to more complex EVAR isn’t clear but if we consider that patients with more complex aneurysmal disease tend to have a higher atheromatous disease burden it may prove to be a very important aspect of their management. Hence I believe cardiovascular medical optimisation should remain a priority at preop assessment and I believe that anaesthetists are perfectly positioned to enforce such an approach is applied early in the clinical pathway.
There are other explanations for this early catch up in mortality; not least that open surgery filters out the weaker patients (by death) and thus we are left with a cohort in the open group who are by definition fitter than those left in the EVAR cohort. The “weaker” patients who survive the initial insult of EVAR suffer their cardiovascular death in the subsequent 1-2 years. This explanation still supports medically optimisation prior to intervention (EVAR or open). An aortic aneurysm is merely one presentation of generalised cardiovascular disease in any given individual. It is an opportunity for vascular anaesthetists to develop local clinical pathways for common cardiovascular diseases (e.g. hypertension, stable coronary artery disease and mild occult cardiac failure) with support from other hospital based specialties and primary care.

In the immediate perioperative period we need to be making repeated assessment of insidious blood loss, the duration of anaesthesia, maintenance of normothermia, guide wire manipulations and potential for acute kidney injury. Blood loss can be considerable, secondary to constant leakage from the access sites. Cell salvage is valuable and considerably limits the volume of allogeneic blood transfused; it is usually possible to salvage blood from around the entry sites of the stent-graft delivery system. Heparin therapy coupled with antiplatelet agents and inadvertent perioperative hypothermia can exacerbate blood loss. Doses of heparin in excess of 1.5 mg kg\(^{-1}\) are not uncommon and it is quite informative to monitor the dose response with a point of care testing device that measures activated clotting time (ACT). Ideally a baseline ACT should be recorded before any heparin is given and the response measured and recorded. Administration of protamine at the end of the procedure should be considered if the patient appears to have developed a coagulopathy that is clinically apparent and is accompanied by an ACT greater than twice the patient’s baseline measurement. However the use of protamine carries a small risk of thrombosis in the stents and/or in the visceral vessels that dissuades some vascular teams from using it. Protamine should only be administered when heparin therapy has been clearly demonstrated (with bedside testing and in the absence of other causes) to be the most significant contributory factor to clinically problematic coagulopathy. The risk of hypothermia is much less compared with open surgery, but standard precautions should be taken to avoid hypothermia with the use of warmed i.v. fluid and forced air warmers.

The advent of complex stent grafts with fenestrations or branches to allow treatment of peri-renal and thoraco-abdominal aneurysms provides an alternative to open surgery that has demonstrated very promising early results. Though originally designed for use in patients considered unfit for open repair, the early encouraging results have led to more patients being offered intervention. At present there are no robust or published RCTs on the long term outcome of this surgical cohort and it is not possible to make long term predictions on re-intervention rates and device failure. However remember the EVAR trials reported high re-intervention rates, significant incidence of secondary rupture and that the aneurysm related mortality benefit was lost over the follow up period. The same may be true in complex EVAR, particularly in those who undergo infra-renal EVAR outside of the IFU and let’s not forget that the EVAR trials reported on patients who conformed to strict anatomical criteria. It is important that anaesthetists are aware of these issues when making judgements on fitness for open surgery, the less risky alternative (EVAR) may be just as disadvantageous to the patient in the long term. I don’t have the answers to this conundrum but we must be aware of it and we should discuss these issues with our vascular colleagues and patients.

Centres undertaking vascular surgery need to be able to access a hybrid theatre which meets modern theatre specification, fixed high quality imaging, appropriately staffed with provision of all the facilities and equipment we would expect in a theatre undertaking major vascular surgery. A vascular theatre requires stocks of specialist grafts, instruments, haemostatic agents and sutures that are often required without delay and must be stocked inside the
theatre. It was as a result of numerous adverse outcomes reported to the MHRA in standard infra-renal cases that led to the formation of a working party (BSIR, VASGBI and VS) and the subsequent publication of a document which outlines these requirements. Significant procedural complications such as endoleak and aortic side branch dissection can be detected earlier with high quality imaging and should have a positive impact on early and longer term patient outcome. Bearing in mind the increased worldwide use of endovascular intervention in patients with more challenging anatomy (“hostile necks” and calcified / tortuous arterial access) these facilities provide the safest environment possible and reduce the risk of peri-procedural complications. The national complex vascular commissioning body and relevant colleges and learned societies agree on this as a standard for fenestrated and branched endovascular repair.

Specific adverse outcomes such as contrast- induced acute kidney injury and spinal cord ischaemia are issues with which anaesthetists need to consider in this patient group. The aetiology of acute kidney injury after EVAR is multi-factorial and includes perioperative reduction in renal perfusion, hypotension, contrast induced nephropathy and thromboembolic insult. These risk factors are more likely to be encountered in patients undergoing stenting of the visceral vessels (e.g. renal, SMA and celiac vasculature) as occurs in fenestrated and branched EVAR. Early risk assessment can identify those at greatest risk and simple interventions may be helpful in reducing the insult and will be discussed during my talk.

Spinal cord ischaemia is a devastating complication that is more frequently seen following complex EVAR procedures that involve extensive coverage of the descending thoracic aorta. It’s not just thoraco-abdominal aneurysms that are at higher risk; thoracic dissection is increasingly being managed with stent grafts so those of us on general rotas need to be aware of the dangers and consideration must be given to the use of spinal cord protection strategies. Factors affecting the risk relate to the extent of thoracic coverage, previous occlusion of any part of the spinal collateral arterial network (e.g. loss of hypogastric supply following previous infra-renal repair) and distal thoracic coverage. Fenestrated EVAR is associated with increased risk of spinal cord ischaemia too, particularly those that require 3 or 4 vessel fenestrations, this probably relates to more extensive distal thoracic coverage in the putative location of the artery of Adamkiewicz. The salient features of both acute kidney injury and spinal cord injury, the risk factors, early detection of and management will be discussed. I will hopefully demonstrate how simple interventions could significantly reduce the incidence in your hospital.

Finally the superiority of the anaesthetic technique for EVAR has not been established. Data from large registries seems to suggest that loco-regional techniques favour shorter length of stay and a reduction in morbidity and mortality. However the methodological flaws in these types of study do not allow us to make firm conclusions. Data from the EUROSTAR registry on low and high risk patients undergoing infra-renal EVAR suggest a benefit in the higher risk patients but unless a very large RCT or large scale propensity score matched cohort analysis is to be conducted it seems unlikely that we will ever have a definitive answer. For complex EVAR there is certainly a greater use of general anaesthesia because of the duration of interventions and perhaps concerns with the use of regional anaesthesia with prolonged anticoagulation and anti-platelet therapy. Due to the relative complexity of the patient cohort and potential for significant complications I believe that invasive monitoring of the blood pressure is essential and that attempts to monitor the cardiac output and oxygen delivery should be standard. Senior anaesthetists should always be involved in the direct patient care of such cases and be cognisant of the pathophysiology of the elderly patient. The personal, patient and procedural characteristics of individual cases will continue to dictate the anaesthetic technique of choice.
Suggested further reading

Fenestrated endovascular grafting: the French Multicentre Experience. Eur J Vasc Endovasc Surg 2010; 39; 537-44


Predictors of Abdominal Aortic Aneurysm Sac Enlargement After Endovascular Repair. Circulation 2011;123:2848-2855


Medical Optimisation Can Reduce Morbidity and Mortality Associated with Elective Aortic Aneurysm Repair. Eur J Vasc Endovasc Surg 2007; 33: 100-104

Early Results of Fenestrated Endovascular Repair of Juxtarenal Aortic Aneurysms in the United Kingdom. Circulation 2012; 125: 2707-15

Endovascular stent–grafts for the treatment of abdominal aortic aneurysms
NICE technology appraisal guidance 167; 2009


Risk-Adapted Outcome After Endovascular Aortic Aneurysm Repair: Analysis of Anesthesia Types Based on EUROSTAR Data. J Endovasc Ther 2007; 14: 12–22

Complex endovascular aortic aneurysm repair. Continuing Education in Anaesthesia, Critical Care & Pain 2012
A rational cross-match strategy for open elective abdominal aortic aneurysm repair.

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Background. Open abdominal aortic aneurysm (AAA) repair is a commonly performed procedure and six units of allogeneic blood are routinely cross-matched pre-operatively. This incurs significant resource and economical cost, in the context of limited evidence. In this observational, service-development study, we examined our local transfusion practice and evaluated peri-operative blood product usage to inform a rationalised cross-match strategy.

Methods. All patients undergoing planned, open AAA repair between October 2009 and October 2012 were identified. Patients not admitted to the intensive care unit post-operatively or those with unavailable data were excluded. The perioperative cross-matching or administration of blood products, including autologous blood was recorded. The haemoglobin level measured pre-operatively and the first haemoglobin measured on admission to the intensive care unit (ICU) was recorded. The serum lactate was also measured post-operatively, on admission to the ICU. A basic economical analysis was then performed for three possible cross-match strategies.

Results. 89 eligible patients were identified from the database, 9 were excluded, and 80 entered the analysis. Non-parametric data are expressed as median (interquartile range [range]), and parametric data as mean±standard deviation. The mean pre-operative cross-match was 6.2±1.0 units. Median intraoperative allogeneic red cell transfusion was 0.0 (0-2, [0-12]) units and 0.0 (0-0, [0-44]) units, post-operatively. During the study period, the cross-match:transfusion ratio was 6.4:1. Cell salvage was routinely used and 65 patients (81%) received autologous blood with a median volume of 653 (356-854, [60-3396]) mls. Total FFP transfusion during the intra operative and post-operative period was 0.0 (0-0, [0-20]) units.

The mean pre-operative haemoglobin measurement was 138±13.2 g.l⁻¹ and the mean post-operative haemoglobin was 111±12.7 g.l⁻¹. The post-operative lactate was 1.7mmol.l⁻¹ (1.2-2.4 [0.8-3.8])

Conclusions. The high CTR suggests that cross-matching six units was unnecessary while post-operative haemoglobin and lactate measurements suggest that adequate oxygen carrying capacity had been maintained.

During the study period, if four units had been cross-matched then approximately £266 per patient could have be saved and less than one patient a year would require additional intra-operative cross matching. If two units were cross-matched then approximately £530 per patient could have been saved and 2.3 patients a year would require an additional intra-operative cross-match. At our institution the vascular surgery, anaesthesia and haematology
departments agreed a revised policy of cross-matching two units for elective AAA repair. This strategy will be reevaluated in 12 months.
Should vascular patients in Sheffield be concerned about post operative delirium and persistent post operative cognitive dysfunction?

Authors

Dr Claire Cruikshanks FRCA, Anaesthetic ST4
Dr Karen Kerr FRCA, Consultant Anaesthetist
Northern General Hospital, Sheffield.

Introduction

A recent meta-analysis has confirmed a link between delirium and institutionalisation, dementia and death [1]. Vascular patients, in particular, present with multiple risk factors for delirium such as advanced age, and cerebrovascular disease, and might be at increased risk of post operative cognitive decline (POCD) [2]. The risk of POCD has been drawing media attention, particularly regarding the issue of consent [3,4]. Using cardiac scoring systems such as the Lee’s cardiac index we can provide patients with pre-operative cardiovascular risk estimates. We are, as yet, unable to calculate the risk of delirium and POCD. We undertook a review to see if our vascular patients were experiencing higher delirium rates and therefore were at greater risk of POCD.

Method

We reviewed the STH Critical Care Database including 10805 patients. Of these 1457 were unscreened and removed from analysis leaving 1792 recorded as scoring positive for delirium, 16.6% of all admissions.

Results

The majority of admissions to critical care were surgical, 74%, with an overall delirium incidence of 13.7%. The delirium incidence in the elective population was 6.5% versus 23.8% in the acutely admitted surgical population. This is in line or lower than other published results highlighting the problem of under-reporting even in a screened population [5,6].

With regard to the elective admissions the highest numbers of delirium positive patients were seen in upper GI, hepatobiliary and vascular patients with rates of 1 in 8, 1 in 9, and 1 in 12 respectively. In the setting of acute admission five surgical specialities displayed similar delirium rates of approximately 1 in 4 patients. These were the colorectal, orthopaedic, vascular, hepatobiliary and upper GI cohorts.
Discussion

Vascular patients have a high delirium risk even in the elective setting, a 1 in 12 risk increasing to 1 in 4 in the acute admission. Our vascular patients did not appear to have greater delirium risk than other specialities which maybe explained by shared delirium risk factors such as age and comorbidities in these surgical groups.

Our high delirium rates in elective surgical patients suggest there is more work needing to be done in the pre-assessment, identification and modification of peri-operative delirium risk. This is of particular importance when considering a proportion of delirium is thought to be preventable7,8.

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CPET can identify patients with reduced survival following elective AAA repair.

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Introduction
The aim of this study was to investigate the relationship between preoperative CPET derived variables with long term survival in patients undergoing aortic aneurysm repair (EVAR and open) at two separate vascular units.

Methods
Prospective data was collected on all patients undergoing CPET prior to elective AAA repair at two university hospitals between January 2007 and May 2012. Mortality data was obtained from the Demographic Batch Service UK. Abnormal CPET variables were defined as AT < 10.2ml/kg/min, VE/VCO\(_2\) ≥ 42, and peak VO\(_2\) <15 ml/kg/min. Abnormal haemoglobin was defined as < 11.0 g/dl for women and < 13.0 g/dl for men. Multivariate analysis was used to identify variables associated with long term survival.

Results
Data was available for 506 patients. The median age of patients was 74 (IQR 68 – 79), and 418 (83%) were men. EVAR was performed in 327 (65%) and open repair in 179 (35%) patients. The median interval between CPET and AAA repair was 56 (IQR 26 – 90) days. Median follow up time was 784 (range 0 – 2047) days. On multivariate analysis peak VO\(_2\) < 15ml/Kg/min (HR 1.85, 95% CI 1.15 – 2.98, p=0.01), VE/VCO\(_2\) ≥ 42 (HR 1.84, 95% CI 1.10 – 3.09, p = 0.02), abnormal haemoglobin (HR 2.00, 95% CI 1.30 – 3.10, p = 0.002) female sex (HR 0.47, 95% CI 0.23 – 0.96, p = 0.038), and a combination of two or more abnormal CPET variables (HR 2.03, 95% CI 1.31 – 3.13, p = 0.001) was associated with reduced survival.

Conclusions
Previous studies have demonstrated that specific preoperative CPET variables can identify a high risk cohort (early mortality both at 30 and 90 days) after AAA repair.\(^1\) We have demonstrated that these CPET also identify patients with reduced survival following elective AAA repair. This may be useful in guiding clinical decisions in high risk individuals and guide the MDT with respect to the mode of intervention offered.

Observation of one year survival and progression of renal disease in patients with severe chronic kidney disease following elective endovascular aneurysm repair (EVAR)

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EVAR has become the predominant method for repairing abdominal aortic aneurysm. Chronic kidney disease (CKD) has been suggested to be a relative contraindication to EVAR in view of the deleterious effect on future renal function.

We reviewed our elective EVAR database to identify patients with who had an estimated glomerular filtration rate (eGFR) less than 30ml/min/1.73m² BSA but excluded those established on renal replacement therapy (RRT). Serum creatinine and eGFR was recorded on two occasions pre-operatively (to assess stability of renal function), in the immediate postoperative period and at six and twelve months postoperatively. We examined the outcome of these patients in terms of deterioration in renal function, commencement of RRT and survival over one year.

Twenty-five such patients were identified who had undergone EVAR between 2007 and 2011. Mortality at 30 days was 1/25(4%), 4/25(16%) at 6 months and 6/25(24%) at one year. In total, 8/24(31%) of the patients had a ≥20% decrease in their eGFR by six month of follow up. RRT had been started in 4/25(16%) at six months. At one year, one of these four patients started on RRT had died and a further two had now started RRT. Two patients (who had been started on RRT between discharge and six months) now no longer required RRT and were still alive at one year. In summary, six (24% of cohort) patients required a period of RRT during the one year follow up period, of these RRT patients one died between six and twelve months and two no longer required RRT.

Initial results suggest that EVAR can be performed with satisfactory early mortality rates, however, the mortality at 6-12 months and sustained decline in renal function suggest that the cost effectiveness and likely long term survival needs to be carefully considered in this group of patients.
THORACIC EPIDURAL ANALGESIA INCREASES PERIOPERATIVE MI IN PATIENTS UNDERGOING OPEN ABDOMINAL AORTIC SURGERY

AUTHORS Gary Dobson1, Reuben Eng1, Michelle Lohman1, Fabiana Gordon2


Introduction: Thoracic epidural analgesia (TEA) is frequently used in patients undergoing open abdominal aortic surgery (OAAS). While TEA provides superior analgesia as compared with the alternatives, no clear reduction in serious perioperative complications has ever been demonstrated. Beta-blockers, agents that reduce peri-operative myocardial ischemia, have recently (1) been associated with increased mortality in the OAAS population when the patients have significant blood loss (BL). The purpose of this analysis was to determine if a similar relationship existed between TEA, BL and peri-operative complications.

Methods: Following institutional approval a retrospective study of all patients who underwent non-emergent OAAS between January 2002 and December 2007 was completed. Factors that might moderate the incidence of peri-operative myocardial infarction (MI) and death were recorded. Patients in whom the thoracic epidural catheter was inserted pre-operatively and was being used as the primary analgesic at 24 hours post-operatively were considered to have had TEA. Statistical analysis and modeling, including interactions, were performed to identify determinants of adverse outcomes.

Results: The charts from the 462 patients who underwent OAAS were reviewed, of which all adverse outcomes were documented in 461. TEA was used in 388 patients. With the exception of a history of ischemic heart disease (IHD) which was increased in the no TEA group, there were no statistical differences in age, sex, ASA status, Detsky score, RCRI, use of beta-blockers (BB), blood loss, or volume of blood transfused between the patients who had TEA and the no TEA group (Table 1). The interaction between no TEA versus TEA and blood loss is given by -1.119+0.00032*BL. Replacing BL by the group average (2560.44) results in -0.2890, suggesting patients without TEA are less likely to have a peri-operative MI (p=0.038).

Discussion: TEA can provide excellent post-operative analgesia and was used in 84% of the patients who underwent OAAS. The odds of a peri-operative MI is a function of blood loss and was increased through the use of TEA, in spite of a lower incidence of ischemic heart disease in these patients. These results suggest that the routine use of TEA in patients undergoing OAAS should be reconsidered.

Abstract Affirmation: Agree
Agree
Agree
Agree

Abstract Ethics Approval: REB approval only
Abstract Funding: Funding - No
Abstract Disclosure: Nothing to Disclose
CURRENT CATEGORY: Cardiovascular & Thoracic: Basic Science & Clinical
Ian White Patient Safety Award: No
Best Paper for Perioperative Medicine: No

PRESENTATION TYPE: Abstract

KEYWORDS: Thoracic Epidural Analgesia, Perioperative Myocardial Infarctions, Abdominal Aortic Aneurysm Repair.
Variable No TEA (n=68) TEA (n=388) p
IHD 36 139 0.024
BB 52 294 0.866
BL 2709 (2162) 2541 (2187) 0.559
p <0.05 considered significant. Mean (SD).
SESSION 5

Haemodynamic therapy for vascular surgery
“haemodynamic pharmacotherapy”

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This contribution will focus on the current knowledge with regard to perioperative
pharmacological cardiac protective strategies. Over the years different pharmacological
interventions have been proposed in order to improve patient’s outcome after vascular
surgery. These therapy include administration of beta-blocking agents, alpha 2 agonists,
statins, and others. Controversial results have been obtained and increasing evidence suggests
that the patient’s genetic profile may be involved in the extent of effect on perioperative
outcome.

In cardiac surgery, the choice of anaesthetic regimen was shown to affect the extent of
myocardial damage with perioperative ischaemia. Data for vascular surgery are scarce and
will be critically reviewed.

Finally, the paradigm shift occurring from pre-operative risk stratification and
optimization to an intra-operative risk stratification and proposal for optimizing tailored
individual postoperative monitoring and treatment, will briefly be addressed.
New anticoagulants

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A substantial part of patients undergoing surgical procedures are treated with antithrombotic drugs. Recently, a couple of new anticoagulants and antiplatelet agents have been introduced in clinical practice. These new drugs partially overcome the disadvantages of the older substances, e.g., the need for monitoring, the risk of heparin-induced thrombocytopenia, and the need for parenteral application. However, to manage these new drugs safely specific knowledge on indications and pharmacology is mandatory. Such knowledge is getting a key competence of perioperative physicians.

New anticoagulants
Rivaroxaban and apixaban are selective direct factor Xa inhibitors (Figure 1) that are administered orally. Rivaroxaban is used in patients with non-valvular atrial fibrillation\(^1\) and in the treatment and prevention of thromboembolism. Apixaban is used in non-valvular atrial fibrillation and prevention of thromboembolism. Dabigatran is a direct thrombin antagonist used in similar clinical situations. The main advantage of these new oral anticoagulatory drugs (NOACs) compared with coumarins in patients with (non-valvular) atrial fibrillation is the reduced incidence of cerebral haemorrhages with a similar or even decreased rate of thromboembolic episodes.\(^2\) Disadvantages are the lack of standardized monitoring and the lack of reversibility.\(^3\)

In elective surgery, timely discontinuation of the NOACs is mandatory. Because of the high renal excretion of dabigatran (80%), renal function must be taken into consideration. In emergency situations with heavy bleeding, four-component prothrombin complex concentrates are suggested.\(^3,^4\) However, these recommendations are mainly based on preclinical animal data, and evidence and clinical experience for this approach is sparse.\(^5\)

![Figure 1. Simplified coagulation cascade and the targets of heparins and thrombin and factor Xa inhibitors. (Reproduced from reference 6)](image-url)
AT, antithrombin; FXa, factor Xa; LMWH, low-molecular-weight heparin; TF, tissue factor; UFH, unfractionated heparin. IXa, Va, VIIa, VIIIa, X, Xa, XIa, XIIa refer to factors.

Antiplatelet agents
The use of aspirin along with P2Y₁₂ inhibitors is common practice in all patients undergoing percutaneous coronary interventions and in patients with acute coronary syndromes (ACS). Recent guidelines recommend the use of prasugrel and ticagrelor instead of clopidogrel.⁷,⁸ In contrast to clopidogrel and prasugrel, ticagrelor does not need biotransformation in the liver and binds reversibly to the P2Y₁₂ receptor.⁹ However, because of active metabolites the antiplatelet effect of the drugs also lasts for days.¹⁰

Patients presenting for surgery under double antiplatelet therapy need careful interdisciplinary evaluation. Noncardiac surgery should be delayed until 12 months after coronary stenting.¹¹ If stopping dual therapy can be justified, clopidogrel and ticagrelor should be stopped 5 to 7, and prasugrel 10 days before surgery. Aspirin should be continued. If delay is not justifiable, perioperative management should be discussed with the surgeon, the anaesthetist, the intensivist, and the cardiologist. Possible approaches are temporary interruption of the P2Y₁₂ inhibitors (with or without perioperative bridging with a GPIIb/IIIa inhibitor), or performing surgery with on-going dual antiplatelet therapy. It is important to note, that dual antiplatelet therapy is not a guarantee for perioperative freedom of ischemic events but goes along with an increased risk of bleeding.¹²

References
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SESSION 6

Monitoring in Carotid Surgery

Dr Mark Stoneham, Nuffield Department of Anaesthetics, Oxford

Monitoring during carotid endarterectomy differs from other major operations in two respects: first because the cerebral circulation is at considerable risk of ischaemia during the period of carotid cross-clamping; and second because the operation involves operating on an area very close to the principal regulatory mechanism for blood pressure control i.e. the baroreceptors.

Monitoring therefore consists of all the usual suspects as recommended by the AAGBI: anaesthetic machine monitors; cardiovascular including ECG, blood pressure; respiration including end-tidal carbon dioxide (very important due to the profound effects CO2 has on the cerebral vasculature); and others including the neuromuscular junction for GA cases, temperature monitoring and, perhaps, depth of anaesthesia monitoring.

The ‘gold standard’ for monitoring the cerebral circulation is the awake patient, with the ability to monitor the cerebral circulation by means of assessing speech (hello Mr Smith are you feeling OK?); cerebration (what day of the week is it?); and grip strength (squeeze my hand). Other available cerebral monitors during general anesthesia for CEA include:

1. Carotid stump pressure – in which a needle attached to a pressure transducer is placed in the internal carotid artery distal to the common carotid cross-clamp – this measures the blood pressure due to collateral blood flow round the circle of Willis
2. EEG – not commonly used – it requires an electrophysiology technician to operate the electroencephalography machine but has good specificity and sensitivity.
3. SSEP – similar, a ‘big box’ required and a technician needed.
4. Transcranial Doppler – the most popular technique used in the UK for GA cases. An ultrasonic Doppler probe is placed over the temporal bone, measuring the velocity of middle cerebral artery blood coming towards it. Flow is derived. It is useful for looking at adequacy of flow during cross-clamping but also is used postoperatively for monitoring at particulate embolism and to assess patients at risk of cerebral hyperperfusion syndrome
5. Cerebral oximetry and other near-infrared spectroscopy techniques. Cerebral oximetry is a ‘quick-fix’ cerebral monitor in which an adhesive electrode is placed on the patient’s forehead and the cortical oxygen saturation is displayed. Unfortunately it has a low sensitivity and specificity for cerebral ischaemia.

Blood pressure control and monitoring is particularly important. The death and stroke rate of carotid endarterectomy (CEA) remains high. Blood pressure instability contributes to the morbidity and mortality (in the GALA trial of 3500 patients, the overall stroke and MI rate was 4.7%) and is common during CEA for several underlying reasons:

1. Many patients are ‘arteriopaths’ with essential hypertension & ischaemic heart disease and therefore have greater lability of blood pressure
2. One of the major control mechanisms of blood pressure – the carotid baroreceptors – are involved in the disease process
3. Patients who have suffered a stroke or transient ischaemic attack may be newly-diagnosed hypertensives and have been recently started on anti-hypertensive treatment.
In addition, specific patient factors also influence peri-operative haemodynamic stability, including: uncontrolled hypertension; the presence of bilateral carotid occlusion and whether or not the patient took their anti-hypertensives, particularly ACE inhibitors.

The author has a simple stepwise approach to blood pressure management during CEA as follows: The patient’s preoperative baseline BP is estimated from patient records, preassessment clinic and the anaesthetic room. The IBP alarm limits are altered appropriately e.g. 140<BP<200. Typical postoperative instructions for PACU are as follows: If BP<120, give Hartmann’s 250 ml IV stat. If BP>180, administer LABETALOL 5mg IV up to 100 mg. Haemodynamic instability should be treated promptly but carefully.

References:

Lower Limb Amputation

Dr Paul Lancaster, Consultant Anaesthetist, Central Manchester University Hospitals NHS Foundation Trust

Major lower limb amputation for peripheral vascular disease presents a significant challenge to clinicians. Despite improvements in revascularisation techniques, the increasing incidence of diabetes is likely to see increased numbers of amputations in the future. Peri-operative mortality is significant and the Vascular Society produced the Quality Improvement Framework with the primary aim of reducing the peri-operative mortality from a current level of 17%\(^1\) to less than 5% by 2015\(^2\). The Framework relies heavily on a multi-disciplinary input and the specialty of Anaesthesia has an important role to play throughout the document.

This talk will examine some of the evidence that may influence the anaesthetic components of peri-operative pathways for amputee patients based on the Framework.

**Preoperative**

Pain management in the perioperative amputee patient centres around control of the pre-operative *ischaemic pain*, acute post-operative *stump pain* and the subsequent development of *phantom limb pain* (PLP). Previous attempts to display reduced rates of PLP with pre-emptive analgesia have been mixed\(^3,4\) and the role of adjunct such as gabapentin is unlikely to be helpful\(^5\). The provision of good analgesia leading up to amputation and continued through the post-operative period is a basic requirement and probably contributes to a decreased incidence of residual stump pain and PLP\(^6\).

The window for optimisation of medical conditions remains small in what is a high-risk group of patients; time to facilitate further investigations or institute therapy must be balanced against the delay to definitive surgery.

**Perioperative**

Patients should ideally be operated on during daytime hours on planned lists by senior surgeons and experienced anaesthetists within 48 hours of the decision to operate\(^2\). Regional anaesthesia has potential benefits including potentially reduced short-term cognitive impairment\(^7\) but sepsis and coagulopathy are not uncommon in providing a relative contraindication in this patient group. A variety of techniques to provide peri-operative analgesia can be used and it is currently unclear if optimised systemic analgesia, such as a fentanyl PCA is inferior to more invasive peripheral or central nerve blockade. The upcoming PLATA study may help resolve this question\(^8\).

**Postoperative**

A formal pain management plan should be continued well into the post-operative period and this clearly needs input from anaesthesia and pain teams. In addition, the process of rehabilitation should begin as soon as possible.

The Framework provides a multi-disciplinary approach with the primary aim of a significant reduction in mortality, but it is likely that important secondary endpoints such as peri-operative analgesia and PLP rates will also be improved. Adoption of a clinical pathway similar to those used in other high-risk groups\(^9\) is likely to be an effective approach in this challenging patient population.

**References**

TOE has been used for many years in cardiac anaesthesia where it is considered a standard of care. More recently, guidelines such as those of the American Society of Anesthesiologists\(^1\) and the European Society of Echocardiography\(^2\) have supported the use of TOE in non-cardiac surgery, particularly in cardiovascularly unstable patients and during major procedures. For vascular anaesthetists, TOE is useful intraoperatively for assessing ventricular function and filling, for assessing ventricular ischaemia and for imaging the thoracic aorta.

**Ventricular function**

Ventricular function can be assessed using TOE, either qualitatively or quantitatively.

Simple measurements of LV function include the *fractional shortening* (the fractional change in left ventricular chamber diameter between diastole and systole) and *fractional area change* (fractional change in LV cross sectional area between diastole and systole). Most TOE machines will estimate end diastolic and end systolic volumes, albeit by assuming that the left ventricle conforms to a standard shape. More accurate estimates of these indices are time consuming to perform, and are not generally carried out in theatre. It is, however, relatively easy to estimate stroke volume and cardiac output with TOE using Doppler.

**Ventricular filling**

Assessment of ventricular filling is relatively straightforward using TOE. A video image of the left ventricle taken when it is full can be stored and compared side-by-side with later of the left ventricle. Provided care is taken to ensure that the two images are taken at the same level of the ventricle, a difference in ventricular diameter indicates a difference in filling.

**Ventricular ischaemia**

Myocardial ischaemia leads to abnormal contraction, which is evident on TOE as a new wall motion abnormality. This may appear before ST changes are apparent. The site of the wall motion abnormality can also be related to the blood supply from a particular coronary artery. However, detecting wall motion abnormalities does require a degree of skill and experience. It is also not possible to view all of the heart at once, and most TOE machines will switch off the ultrasound beam after a few minutes (on the grounds of safety). Therefore, unlike ECG, TOE cannot continuously monitor the whole of the myocardium for ischaemia.

**Thoracic aorta**

In addition to imaging the heart, TOE can also be used to view the thoracic aorta. This may be helpful during the placing of thoracic endovascular stents.

Following suitable training, accreditation in TOE can be obtained. The current accreditation framework in TOE in the UK is essentially designed for cardiac anaesthetists; however in the USA, the National Board of Echocardiography provides basic accreditation in TOE which
can be fairly easily obtained by those undertaking non-cardiac anaesthesia, and it will soon be possible to sit the NBE exams in the UK\textsuperscript{3}.

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Impact of a local guideline on the incidence of acute kidney injury in patients undergoing elective endovascular aortic aneurysm repair (EVAR)

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Acute kidney injury (AKI) is often overlooked and poorly managed in the general surgical population. This was highlighted by the 2009 NCEPOD report: Adding Insult to Injury¹. The development of wider ranging complex endovascular interventions within our unit and the increase in standard EVAR intervention in an increasingly co-morbid and aged population led us to develop a strategy to minimise the risk of AKI.

Using data from patients who underwent EVAR between 2005 and 2011 we had previously produced a risk stratification algorithm for use at vascular preoperative assessment clinic. We produced a guideline which provides a structured approach to risk stratification, allows early clinical detection of AKI and which prompts the vascular team to consider strategies to reduce the impact of AKI. Such strategies included the cessation of potentially nephrotoxic drugs 24 hours prior to surgery, avoidance of contrast within 7 days of surgery, pre-operative IV fluid therapy and N-acetylcysteine. We also agreed a benchmark dose of 100ml of contrast agent (Iodixanol 270 mg l/ml) for standard infra-renal EVAR after discussion with our radiology and surgical colleagues.

Data from 327 elective patients were analysed. 199/327 underwent surgery prior to the guideline and 128/327 since its introduction. The incidence of AKI prior to the guideline was 22/199 (11.1%) and since the guideline was 10/128 (7.8%); Chi-squared; $P=0.34$. The mean dose of contrast administered before and after implementation of the guideline has decreased from 201.1ml to 134.4ml ($p<0.0005$), Student’s T test with log transformation.

Since the introduction of the guideline we have observed a reduction in AKI, this appears to relatively modest at present; however it is too early to know whether the impact will increase and be sustained. Practice has changed within the unit with a significant decrease in the dose of contrast administered and we believe that awareness of AKI is increased. Adherence to the guideline needs to be audited in the future to understand whether further reductions in AKI can be achieved using this initiative.

References

Does anaesthetic technique influence 30 day mortality and morbidity in patients undergoing major lower limb amputation?

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Background Lower limb amputations are associated with significant mortality and morbidity. The objectives of this audit were:

1. To compare 30 day mortality rates and complications rates between patients undergoing general or spinal anaesthesia for major lower limb amputations.
2. To evaluate whether the addition of sciatic nerve infusion catheters (SNIC) ± regional nerve blocks (femoral ± sciatic) yield a mortality and morbidity reduction for patients requiring major lower limb amputations.

Methods Retrospective review of medical records for consecutive patients requiring major lower limb amputations (primary and revision) between January 1, 2011, and December 31, 2012. Demographic details, ASA, procedure, anaesthetic technique and 30 day mortality and morbidity were recorded. The main outcome measures were cardiovascular, respiratory, neurological and infectious complications, as well as subsequent operation.

Results 30 day mortality rate was 6%. Of the three patients that died, 2 of the patients had a general anaesthetic. 63% of patients had complications within 30 days post operatively. Cardiovascular complications were the most common. Five patients required a revision operation. On analysis of chi squared there was no significant difference in the proportion of patients that developed post operative complications between those that had general anaesthesia and those that had spinal anaesthesia.(p=0.865)

Discussion Mortality rates are lower in our centre in comparison to those previously described. (1) Post operative complications were independent of anaesthetic technique. The data set collected was insufficient to evaluate whether the addition of (SNIC) ± regional blocks improve mortality and morbidity in patients undergoing major lower limb amputations. Further data collection is required.

References

Major pitfalls in management of lower limb amputations

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Those undergoing major lower limb amputations (MLLA) represent a sick group of patients often with multiple complex comorbidities and poor outcomes. This prompted the development of the Quality Improvement Framework for Major Amputation Surgery (Vascular Society, November 2010). This study aims to review current practice and outcomes for MLLA against this framework; electronic based systems and case notes were reviewed of 68 MLLAs undertaken by a vascular unit over a two year period.

MLLA was most commonly undertaken on male (74%), diabetic (53%), smokers (74%) presenting with critical limb ischaemia (71%). Mean length of hospital stay was 17 days. Overall 53% of patients developed a major postoperative complication. Mortality rates at 30 days and 1 year were 10% and 40.8% respectively. The majority (65%) of cases were undertaken on emergency theatre lists. MLLA performed on an emergency list rather than in a vascular theatre had a considerably higher complication rate (61.4% versus 45.8%) and revision rate (11.4% versus 8.3%). Mortality at 30 days was over three times higher when performed on an emergency list (13.6% versus 4.2%). Involvement of the acute pain team and consideration of regional techniques were underutilised. Anaesthetic assessment was made on the morning of surgery in all. Only 45% of patients were reviewed postoperatively by the acute pain team. Rates of significant post amputation pain reported in 12%. Use of epidural was underutilised (Table 1).

Table 1. Intraoperative and postoperative analgesia

<table>
<thead>
<tr>
<th>Intraoperative analgesia</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal</td>
<td>48.5</td>
</tr>
<tr>
<td>General anaesthetic</td>
<td>36.8</td>
</tr>
<tr>
<td>Nerve block</td>
<td>8.8</td>
</tr>
<tr>
<td>Epidural</td>
<td>5.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Postoperative analgesia</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>69.1</td>
</tr>
<tr>
<td>Epidural</td>
<td>16.2</td>
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<tr>
<td>Patient controlled analgesia</td>
<td>11.8</td>
</tr>
<tr>
<td>Epidural + Patient controlled analgesia</td>
<td>1.5</td>
</tr>
</tbody>
</table>

This study identifies major pitfalls in our management of patients undergoing MLLA. It illustrates high rates of MLLA performed on emergency lists with subsequently poorer outcomes. MLLA performed on emergency lists should be replaced by dedicated access to a vascular theatre, or named operative lists. This study highlights suboptimal pain control; development of a formal pain management protocol with focussed management for neuropathic pain may improve rates of assessment by specialist teams and increase anaesthetic input. This should allow for better planning preoperatively and optimization of pain control throughout the patient pathway.

Acknowledgements: No competing interest declared
An audit of major lower limb amputations at the Royal Sussex County Hospital, Brighton.

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Aim: To determine the mortality rate for major lower limb amputations at the Royal Sussex County Hospital and compare current care with the recommended standards from the Quality Improvement Framework for set out by the Vascular society of Great Britain and Ireland (VSGBI).

Method: Retrospective cohort study of 90 knee amputations between January 2009 and December 2012. Data that was collected preoperatively: co-morbidities, ASA, arterial assessment, previous limb revascularisation. Operation: Time, theatre number, surgeon grade, anaesthetist grade, type of anaesthetic, level of amputation. Post operation: Pain team, morbidity and mortality.

Results: A total of 90 patients were included, 38 above knee amputations, 33 below knee amputations, 19 through knee amputations (ratio 2:1.7:1) with a mean age of 70 years. Fifty patients had an arterial assessment, and 26 had previous revascularisation. Sixteen (18%) operations were performed on out-of-hours lists. The surgeon performing the operation was a consultant in 39 (43%) cases and the anaesthetist was a consultant on 69 (77%) cases. Eighty-seven percent of patients were anaemic pre operation. Increasing ASA grade was associated with higher morbidity and mortality. Twenty-seven patients had a post-operative infection and 9 needed a revision to a higher level. Mortality rate was 12.7% with cardiac and respiratory failure being the leading causes.

Recommendations: Amputation is a major life event and carries a high mortality rate. Our mortality is higher than the VSGBI target (<5%) and work needs to be done to reduce it. This includes increasing the number of operations performed by consultants, performing more emergency operations during working hours on a vascular emergency list, and wherever possible, optimising patient’s pre-operation. We believe that new surgical techniques and prosthetics for through knee amputations are proving advantageous for patient quality of life and therefore BSUH is performing more than other centres.
A local assessment of anaesthetic compliance with the Abdominal Aortic Aneurysm Quality Improvement Programme (AAAQIP)

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In 2008, the UK’s mortality rate of 7.9% for elective abdominal aortic aneurysm (AAA) surgery was significantly higher than for the rest of Europe. Collaboration between the Vascular Society of Great Britain and Ireland (VSGBI), the Vascular Anaesthetic Society of Great Britain and Ireland (VASGBI) and the British Society of Interventional Radiology (BSIR) aimed to reduce this figure to 3.5% by 2013. Recommendations in order to achieve this include formal risk assessment, using the “safe for surgery” traffic-light checklist with correction of adverse clinical features. All those involved in their care should have a regular vascular specialist practice.

The medical records of all patients who underwent elective AAA repair at Royal Derby Hospital, UK, between 1st January and 31st December 2012 (prior to introduction of the “safe for surgery” traffic light checklist) were retrospectively reviewed. The checklist and a V-POSSUM was retrospectively calculated (blinded to outcome).

Fifty-eight (56 male, 2 female) patients underwent elective AAA surgery (10 open, 33 standard infra-renal endovascular aneurysm repair (EVAR), 15 fenestrated EVAR). Fifty-three (91%) patients were seen pre-operatively by a vascular specialist anaesthetist. Patients were most commonly first seen by an anaesthetist on the day of surgery (median time seen pre-operatively: 0 days, range 0 to 55 days). Optimization of co-morbid conditions was instigated in 6 (10%) patients (change in medication in all 6, with additional blood pressure control for 1 and referral to nephrologist for 2). Twenty-seven (47%), 19 (33%) and 12 (21%) patients were classed as “green”, “amber” and “red” retrospectively on the “safe for surgery” checklist. Two (7%) “green” patients, 1 (5%) “amber” patient and 4 (33%) “red” patients suffered non-aneurysm-related morbidity (sensitivity=57%, specificity=84%, p=0.03). There was no difference in the median V-POSSUM scores for patients suffering post-operative morbidity versus those suffering no morbidity (35% vs. 34%, p=0.71). Overall 30-day mortality was 0% and non-aneurysm related morbidity was 14%. A specific discussion with the patient about risk was documented in 45 (78%) patients’ notes.

In accordance with AAAQIP guidance, a specialist vascular anaesthetist saw the majority of our patients pre-operatively. However, this was usually on the day of surgery, leaving little scope for pre-operative optimization in light of the anaesthetic assessment. Our data would support the use of the “safe for surgery” checklist, particularly in identifying patients at high risk of post-operative morbidity, and this analysis supports the introduction of a dedicated pre-operative anaesthetic assessment clinic to enhance the shared decision-making process.
An audit of acute pain management following major lower limb amputation at the Royal Oldham Hospital

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Pain following lower limb amputation can contribute to long-term physical and psychological morbidity. Effective pain control relies on regular assessment that should be incorporated with routine physiological observations, patients identified as having uncontrolled pain should have this managed. We audited current pain assessment practice and quantified the prevalence and management of uncontrolled pain at a district general hospital.

This retrospective audit collected data on all patients having NCEPOD class 2 or 3 major lower limb amputations at The Royal Oldham Hospital in 2012. Proposed standards for best practice of postoperative pain control were as follows:

- Pain assessed and documented every time pulse and BP recorded (>95% patient days)
- Isolated events of moderate/severe pain in a 24 hour period (<5% patient days)
- No consecutive occurrences of moderate/severe pain in 24 hour period

Pain control was recorded on The Penine Acute Trust observation chart as a 4 point verbal rating scale as follows: 0 = No pain, 1 = Mild pain, 2 = Moderate pain, 3 = Severe pain.

Serial observations were then stratified as follows: Good control (all pain assessments no pain or mild pain), borderline control (isolated incidences of moderate or severe pain) or poor control (two or more consecutive incidences of moderate/severe pain).

58 patients having 60 operations were identified. Of these 33 (56.9%) were male. The average age was 69.2 years. 40/60 operations were above knee amputations, there were 17 below knee amputations and we were unable to identify 3 operations. Of the 58 patients, we were able to retrieve notes for 30 and of these 26 were complete enough to allow extraction of data. Audit data were analysed for a postoperative period of 7 days, there was a total of 173 postoperative patient days available for analysis.

Pain assessment was documented with other observations on every occasion in 158/173 days (91.3%). Pain control was rated as borderline in 14/158 days (8.86%) and as poor in 6/158 days (1.89%).

This audit found that assessment of pain fell below the expected standard in terms of frequency. When recorded there was a higher than expected incidence of borderline and poor pain control. These 20 days of uncontrolled pain occurred in a cohort of just 8 patients, experiencing repeated, consecutive episodes of moderate or severe pain. This is not surprising given that a change in management was instigated in only 4/20 (20%) patient days where borderline or poor pain control was observed. 6/8 of these patients took regular strong opiates prior to surgery with 7/8 of them achieving good preoperative pain control.

Our audit found suboptimal performance in terms of frequency of pain assessment and subsequent management when pain control was found to be poor. This highlights the need for
a formal pain management protocol, this protocol should be available to guide ward staff in terms of frequency of pain assessment and a stepwise pathway focusing on non-opiate adjuvants to manage poorly controlled acute postoperative pain, as opiate tolerant patients seemed to have more uncontrolled pain following lower limb amputation.
Postoperative analgesia following amputation surgery: Clinical audit of current practice at a tertiary vascular centre

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Providing effective postoperative pain relief following lower limb amputation represents a complex challenge and a central focus of national quality improvement initiatives. Availability of multiple regional options and extensive comorbidity generates uncertainty surrounding the optimal analgesic strategy. Vascular surgical opinion in our institution is starkly divided regarding the utility of sciatic nerve catheters in this setting, confounded by limited published evidence. We undertook a clinical audit of our current practice with 3 specific aims: 1. Evaluate the quality of postoperative pain control. 2. Assess the impact of a sciatic nerve catheter infusion on subjective pain scores. 3. Evaluate postoperative prescribing and use of adjunctive agents.

We undertook a retrospective case note review of all elective and emergency amputations for peripheral vascular disease over a two-year period. Postoperative days 1-3 were evaluated. No exclusion criteria were utilized.

A total of 56 cases were identified. Subjective pain scores were documented across a variety of pain tools, 26% of cases were deemed to have an incomplete assessment of postoperative pain. Above-knee patients (AKA) were shown to be more comfortable than below knee cases (BKA) overall. Multiple regional combinations were employed with most effective analgesia following PCA usage. Table 1 demonstrates the impact of sciatic nerve catheters (SNC).

<table>
<thead>
<tr>
<th></th>
<th>Mean pain score (0-10) Day 1</th>
<th>Mean pain score (0-10) Day 2</th>
<th>Mean pain score (0-10) Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BKA with SNC (n=20)</strong></td>
<td>3.1</td>
<td>3.9</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>BKA no SNC (n=7)</strong></td>
<td>4.3</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td><strong>AKA with SNC (n=10)</strong></td>
<td>1.3</td>
<td>2.4</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>AKA no SNC (n=4)</strong></td>
<td>3.0</td>
<td>4.3</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Table 1 - mean pain scores and impact of sciatic nerve catheter on subjective pain scores.

Of 51 cases with an available drug kardex, 64% of cases had postoperative prescriptions consistent with the WHO analgesic ladder. Regular paracetamol was not utilized in 3 cases. A GABAergic adjunctive agent was employed in only 10% of cases.

This audit has highlighted the difficulty of coordinated postoperative pain assessment and management when multiple infusions and techniques are utilized. Our current practice does not provide adequate analgesia in all cases, notably in BKA. Patients appeared to be
marginally more comfortable overall when a sciatic nerve infusion was utilized. Postoperative prescribing was highly variable with potential under-use of adjunctive agents reflecting concerns surrounding side effects in this highly co-morbid patient group. This audit recommended the design and trial of a dedicated pain tool for vascular amputation to centralize the assessment and guide evidence based management of postoperative pain.

References

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Our Trust introduced an ERAS pathway for elective open abdominal aortic aneurysm (AAA) and endovascular aneurysm repair (EVAR) in July 2013. Evidence for ERAS in vascular surgery includes: shorter hospital stay and reduced cost; reduced requirement for mechanical ventilation, shorter ITU stay, time to enteral feeding and incidence of post-operative medical complications.

We performed a retrospective audit of practice in 31 randomly selected elective open AAA or EVAR patients operated upon within 2 years prior to pathway implementation. Table 1 summarises some of the domains measured. Further supplementary data on patients managed via the ERAS pathway is expected by September.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Expected Standard (%)</th>
<th>Current Compliance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-operative</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardio pulmonary exercise testing</td>
<td>80</td>
<td>87</td>
</tr>
<tr>
<td>Temperature &gt;36°C on arrival to theatre</td>
<td>100</td>
<td>64</td>
</tr>
<tr>
<td><strong>Intra-operative</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal-directed fluid therapy</td>
<td>100</td>
<td>58</td>
</tr>
<tr>
<td>Thoracic epidural for open repair</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Forced-air &amp; fluid warming</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>Post-operative</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Troponin measured</td>
<td>100</td>
<td>26</td>
</tr>
<tr>
<td>EVAR epidural removed by day 1</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Open epidural removed by day 3</td>
<td>100</td>
<td>80</td>
</tr>
</tbody>
</table>

Table 1: Summary of ERAS pathway compliance by domain, n = 31

Much of the current aortic surgery pathway within our Trust mirrors the AAA Quality Improvement Framework and shares components with our proposed ERAS pathway. Variation in practice, however, remains and one of the aims of the ERAS pathway will be to reduce this and guide peri-operative care towards best practice. Not all patients in a group with a heavy co-morbid burden and frequent non-elective presentations – for example large
symptomatic aneurysms – can rigidly adhere to a predictable clinical course. However, it may be that an ERAS pathway will remove unnecessary variance for those elective AAA patients resulting in improved outcome. To evaluate any such improvement, pathway compliance is now monitored by a dedicated ERAS coordinator and will be re-audited at regular intervals.

References
Prospective observational service evaluation of the impact of the anaesthetic techniques on length of stay, time to mobilization and morbidity following elective endovascular repair of aortic aneurysm (EVAAR)

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An increasing proportion of abdominal aortic aneurysms are repaired via endovascular stenting as opposed to an open repair. There is an on-going debate regarding the type of anaesthesia employed during the procedure and its impact on the post-operative morbidity and mortality. Several studies have shown that rates of cardiac complications and length of stay were increased amongst patients having a general anaesthetic (GA).[1,2].

The aim of this service evaluation was to identify the time to mobilization, rates of morbidity and the changes in quality of life after infra-renal EVAAR under general anaesthesia versus regional anaesthesia at St. Thomas' Hospital.

Data was collected prospectively at St Thomas' Hospital following elective infra-renal and non-complex EVAAR. Consent was obtained from each patient to be followed up on day one post-operatively as an in-patient as well as by telephone interview on day 30 post-operatively. Before induction, the following data were recorded: patient identifiers, reason behind the choice of anaesthesia (general versus regional) and predicted morbidity by V-POSSUM score. On day one post-operatively, the following data were obtained: pain score and supplementary analgesia required in recovery, time taken to mobilise and complications. An EQ-5D questionnaire was completed on days one and 30 post-operatively. Statistical analysis of the primary outcome (time taken to mobilise) and the secondary outcomes was carried out to evaluate any significant differences. Ethical approval was deemed not to be necessary according to our trust guidelines.

Data was collected from twenty-two patients between May and July 2013. Fifteen patients had general anaesthesia and local infiltration at the end of surgery and six had lumbar epidural anaesthesia.

There was a statistically significant difference in the time to mobilization. 25.1 hours (SD 25.2) following GA versus 11.4 hours (SD 6.4) following RA, \(p=0.0278\). There was no difference in V-POSSUM scores, length of stay or quality of life indicators (EQ-5D questionnaires).

From this snapshot of current practice and outcomes it appears that there is a shorter time to mobilization following epidural anaesthesia compared to GA with no overall difference in morbidity or length of stay.
References


Do we meet Vascular Society Amputation QOF standards and do they matter?

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There are around 5000 major lower limb amputations per year in the UK due to peripheral arterial disease and current mortality figures are high compared with other European countries¹. Optimising pain relief during the perioperative period can result in improved clinical outcomes². The quality improvement framework presented by the Vascular Society has set the standards of care for these patients³. The aim of this audit was to compare current practice at Doncaster Royal Infirmary against the current pain management framework recommended by the Vascular Society: i) pain should be controlled, and the pain team involved as needed pre-operatively and ii) there should be a formal pain management protocol, and access to an acute pain team³.

A retrospective audit using a combination of case note review and Dr Foster Intelligence data was undertaken for the period August 2011 -October 2012. Fifty one patients were identified who underwent 53 major lower limb amputations. Case notes were retrieved for 33 patients. In addition, Dr Foster data was obtained for 46 patients.

Fifty-five percent (n=28) of patient were male with a mean age of 70.3 years (SD13.9). Thirty day mortality was 7.8% (n=4) and 1-year mortality was 19.6% (n=10). Five patients were readmitted within 28 days. Above knee amputations made up 54% (n=29) of operations.

There is currently no post-operative pain protocol and access to the acute pain team is limited out of hours. Mean pre-op pain score (Nursing Pain Score NPS 0-4) was 2.9(0.95) and post-op pain score (NPS 0-4) was 1.28(1.1). Patients (n=21; 63.6%) who had an epidural or wound soaker had significantly better post op pain scores [1.03(0.8)] compared to those without [1.95(1.5), p=0.04]. Post-operative pain scores were lower in patients operated on a weekday [1.1(0.81)] compared to the weekend [1.4(1.3); p=0.45]. Patients with worse pain control pre-operatively and those receiving opiates pre-operatively had longer lengths of stay.

These findings demonstrate that the standards of care set by the vascular society are not currently being met and that inadequate pain management is possibly associated with worse patient related outcomes including longer length of stay. In order to achieve better pain management an enhanced MDT approach is required with greater availability of the acute pain team out of hours and at weekends. We aim to implement a unified pain protocol emphasising that post-operative pain control with an epidural or wound soaker is the gold standard of care. We intend to repeat this audit after these changes have been implemented.

References
A Case of Cardiac Arrest during TEVAR with Rapid Ventricular Pacing

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TEVAR is a relatively new technique for repairs of the thoracic aorta. Data on complications and outcomes is important in expanding the knowledge base for this rapidly developing treatment modality. We present a case of cardiac arrest during TEVAR.

A 70 year old female presented for a total aortic arch endovascular repair for an aortic aneurysm which extended from the proximal aortic arch to the abdominal aorta. She had no significant past medical history, was taking no medications and had a good functional capacity. She had undergone a left carotid-subclavian bypass the previous week.

She underwent an uneventful induction of anaesthesia followed by insertion of a pacing wire via the left femoral vein by a consultant cardiologist. Some manipulation was required to achieve an adequate position of the pacing wire. Following insertion of the stent guide wire through the aortic valve the patient was heparinised. On achieving adequate position of the first stent graft, rapid ventricular pacing (RVP) was commenced with the systolic BP falling to 45mmHg for 25 seconds, and the stent graft was deployed. On discontinuation of RVP there was no cardiac output despite giving vasopressors so CPR was commenced. Transthoracic echo confirmed cardiac tamponade and pericardiocentesis followed by thoracotomy was performed – draining a significant volume of blood from the pericardium. (Heparin was reversed with protamine). A cardiac surgeon confirmed perforation of the right ventricle caused by the pacing wire. The procedure was abandoned with no distal seal of the aneurysm.

Her post-operative course was complicated by a right parietal stroke and multiple embolic cerebral emboli. She developed cardiac chest pain and a CT coronary angiogram excluded stent migration over the coronary ostia as a cause of this.

RVP has advantages over pharmacological methods of induced hypotension in TEVAR including rapid onset and offset and reduced cardiac stress and it is recommended as the technique of choice if profound hypotension is required\(^1\). The incidence of ventricular perforation with transvenous pacing wires in the medical population is up to 20\(^\%\)^{2} with the majority being subclinical and the incidence of cardiac tamponade is approximately 0.4\(^\%\). The risk in patients undergoing TEVAR who are heparinised is likely to be greater and particularly when insertion is via the femoral vein which is known to be a more difficult procedure. A joint decision between surgeons, cardiologists and anaesthetists should be made regarding its use, balancing its risks and benefits.
References

Ballooning the infra-renal sealing zone during endovascular abdominal aortic aneurysm repair (EVAR); is there a hidden cost?

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The initial early survival advantage gained by EVAR in comparison with open surgery is lost over the long term. Early postoperative Troponin are associated with increased risk of death in vascular patients. The use of a moulding balloon may place extra stress on the heart during the brief period of aortic occlusion. In this study we sought to investigate a relationship between balloon use and early postoperative Troponin levels.

Between July 2010 and May 2011, thirty-four patients undergoing standard EVAR had serum collected and analysed for serum troponin as per our unit protocol before surgery and on the first and second postoperative days. Seven were excluded with a preoperative estimated glomerular filtration rate of less than 60ml/min/1.73m² BSA, leaving twenty-seven for analysis. Use of a moulding balloon intraoperatively and troponin levels were then compared. The results were analysed using the Wilcoxon signed ranks test.

In twenty of these twenty-seven patients a moulding balloon was used in the infrarenal sealing zone. Of these, 14/20 patients exhibited a rise in their Troponin on days 1 and 2 postoperatively (preop Troponin vs. day 1 p= 0.004, preop Troponin vs. day 2 p=0.001). Three of these patients were dead at two years. No significant increase in Troponin levels were seen in the patients who did not receive a moulding balloon, all of these were alive at two years.

The use of a moulding balloon may not be entirely without consequence. In this study there is evidence of increased troponin leak and myocardial injury when they are used.
Title: Perioperative Cardiac Ischemia - what's the point of no return?

Author(s): Nair S, Kelly D.

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Introduction: Carotid endarterectomy (CEA) carries a 1-5% mortality primarily due to myocardial infarction. Coronary risk assessment is a key component of anaesthetic management. Predictors of risk are only probability statements, not certainties. Our interpretation of the available clinical information must be constantly re-evaluated perioperatively.

Case report: Following 'Preoperative Assessment Clinic' evaluation, a 67 year old male presented for CEA with symptomatic 95% stenosis of the right carotid artery. He smoked 50/day with NIDDM, hypertension and hypercholesterolaemia. He denied chest pain but had limited exercise tolerance of approximately 4 MET's. ECG was unremarkable. He was deemed fit for surgery.

After careful induction and intubation, the heart rate increased to 110/min and BP transiently measured 202/112 mmHg. Minimal ST depression was noted in leads II and V5. This reversed with labetalol induced haemodynamic stability. Over 10 - 15 minutes, the HR and BP remained labile. Given the suggestion of active ischaemia, the surgery was postponed and the patient awoken. Despite the patient being asymptomatic, emergency coronary angiogram showed severe triple vessel disease (LMS 90%, LAD moderate disease, RCA 90%) requiring coronary stenting. No perioperative infarct occurred.

Conclusion: Prediction of perioperative cardiac ischemia remains challenging without a reliable predictive test. Data doesn't support coronary angiography pre-operatively [1,3]. Multifactorial causes of ischemia - platelet activation, vasospasm etc. - are promoted by the neurohormonal surgical stress response [2]. Where ischemia develops during induction, postponing surgery avoids this stress response and surgically induced increases in myocardial oxygen demand. The ESC pre-operative cardiac guidelines whilst valuable, have practical and interpretational difficulties [3]. When we assess the risk profile, there remains a large subjective component to the interpretation of relevant cardiac symptoms and investigations. Our opinion of the patient’s cardiac risk may alter following induction of anaesthesia, especially in high risk candidates. Reconsidering one's decision to proceed with surgery as the clinical scenario changes may represent the safest option by limiting myocardial strain and allowing angiographic assessment of the coronary status.

Interpretation of coronary risk factors and associated clinical guidelines is critical to improving patient outcomes. The nuances of the available guidelines need to be understood. As clinical information presents anaesthetists must reinterpret the risk index and alter the planned clinical course accordingly. Postponing surgery even after induction should be considered part of the care pathway.

Assessing the impact of two simple interventions to improve postoperative beta-blocker and statin administration and troponin measurement following major vascular surgery.

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European Society of Cardiology (ESC) guidelines recommend continuing beta-blockers and statins postoperatively and monitoring troponins following major non-cardiac surgery as raised levels are associated with worse outcomes. Following a baseline audit of local practice we now report the findings of a re-audit after the implementation of two simple interventions to improve compliance with the guidelines.

The aim of the interventions was to ensure all patients taking statins and beta-blockers preoperatively received them on the first two days following their operation and to quantify the numbers of patients at a higher risk of morbidity by measuring postoperative troponin levels. We therefore affixed stickers to the drug charts exhorting ward staff to ensure beta-blockers and statins were administered postoperatively and provided pre-filled blood request forms for postoperative troponin measurements on the front of the patients’ notes. Data was collected for 100 consecutive elective major vascular patients.

Improvements were seen in both drug administration and postoperative troponin monitoring. These are summarised in the table below.

This audit indicates that simple interventions can lead to better compliance with the ESC guidelines for patients undergoing major vascular surgery. A high proportion of patients had raised troponins postoperatively but at which level this warrants intervention and what interventions are appropriate remain unclear.

<table>
<thead>
<tr>
<th></th>
<th>Initial audit % (number)</th>
<th>Re-audit %/(number)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preop Beta blocker</td>
<td>32% (16)</td>
<td>32% (31/97)</td>
<td>-</td>
</tr>
<tr>
<td>Beta blocker administered post op</td>
<td>12% (6)</td>
<td>65% (14/22)</td>
<td>+53%</td>
</tr>
<tr>
<td>Preop Statin</td>
<td>80% (40)</td>
<td>90% (87/97)</td>
<td>+10%</td>
</tr>
<tr>
<td>Statin administered post op</td>
<td>60%</td>
<td>79% (58/74)</td>
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<tr>
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<td>0</td>
<td>1% (1/91)</td>
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</tr>
<tr>
<td>Tn measured Day 1</td>
<td>10% (5)</td>
<td>89% (71/80)</td>
<td>+79%</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>(%)</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>-----</td>
<td>-----</td>
<td></td>
</tr>
<tr>
<td>Tn measured Day 2</td>
<td>2%</td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70%</td>
<td>(52/75)</td>
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</tr>
<tr>
<td>Tn &gt;14 ng/L d1</td>
<td>NA</td>
<td>56%</td>
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<td>Tn &gt;14 ng/L d2</td>
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<td>58%</td>
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**Reference(s)**
A survey of patient satisfaction with the vascular anaesthetic service at the Royal Oldham Hospital using a unique patient experience assessment tool.

P Deka, P Ross

Department of Anaesthesia, Royal Oldham Hospital, Rochdale road, OL1 2JH

**Introduction:** The Royal College of Anaesthetists has indicated that reliably-sourced patient feedback is a vital instrument to support revalidation. Commissioning of hospital services will now be driven by the quality of the patient experience. The Commissioning for Quality and Innovation Scheme (CQUIN) also regards the patient experience as one of its central domains. However, no tool exists to accurately assess the elective vascular patient’s perioperative experience. The aim of this survey was to accurately measure patient satisfaction of the elective vascular anaesthesia service at the Royal Oldham Hospital using a novel and valid patient questionnaire.

**Methods:** The Pennine questionnaire seeks to quantify the patient experience according to the five domains set out by the extensively validated Heidelberg perioperative experience questionnaire: 1. Information and waiting 2. Trust and atmosphere 3. Fear 4. Discomfort 5. Interaction with personnel. A pilot survey was given to 10 inpatients 24 hours post-elective vascular surgery to increase construct and content validity. Further modifications were made after consultation with a psychometrics team from the University of Manchester. The questionnaire was sent to all patients who underwent an elective vascular procedure at the Royal Oldham Hospital over a period between April and June 2013. These questionnaires were sent within 4 weeks of their inpatient stay.

**Results:** Data from 75 elective patients has been analysed. 53% of patients had a general anaesthetic (GA) with 47% undergoing regional anaesthesia (RA). 67% of patients attended a preoperative assessment clinic and 48% of these were seen by a consultant anaesthetist. Importantly 94% patients understood the information given to them and out of the 63% that received an anaesthetic booklet 100% found it useful. On the day of surgery 61% saw an anaesthetist on the ward prior to the operation. Risks were discussed in 64% of cases and 88% of patients felt that this was done in a sensitive way. 96% of patients felt safe. Staff in theatre introduced themselves to 86% of patients and 99% of patients felt there was a pleasant atmosphere in the anaesthetic room (99%). Of those receiving RA, 33% felt anxious intraoperatively but 97% felt reassured by the anaesthetic staff. 42% felt some discomfort during the procedure. Post operatively 23% felt thirsty, 10% felt cold and 9% felt some discomfort, with 41% experiencing no symptoms. Overall patient satisfaction with anaesthetic service scored a mean of 8.8/10

**Conclusions:** Overall patient satisfaction regarding our vascular anaesthesia service is high. However, our unique patient experience questionnaire has highlighted several key areas which we hope will lead to a greater level of patient satisfaction. Furthermore, we hope that our questionnaire will gain wider acceptance as a valid assessment tool of satisfaction with any vascular anaesthesia service.

**References**
1. Revalidation. The Royal College of Anaesthetists. [http://www.rcoa.ac.uk/](http://www.rcoa.ac.uk/)
Vascular Surgeons Outcome Data – Survey of Attitudes

N. Arora, P. Bradley, Cambridge University Hospitals NHS Foundation Trust CB20QQ

Background: The Royal College of Surgeons have recently published individual vascular surgeon’s outcome data. The attitudes and concerns of the vascular surgeons, to this publication, have not been reported. We therefore asked all vascular surgeons views, in our region, on this publication. This is similar to the publication of outcome data of cardiothoracic surgeons which has been associated with a reduction in mortality following coronary artery bypass grafting1.

Methods: We carried out an electronic survey to all 28 Consultant vascular surgeons in the East of England Region. We received 15(54%) responses.

Results: 80% of the surgeons favoured the publication of individual outcome data but felt that it will not be adequately risk adjusted. All the surgeons agreed with the publication of unit outcome data and 73% felt it will improve surgical care. 40% surgeons said that it is likely to alter their case selection.

Conclusions: The publication of outcome data for individual vascular surgeons has been widely publicised in the national media and many of the responses to our survey expressed misgivings about the completeness or robustness of the data. Despite this most of our responders were in favour of the data publication. We probably need a more robust system of risk adjustment including degree of co-morbidities of the patient and the severity of illness. Multidisciplinary team including vascular surgeons, radiologists, anaesthetist and intensivist are involved in the care of these patients and the outcome is dependent upon the performance of the whole team rather than individual surgeon.

Arterial blood pressure management during Carotid Endarterectomy surgery at Plymouth Hospitals NHS Trust – An audit of current practice, April, 2013.

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The aims of the audit were to monitor standards of blood pressure management and blood pressure control during and complication rates during and immediately after elective carotid endarterectomy (CEA) surgery at Derriford hospital, Plymouth.

There are currently no nationally agreed standards for blood pressure parameters that should be achieved peri-operatively with CEA in the UK, however, a consensus of opinion has been advised of a blood pressure not exceeding 180/115 mmHg intra-operatively (1).

It is also widely acknowledged that poor peri-operative blood pressure control during CEA leads to higher complication rates such as CVS outcomes, haematoma formation and neurological sequelae in the post-operative period (2).

Retrospective analysis of case notes of patients who have undergone carotid endarterectomy surgery from December 2010 to February 2012, at Derriford hospital. The anaesthetic chart from the CEA was analysed to record invasive blood pressure readings recorded during the procedure and the immediate post-operative recovery period.

Analysis included data from 38 patients presenting for surgery at a mean time of 13 days from onset of their symptoms. 100% had intra-operative invasive arterial blood pressure monitoring with 95% (36/38) of cases performed with sedation and cervical plexus block. 65% (26/38) of cases exceeded the blood pressure target of 180/115 mmHg and only 50% (13/26) of these cases were treated. Of these, 31% (4/13) developed neurological sequelae in the immediate post-operative period or 12.9% of the study population, in comparison to 0.5 – 1.8% UK complication rate for CEA (3).

In the wake of this audit, Plymouth Hospitals NHS Trust is currently drafting guidelines for the management of intra-operative blood pressure control during CEA. The results from future surgery will be re-audited once the guidelines have been finalised.

Reference(s)
Audit of Post Operative Analgesia in Lower Limb Amputation Patients

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The Royal College of Anaesthetists recommends that all patients should be pain free at rest post-operatively1. Post-operative analgesia in the patients undergoing lower limb amputation at our Trust was reported by the acute pain team to be suboptimal.

A retrospective audit was conducted of all patients who had undergone lower limb limb amputation between 1st April 2010 and 30th September 2012. 94 patients were identified, from which 68 unique sets of notes were examined. For each case, modalities of pre-, peri- and post-operative analgesia and anaesthesia were recorded, in conjunction with subsequent pain scores as recorded by nursing staff in the post-operative period.

Across all modalities of analgesia, 74% of patients experienced moderate or severe pain in the post-operative period. Sub-group analysis showed that single-shot nerve blocks in particular provided very poor analgesia. Patients who received a regional block had the lowest pain scores on average over the subsequent 7 days.

Our results showed a clear benefit from the use of a regional technique, particularly during the first 24 hours. A small number of studies2,3 have shown a significant reduction in the consumption of morphine with Figure 1. Comparison of Analgesic Techniques the use of peri- and intra-neural LA infusion catheters. Others have shown a significant reduction in phantom limb pain following their use4. We have devised a guideline for these patients which includes both regional and LA infusion techniques

References