Vascular Anaesthesia Society of Great Britain and Ireland

Annual Scientific Meeting

Abstracts for the Bristol Meeting

19th & 20th September 2019

We The Curious
One Millennium Square
Anchor Rd
BS1 5DB

VASCULAR ANAESTHESIA SOCIETY

Thursday 19th September 2019

Session 1: New Perspectives on Familiar Issues

11.05am **"Perioperative Reperfusion Injury"**
Prof Saadeh Suleiman, Bristol

11.30am **"Volatile versus TIVA for Myocardial Protection"**
Dr Gudrun Kunst, London

11.55am **"Oxygen: The Good, the Bad and the Ugly"**
Dr Ronan O'Driscoll, Salford

Session 2: Into the Future

1.30pm "**What's New in the Press?"**
Prof Rob Hinchliffe, Bristol

1.50pm "**Depth of Anaesthesia Monitoring"**
Dr Lorenzo Dimpel, Plymouth

2.10pm "**Palliative Care for Vascular Patients"**
Dr Laura Bernstein, Bristol

2.30pm "**Your Anaesthetic and the Environment"**
Dr Samantha Shinde, Bristol

2.50pm "**Artificial Intelligence for Drug Administration in Anaesthesia: Ready for Prime Time?"**
Prof Michel Struys, Groningen

Session 3: Vascular Simulation

4.10pm "**Management of a Patient transferred to a Vascular Centre with a Ruptured AAA; undergoing EVAR under Local Anaesthesia; Vascular Team Communication and Human Factors"**
Dr Curtis Whittle, Mr Tim Beckitt, Dr Neil Collin, Ms Catherine Simmonds & Dr Anna Davey, Bristol

VASCULAR ANAESTHESIA SOCIETY

Friday 20th September 2019

Session 4: NICE Guidelines for the Management of Abdominal Aortic Aneurysms

9.00am **"NICE Process"**

"Overview & Health Economics"
Dr Chris Hammond, Leeds

"Implications for Vascular Anaesthesia"
Dr Adam Pichel, Manchester

Followed by interactive audience and panel discussion

Session 5: Research and Audit

10.45am **Free paper session**

Session 6: Connective Tissue Disorders and the Vascular Anaesthetist

11.45am **"The Importance of Evolving Connective Tissue Disorders"**
Prof Bart Loeys, Antwerp

12.10pm **"Perioperative Management of Patients with Connective Tissue Disease"**
Dr Stephanie Curtis, Bristol

12.30pm **"Vasculitis: Don't get Caught Out"**
Dr Harsha Gunarwardena, Bristol

Session 7: Updates

2.00pm **Prize Presentations**
Dr Ronelle Mouton, Bristol

2.15pm "**Perioperative Cardiac Arrest"**
Dr Matt Thomas, Bristol

2.30pm "**New Generation Pacemakers and ICDs"**
Dr Ihab Diab, Bristol

2.45pm "**Opioids for the Elderly Patient: Friend or Foe?"**
Dr Cathy Stannard, Bristol

3.00pm "**Rectus Sheath Catheters"**
Dr Madan Narayanan, London

3.15pm "**Point-of-Care Testing for Major Haemorrhage"**
Dr Tim Hooper, Bristol

“Perioperative Reperfusion Injury”

Professor Saadeh Suleiman, PhD DSc FIACS FRSB FPhysiol
Professor of Cardiac Physiology
The Bristol Medical School, University of Bristol

Atherosclerosis of the coronary arteries reduces their ability to increase myocardial blood flow during increased cardiac work. A mainstay of treatment is to bypass the stenosed arteries. During surgery the heart is bypassed and arrested using cardioplegic solution. During this arrest the heart is rendered ischaemic and upon reperfusion sustains significant injury. Ischaemic duration (cross clamp time) is a key determinant of the extent of reperfusion injury. This injury is followed by cardiac remodelling which can eventually lead to heart failure.
Our work in Bristol for the last 30 years has focused on understanding cardiac changes during ischaemia/reperfusion and used the obtained information to design and validate cardioprotective interventions.
Ischaemia disrupts metabolic and ionic homeostasis in cardiac myocytes resulting in ATP depletion, accumulation of lactate and therefore cellular acidosis. These changes result in intracellular Na^{+} accumulation and subsequently Ca^{2+} accumulation. The latter disrupts both mitochondrial and structural integrity of the contractile myofilaments particularly during reperfusion.
Rodent adult and immature hearts have been used to design & validate novel cardioprotective strategies. These include substrate replenishment, inhibition of Ca^{2+} loading, mitochondrial permeability transition pore attenuation through cAMP signalling targets and a variety of conditioning protocols (for instance, ischaemic, remote ischaemic and temperature preconditioning). To enable translation, several disease models have been used to validate cardioprotective interventions. These include models of cardiac hypertrophy, coronary artery disease, heart failure, diabetes, and non-obesogenic model of high-fat feeding.
Clinical research has focused on investigating cardiac metabolic and molecular changes that result from disease and also during cardiac surgery. Biopsies from left & right ventricles have been used to assess disease-induced cardiac remodelling and the effect of cardioplegic arrest. as well as for metabolomic and proteomic changes.
Several surgical and cardioplegic interventions during open heart surgery have been assed which include cardioplegic content, temperature and delivery. Additionally, the efficacy of cross-clamp fibrillation and the use of mini-cardiopulmonary bypass in addition to off-pump surgery have also been investigated. Several clinical studies (trials) investigating cardioprotection have been conducted, including those of remote ischaemic preconditioning and Propofol cardioplegia.
Our work has demonstrated that basic science and fundamental understanding of physiology is important for the design of therapeutic interventions to protect the heart against ischaemia & reperfusion injury during open heart surgery.

Acknowledgements: This work has been supported by several organisations including the British Heart Foundation, Heart Research UK, NIHR-BRU, NIHR-EME & MRC.

"Volatile versus TIVA for Myocardial Protection"

Dr Gudrun Kunst MD PhD DEAA
Consultant Anaesthetist
Kings College London

Perioperative Morbidity and Mortality

About 35,200 adult cardiac surgical procedures were carried out in the United Kingdom in 2015, including 16,200 coronary artery bypass graft (CABG) procedures and 15,600 valvular repairs or replacements, many of which also required concurrent CABG. Overall mortality was 2.57% (http://bluebook.scts.org). The population requiring surgery is older than before, and more patients present with multiple comorbidities, including obesity, diabetes, chronic renal failure and peripheral vascular disease, increasing the risk of postoperative complications. Thus, peri-operative morbidity and mortality remain frequent in non-cardiac and cardiac surgery. The VISION (Vascular events In noncardiac Surgery patIents cOhort evaluatioN)-study included approximately 15,000 patients over 45 years of age having non-cardiac surgery. It demonstrated that 8% of patients suffered myocardial injury postoperatively [1]. Furthermore, in the ERICCA (Effect of Remote Ischaemic preconditioning on Clinical outcomes in patients undergoing Coronary Artery bypass graft surgery)-trial in moderate to high-risk cardiac patients we found that 23% of patients suffered a myocardial infarction [2]. There is a direct relationship between postoperative troponin levels and outcome after surgery, and the ESC Joint Working Groups on Cardiovascular Surgery and the Cellular Biology of the Heart have very recently clarified definition and diagnosis of perioperative myocardial ischaemia in cardiac surgery in a position paper, which will be helpful for optimising treatment in the future [3].
Recent large randomised controlled trials (RCTs) in non-cardiac surgery have demonstrated that pharmacological prophylaxis of cardiovascular adverse events is essentially ineffective: POISE2 showed that alpha2-adrenergic receptor agonists and aspirin don't offer any myocardial protection regarding postoperative mortality [4,5]. Similarly, in cardiac surgery remote ischaemic preconditioning has demonstrated neutral effects only on postoperative clinical outcomes [2]. Therefore, alternative approaches reducing postoperative cardiac complications are warranted.
Volatile anaesthetics have been shown to offer organ protection in pre-clinical models, and also in some trials in cardiac anaesthesia. The potential secondary protective or pleiotropic effects by volatile anaesthetic agents include myocardial, renal and cerebral protection and direct protection on the endothelium [6].
However, whereas surgical myocardial protection and cardioplegic strategies are routinely employed to improve organ protection during cardiac surgery, management of general anaesthesia has remained unchanged over the last 20 years, with some anaesthetists using intravenous propofol only for maintenance, and others volatile anaesthetics alone or volatile anaesthetics plus propofol in combination. This variation in clinical practice stems from a lack of evidence as to which type of anaesthetic is superior and it demonstrates the potential for more protective anaesthesia if the best practice could be conclusively demonstrated [7].

Volatile Anaesthetics and Cardioprotection in vitro

Volatile anaesthetics have been reported to protect the heart against acute ischaemia reperfusion injury in several different animal models when compared to intravenous anaesthesia. Two main intracellular signal transduction pathways directing cardioprotection from cell surface receptors to convergent targets in the mitochondria have been proposed as models to explain myocardial protection: the RISK (Reperfusion Injury Salvage Kinase)-pathway [8] via G-protein coupled cell surface receptors, and the SAFE (Survivor Activating Factor Enhancement)-pathway [9]. The latter operates mainly through the tumour necrosis factor alpha receptor. Further downstream in the intracellular signal transduction cascade, protection is triggered by inhibition of the opening of the mitochondrial permeability transition pore (mPTP). Mitochondria supply ATP to cardiomyocytes, but they have also recently been identified as activators of cell death pathways. Cell death can be inhibited by mitochondrial autophagy and pro-survival pathways, and the mPTP plays an important role in modulating the balance of pro-survival over cell death pathways. Interestingly, most of the intracellular signal transduction proteins and molecules associated with myocardial protection have also been shown to interact with volatile anaesthetic agents, (reviewed in [6]). These interactions may result in myocardial protection, which has been demonstrated in in-vitro models including isolated perfused hearts, human atrial

myocardium and human embryonic stem cells.

Clinical Evidence of Myocardial Protection by Inhibition of the mPTP and Anaesthetic Protection?

As perioperative cardiac morbidity and mortality remain frequent and based on the strong evidence in experimental studies demonstrating cardioprotective effects, clinical research has resulted in many small RCTs, which have partly been supportive for myocardial protection, however overall results have been conflicting. Our proof-of-concept RCT in 78 patients undergoing cardiac surgery demonstrated that a single bolus of cyclosporine, which has the ability to prevent the opening of the mPTP, administered before cardiopulmonary bypass, reduced perioperative myocardial injury in patients with longer bypass times [10]. In addition, we demonstrated in patients undergoing CABG surgery that remote intermittent ischaemia does not protect the myocardium when added to patients receiving volatile anaesthetics [11], which might suggest that volatile anaesthetics already maximally provide protection. A large meta-analysis including 3,600 patients in 38 trials showed that mortality was doubled from 1.3% to 2.6%, if propofol was used for general anaesthesia instead of volatile anaesthetics [12]. Based on the observation that propofol worsens oxidative stress during cardiac surgery [13], the crucial question remains whether propofol is the 'villain' or whether there is a benefit with volatile anaesthetics [14], or both? A large, pragmatic multi-centre, worldwide RCT investigated whether volatile anaesthetics improve one-year mortality in comparison to propofol anaesthesia in patients undergoing CABG surgery [15]. However, the results of this study were inconclusive, which may have been due to the fact that low to medium risk patients were included and that co-administration of propofol together with volatile anaesthetics was allowed in the intervention group.

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"Oxygen. The Good, the Bad and the Ugly."

Dr Ronan O'Driscoll
Consultant Respiratory Physician
Salford Royal Foundation NHS Trust

Summary

Oxygen is the most commonly used drug in critical care and emergency medicine, and it is widely used in the practice of anaesthesia. However, because it is a gas, most clinicians and most patients do not regard it as a drug. For this reason, the use of medical oxygen over the past century has been driven by custom and practice and "precautionary principles" rather than by scientific principles.
Oxygen is a life-saving drug for patients with severe hypoxaemia but, as with all other drugs, too much can be harmful. It has been known for many decades that the administration of supplemental oxygen is hazardous for some patients with chronic obstructive disease (COPD) and other patients who are vulnerable to retention of carbon dioxide (hypercapnia). It has been recognised more recently that excessive oxygen therapy is associated with significantly increased mortality in critically ill patients and medical emergencies, even in the absence of risk factors for hypercapnia.
This presentation will provide a critical overview of past and present oxygen use in hospital settings and will provide guidance for safer oxygen use in the future.

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"Palliative Care and Peripheral Artery Disease"

Dr Laura Bernstein
Palliative Care Consultant
North Bristol Trust

What is palliative care?

Specialist level palliative care is required by people whose complex needs cannot be met by the capability of their current care team. Referral must be based on the needs of the person and not their illness. These needs may include the physical, psychological, social and spiritual. Examples include complex symptoms, rehabilitation or family situations and ethical dilemmas.[1]

Some core elements of palliative care, such as aligning treatment with a patient's goals and basic symptom management, should be routine aspects of care delivered by any practitioner. Other skills are more complex, such as negotiating a difficult family meeting, addressing veiled existential distress, and managing refractory symptoms.[1]

Palliative care specialists may treat patients receiving disease-directed medical therapy, to improve quality of care and medical decision-making regardless of the stage of illness.[1] Contact can be episodic or sometimes for prolonged periods.[2]

Peripheral artery disease trajectory

Peripheral artery disease (PAD) is more prevalent in older people with multiple comorbidities. The end-stage of chronic limb-threatening ischemia (CLTI) with rest pain, gangrene, or a lower limb ulceration is associated with high mortality, limb loss, pain, and diminished health-related quality of life.[3]

High quality data on epidemiology are lacking[3]: The annual incidence of critical limb ischaemia is estimated to be 500-1000 per million people in a Western population, accounting for about 1% of all patients with PAD.[4]

Treatment aims of CLTI are to prolong survival, relieve ischaemic pain, minimise tissue loss and heal wounds and preserve a functioning limb.[4] Management is with medical treatment (25%), revascularization (50%) or amputation (25%).[4] A year after diagnosis 25% of patients will have died, 25% will be alive but will have required a major amputation and only 45% will be alive with two limbs.

40-60% of those with PAD die from coronary artery disease, 10-20% of deaths are from cerebral artery disease and 10% of deaths are from "other vascular events", mostly ruptured aortic aneurysm. Thus, only 20% to 30% of patients with PAD die of non-cardiovascular causes.[4] Over half of deaths occur in NHS hospitals.[5]

Palliative care needs

The morbidity and mortality associated with CLTI are akin to many advanced cancers.

Chronic ischaemic pain negatively impacts on multiple dimensions of quality of life.[6] There are unique psychological, spiritual and social aspects to the suffering: Pain can be complicated by feelings of blame where vascular disease is a result of lifestyle. Individuals may have poor mobility leading to loss of independence and social isolation. The stigma associated with ulcers, gangrene and amputation may be cause for embarrassment and further isolation.[7]

Nearly a third of patients with PAD have comorbid depression or depressive symptoms.[8] Depressive symptoms have been associated with worse claudication, decreased patency after peripheral revascularisation and increased incidence of major amputation, adverse cardiac events, and mortality.[9]

People with PAD encounter complex treatment decisions in the face of poor prognosis and do want to be involved in shared decision-making.[10] Care planning discussions held in advance of crises can help people

receive medical care that is consistent with their values, goals and preferences during serious and chronic illness.[11]

Timing of palliative care referral

There is little research on the palliative needs of these patients and a model for joint working has yet to be developed.

Judging prognosis is particularly difficult for non-cancer patients. Too much emphasis on prognostic accuracy in fluctuating illnesses can hinder a positive focus on reasonable, patient-centred goals at the end of life.[12]

Being alert to the possibility that a patient might benefit from palliative care is central to delivering better end of life care. A positive answer to the question: "Would I be surprised if this patient died within the next 6-12 months?" is one trigger indicating that such care should begin.[13]

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“The Environment and Anaesthesia”

Dr Samantha Shinde
Consultant Anaesthetist
Southmead Hospital, North Bristol NHS Trust

Co-chair of the Association of Anaesthetists and Sustainable Development Unit’s ‘2% carbon emissions task group’
Past chair of the Environment and Sustainable Committee of the Association of Anaesthetists

Dr Shinde will be talking about the Climate change act, the 2019 NHS long term plan and her work with the Sustainable Development Unit to deliver the 2% reduction in NHS carbon footprint through transforming anaesthetic practices. In addition, she will talk about plastics waste, propofol, volatile agents and nitrous oxide use in maternity, a new anaesthetic carbon calculator app and waste flowchart as well as new Innovations, and what Trusts and individuals can do to reduce their impact on global warming.

“Artificial Intelligence for Drug Administration in Anaesthesia: Ready for Prime Time?”

Prof Michel Struys
Professor of Anaesthesia
University Medical Centre Groningen, Netherlands

1

Conflicts of interest

Our research groups in Groningen recieved support/consultancy from (last 5 years) : Baxter, Carefusion, Covidien, Dräger Medical, Masimo, The Medicines Company, Fresenius, QPS, PRA, Acacia Design, Demed

I’m an editorial Board member and Director for the British Journal of Anaesthesia / associated editor Anesthesiology

I’m the co-owner of RUGLOOP I and II. The Ghent University owns patents on the closed-loop technology invented by Michel Struys, Tom De Smet and Steven Shafer.

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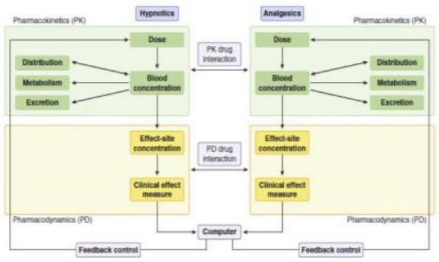
2

drug delivery



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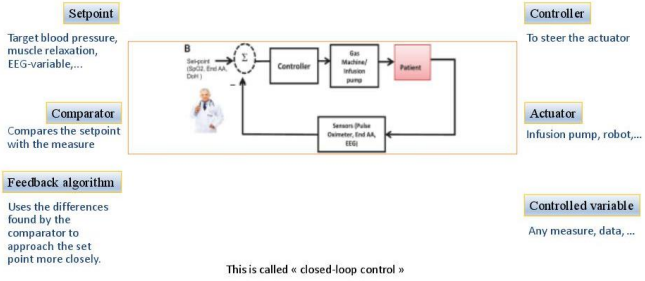
3

Computer control …. system components?



This is called « closed-loop control »

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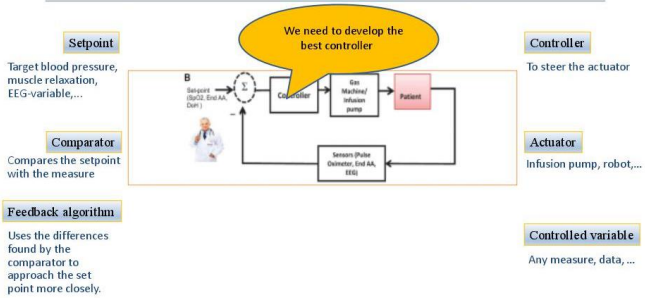
Computer control …. system components?



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« Houston … we have a problem »

Problem —method→ Solution

1) Find a solution using a method with specific rules (e.g. if-than, NONMEM, PID control, model-based, ...)

2) Find a solution learning from the available data and do not use « too much » rules (e.g. arteficial neural networks) .....

3) Eventually, update the solution method using online incoming new data

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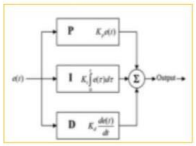
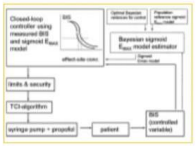
6

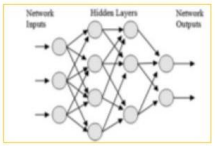
Feed back algorithms / Controllers?



PID control



model-based control
(with Bayesian filtering)



neural network control
(or another method of machine learning)

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Machine Learning : Quid ?

Basically:

- Training a model on a lot of data
- Make decisions or predictions without explicitly programming how it should do so

Types:

- Supervised, unsupervised or reinforcement learning
  - Supervised : data are labelled (means problem and solution are provided)
  - Unsupervised : data are unlabeled (find natural clustering of the data to groups, and then map new data to these formed groups)
  - Reinforcement learning : data might be unlabeled but "critique" is allowed to guide the learning

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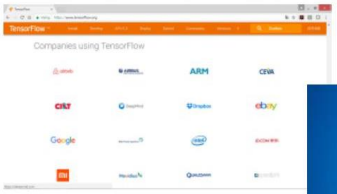
Machine Learning



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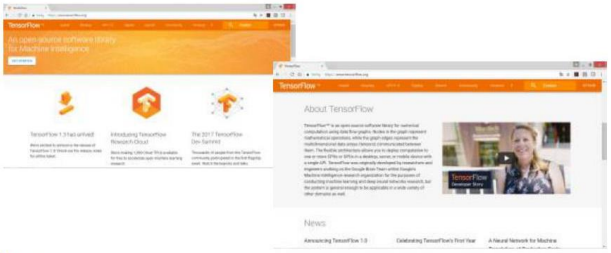
Machine Learning



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Machine Learning : Quid ?

Basically:

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Day	Sun? (X1)	Rain? (X2)	Shorts (Y)
1	Yes	Yes	No
2	No	Yes	No
3	Yes	No	Yes

Day	Sun? (X1)	Rain? (X2)	Shorts (Y)
4	No	No	?

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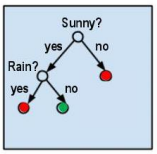
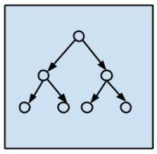
Machine Learning : Applied algorithms (1)

- Decision Tree
- Random Forest
- Support Vector Machine
- Neural Network



Machine Learning : Applied algorithms (2)

- Decision Tree
- Random Forest
- Support Vector Machine
- Neural Network



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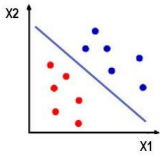
Machine Learning : Applied algorithms (3)

- Decision Tree
- Random Forest
- Support Vector Machine
- Neural Network



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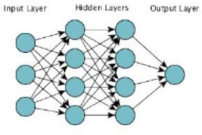
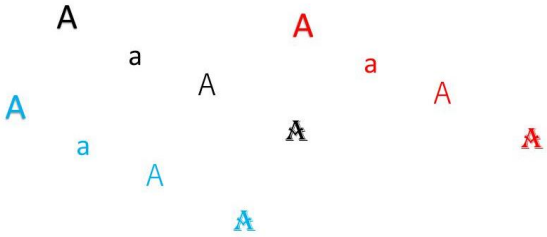
Machine Learning : Applied algorithms (4)

- Decision Tree
- Random Forest
- Support Vector Machine
- Neural Network



15

Machine Learning … how does it work ?



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Machine Learning… how does it work ?

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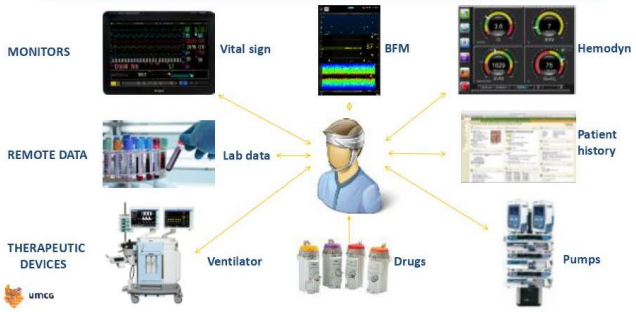
Computer control …. system components?

18

Controlled variables



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Autonomous systems in Anesthesia

Table. Status of Autonomous Systems Available in Anesthesiology

Physiological Variable	Autonomous Control (Status)
Ventilation	On the market
Oxygenation	On the market
	On the market
Hypnosis	On the market
	Research — On the market outside USA
Analgesia	Research
Muscle relaxation	Research
Hemodynamic management	Research — On the market outside USA
Temperature management	On the market

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System for blood pressure control

The IVAC TITRATOR
Picture courtesy of Bob Butterfield,
Alaris Medical Inc., San Diego, USA

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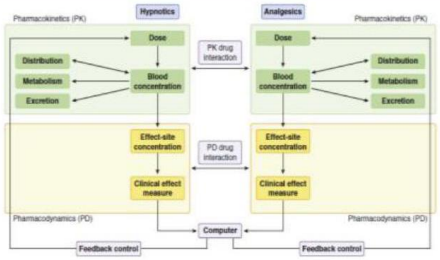
drug delivery



Sahinovic MM, Absalom AR, Struys MM: Administration and monitoring of intravenous anesthetics.
Curr Opin Anaesthesiol *23:734-734, 2010.*

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Closed-loops drug delivery : PK target

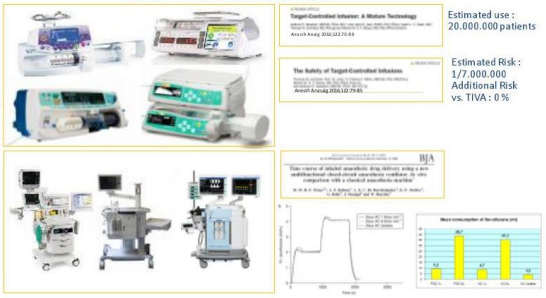
These systems use « conventional control techniques »

Intravenous
- plasma TCI
- effect-site TCI

Estimated use : 20.000.000 patients

Estimated Risk : 1/7.000.000 Additional Risk vs. TIVA : 0 %

Inhaled
ET control



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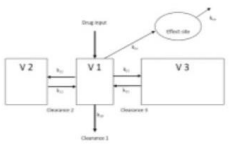
Dose-effect control models for TCI

1) Compartmental models are used to describe the time course of plasma and effect-site concentration.
(Models developed using NONMEM).



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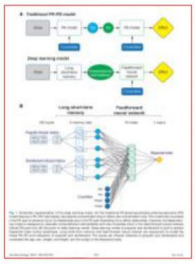
Dose-effect control models

2) Deep Learning Approach used to describe the dose-effect relationship ..... NOT YET USED IN TCI TECHNOLOGY



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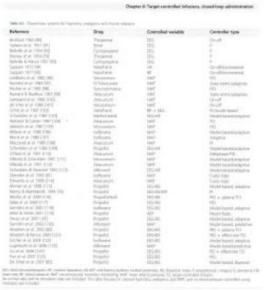
Autonomous drug delivery : PD target

> 65 years of research



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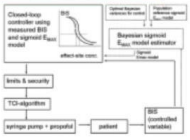
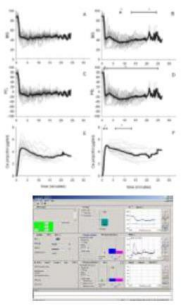
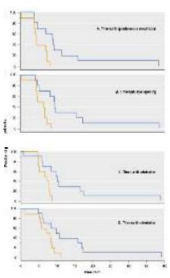
Autonomous drug delivery : PD target







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Closed-loops drug delivery : PD target

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Closed-loops drug delivery : PD target

The RUGLOOP Bayesian objective function :

$$\sum \frac{(BIS_{sample} - BIS_{estimated})^2 \times MAX\left[\left(1 - \left[\frac{(t-t_{sample})}{sample_{TOI}}\right]^2\right), 0\right]}{VAR^2_{samples}} + \frac{(EC_{50,Population} - EC_{50,Estimated})^2}{VAR^2_{EC_{50}}} + \frac{(T_{Population} - T_{Estimated})^2}{VAR^2_T} + \frac{(D_{Population} - D_{Estimated})^2}{VAR^2_D} \quad (2)$$

Patent : Struys M, De Smet T, Shafer SL : US 20060167722 A1

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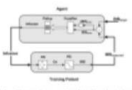
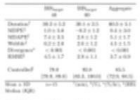
Closed-loops drug delivery : PD target





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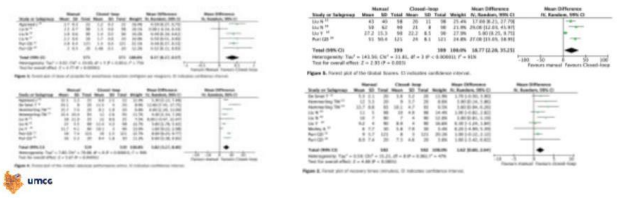
Closed-loops drug delivery : evidence

Closed-Loop Delivery Systems Versus Manually Controlled Administration of Total IV Anesthesia: A Meta-Analysis of Randomized Clinical Trials

Laura Pasin, MD, Pasquale Nardelli, MD, Margherita Pintaudi, MD, Massimiliano Greco, MD, Massimo Zambon, MD, Luca Cabrini, MD, and Alberto Zangrillo, MD

Anesth Analg 2017; **124**:456-64



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31

Closed-loops drug delivery : evidence

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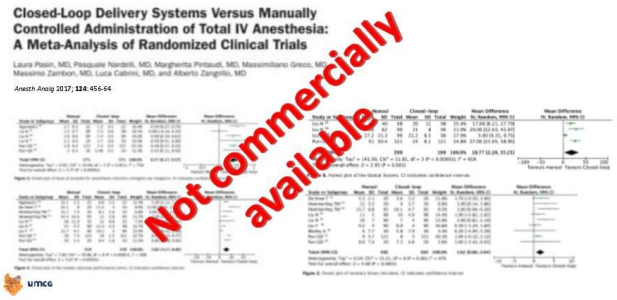
Anesth Analg 2017; **124**:456-64



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32

Regulatory requirements ?

Regulatory Considerations for Physiological Closed-Loop Controlled Medical Devices Used for Automated Critical Care: Food and Drug Administration Workshop Discussion Topics

Anesth Analg 2018; 126:1916-1925.

- Sensor considerations
- Controller design considerations
- Clinical use considerations
- Usability/human factors considerations
- Implementation considerations
- Preclinical evaluation considerations
- Future challenges and considerations

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33

The route to success ?

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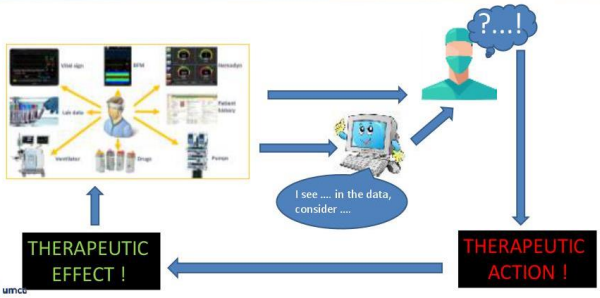
34

What is an advisory system ?



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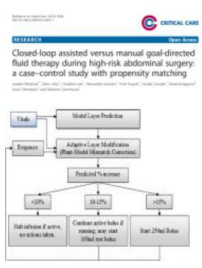
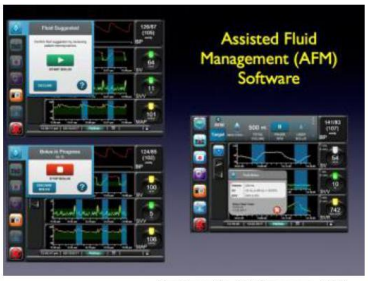
35

Advisory systems for fluid administration





Courtesy of Prof. M. Cannesson, UCLA

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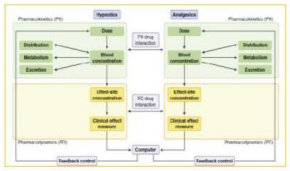
36

Advisory systems for drug administration



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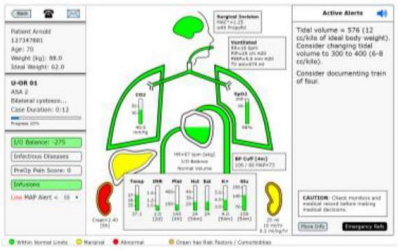
37

Advisory systems for anesthesia



Alert Watch ©, K. Tremper, U Michigan,

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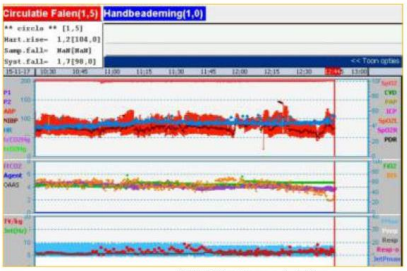
38

Advisory systems for anesthesia



UMCG Alert System, B. Ballast

Relative importance
sign if > 1

1.5 for Circulation failure
... components are
- 1.2 HR increase
- 1.7 BP decrease

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39

What's the next step

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40

What's the next step

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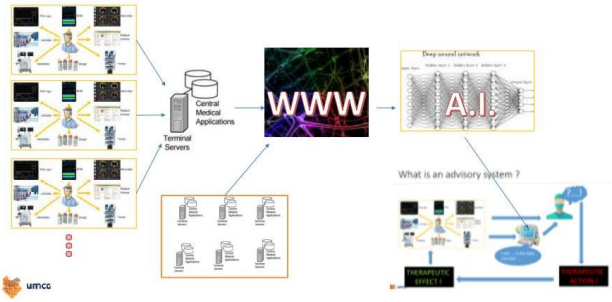
41

What's the next step



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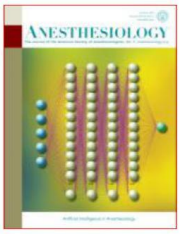
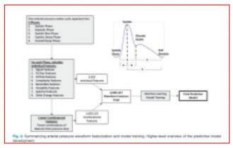
42

Some “AI in Anesthesiology” examples





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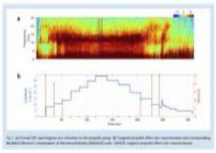
43

Some “AI in Anesthesiology” examples



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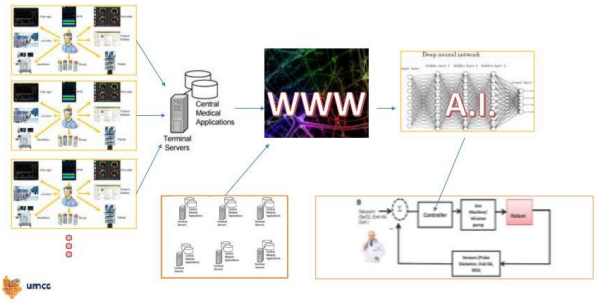
44

What’s the next step



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46

All components are present

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45

Some “AI in Anesthesiology” examples

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47

"Depth of Anesthesia Monitoring"

Lorenzo Dimpel
Consultant Anaesthetist
Plymouth University Hospitals

Since the early days of ether, or chloroform anaesthesia, *side-effects* of anaesthetic drugs (e.g. muscle relaxation and reduction of motor responses, reduction of nociceptive responses, especially of the autonomic nervous systems) have been used to gauge "Depth of Anaesthesia".

However, from the mid-nineties on, interest shifted away from controlling untoward reflexes, and towards an understanding of the effects of anaesthetic agents on the brain, and the mechanism through which they block the processes of consciousness. As such, (depth of) anaesthesia "happens "(largely) in the **cerebral cortex**.

The above mentioned side-effects are, therefore, "not part of the state of anaesthesia" (Prys Roberts 1987 !) and "need to be explicitly unbundled" (Sleigh 2011) from anaesthetic unconsciousness. For example, a blood pressure rise after skin incision does not indicate lack of anaesthesia, but, rather, inadequate anti-nociception.

Anaesthesia is not a binary phenomenon, as multiple levels of cortical processing, and various networks, with differential sensitivity to anaesthetics are involved, and may fail sequentially. For example, *loss of behavioural response* is associated with suppressed response to stimuli in the right dorsal anterior insula cortex (DAIC), as well as a reduced connectivity of the DAIC with frontoparietal regions (Warnaby 2016). Possibly, the last little "pilot light of selfhood" (Sleigh … 2018) is turned off in the posterior cingulate cortex at very deep anaesthesia ("Burst Suppression").

Getting the DoA wrong can, on one side, lead to distressing awareness, whilst the other extreme, excessive anaesthesia, will cause prolonged wake up times, and possibly have a detrimental effect on cognition. In some studies, deep anaesthesia (usually as determined by BIS numbers - a flaw of these studies) was associated with increased incidence of delirium, and cognitive dysfunction even three months later. Chan et al. 2012, Radtke et al. 2013**,** Hesse et al. 2019

The burst suppression (BS) pattern (where cortical "silence" alternates with burst of activity) denotes very deep anaesthesia. It has also been associated with 6 month mortality after ICU care. Watson et al. 2008
A recent study compared "routine care" (no depth of anaesthesia monitor) with BIS to avoid burst suppression) The intervention did not reduce delirium Wildes at al. 2019. However, burst suppression occurred in both groups, and the difference of median vapour concentrations, is not clinically convincing (0.69 vs 0.80 MAC).

Commercial DoA monitors, record frontal EEG (and to a degree EMG) and use certain features - ratios of (bispectral) power of various frequency ranges (BIS), EEG entropy (the Entropy monitor), or EEG patterns (Narcotrend) to construct a scale of DoA. BIS and Narcotrend (and probably all others) use algorithms to detect and quantify BS. These monitors have many flaws. A serious flaw *specific to the BIS* is use of frontalis myogram in its algorithm. This leads to low or very low BIS numbers in the presence of full paralysis in fully awake people. Messner et al 2003, Schuller et al 2015. All of these monitors have a long lag times, and significant failure rates (Zanner 2009). Failure to detect BS is common.

I recommend using raw EEG**:** the patterns caused by commonly used anaesthetic agents are well described (Rampil, Purdon, Sleigh). The required level of pattern recognition skill is comparable to ultra sound guided nerve blocks. Raw EEG has virtually no lag time; artefacts can be recognized by the anaesthesiologist. Occasionally, it may be impossible to interpret the trace: however, recognizing this, is clearly safer than trusting a fictive number. Power spectral displays (where EEG power, split up into the frequencies, is expressed in a colour scale), as well as measured values, such as the "spectral edge frequency", and the

percentage of power contained in the classical frequency bands (α, β, θ, δ) may be useful for fine tuning - as long as the anaesthesiologist is certain that the raw trace is not contaminated by artefacts.

Finally, experience with anaesthesia-EEG, can be extended to monitoring brain well-being, e.g. in neuro-anaesthesia and vascular anaesthesia. In the latter field, EEG can, for example, be used to guide selective shunting during carotid surgery under general anaesthesia. When EEG is used, the shunt rate is between 3 and 5%. Outcomes with EEG compare favourably to Doppler flow monitoring. (Reviewed by van Putten &, Hofmeijer 2016)

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“NICE Process: Overview & Health Economics”

Dr Christopher Hammond
Consultant Vascular Radiologist, Leeds
Member of the NICE AAA GDG

The controversial, and still in draft, NICE guidance for the management of AAA relies substantially on a health economic evaluation of open surgical repair and EVAR. This talk will explore the philosophical framework in which health economic decisions are made, the concept of cost-effectiveness within the context of the wider healthcare economy and the ethical issues raised by the strict utilitarian analysis implied by a cost-effectiveness evaluation. Illustrative examples and thought experiments from other areas of healthcare will be offered.

The outputs from NICE’s health economic evaluation of treatments for AAA will be explained including sensitivity of the result to variation in input data (eg. cost, reintervention rate, long term outcome). Areas of uncertainty and where data is entirely lacking will be identified and approaches to these discussed.

The potential consequences of the NICE guidance on vascular services and the wider healthcare economy will be briefly explored and some of the initial criticism of the guideline addressed.

“NICE Clinical Guideline on AAA – Implications for Vascular Anaesthesia”

Dr Adam C Pichel
Consultant in Anaesthesia
Manchester Royal Infirmary
Manchester University Hospitals NHS Foundation Trust

I will summarise the recommendations made in the draft NICE AAA guideline published in May 2018. I will provide some insight into the final wording of the recommendations and suggest the future implications that the guideline may have on our specialty.

"Perioperative Management of Patients with Connective Tissue Disease"

Dr Stephanie Curtis
Consultant Cardiologist
University Hospitals Bristol

Patients with connective tissues diseases present a unique challenge to the anaesthetist. It is important to be aware of the different conditions and how they mimic one another clinically. Most of this talk will focus on Marfan's Syndrome.

Specific Connective Tissue Diseases

Marfan's Syndrome (MFS)

MFS is the most common heritable CTD and is caused by mutations in the Fibrillin-1 gene, which result in skeletal, cardiovascular, and ophthalmological abnormalities.

Loeys-Dietz Syndrome (LDS)

LDS is rare. It is similar caused by mutations in TGFBR1, TGFBR2, SMAD3, TGFB2 and TGFB3 and, though similar to MFS, has specific features.

Vascular Ehlers-Danlos Syndrome (vEDS)

vEDS is rare, with an estimated incidence of 1 in 50, 000 to 1 in 200, 000. It is caused by mutations in the gene COL3A1 and causes an aggressive aortopathy.

Familial Thoracic Aortic Aneurysm and Dissection Syndrome (FTAAD)

FTAAD is relatively common, affected 1 in 500 with reduced penetrance. It is not associated with dysmorphia. Genetic mutations have been including ACTA2, TGFBR2, TGFBR1 and MYH11. There are some clinical features which can act as red flags, highlighting that a particular gene may be the culprit.

Clinical Assessment

History

It is useful to ask patients with suspected CTDs specific questions. For example, history of hypermobility or joint problems, abnormal scarring or poor wound healing and easy bruising, dental overcrowding, myopia, pneumothorax, scoliosis, stretch marks, and flat feet. Patients with LDS in particular may have multiple allergies. A detailed family history is mandatory.

Examination

Examining the front of the patient will allow assessment of the chest wall, carrying angle, arm span and segments. Examining the back of the patient allows assessment of the skin and for kyphoscoliosis. The facies, mouth, palate and uvula should be assessed.

Imaging

Plain radiography

AP and lateral cervical spine X-rays should be done prior to surgery to look for C spine malformations (LDS).

Echocardiography

A recent echo should be done on all patients pre-operatively. Valves, the aorta and biventricular function need to be assessed.

MRI

MRI imaging is vital. It can it clearly show chest wall abnormalities and scoliosis, but all vessels can be imaged from the brain to the pelvis and any dilatation or aneurysms noted. Dural ectasia is pathognomonic of Marfan's syndrome and is relevant for regional anaesthesia, as is the presence of Harrington rods for scoliosis correction. When marked dural ectasia is present, epidural anaesthesia may be difficult to achieve.

Heart Disease

A careful cardiac history needs to be sought focussing on history of aortic dilatation, family history of aortic dissection and history of valve disease, typically mitral valve prolapse. Valve independent cardiomyopathy has also been described in MFS, as have arrhythmias ranging from premature atrial and ventricular complexes to ventricular tachycardic and sudden death. Previous surgery may include valve repair or replacement, aortic replacement or endovascular stenting. Mechanical valves are common.

Patients are likely to be on medication that lowers blood pressure and/or heart rate, such as beta-blockers and angiotensin receptor blockers. They may be on warfarin if they have a mechanical valve or history of atrial fibrillation.

Lung Function

Abnormal lung function is common in MFS and symptoms are variable. Typically the lung parenchyma is normal but function is affected by chest wall abnormalities and/or kyphoscoliosis. Lung function tests may show obstruction, restriction (and more so in the context of previous cardiac surgery) and isolated diffusion impairment or isolated hyperinflation.

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"Vasculitis: Don't get caught out"

Dr Harsha Gunawardena MRCP(UK) PhD
Consultant in Rheumatology, Autoimmune Connective Tissue Disease and Vasculitis
Honorary Senior Lecturer
North Bristol NHS Trust and University of Bristol

Abstract

Vasculitis the term used to describe a group of disorders associated with inflammation of the blood vessels. The exact cause of vasculitis is unknown, although pathogenesis in most cases is assumed to be largely autoimmune. Traditional classification is based on vessel size encompassing large, medium and small vessel vasculitis, and may involve a single or multiple organs. It can affect people of all ages and races, and both sexes, although subtypes differ in whom they affect and the organs that are involved. The heterogeneous nature of vasculitis presents a diagnostic challenge which may hinder early diagnosis with studies demonstrating a lag of three to 12 months between disease onset and diagnosis. Although the vasculitides are relatively rare, they must be diagnosed and treated early because untreated disease may rapidly develop into end organ failure and death.

The 2012 revised international Chapel Hill criteria for vasculitis describe now established terminology for vasculitis (Arthritis Rheum. 2013 Jan; 65(1):1-11):

Large vessel vasculitis: Takayasu's arteritis and Giant cell arteritis

Medium vessel vasculitis: Polyarteritis nodosa and Kawasaki's disease

Small vessel vasculitis:

ANCA associated vasculitis (AAV)	*Immune Complex*
Microscopic polyangiitis (MPA) Granulomatosis with polyangiitis (GPA) Eosinophilic granulomatosis with polyangiitis (EGPA)	Anti-GBM disease Cryoglobulin vasculitis IgA vasculitis

Variable vessel vasculitis: Behcet's disease and Cogan's syndrome

Single organ vasculitis: cutaneous | CNS angiitis | isolated aortitis

Others (vasculitis associated with systemic disease or probable aetiology)

Another approach to disease stratification is based on degree of organ involvement and response to treatment regardless of subtype. Patients can be catergorised into non-organ threatening, organ threatening and / or rapidly progressive (severe or refractory) and this can guide treatment strategies.

As anaesthetists who care for patients undergoing vascular surgery, the aim of my talk is to give you an overview of vasculitis, outline key clinical features to aid recognition and assessment. I will highlight my presentation with clinical case are co-manage with the vascular network team in Bristol. I will focus on large to medium vessel vasculitis as these are the patients at risk of aortic luminal narrowing, aneurysm, and dissection and who in particular you may see in clinical practice.

"New Generation Pacemakers and ICDs"

Dr Ihab Diab
Medical Consultant
University Hospitals Bristol NHS Foundation Trust

Subcutaneous ICDs and Leadless pacemakers are two relatively recent additions to the range of cardiac devices. They have distinct advantages and considerations compared to standard ICDs and pacemakers. The subcutaneous ICDs are used increasingly, preferentially for younger patients who are at risk of sudden cardiac death with no pacing indications and provide less invasive protection against serious ventricular arrhythmias. The Micra leadless pacemaker is a completely intracardiac device that is delivered and implanted percutaneously from a femoral vein access site with no requirement to surgically create an incision or pacing pocket. They are sometimes the only way to pace patients who have venous vascular occlusions as a complication of previous pacing. Compared to conventional pacing, leadless pacemakers carry no risk of infection.

The programming of ICDs has evolved over the past few years to minimise defibrillator shocks. There is now an awareness of the detrimental effects of defibrillator shocks and an appreciation that not all "appropriate" shocks are "necessary".

This talk will briefly discuss subcutaneous ICDs, leadless pacemakers and changing concepts in ICD programming."

"Opioids for the Elderly Patient: Friend or Foe?"

Dr Cathy Stannard
Consultant in Complex Pain and Pain Transformation Programme Clinical Lead
NHS Gloucestershire CCG

The crisis of opioid misuse and mortality in the United States is a public health catastrophe. Opioid prescribing in Europe has not been associated with problems on the scale of that seen in the US but has focused attention on the role of opioids in treatment of both acute and chronic pain.

The likelihood of painful comorbidities associated with aging explains the increasing prevalence of chronic pain in elderly populations and in part explains the increased use of opioid medicines in this cohort. Older patients are more vulnerable to many of the adverse effects of opioids with the added complications of polypharmacy. The poor efficacy of medicines for chronic pain has prompted healthcare professionals to reconceptualise persistent pain and explore alternative ways of supporting patients.

By contrast, opioids have demonstrable efficacy for the treatment of acute pain and removal of opioids from the treatment repertoire would leave a significant therapeutic vacuum. Caution still needs to be exercised when prescribing for older patients but the complex antecedents of the US opioid epidemic need to be understood in detail and contextualised for that population if we are to retain rational and evidence-based strategies for the treatment of acute pain in Europe.

Further reading

Solomon DH, Rassen JA, Glynn RJ et al The Comparative Safety of Analgesics in Older Adults with Arthritis. *Arch Int Med* 2010; 170(22): 1968 – 1978

Reid MC, Bennett DA, Chen WD et al Improving the Pharmacologic Management of Pain in Older Adults: Identifying the Research Gaps and Methods to Address Them. *Pain Med* 2011; 12(9): 1336–1357

Schepsis TS, McCabe Se, Teter CJ Sources of opioid medication for misuse in older adults: results from a nationally representative survey *Pain* 2018;159:1543–1549

Weisberg D, Becker W, Fiellin D and Stannard C Prescription opioid misuse in the USA and UK: Cautionary lessons *Int J Drug Policy* 2014;25:1124-1130

"Rectus Sheath Catheters for Analgesia in Open Abdominal Aortic Aneurysm Surgery"

Dr. Madan Narayanan, MB.BS, MD, FRCA, FCARCSI, EDIC, EDRA, FFICM
Consultant in Intensive Care and Anaesthesia
Frimley Park Hospital, Surrey, United Kingdom

Thoracic epidural analgesia remains the gold standard modality for analgesia in open abdominal aortic aneurysm (OAAA) surgery. Epidural analgesia reduces systemic opiate requirements, ileus and pulmonary complications but can commonly cause hypotension. Despite the benefits outlined, epidural analgesia is not without risks. The findings from third National Audit project (NAP 3) suggest the incidence of permanent injury from perioperative epidural analgesia ranges between 1:5700- 1:12,200. In the same study, the incidence of vertebral canal hematoma was 1:20,000 after epidural catheter insertion, with the risk being highest in the thoracic region, elderly, vascular surgery and in patients receiving perioperative anticoagulation.[1] All these risk factors are applicable to open AAA surgery. The incidence of failure of post-operative epidural analgesia after major abdominal or thoracic surgery ranges between 14-47%.[2] With the advent of ultrasound guidance in regional anaesthesia, there has been a proliferation in the descriptions of superficial and low risk fascial plane blocks (Rectus sheath and Transverse Abdominis plane) for truncal surgery. Previous retrospective studies[3,4] have found no significant difference in pain scores between epidural analgesia and rectus sheath catheters. However, Tudor et al found a significant reduction in time to mobilisation in their RSC group in colorectal surgery. The presenter describes their centre experience in the use of simple continuous fascial plane blocks (Rectus sheath catheters) in emergency laparotomy. The success of their programme in reducing the length of stay in these critically ill patients prompted them to extrapolate its use in open aneurysm surgery. The speaker presents the data of a retrospective 2-year review of analgesia after OAAA repair in their institution.

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2. J. Hermanides, M. W. Hollmann, M. F. Stevens, P. Lirk, Failed epidural: causes and management, *BJA: British Journal of Anaesthesia*, Volume 109, Issue 2, August 2012, Pages 144–154.
3. Tudor ECG, Yang W, Brown R. Rectus sheath catheters provide equivalent analgesia to epidurals following laparotomy for colorectal surgery. *Annals of the Royal College of Surgeons of England*. 2015; 97:530–533.
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VASCULAR ANAESTHESIA SOCIETY

Poster Presentations

Major Lower Limb Amputations - A Review of Practice at Cardiff
Umesh Ramesh, University Hospital of Wales

Abdominal Aortic Aneurysm (AAA) Repair in Octogenarians
Catherine Britton-Jones, University Hospital of Wales

Management of post-operative anaemia in elective patients at a regional vascular centre. Are international consensus guidelines being met?
Alastair Thomas, Bedford Hospital

Recovery after Carotid Endarterectomy: Re-audit of Guideline Implementation
Richard Lowe, Manchester and Mersey Anaesthesia and Critical Care

A local quick reference guide for the anaesthetic management of open ruptured abdominal aortic aneurysm repair.
Esme Sleap, University Hospital Southampton

Major Lower Limb Amputations - An Audit Cycle. Demonstration of improvement in scheduling and staffing over consecutive years in a District General Hospital.
Jennifer C Taylor, Leicester Royal Infirmary

Pre-optimisation of Open Abdominal Aortic Aneurysm Patients – Can we improve the perioperative care pathway?
Thomas Sheppard, University Hospital of Wales

Patients referred for elective abdominal aortic aneurysm repair, 2006-2018: are patient characteristics changing over time? A review of the cardiopulmonary exercise tests undertaken.
Anupam Sharma, Sheffield Teaching Hospitals

Improving the peri-operative pain management of patients undergoing lower limb amputation using a multidisciplinary team approach and local guidelines. Department of Anaesthesia, Cambridge University Hospitals NHS Foundation Trust.
Samantha Chan, University Hospitals of Leicester

TB Aortitis: A Case Report
Kerry Featherstone, The Royal Victoria Hospital, Belfast

Rectus Sheath Catheters vs Thoracic Epidural for Open Abdominal Vascular Surgery.
Kerry Featherstone, The Royal Victoria Hospital, Belfast

Mild Anaemia Prior to Endovascular Aortic Aneurysm Repair
David Timbrell, Guy's & St Thomas' Hospitals

The association of sarcopenia and cardiopulmonary fitness in patients who have undergone abdominal aortic aneurysm surgery at the Royal Preston Hospital (RPH), a retrospective analysis of data.
Azeem Kapasi, Royal Preston Hospital

Does a target activated clotting time (ACT) greater than 250 increase intraoperative bleeding and transfusion rates in endovascular aneurysm repair (EVAR) surgery?
Rebecca Thorne

Early Detection and Management of Preoperative Anaemia in an Elective Vascular Surgery Cohort: a Quality Improvement Project.
James Walker, Kent & Canterbury Hospital

Carotid endarterectomy: an audit of current practice and review of outcomes in a regional centre
N. Harris, North Bristol NHS Trust

Time to Pre-Optimise: A Quality Improvement Project addressing the complex pre-operative needs of patients presenting for urgent vascular surgery in a tertiary vascular centre.
Michael McGinlay, Manchester Royal Infirmary

Implementing a Perineural Catheter Protocol for Lower Limb Amputations in a Vascular Centre – Does it Make a Difference?
Araz Pourkashanian, Frimley Park Hospital, Surrey, UK

A Nationwide survey looking at Enhanced Recovery Programmes in Vascular Surgery
Sarah Thomas, Bristol Royal Infirmary

Total psoas muscle area in patients with abdominal aortic aneurysm: relationship with type of intervention
Miss Sarah Nduwayo, Leicester Vascular Institute

Major Lower Limb Amputations - A Review of Practice at Cardiff

Umesh Ramesh, University Hospital of Wales

Introduction:
Major lower limb amputations form a big part of any vascular service. They are invariably added on to the list as semi-urgent, because they need to be done for ischemia/infection or various other reasons. Patients are hardly at the optimum physiological state, and time is always at a premium to pre-habilitate or optimise them prior to the surgery. This project was done to compare and review the major lower limb amputations at University Hospital of Wales, Cardiff with the UK national standard.

Methods
We collected data of all major lower limb amputations (Below Knee and Above Knee) in 2018 at University Hospital of Wales, with the help of notes and online services-Theatreman, Clinical Portal and Welsh Clinical Portal. We compared our performance with the national average, using well established databases like the National Vascular Registry (2018), Vascular Services Quality Improvement Programme (VSQIP) guidelines and NCEPOD Lower Limb Amputations Report (2014). Further, we analysed our strengths and weaknesses, assessed what we have done well and what we could do better moving forward.

Results
52 patients had lower limb amputations in Cardiff in 2018. Age and sex distribution were similar to the national average. The other data comparisons are detailed below.

Assessment	Cardiff (in %)	UK (in %)
Surgery done in vascular lists	75	80
Below knee amputations	67	53
General Anaesthesia	58	70
Respiratory Complications	14	9
Cardiac Complications	9	6
Renal Complications	4	4
Average length of stay	44	23
30 day mortality	4	5
In hospital mortality	10	8

Conclusions
Cardiff does more Below Knee Amputations than UK (67% vs 53%). In terms of anaesthetic choice, Cardiff does more spinals and regional blocks compared to GA. Cardiff could do better to get more amputations done in daytime in vascular lists (Target >80%). Post-operative complication rate seems slightly higher in all organ systems, including wound infection. Ideally, the Vascular team would benefit from the input of a Perioperative Physician on a regular basis, along the lines of the Ortho-Geriatrician in Orthopaedics. This is currently being discussed at the Directorate and Management level. The average time to discharge is much higher than the national average. Although the reasons are complex social, organisational and logistical, they need to be urgently addressed for the welfare of our patients. Further, the median might have given a better comparison, but there was no national median to compare. Hub and spoke concept is an established model for centralisation and improvement of healthcare services. The disadvantage is delayed discharge in tertiary centres like University Hospital of Wales (hub). The way forward is probably repatriation to the referring hospital (spoke), who would probably be better at organising the social care, prosthetics and home adjustments.

References:
1) National Vascular Registry (2018)
2) Vascular Services Quality Improvement Programme (VSQIP) guidelines
3) NCEPOD Lower Limb Amputations Report (2014)

Abdominal Aortic Aneurysm (AAA) Repair in Octogenarians

Catherine Britton-Jones, University Hospital of Wales

Studies have shown that AAA repair should be approached with extreme caution in octogenarians. (1) Abdominal aortic aneurysm repair in octogenarians is associated with higher mortality compared with non-octogenarians.(1,2) Draft NICE guidelines advocate open repair for all elective infra-renal aneurysm repairs. Endovascular aneurysm repair (EVAR) should not be offered even to those medically unfit for surgery. EVAR is the repair of choice in ruptured infra-renal aneurysm in women and men greater than 70 years. (3)

We undertook an audit to look at current practice within South East Wales. All aneurysm repairs from the period March 2015 to December 2016 were identified from the vascular database, a total of 220 cases. All those over eighty years of age at time of discussion at the multidisciplinary meeting were included. Sixty cases identified with an average age of eighty-four years (range: 80-90 years.) We also looked at the rate of patients being refused surgery in the same time period and identified 101 cases, of which 54 were in those over 80 years of age. Reasons for turndown from surgery included: patient frailty, multiple comorbidities, patient refusal and patient not fit of open procedure with no endovascular option for surgery available.

Forty nine patients underwent elective surgery, with 42 octogenarians undergoing elective EVAR repair. Average length of hospital stay following EVAR was 6.2 days (elective: 4.6 days emergency: 22.5 days) compared to open repair which was 18.3 days (elective: 9 days, emergency: 22.3 days.) The survival plot shows: P= 0.553, log-rank test. Therefore there was no statistical difference between survival following elective and emergency surgery in this group.

This leads to a number of questions needing to be answered:
1. Should we be performing emergency EVAR repair for octogenarians?
Care must be taken as number of patients included is small within each group, particularly the number of patients undergoing emergency surgery.
2. Should there be different criteria for operating for example the size of aneurysm in octogenarians?
3. Should we be performing pre-operative cardiopulmonary exercise testing (CPET) for all octogenarians undergoing aneurysm repair irrespective of open/EVAR procedure? (4)
Currently in South East Wales patients undergoing open repair routinely undergo CPET, while those undergoing EVAR do not.
4. Will NICE guidance affect Welsh practice?
Currently there is much discontent with the draft guidelines, taking elective EVAR off the table would have great implications for AAA repair, particularly in the octogenarian group.

References:

1) Hicks CW, Obeid T, Arhuidese I et al. Abdominal aortic aneurysm repair in octogenarians is associated with higher mortality compared with nonoctogenarians. J Vasc Surg. 2016 Oct;64(4):956-965.e1. doi: 10.1016/j.jvs.2016.03.440. Epub 2016 Jun 28.
2) Hicks CW, Obeid T, Arhuidese I et al. AAA Repair in Octogenarians: Is it Worth the Risk? Journal of Vascular surgery January 2016 Volume 63, Issue 1, Page 286
3) Abdominal aortic aneurysm: diagnosis and management NICE guideline Draft for consultation, May 2018
4) Pichel A, Danjoux GR, Thompson JP. Guidelines for the Provision of Anaesthesia Services (GPAS) Guidelines for the Provision of Anaesthesia Services for Vascular Procedures 2019

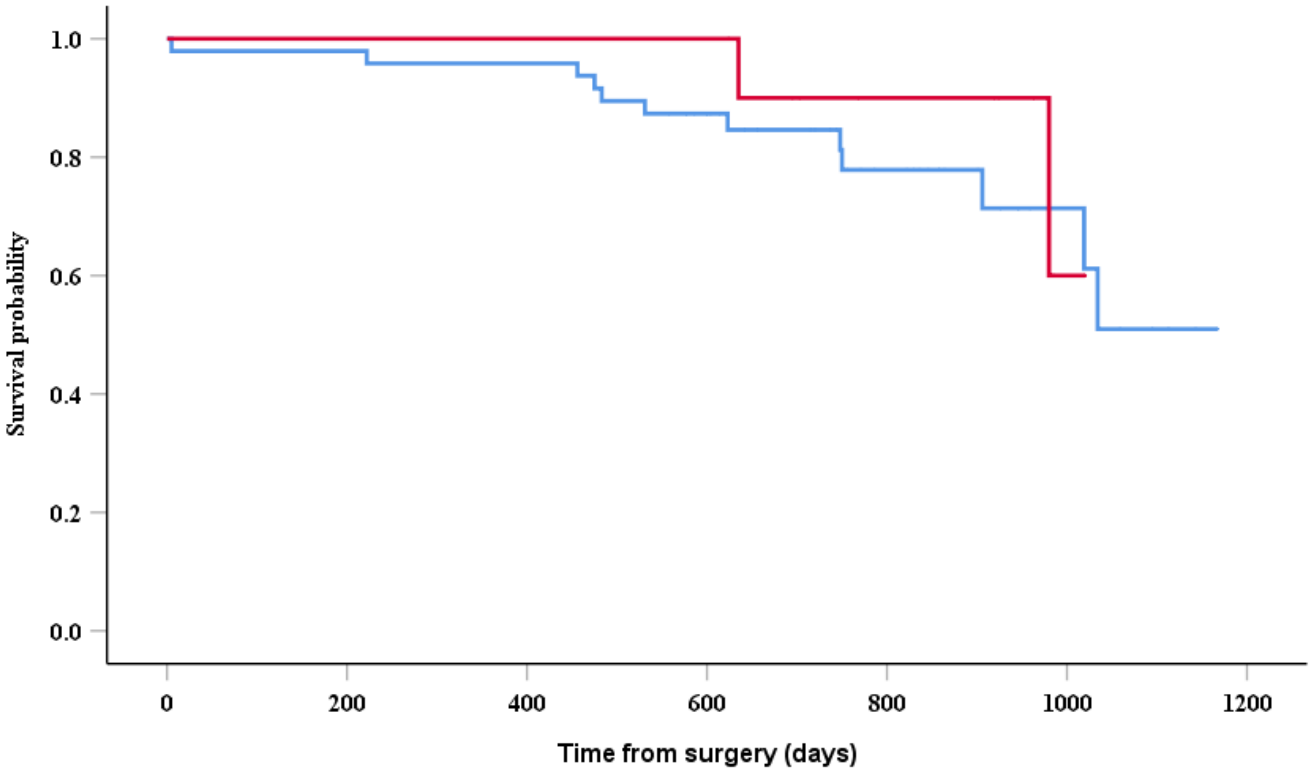

Figure 1: Survival plot for octogenarians following Abdominal Aortic Aneurysm repair.
The red line shows survival following emergency surgery, the blue line shows survival following elective surgery. (P=0.553, log rank test.)

Management of post-operative anaemia in elective patients at a regional vascular centre. Are international consensus guidelines being met?

Alastair Thomas, Bedford Hospital

Anaemia in post-operative patients is a common problem, occurring in as many as 70-80% of individuals after surgery and is associated with a significant increase in morbidity and mortality (1). In 2018, an international consensus statement on the management of post-operative anaemia was published, laying out the standards for early detection and treatment of anaemia after surgery (2). In this audit, we assess whether these standards are being met for patients undergoing three major elective vascular procedures at a regional vascular centre.

Data were collected from all patients undergoing elective endovascular aneurysm repair (EVAR), open aneurysm repair and aorto-bifemoral bypass (ABF) between November 2017 and November 2018. Electronic records of patient pathology results, medication charts and discharge summaries were used to collect data on the monitoring of haemoglobin concentration and administration of supplementary iron and blood products.

All procedures were associated with a statistically significant drop in haemoglobin concentration on the first post-operative day (mean Day 1 Hb drop in EVAR/Open/ABF was 19.5/25.8/28.0 g/L respectively), with further falls demonstrated on subsequent days (mean maximal recorded Hb drop in EVAR/Open/ABF was 23.4/48.3/42.5 g/L respectively). 69 out of 71 patients (97%) had at least one day of post-operative monitoring for anaemia. The median number of days haemoglobin was monitored in patients undergoing EVARs was one day, below the three day standard set in the consensus guidelines, due to the majority of these patients being discharged on the first post-operative day. Open repair and aorto-bifemoral bypass had a median monitoring time of 5 and 9 days respectively. Post-operative iron levels were not measured in any of the patients in this period.

These results suggest that the guidelines on post-operative anaemia are not being met in the majority of cases. This is largely due to the early discharge of patients following EVAR, resulting in a reduced period of haemoglobin monitoring.

We are currently in discussion with the haematology department at the hospital to agree a protocol to improve monitoring of post-operative anaemia. We will also aim to introduce protocols to improve the outcomes of anaemic patients including, preoperative identification of patients with low iron levels, IV iron supplementation in the post-operative period and the use of erythropoetin in selected patients. We will subsequently re-audit the centre to identify if the interventions have been successful.

References:

1) Kougias P, Sharath S, Barshes NR, Chen M, Mills JL. Effect of postoperative anemia and baseline cardiac risk on serious adverse outcomes after major vascular interventions. J Vasc Surg 2017; 66: 1836–43
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Procedure (Number of Cases)	Mean Pre-op Hb (g/L)	Mean Day 1 Post-op Hb (g/L)	Mean Day 1 Hb drop (g/L)	Mean Lowest Hb during admission (g/L)	Mean Max Hb Drop (g/L)
EVAR (58)	135.6	116.1	19.5 p<0.001	112.1	23.4 p<0.001
Open (4)	143.7	118.0	25.8 p=0.013	95.5	48.3 p=0.010
ABF (4)	138.5	110.5	28.0 p=0.016	96.0	42.5 p=0.001
Combined (66)	136.3	115.1	21.2 p<0.001	110.2	26.1 p<0.001

Figure 1. Average values for pre-operative Hb, Day 1 post-op Hb and lowest recorded Hb during admission. P values represent the significance of the Hb drop, calculated using a one-tailed Student's paired t-test to compare pre and post-op populations.

Recovery after Carotid Endarterectomy: Re-audit of Guideline Implementation

Richard Lowe, Manchester and Mersey Anaesthesia and Critical Care

Carotid endarterectomy is a risk reduction surgery commonly performed after stroke or transient ischemic attack. Pre-existing comorbidities may be exacerbated after intervention. Hypertension is exacerbated in up to 40% of post-operative patients (1), increasing risk of wound haematomas, cerebral hyperaemia and myocardial infarction (2). This re-audit examines the implementation of a local guideline for perioperative blood pressure management.

A retrospective review of anaesthetic charts and recovery documentation was performed between 01/05/2017 and 30/04/2018 via the EvolveTM electronic notes system. Data was recorded on anaesthetic technique, time spent in recovery, documentation of target blood pressure, blood pressure management (fluids or pharmacological), discharge destination and complications in recovery.
Ninety-five patients were included: 8 cases under general anaesthesia (8.4%), 87 under local anaesthetic (91%) and 3 converted from local to general (3.4%). Target blood pressure was documented in 73 cases (76.8%). Blood pressure targets, where documented, were achieved in 67 patients (82%). Sixteen patients received additional intravenous fluids, 19 (20%) received vasopressors, 3 (3.1%) received antihypertensive agents. Mean time in recovery was 257 minutes. Ten cases (10.5%) required vasopressor infusion, 5 discontinued in recovery (50%). Five patients (5.2%) required critical care admission. Ninety-four (98.9%) patients were monitored in theatre recovery for the recommended 240 minutes. One patient (1.1%) returned to theatre for evacuation of a wound haematoma. There were no other neurological or cardiovascular complications in the immediate post-operative period.

The results show a low complication rate with a minimal intervention required to manage hypertension. It is interesting to note that all of the critical care admissions during the study period were due to hypotension rather than hypertension. This may be partly due to the predominance of surgery under regional block at this institution, although this is beyond the scope of this audit. Encouragingly where blood pressure targets were documented, the target was met in 82% of cases.

Documentation of blood pressure targets improved from the original audit (50% vs 82%), however further improvements can be made. We intend to do this by raising awareness of the guideline amongst anaesthetists and surgeons. It is also important that recovery staff feel empowered to challenge clinicians in cases where a blood pressure target is not documented. We also plan further recovery staff training to familiarise them with the algorithms within the guideline. This will allow them to use bolus dose vasopressors to meet blood pressure targets.

References

1) Newman JE, Bown MJ, Sayers RD, Thompson JP, Robinson TG, Williams B, et al. Post-Carotid Endarterectomy Hypertension. Part 1: Association with Pre-operative Clinical, Imaging, and Physiological Parameters. Eur J Vasc Endovasc Surg. 2017;
2) Stoneham MD, Thompson JP. Arterial pressure management and carotid endarterectomy. British Journal of Anaesthesia. 2009.

A local quick reference guide for the anaesthetic management of open ruptured abdominal aortic aneurysm repair.

Esme Sleap, University Hospital Southampton

Patients requiring repair of a ruptured abdominal aortic aneurysm (AAA) will always present an anaesthetic and surgical challenge. Their acute life threatening pathology is often on a background of chronic disease, and 30 day operative mortality is over 35% (1). The successful management of these patients relies on timely surgery and effective multidisciplinary working in a stressful situation, often out of hours.

Exposure to such cases is changing; recommendations in recent years to consider endovascular aortic repair (EVAR) (2) and centralisation of vascular services mean that depending on their rotations even senior trainees may have had little experience of this scenario. Despite the theory being well-rehearsed, there is evolving evidence from trials such as IMPROVE (3), and challenges to some established practice. A national guideline does not currently exist.

For all these reasons we identified a need to refresh our local guidance on the anaesthetic management of open ruptured AAA repair. It is particularly aimed at non-vascular consultant anaesthetists and trainees who may encounter these cases out of hours. It is concise, in a 'quick reference' style (Figure 1) and divided into sections which highlight important stages in the patient journey for example 'resuscitation in ED', 'induction' and 'prior to coming off cross-clamp'. Where available the guidance is informed by evidence, for example in hypotensive resuscitation targets (3). However, we have avoided being unnecessarily prescriptive (e.g. choice of induction agents) and do not make recommendations for which there is no current evidence e.g. mannitol or furosemide for renal protection. The guide sits alongside our hospital's emergency EVAR guideline which is formatted similarly. We hope that the guides will provide a useful up to date reminder for anaesthetists who may be infrequently involved in the care of these high risk patients where attention to detail is vital. They may also provide a basis for teaching and audit.

References:

1) IMPROVE trial investigators. Endovascular or open repair strategy for ruptured abdominal aortic aneurysm: 30 day outcomes from IMPROVE randomised trial. BMJ 2014;348: f7661
2) Erbel R, Aboyans V, Boileau C et al. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases. Eur Heart J 2014 1;35(41):2873-926
3) IMPROVE trial investigators. Observations from the IMPROVE trial concerning the clinical care of patients with ruptured abdominal aortic aneurysm. Br J Surg 2014 101:216-224

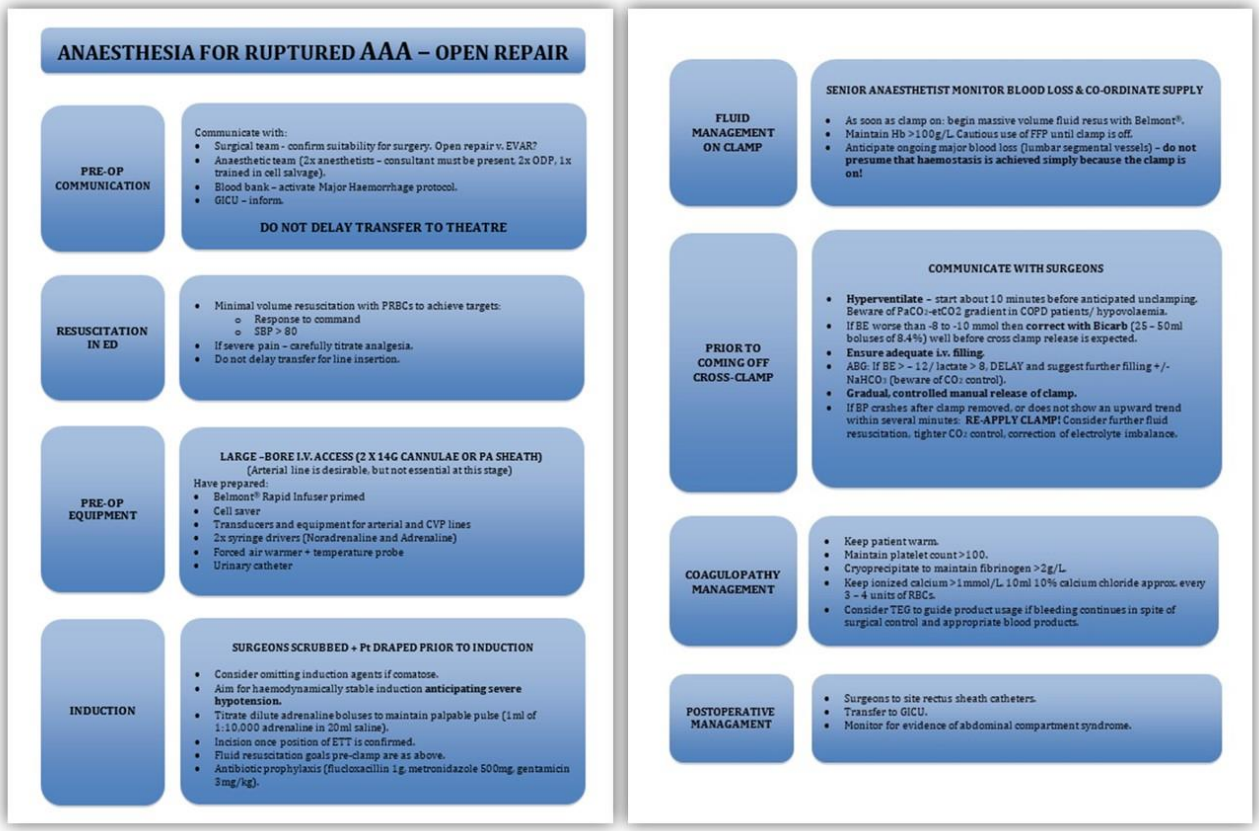

Figure 1. Reproduction of our quick reference guide for the anaesthetic management of open ruptured abdominal aortic aneurysm repair.

Major Lower Limb Amputations - An Audit Cycle. Demonstration of improvement in scheduling and staffing over consecutive years in a District General Hospital.

Jennifer C Taylor, Leicester Royal Infirmary

Royal Derby Hospital offers both fully elective and planned emergency vascular lists (separate from general emergencies) spread throughout the week.
Following the publication of the National Vascular Registry Annual Report 2017 (1), it was decided to review local performance in vascular lower limb amputations, and to audit adherence to the best practice recommendations given therein. These recommendations mirror those given in the VSGBI Major Amputation Care Pathway (2) and were amalgamated with those given in the Vascular GPAS (3).
Our standards were as follows:
-100% Consultant Surgeon presence
-100% Consultant Anaesthetist presence
-90% of cases performed on dedicated vascular lists
-90% of cases performed within normal working hours (NWH – Monday to Friday, 0800-1800)

Data were extracted from the ORMIS theatre management system by selecting for cases where above or below knee amputation had been coded. Cases for amputations performed by Orthopaedics were excluded, as were 3 miscoded cases. This was performed for the twelve months from 1st April 2017, and again from 1st April 2018, completing the audit cycle.

The 2017/18 year yielded 52 cases, with 41 (79%) cases starting, and 36 (69%) finishing within NWH, and 8 weekend cases. A total of 31 (60%) cases were performed on elective or planned emergency vascular lists. A Consultant Surgeon was involved in 40 (80%) cases, a Consultant Anaesthetist in 43 (83%) cases, and both in 33 (63%) cases.
2018/19 yielded 45 cases, with 42 (93%) cases starting, and 38 (84%) finishing within NWH, and 1 weekend case. A total of 37 (82%) cases were performed on elective or planned emergency vascular lists. A Consultant Surgeon was involved in 41 (91%) cases, a Consultant Anaesthetist in 38 (84%) cases, and both in 35 (78%) cases.
Results of the 2017/18 year were reported back to anaesthetic and vascular surgical colleagues at departmental meetings. The 2018/19 data is due to be reported back to these groups in the coming months.

All our data was collected retrospectively, reducing collection bias.
There are many issues with ORMIS as a data source, particularly as information can be easily missed, or miscoded. However, timings are likely to be correct, and it is much more common that the seniors within a team will be recorded than the juniors.

Consultant Anaesthetist presence remains similar at 84%, but there has been an increase in Consultant Surgeon presence (80-91%) and joint cases (63-78%). These results demonstrate a significant improvement in scheduling practices with an increase in both in hours (79-93%) and vascular theatre list cases (60-82%) between the comparison years.
There is still work to do to further improve these figures. There will always be a small percentage of patients who require an amputation as a true emergency, but these are few and far between. More liaison is needed between surgeons and anaesthetists to streamline the scheduling of urgent theatre cases to provide the best and safest care to this complex patient group.

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3) Royal College of Anaesthetists. Guidance on the Provision of Vascular Anaesthesia Services 2017. London: RCoA, January 2017

Pre-optimisation of Open Abdominal Aortic Aneurysm Patients – Can we improve the perioperative care pathway?

Thomas Sheppard, University Hospital of Wales

University Hospital of Wales (UHW), Cardiff is a tertiary referral centre for vascular surgery and forms part of the South East Wales Vascular Network. The Welsh Abdominal Aortic Aneurysm Screening Programme (WAAASP) [1, 2] has been in place since 2013. UHW is the only centre in South Wales that performs open retro-peritoneal abdominal aortic aneurysm (AAA) repair. Consequently higher-risk patients deemed unsuitable for standard open repair or endovascular aneurysm repair (EVAR) are referred for surgery in UHW. All patients for open AAA repairs in UHW receive cardio-pulmonary exercise testing (CPET) and this forms an integral part of their pre-operative assessment.

The aims of the quality improvement project were two-fold, firstly to identify if open AAA patients were delayed as a result of inadequate pre-operative optimisation, and secondly to identify a window of opportunity to address modifiable risk factors.

Data of open AAA repairs from 1st January to 31st December 2018 were collected from the registry at UHW and electronic patient records were analysed to determine timings of events. All CPET data is uploaded to the electronic record. The following variables were recorded; sex, age at time of surgery, date of surgery, date of surgical clinic, CPET date, CPET risk, vascular network multi-disciplinary team (MDT) meeting date, AAA surveillance, referral to other medical practitioners, blood pressure control, statin use, smoking status, and anti-platelet use. These were collated into two groups; “urgent” - large aneurysms identified incidentally which included direct referral from WAAASP and; “surveillance” - small-medium aneurysms that had been regularly monitored and now reached the surgical threshold.

Table 1 shows the characteristics of the two groups. Of the six delays, two were for clinical reasons (one turn-down {102 days} and one for discussion of open/EVAR after CPET {119 days}). The mean time from MDT decision to surgery was 54 days in “surveillance” group and 75 days in “urgent” group. There were more “high-risk” (two) CPET patients within the “urgent” group but a higher proportion of “low-risk” patients, resulting in the positive data skew.

The data show both that there are deficits in the perioperative optimisation of all patients and opportunities to intervene. The “Do” portion of the PDSA (Plan, Do, Study, Act) cycle is to send a letter to the GP along with the MDT discussion letter. This focuses on the modifiable risk factors (hypertension, hyperlipidaemia and smoking) [3-5] and prompts therapy where indicated. Steps have been taken to change WAAASP processes too – by contacting GPs to invite patients for review, rather than the patient being advised to see their GP [1].

Declarations and funding: None

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		Surveillance n = 11	Urgent n = 10
Age (years)		73.2	71.8
Delayed surgery		27.3%	30.0%
CPET risk (mode)		Intermediate	Low
Surgical clinic - Operation		27d	43d
MDT - Operation		54d	75d
Surveillance - Operation		1054d	-
Referrals to GP/Secondary care		27.3%	30.0%
Blood pressure control		80.0%	55.6%
Smoking status	Current	27.3%	55.6%
	Ex-smokers > 1year	70.0%	44.4%
Statin use		72.7%	70.0%
Anti-platelet use		27.3%	60.0%

d, days; values expressed as mean except where stated

Table 1. Comparison of "surveillance" and "urgent" patient groups.

Patients referred for elective abdominal aortic aneurysm repair, 2006-2018: are patient characteristics changing over time? A review of the cardiopulmonary exercise tests undertaken.

Anupam Sharma, Sheffield Teaching Hospitals

The UK population aged over 65 rose from 15.9% to 17.7% between 2004 and 2014, with a projected rise to 24.3% by 2039 (1). Cardiorespiratory fitness (CRF) is known to decline with age and comorbidities increase (2). This carries implications for the postoperative outcomes of patients referred for abdominal aortic aneurysm (AAA) repair. Potentially, the burden of surgery increases - patients to pre-optimise, an increase in peri-operative interventions, more involved post-operative management and an increase in post discharge social care. In our institution, all patients referred for AAA surgery undergo cardiopulmonary exercise testing (CPET), providing an assessment for cardiorespiratory fitness and allowing surgical risk stratification (3). An analysis of the change in the population over time is useful in forecasting future service needs and ensuring sustainability (4).

The CPET database was interrogated for all patients being assessed for elective AAA repair between 2006 and 2018, using the bike ergometer. If patients underwent multiple CPET tests, only the first test was included. All tests were included in which an anaerobic threshold (AT) or maximum rate of oxygen consumption (VO2 max) were obtained. Time series data was analysed for 3-yearly moving averages and box/whisker plots of age, BMI, VO2 max and AT. Spot comparison and analysis was performed using Microsoft Excel 2013 between the 2006 and 2018 groups.

A total of 1429 patients were included. Graphs of moving averages (figure 1) show a consistent AT throughout the study period, while there is a gradual decline in VO2 max. There is an upward trend in age and BMI. Comparison between 2006 and 2018 showed that there was not a statistically significant difference in age (mean 72.8 vs 73.6 years old, p=0.58), BMI (mean kg/m2 27.1 vs 28.1 p=0.24), VO2 max (mean 16.3 vs 16.0 mL/kg/min, p=0.65) and AT (mean 11.5 vs 11.3 mL/kg/min, p=0.79).

Our results show that there was little clinically significant difference between the 2006 and 2018 patient groups, and no statistically significant change was identified in the CRF of patients being referred. Investigation into causes for this disparity with population trends and the potential impact of a shift in surgical technique for patients with AAA would be beneficial to support forecasting of future service needs. With an ageing population, ensuring a robust system for identifying the surgical risk of patients at the earliest stages in the referral process is essential to providing a sustainable service.

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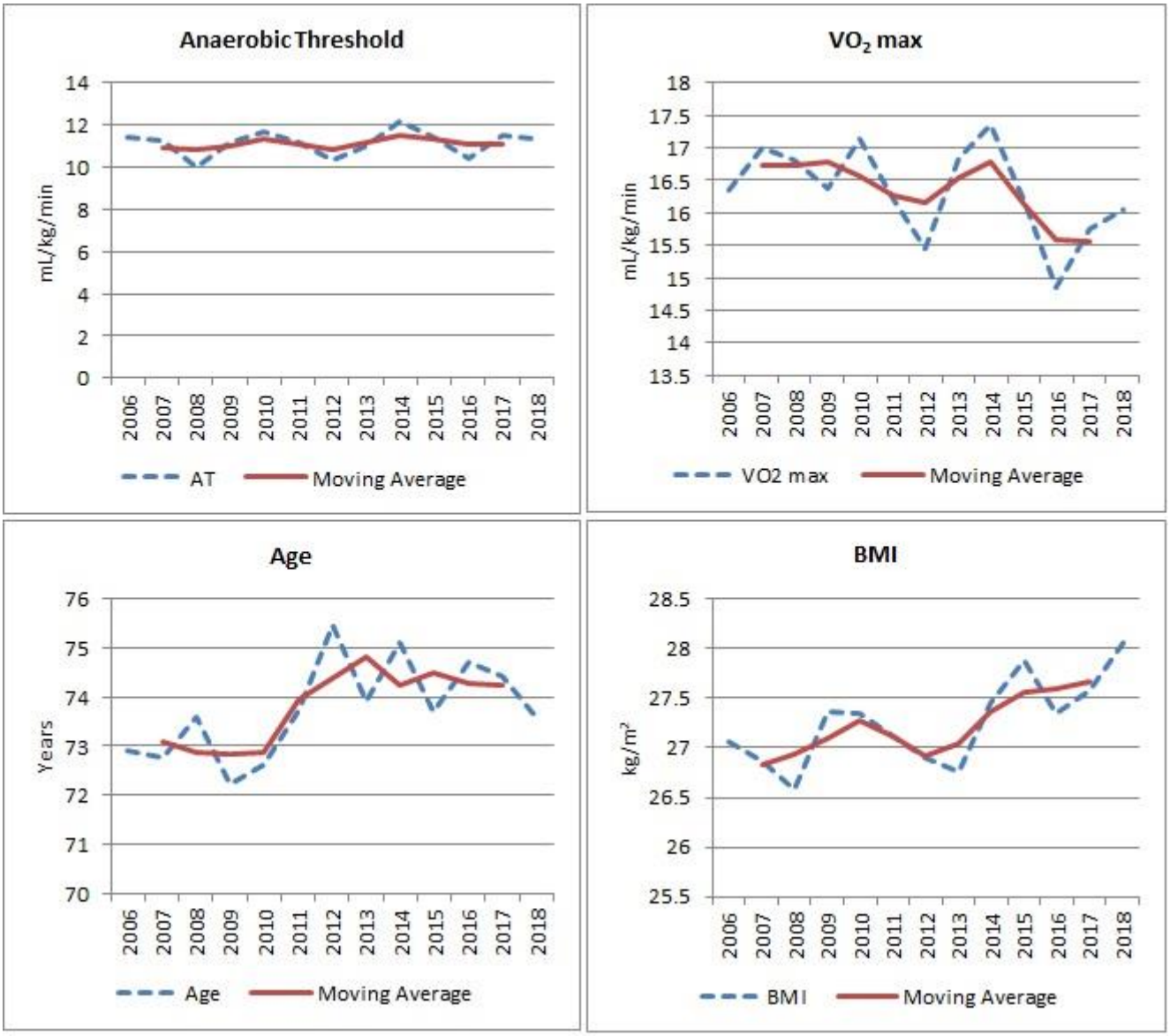

Figure 1. Moving averages, 2006-2018

Improving the peri-operative pain management of patients undergoing lower limb amputation using a multidisciplinary team approach and local guidelines Department of Anaesthesia, Cambridge University Hospitals NHS Foundation Trust

Samantha Chan, University Hospitals of Leicester

Lower limb amputation carries significant morbidity and mortality. Following an audit of pain management of patients undergoing lower limb amputations at our centre, we introduced a multidisciplinary Amputation Care Pathway (ACP)[1] in January 2018, in line with the 2014 NCEPOD report[2] and the 2016 Vascular Society's clinical care pathway[3] on Major Lower Limb Amputation. Our ACP encouraged the use of multi-modal analgesia and regional techniques including nerve catheters. We assessed peri-operative pain management of patients undergoing major lower limb amputation surgery in Cambridge University Hospital following implementation of the ACP. The project was registered with the local clinical governance committee.

Data was collected retrospectively from consecutive patients who had above- or below- knee amputations between September 2018 and May 2019. Where available, we recorded patient-reported pain scores, analgesia type/route of administration, modes of anaesthesia, and pain team involvement. The audit standards were for 100% of patients to have preoperative pain team/anaesthetic input with a documented plan for pain control, and for 100% of patients to be reviewed by the acute pain service postoperatively. We also compared the use of regional anaesthesia, antineuropathic medication and pain scores with the previous audit. We excluded patients undergoing amputation following trauma, or who had other surgeries within 5 days post-amputation.

99 and 71 amputations were included in the pre and post-ACP audits respectively. After introduction of the ACP; 17% of patients had documented preoperative input from pain team, (vs 9% in previous audit p=0.13). Postoperative input from the pain team improved to 92% of patients compared to 53% prior to implementation of the ACP (p<0.0001). Use of regional anaesthesia increased (93% vs 70% p=0.0002) with more patients receiving nerve catheters intraoperatively (75% vs 48% p=0.0006), as did the administration of intraoperative anti-neuropathic medications (55% vs 11% p<0.0001). Fewer patients had general anaesthesia as the sole anaesthetic technique (7% vs 30% p=0.0002). More patients reported having no pain on postoperative day 1(59% vs 38% p=0.01) and 5 (68% vs 45% p=0.007).

Significant improvements have been made to the post-operative involvement of the inpatient pain service but audit standards are still not being met, and there has been no improvement in pain team involvement pre-operatively. Use of regional anaesthesia techniques and anti-neuropathic medications has improved. Following this audit, it has been agreed with the acute pain service that all patients having lower limb amputations will have their notes reviewed by the pain team and a face to face consultation if required, to allow implementation of the ACP.

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TB Aortitis: A Case Report

Kerry Featherstone, The Royal Victoria Hospital, Belfast

Tuberculous aortitis (TA) is a potentially fatal but rare complication of tuberculosis (TB). It is thought to make up approximately 1% of cases of aortitis which itself carries an incidence of 0.01 per 100,000(1). Involvement of the aorta usually occurs due to direct extension from infected contiguous lesions. TA aneurysms occur in about 50% of cases of TA(2) and are usually treated with a combination of surgical and medical therapy. We report the case of an adult patient presenting with an infra-renal abdominal aortic aneurysm (AAA).

A 54 year old Lithuanian male was referred from a District General Hospital with a symptomatic AAA. He had a 2 week history of abdominal pain radiating to the back, and weight loss. A recent CT (approximately 1 month prior) revealed a markedly abnormal aorta, in keeping with aortitis, with a 3.3cm aneurysm and multiple pulmonary nodules. A CT angiogram on this admission (Figure 1) showed a 4.6cm aneurysm, with right renal artery stenosis +/- dissection. Echocardiography revealed a normal aortic valve, and mild biventricular dysfunction. Alcohol and acid fast bacilli cultures were negative, and the pulmonary nodules improved, so anti-TB treatment was suspended. Past medical history included previous pulmonary TB in 2016 (culture positive, AAFB negative), atrial fibrillation and epilepsy. The patient was transferred to the tertiary centre, and following a further MDT discussion, the decision to proceed with an endovascular aneurysm repair (EVAR) was made.

This case presented a number of challenges. A theatre with laminar flow was used. The patient's path to theatre was chosen to eliminate the chance of contact with other patients. The theatre was isolated by a specially constructed screen and staff remained inside for the duration of the procedure. Personal protective equipment (PPE) throughout including gloves, eye protection and a filtering face piece (FFP3) mask. Staff who had not been fitted for this were given powered air respirators with full head pieces. The patient wore a protective mask up until pre-oxygenation, and as soon as possible after extubation. An aorto-bifemoral endoprosthesis was sited with radiological guidance under general anaesthesia without significant event. As per the Association of Anaesthetists of Great Britain and Ireland Safety Guideline on Infection Control in Anaesthesia(3) recommendations, the breathing circuit was changed after the case, and all other equipment was sterilised. The patient was returned to a ward isolation room. Post-operative course was uneventful.

Diagnosis of TA remains a challenge. Patients may present with features of the inflammatory/expansive effects of the lesion. Dissection, rupture, fistula and perforation may also occur. The TB-defining pathogen, M. tuberculosis is often not present, thus it can become a diagnosis of exclusion. TA may also involve the aortic valve, causing stenosis. Echocardiography is essential. TA presents challenges for both diagnosis and management. There are no established guidelines. Further epidemiological studies and outcome investigations are needed to better classify and manage this rare condition.

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Figure 1. Infra-renal AAA

Rectus Sheath Catheters vs. Thoracic Epidural for Open Abdominal Vascular Surgery.

Kerry Featherstone, The Royal Victoria Hospital, Belfast

Epidural analgesia remains the gold standard for laparotomies. However, it has certain limitations and may be contraindicated. Contraindications include patient refusal, sepsis and some coagulation abnormalities. Rectus sheath catheters (RSCs) provide an alternative for analgesia in these patients, though their outcomes and efficacy are poorly investigated in the literature.
Our aim was to investigate rectus sheath catheters vs epidural analgesia for patients undergoing open abdominal vascular surgery.

We performed retrospective data collection on patients having open abdominal vascular surgery (elective and emergency) between August 2017 and July 2018. Data collected included age, analgesia technique used, operation time (including clamp time), critical care and overall length of stay.
Data for comparison between the groups were: high and low pain scores (on a 0-10 visual analogue scale), number of interventions (including clinician top ups, reviews by on-call anaesthetic team or pain team), number of episodes of hypotension (<100 systolic or BP requiring intervention with IV fluids or vasopressors).

A sample of data from 33 patients is presented. Data collection is ongoing. Age range was from 53 – 83 years old. 21 patients had an epidural, 12 patients had RSCs.
76% of patients who had an epidural stayed at least 2 days in critical care. 73% of patients with RSCs stayed only 1 day in critical care.
The high pain scores were significantly higher in the epidural group than the RSC group ($p<0.001$). Pain scores on day zero were not included as some of the RSC patients had received a spinal also.
Comparing equal sample sizes, there were 12 interventions in the epidural group vs 0 in the RSC group.
There were 47 episodes of hypotension in the epidural group, and 7 in the RSC group.

The data presented suggest that RSCs are associated with lower pain scores and fewer interventions and complications than thoracic epidurals for open abdominal vascular surgery in our centre. RSCs may provide a useful alternative to epidural and may be considered in patients in whom an epidural is difficult or contraindicated.

This study has limitations including its current small sample size, and the possibility of other factors confounding the results, such as patient co-morbidities. Further data collection and analysis is ongoing. It is hoped that a randomised controlled prospective trial, and subsequent guidelines for the management of these patients could follow on from this project.

Mild Anaemia Prior to Endovascular Aortic Aneurysm Repair

David Timbrell, Guy's & St Thomas' Hospitals

Pre-operative anaemia is well recognised to correlate with poor outcomes after surgery.[1] Severe anaemia (Hb < 100 g/L) is commonly sought for, however, our perception has been that mild anaemia (Hb 100-120 g/L in women, 100-130 g/L in men) does not necessarily trigger such concern from clinicians despite being associated with significant rates of morbidity. A recent US study demonstrated a 28.5% incidence of mild anaemia in patients undergoing elective abdominal aneurysm repair. For those undergoing endovascular aortic repair (EVAR) mild anaemia increased the odds of major adverse cardiac events (MACEs) by 40% and 30-day mortality by 56%.[2] We sought to identify the incidence of anaemia (mild/severe) in our EVAR population and to assess the level of investigation to which these patients are subjected preoperatively.

We performed a retrospective analysis of the electronic records of 149 consecutive patients who had undergone elective EVAR in our unit. We sought to identify patient demographics, duration between referral and surgery, the timing of investigations to assess for anaemia and whether this was repeated prior to surgery.

112/149 records analysed (37 records excluded). 99 male (88.4%). Mean age 75yrs. Median time from Referral to Surgery 97 days. Median length of stay (LOS) 2 days. Initial Hb (following referral or within 2 months prior) performed in 110 (98.2%) cases. Mean initial Hb 137 (89 – 175)g.l-1. Median time from referral to initial Hb 39 days. Anaemia incidence; Mild 32 (29.1%), Severe 1 (0.9%), Non-anaemic 77 (70%). Hb repeated prior to surgery in 57 (50.9%) cases. Of the 57 cases in which Hb was repeated; Mean repeat Hb 134 (89 – 171)g.l-1, Hb Rise in 23/57 (0 – 13, Median +3)g.l-1, Hb Drop in 34/57 (-1 - -49, Median -6.5)g.l-1. Median time from repeat Hb to surgery 1 day. No correlation identified between initial Hb and LOS ($r = 0.03$, $p = 0.72$).

Incidence of mild anaemia in our sample is akin to that of a similar US population.[2] It is not unreasonable to assume that similar rates of morbidity exist as well. Our findings support improvements in the perioperative pathway for patients scheduled for elective complex EVAR in line with recommendations from the International Consensus Statement.[3] We hope that highlighting these findings might also prompt other units to assess their management of patients with mild anaemia prior to surgery.

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The association of sarcopenia and cardiopulmonary fitness in patients who have undergone abdominal aortic aneurysm surgery at the Royal Preston Hospital (RPH), a retrospective analysis of data.

Azeem Kapasi, Royal Preston Hospital

Cardiopulmonary exercise testing (CPET) is used in the preoperative assessment of patients undergoing major surgery. CPET data is an independent predictor of postoperative mortality and morbidity after elective AAA repair [1]. A VO2 at Anaerobic Threshold (AT) of <10.2 to 11 ml/kg/min is associated with increased risk of postoperative mortality in AAA patients (pts) [2,3]. Sarcopenia is associated with postoperative mortality in colon cancer surgical pts [4]. We undertook a study to test the hypothesis that a surrogate marker for sarcopenia, the iliopsoas muscle, is related to preoperative CPET data in patients who have undergone AAA repair surgery. Complete CPET data and preoperative CT imaging was available for 64 pts who had undergone AAA surgery at RPH in 2018. An independent specialist in radiology measured the iliopsoas muscle from preoperative CT imaging. An independent statistician, using linear regression with a 5% significance level analysed the CPET data and iliopsoas muscle measurements.

Using our results, we can predict that at a L4/L5 Anterior Posterior measurement of the Right Iliopsoas muscle of 'x' cm, the VO2 at AT will be 0.235'x' +0.015 Litres per min, the peak VO2 will be 0.377'x' -0.191, and the maximum load will be 27.84'x' -1.903.

Iliopsoas muscle measurements are highly significant for VO2 at AT, peak VO2 and maximum load. We recommend further study to explore these relationships further as we have found strong associations between iliopsoas measurements and CPET data.

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	VO_2 at AT			VO_2 at Peak VO_2			Maximum Load (W)		
Iliopsoas measurements	Constant	Coefficient (95% CI)	p-value	Constant	Coefficient (95% CI)	p-value	Constant	Coefficient (95% CI)	p-value
L4/L5 width AP right	**0.015**	0.235 (0.117, 0.354)	0.0002	**-0.191**	0.377 (0.219, 0.536)	<0.0001	**-1.903**	27.84 (13.96, 41.72)	0.0002
L4/L5 width AP left	**-0.212**	0.290 (0.179, 0.400)	<0.0001	**-0.105**	0.350 (0.187, 0.513)	0.0001	**11.04**	24.19 (9.83, 38.54)	0.0013
L4/L5 TR right	**0.02**	0.247 (0.149, 0.344)	<0.0001	**-0.059**	0.362 (0.228, 0.496)	<0.0001	**12.82**	25.37 (13.34, 37.39)	0.0001
L4/L5 TR left	**0.235**	0.201 (0.100, 0.301)	0.0002	**0.134**	0.330 (0.196, 0.463)	<0.0001	**28.88**	22.36 (10.39, 34.33)	0.0004
Max TR in coronal plane right	**0.04**	0.229 (0.138, 0.321)	<0.0001	**0.011**	0.326 (0.199, 0.454)	<0.0001	**25.17**	20.93 (9.30, 32.56)	0.0006
Max TR in coronal plane left	**0.214**	0.191 (0.093, 0.289)	0.0002	**0.084**	0.318 (0.188, 0.448)	<0.0001	**19.53**	23.15 (11.73, 34.58)	0.0001

Table 1. Shows the results for linear regression of VO2 at AT, peak VO2, and maximum load against iliopsoas measurements.

Does a target activated clotting time (ACT) greater than 250 increase intraoperative bleeding and transfusion rates in endovascular aneurysm repair (EVAR) surgery?

Rebecca Thorne, Frimley Park Hospital

There remains no clear consensus regarding target ACT in endovascular surgery. Much of the data has been extrapolated from coronary interventions. Adequate dosing of heparin is necessary to reduce risk of thromboembolic events but higher doses may be associated with increased bleeding risk with an ACT > 250 being identified as a risk factor for increased transfusion rates in peripheral vascular interventions (1). We have previously described how we introduced a target ACT of greater than 250 at our institution and the aim of our study was to identify whether an intraoperative ACT threshold of > 250 was associated with increased bleeding and/or higher rates of transfusion.

Using the National Vascular Registry, we identified patients having undergone EVAR surgery at Frimley Park Hospital in 2016. A retrospective electronic anaesthetic chart and pathology review enabled patient demographics (age, weight, ASA), EVAR complexity, heparin dosage, ACT (baseline and intra-operative), haemoglobin (Hb) (pre- and post-operatively) and transfusion history to be identified. We grouped the patients into Group A (ACT < 250) and Group B (ACT > 250).

There were 20 and 32 patients in Group A and B respectively. Average age (median and range) was 80.3 years (65-87.8years) and 76.3 (65.1-87.7years). Average patients weight (median and range) was 80kg (46-84) versus 81.5kg (60-143). Average ACT post heparin (median and range) was 232 (199 – 248) and 292 (252 – 397). Heparin dose/kg was 68.4units (21.1-110.4) versus 92.4units (54.7-107.1). Average Hb drop (g/dL) from pre-op to day 1 was 22.5 (0-55) versus 21 (0-46). For this analysis we excluded patients who had been transfused.

The transfusion rates for group A were 1 (5%) (ACT 236) vs 6 (19%) patients in Group B. Average ACT of patients receiving a transfusion in group B was 334 (284 – 382).

There was no difference with regards to haemoglobin drop between the two groups. Of clinical significance, more patients who had an ACT of over 250 required a transfusion and the majority of these had an ACT >300. Further work is required to identify optimum ACT.

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Early detection and management of preoperative anaemia in an elective vascular surgery cohort: a Quality Improvement Project

James Walker, *Kent & Canterbury Hospital*

Iron deficiency anaemia is the commonest cause of anaemia in the surgical population (1). It has been demonstrated that preoperative anaemia is independently associated with increased mortality and length of hospital stay (2), indicating the early management of pre-operative anemia is likely to reduce major surgical patient morbidity and mortality. Previous studies have demonstrated that 33% of patients undergoing major vascular surgery operations are anaemic (haemaglobin, Hb, <130g/L). We aimed to reduce the proportion of anaemic patients undergoing major vascular surgery by introducing point-of-care Hb measurement and immediate oral iron prescription in the vascular surgery clinic.

A point-of-care HemoCue machine was used to measure Hb in patients who were referred for elective major surgery in 11 vascular surgery clinics (9 vascular clinics in East Kent hospitals and 2 in Central London hospitals). Patients with Hb <130g/L were prescribed a 1 month course of Ferrous Sulfate (200mg TDS), accompanied by a letter to the patient's GP informing them of the Hb and prescription with the suggestion to follow up with iron function tests and continuation of oral iron.

During the course of this study 11 patients were referred for major surgery, of which 4 were identified as anaemic (36%). The mean Hb concentration of these patients at the time of referral to surgery was 121.3g/L, which increased to 137.3g/L following oral iron therapy (Fig. 1). The mean duration of follow-up was 36 days.

Figure 1. The mean haemoglobin concentration of anaemic patients increased from 121.3g/L at the vascular surgery clinic to 137.3g/L at follow-up.

The implementation of a HemoCue machine to identify and manage preoperative anaemia was successful in our pilot study. In order to ensure the sustainability of this project a few key factors need to be addressed, including acquiring necessary HemoCue machines, gaining further support from clinic staff willing to use the machine and also ensuring effective coordination with primary care to ensure ongoing management of the patient. This will enable evaluation of the impact of our intervention on a wider scale.

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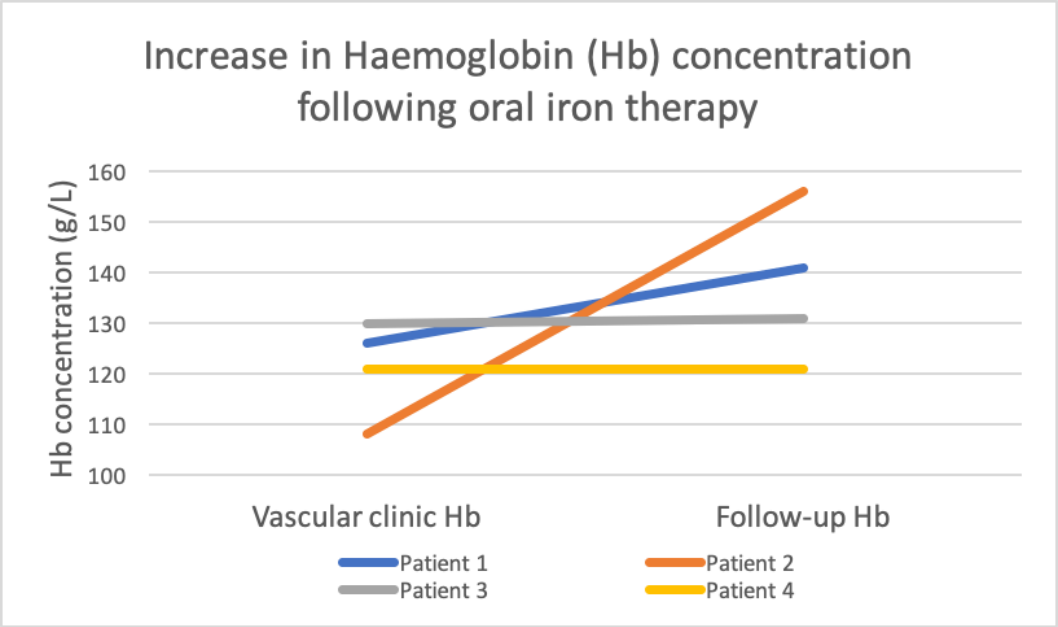

Figure 1. The mean haemoglobin concentration of anaemic patients increased from 121.3g/L at the vascular surgery clinic to 137.3g/L at follow-up.

Carotid endarterectomy: an audit of current practice and review of outcomes in a regional centre

N. Harris, North Bristol NHS Trust

North Bristol NHS Trust perform approximately 100 carotid endarterectomies (CEA) each year [1]. In 2014 an evidence-based guideline was introduced to improve peri-operative care. This focused on blood pressure (BP) management, since poor control is associated with increased morbidity and mortality. It required a BP target to be stipulated, provided an algorithm for treatment and contact details to facilitate patient review. An initial audit was performed in 2016. This demonstrated an improvement in BP management, but was hampered by a lack of available patient notes, with just 40 sets of notes from 63 eligible cases (63.5%) being available for review. As such, limited conclusions were drawn.
In 2018 we reviewed our practise. 44 CEA's were performed over a 6-month period, with data gathered retrospectively for these patients using their electronic record. 66% of the patients were male, with had an average age of 74 years.

We conclude that:

- Use of electronic records allowed 100% of the notes to be reviewed
- Staff continue to engage with the guideline:
    - A BP target was stipulated in 97.7% of cases
    - Post-operative management followed the guideline
- Over-all 25% of patients stayed in Recovery overnight. This was sometimes due to a lack of available ward beds, but also includes patients on vasopressor or beta-blocker infusions to manage their BP.
- Our haematoma rate was 9%. The national average from the National Vascular Registry is 2% [1]. This highlights that our current pathway is not reducing complication rates, however further analysis is required to identify the reason for this.
- During this period out mortality rate was 4%. This too is greater than the national average, but of note, these cases were not associated with poor BP control in the 4 hours post-surgery.
- Although there appears to be an association between GA and subsequent complications/escalation to a critical care area, the case numbers are small and those returning to Theatre are more likely to be transferred to a high dependency area post-procedure, which is a confounding factor.
- Long Recovery times may reflect delays in reviewing patients and commencing treatment for suboptimal BP, or bed pressures. This requires further analysis.
- Magnesium was only used in 3 cases. Its use was not associated with post-operative hypotension or an increased rate of complications, but the case numbers were small and it is therefore difficult to draw conclusions about its use.
- The quality of clinical documentation was poor†:
    - Anaesthetists were responsible for the majority of patient reviews but rarely wrote an entry in the patient record, instead relying on Recovery nurses to do so.
    - On average it took 45 minutes to review a patient, but this time was not recorded in 73% of cases.
    - The location of the patient and the duration during which their BP was out-of-range was also poorly documented. The maximum amount of time during which the BP was out-of-range was presumed to be 270 minutes but could have been as long as 13 hours.
    - In view of the above we propose to expand the current guideline into a proforma which will:
        - Provide a unified document for staff to write their notes
        - Have designated areas to record the time and location of an entry, as a prompt to staff

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Total character count (including spaces): 3489

BP	
BP target recorded by the end of surgery	*97.7%*
Average time spent with BP out of target range post-operatively	*110 minutes†*
Intra-operatively	
Patients undergoing GA alone or in combination with a local anaesthetic (LA) technique	*84%*
Number of patients receiving Magnesium	*7%*
Reviews	
Reviews involving an anaesthetist	*91%*
Average time taken to review	*45 minutes†*
Post-operative destination (patients receiving LA only)	
Overnight stay in Recovery	*29%*
Ward	*71%*
Average time spent in Recovery prior to transfer	*390 minutes*
Post-operative destination (patients receiving GA)	
Overnight stay in Recovery	*18%*
Ward	*61%*
Returned to Theatre with a complication	*12%*
Transfer to a critical care area	*6%*
Average time spent in Recovery prior to transfer	*313 minutes*
Over-all complication rate	
Haematoma	*9%*
Cases returning to Theatre (from Recovery)	*9%*
Cases returning to Theatre (including those from the ward)	*14%*
Inpatient mortality	*4%*
†poor documentation may limit the accuracy of these numbers – see 'Conclusions' below	

Table 1. Key findings

Time to Pre-Optimise: A Quality Improvement Project addressing the complex pre-operative needs of patients presenting for urgent vascular surgery in a tertiary vascular centre.

Michael McGinlay, Manchester Royal Infirmary

UK national recommendations have prompted the drive to reconfigure all vascular surgery as 'urgent' having identified unacceptable delays to revascularisation universally (1). A third of patients undergoing vascular surgery are over 75 years old and mortality rates remain higher than for most other types of surgery (2). The high prevalence of co-morbidities and frailty amongst this cohort, in conjunction with the unscheduled nature of their hospital admission, places increasing pressure on anaesthesia to ensure that patients are adequately risk assessed and optimised prior to surgery. As a tertiary centre vascular 'hub' we provide emergency vascular surgery 24 hours a day 7 days a week. To quantify the volume and efficiency of unscheduled vascular surgery at out institution we carried out a retrospective service evaluation audit. Our primary aim was to develop a pathway to improve the pre-optimisation and peri-operative care of patients with critical limb ischaemia undergoing urgent surgery.

Data from all vascular surgical cases booked via our electronic emergency theatre booking system over a 6-month period (July – December 2018) was collated and analysed. Data obtained included patient demographics, vascular procedure performed, time of booking and arrival time in theatre. 145 emergency cases were completed (7.6% of all non-elective work). Peripheral revascularisation, major amputation and carotid endarterectomy comprised 71% of the workload (29% (n=36), 25% (n=42) and 17% (n=24) respectively). 23% of cases were performed out-with 'normal' working hours. 14% at the weekend and 9% between 1800 and 0800. Peripheral revascularisation accounted for the majority of out of hours work. Delays in surgery were evident with 19% of major amputations, 12% peripheral revascularisation and 25% carotid endarterectomy waiting over 48 hours.

Genuine vascular emergencies represented a smaller proportion of our workload and proceeded to theatre with minimal delay. It is the larger population of vascular patients needing urgent surgery who faced longer and variable waits. Reasons for this are multifactorial with co-morbid disease and inadequate pre-operative optimisation likely key contributors. The current provision of perioperative care fails to adequate address the complex needs of our vascular population. Deficiencies in appropriate assessment, investigation and optimisation all act to hinder safe and timely surgery. The VSGBI support the expansion of perioperative medicine within vascular services and emphasise the importance of a multi-disciplinary approach, in particular, input from a geriatric physician (3). Within our institution, the directorates of vascular surgery, anaesthesia and geriatric medicine are currently collaborating with the aim to introduce this. As an initial step to improve the pre-operative care we have developed an anaesthetic pre-operative pathway intended to be used for all vascular surgical patients requiring urgent surgery. 'Pre-Optimise' is a structured, comprehensive anaesthetic document aiming to reduce avoidable delays and ultimately improve patient outcomes by preparing patients for theatre at the point of admission.

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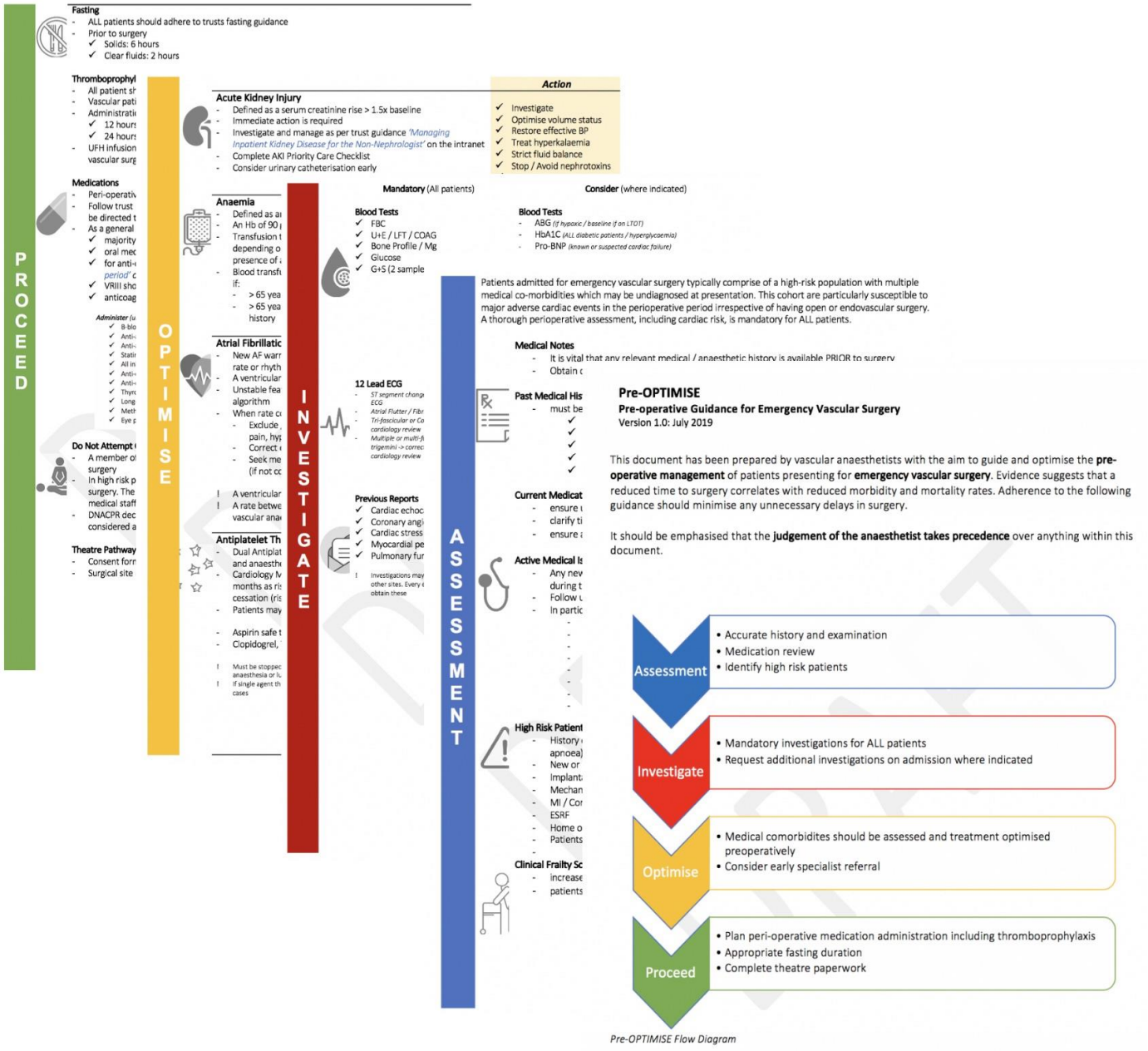

Figure 1: Pre-OPTIMISE: pre-operative guidance for emergency vascular surgery

Implementing a Perineural Catheter Protocol for Lower Limb Amputations in a Vascular Centre – Does it Make a Difference?

Araz Pourkashanian, Frimley Park Hospital, Surrey, UK

Introduction:
Lower limb amputations remain a common operation in England, with the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) reporting an annual rate of around 5500 cases [1]. The overarching aim of major lower limb amputation is to ensure the patient has a pain-free limb with optimal potential for prosthesis [2]. Pain management is difficult owing to the nociceptive and neuropathic elements. Optimizing control of acute pain may have wide ranging implications – minimizing physiological stress in a vulnerable cohort, improving functional recovery, and reducing progression to chronic (stump and phantom) pain. To this effect, we recently introduced a hospital guideline for the perioperative analgesic management of patients undergoing major lower limb amputations. This includes the preoperative initiation of analgesics and anti-neuropathics, and the intraoperative insertion of perineural catheters. We recommend that all below knee amputations (BKA) should have a sciatic catheter inserted and all above knee amputations (AKA) or through-knee amputations should have femoral and sciatic catheters. Compliance with this guideline was audited along with postoperative analgesic requirements, and pain scores.

Methods:
Data was collected over an eight-month period. We looked at compliance with preoperative (commencement of an anti-neuropathic agent, and regular paracetamol) and intraoperative guideline recommendations (perineural catheter insertion) over the first 96 hours after surgery. Rest and dynamic pain scores were recorded on a 4-point categorical scale (0 = no pain, 3 = severe pain). Opioid requirements were also recorded.

Observations:
A total of 56 patients underwent major lower limb amputation in the audit period. This included 20 AKAs, 7 through-knee, 28 BKAs, and one bilateral BKA. In the perioperative phase, all patients received regular paracetamol and 38 (68%) patients were prescribed an anti-neuropathic agent appropriately. Perineural catheters were used according to guidelines in 66% of cases. Of the remaining 19 patients, 17 were AKA and through-knee amputations, with femoral catheters not being sited in the majority of cases. In the first 24 hours after surgery, 44% of patients reported at least one episode of severe pain if the guideline was not followed compared to 25% if it was (see Figure 1). This translated to differences in opioid requirements, with an averaged 24-hour oramorph equivalent of 21.2mg (guideline non-compliant) vs. 10.4mg (guideline compliant). By postoperative day three, 72% of patients with appropriate perineural catheters had no or mild pain, compared to 59% in the other group.

Conclusions and Recommendations:
If guidelines were followed, patients were found to have lower pain scores and lower opioid requirements. Lack of femoral nerve catheter insertion was the main reason for guideline non-compliance. We believe provision of perineural catheter workshops for our vascular anaesthetists will improve guideline adherence. We also believe the introduction of a patient controlled regional analgesia protocol will further reduce pain scores and opioid requirements in patients where perineural catheter guidance is followed.

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No conflicts of interest or funding to declare

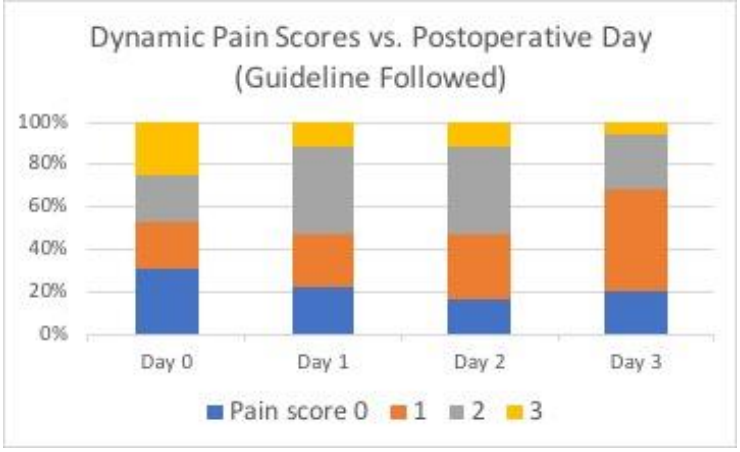

Figure 1. Dynamic pain scores from day of surgery to postoperative day 3, when guidelines followed. 25% of patients had at least one episode of severe pain on day 0 compared to only 6% by day 3.

A Nationwide survey looking at Enhanced Recovery Programmes in Vascular Surgery

Sarah Thomas, Bristol Royal Infirmary

Following pioneers of the enhanced recovery programme ERP in colorectal surgery enhanced recovery has met with success through multiple specialties Fewer complications reduced length of stay enhanced patient satisfaction and cost savings are just a few of the benefits found However there is sparse evidence for ERPs in vascular surgery Most studies have a small cohort with one randomised control trial published so far 1 The few studies available demonstrate improved outcome for patients on ERPs 2 A recent systematic review 3 concluded it reasonable to consider implementation of ERAS pathwaysbased on limited data and extrapolation from other surgical specialties until further research is done We aimed to find out whether UK wide vascular centres had set up their own ERPs what elements were included and whether ERPs had improved results Of 89 vascular centres listed on the vascular database website 9 were excluded as they no longer undertake vascular surgery Vascular surgeons and anaesthetists from the remaining 80 centres either orally answered or were emailed a survey60/80 75 centres responded to the survey Of 60 centres 8 133 had an ERP for their vascular surgeries 75 had an ERP for EVARS and open AAAs Lower limb bypass grafts 38 carotid endarterectomy 38 and 22 for elective amputations 22 3 centres had established vascular ERPs for 5 years 3 centres for 35 years 2 centres for 13 years 5 centres had an anaesthetist as their vascular ERP lead 2 had a surgeon one centre had both an anaesthetist and specialist nurse and one centre had no lead Elements of the ERPs included peri operative 88 postoperative algorithms 75 carbohydrate loading 63 prehabilitation programme 38 gut motility measures 25 enhanced recovery nurse 13 Fig 1 56 of centres recruited 76100 of their patients to their ERPs 25 recruited 5075 25 recruited 2549 and 13 recruited 124 3 centres had audited effectiveness of their ERPs 1 showed a reduced LOS and 1 found reduced postoperative complications it is notable that both centres recruited 50 of patients to their ERPs the third with no change recruited 50With the success of ERPs in multiple specialties it is logical that vascular surgery should follow suit Our snap shot nationwide survey shows 13 of vascular centres currently have ERPs for their surgery The commonest ERP was for EVARs and open AAA The commonest ERP elements were perioperative and postoperative algorithms 56 of centres recruited 75 of their patients to an ERP Of 3 centres that audited ERP effectiveness 1 centre showed a reduced LOS and one centre found decreased rate of complications More research is needed to ascertain effectiveness of ERPs in vascular surgery REFERENCE1Gurgel SJT El Dib R do Nascimento P Jr 2014 Enhanced Recovery after Elective Open Surgical Repair of Abdominal Aortic Aneurysm: A Complementary Overview through a Pooled Analysis of Proportions from Case Series Studies PLOS ONE 96: e98006 https://doiorg/101371/journalpone00980062Tatsuishi W Kohri T Kodera K et al Usefulness of an enhanced recovery after surgery protocol for perioperative management following open repair of an abdominal aortic aneurysm Surg Today 201242:1195200 3 McGinigle KL A systematic review of enhanced recovery after surgery for vascular operations J Vasc Surg 2019 S07415214

	Average LOS	National average
Open AAA	6.25	8
EVAR	2.3	3
FEVAR/TEVAR	3	5
Carotid	1.25	3
LLBG	5	7

Fig 1 Average Length of stay (LOS) of the 8 centres with vascular ERPs combined compared with National average as per National vascular database 2017

Total psoas muscle area in patients with abdominal aortic aneurysm: relationship with type of intervention

Sarah Nduwayo, Leicester Vascular Institute

Introduction
Total psoas muscle area (TPMA) used as a marker of sarcopenia can be associated with poor outcomes. However, recent studies have failed to show an association between sarcopenia and outcomes in patients undergoing abdominal aortic aneurysm (AAA) intervention. We aim to investigate the relationship between TPMA and type of intervention in patient with treatment threshold AAA.

Method
Patients seen in a combined surgical and anaesthetic clinic in 2018 with treatment threshold AAA were included. Computer tomography (CT) scans were analysed to calculate TPMA (combined right and left psoas muscle area at L3 vertebral level). Difference in TPMA between open, endovascular and conservative treatment are reported as mean standard deviation, $p<0.05$ is statistically significant.

Results
Fifty-nine patient images were analysed. Twenty were managed by conservatively, 16 with endovascular and 23 with open repair. The mean TPMA for the cohort was 23.39 5.32mm2. There was no difference of TPMA between patients managed conservatively vs. surgically (20.945.28mm2 vs. 24.495.01mm2, p=0.98). There was also no difference between patients managed with endovascular vs. open repair (24.034.25mm2 vs. 24.815.56mm2, p=0.37)

Conclusion
In this cohort, no association was found between TPMA and type of intervention in patients with AAA. Further analysis is required in a larger cohort of patient.

VASCULAR ANAESTHESIA SOCIETY

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Mode of anaesthesia in emergency surgery: clinical and patient perspectives
Lucy Elliot, Southmead Hospital, Bristol

Prediction of Nutritional Scoring Systems and Outcomes in Patients Undergoing Major Vascular Surgery
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Julia Benham-Hermetz, Royal Free London NHS Foundation Trust

The effect of mode of anaesthesia on outcomes after elective endovascular repair of abdominal aortic aneurysm in the UK National Vascular Registry
Richard Armstrong, Bristol Royal Infirmary

Feasibility and Reliability of Clinical Frailty Scale in Patients Scheduled for Arterial Vascular Surgical Procedure
Reema Ayyash, South Tees NHS Foundation Trust

Mode of anaesthesia in emergency surgery: clinical and patient perspectives

Lucy Elliot, Southmead Hospital, Bristol

Delivering a chosen mode of anaesthesia for certain emergency vascular surgical procedures is potentially beneficial for patients, but a complex intervention to evaluate in clinical trials. A recent analysis of the UK National Vascular Registry reported lower mortality rates after emergency ruptured abdominal aortic aneurysm repair (rEVAR) when local anaesthesia (LA) was used compared to general anaesthesia (GA) (1). However, little is known about the clinical decision-making process. Qualitative research methods are integral to understanding practice in such settings. This qualitative study explored clinician and patient perspectives about mode of anaesthesia for rEVAR and other emergency surgical procedures.

Snowball sampling was used to recruit participants from 8 NHS trusts. A qualitative researcher conducted 79 interviews with 21 anaesthetists, 21 surgeons, 14 operating theatre staff, and 23 patients. Thematic analysis was applied to the interview transcripts: the analysts approached the text without a predefined theory and themes were generated through rigorous coding. Codes were then grouped to form two main themes and four subthemes. Ethical approval was granted by the NHS Health Research Authority (REC ref 17/SC/0548).

The first theme was ‘impact of mode of anaesthesia in emergency surgery’. Subthemes included context and the “best” mode of anaesthesia; the balance in choosing a mode of anaesthesia; change and developments over time; and the importance of anaesthesia mode for outcomes. Clinicians and patients showed varied preferences for differing types of anaesthesia, with experience shaping the ultimate choice. This choice was recognised as a balance between various competing factors (Figure 1) and perspectives changed over time in response to increasing research evidence. The impact of mode of anaesthesia on patient outcomes was debated.

The second main theme described ‘tensions in decision making’. Subthemes were clinical autonomy and guidelines; ‘norms’ in mode of anaesthesia; the relationship between expertise, preference and patient involvement; and team dynamics. Autonomy was recognised as resulting in variation in practice, with many sites having no guidelines for emergency anaesthesia. However, conforming to ‘norms’, for example the use of GA for rEVAR, was identified as ingrained in hospital culture. Expertise led to preferences and default patterns of anaesthesia, though these were informed by patient wishes. A positive team dynamic was regarded as important, but often variations in personnel, training and experience contributed to familiar techniques being favoured, such as GA for rEVAR.

These results demonstrate that decisions about mode of anaesthesia in emergency vascular surgery depend upon several interlinking factors, including expertise, preference, habit, practicalities, norms and policies. There is recognised variation in practice in choosing modes of anaesthesia, alongside debate as to whether anaesthetic autonomy is necessary or results in a lack of willingness to change. Additionally, there is significant uncertainty regarding the effects of different anaesthesia types on postoperative outcomes. An exploration of the effects of different modes of anaesthesia on patient outcomes after emergency vascular surgery may provide evidence-based guidance for clinical decision-making.

Reference

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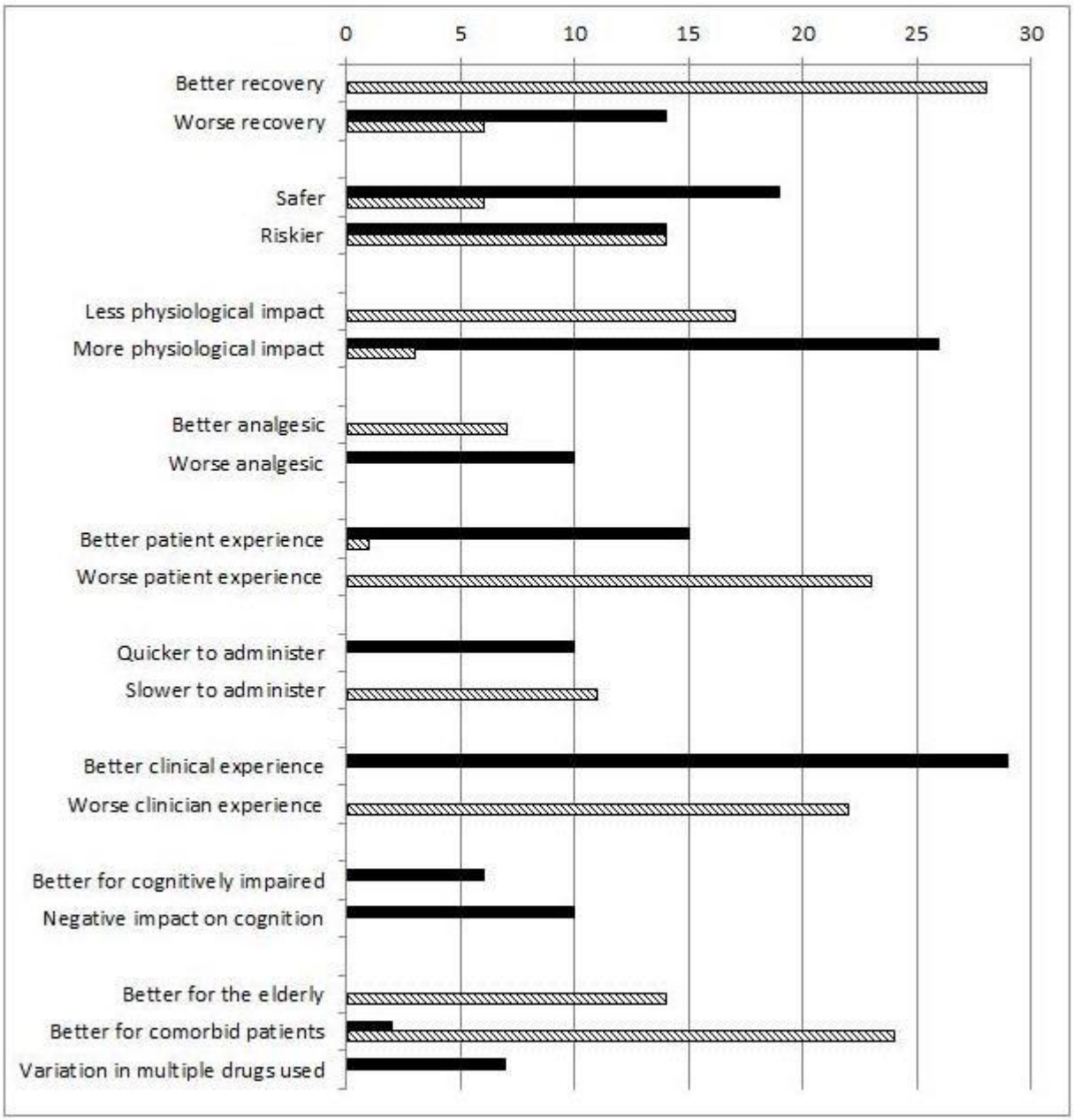

Figure 1: Number of interviews in which pros and cons of general anaesthesia (GA) (solid bars) and local/regional anaesthesia (LA/RA) (shaded bars) were discussed.

Prediction of Nutritional Scoring Systems and Outcomes in Patients Undergoing Major Vascular Surgery

Katie Ayyash, York Teaching Hospitals NHS Foundation Trust

Background: Malnutrition is a significant risk factor for adverse perioperative outcomes and can have a substantial impact on healthcare costs [1]. Vascular surgery patients are particularly susceptible due to several contributory factors [2]. Nutritional screening tools are validated for use in the general hospital population for predicting post-operative outcomes [3,4]. The aim was to assess the predictive value of nutritional screening tools: Short Nutritional Assessment Questionnaire (SNAQ), Mini Nutritional Assessment (MNA), Subjective Global Assessment (SGA), and Malnutrition Universal Screening Tool (MUST) with regards to postoperative wound infection in patients presenting for major vascular surgery. Secondary outcomes assessed the relationship of these tools with length of hospital stay (LOHS), place of discharge, 30-day readmission and deprivation index.

Methods: A prospective observational multi-centre study. 200 patients recruited to date. Nutritional screening tools were completed preoperatively by patients and if found to be at nutritional risk or malnourished, they were referred to a hospital dietician. A patient satisfaction questionnaire was completed following completion of screening tools. Follow-up was undertaken post-operatively by a blinded assessor on 3 non-consecutive days using a modified wound asepsis score.

Results: Interim analysis. 200 patients were included; follow-up data were complete for 149. The majority were male (81%), mean age 70.85 years, and mean BMI 26.97 Kgm-2. Surgical procedures were predominantly elective (68.5%); intra-abdominal (39.2%) and infra-inguinal (38.5%). Malnutrition prevalence varied between 41.3% and 81.8%. No significant association between wound infection and nutritional risk was shown. No significant correlation between LOHS and nutritional status. Correlation between deprivation index and nutritional risk with MNA was significant ($p = 0.019$). No observed significant association between 30-day readmission and wound infection. SNAQ ranked the friendliest and easiest to understand; SGA ranked best tool to determine nutritional status.

Conclusion: A high prevalence of malnutrition is present in vascular surgery patients. Older patients are at particular risk due to a multiplicity of contributory factors and high poverty rates. No screening tool predicted the association of nutritional risk with wound infection. Deprivation may play a significant role in developing malnutrition, particularly in the elderly living in social isolation coupled with a decrease in social services. We may identify a screening tool with good predictive value of postoperative outcomes on completion. Further work is needed to identify a validated tool for this population.

VASGBI funded.

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		B	Significance	Exp(B)	95% CI for Exp(B)
BMI*		-0.017	0.608	0.983	0.919 – 1.051
	Constant	0.278	0.764	1.321	
SNAQ, n = 149					
Age		0.030	0.054	1.030	1.00-1.062
BMI		-0.008	0.820	0.992	0.924-1.065
No intervention; n=123			0.858		
Mild/moderately malnourished; n=6		0.090	0.916	1.094	0.207-5.780
Severely malnourished; n=20		-0.268	0.595	0.765	0.285-2.056
	Constant	**-2.087**	**0.194**	**0.124**	
SGA, n = 145					
Age		0.031	0.045	1.032	1.001-1.064
BMI		0.010	0.781	1.010	0.940-1.086
Well nourished; n=112			0.375		
Mild/moderately malnourished; n=28		0.594	0.175	1.811	0.767-4.272
Severely malnourished; n=5		-0.200	0.835	0.819	0.125-5.370
	Constant	**-2.800**	**0.089**	**0.061**	
MNA, n = 149					
Age		0.031	0.053	1.031	1.001-1.064
BMI		0.010	0.781	1.010	0.940-1.086
Normal nutrition; n=84			0.375		
At risk; n=50		0.721	0.054	2.057	0.988-4.280
Malnourished; n=15		0.538	0.377	1.712	0.519-5.642
	Constant	**-2.955**	**0.078**	**0.052**	
MUST, n = 147					
Age		0.030	0.058	1.030	0.999-1.062
BMI		0.004	0.909	1.004	0.934-1.080
No intervention; n=118			0.930		
Moderately malnourished; n=14		0.221	0.705	1.247	0.398-3.908
Severely malnourished; n=15		0.050	0.931	1.051	0.342-3.227
	Constant	**-2.451**	**0.135**	**0.086**	

Table 1 - Binary logistic regression for BMI and wound infection. Binary logistic regression for analysis of nutritional screening tools (MUST, SGA, MNA and SNAQ) and covariates age and BMI, and association with prediction of wound infection.

The collection of patient reported outcomes after aortic surgery: a randomised controlled trial of short message service versus pen and paper

Julia Benham-Hermetz, Royal Free London NHS Foundation Trust

Healthcare interventions aim to increase a patient's length and quality of life. Traditionally we have evaluated success in surgery by measuring morbidity and mortality. It is increasingly recognised that these metrics alone are inadequate and we need to assess broader outcomes, in particular we need to measure success from the patients' perspective.1

Patient reported outcome measures (PROMs) allow patients to assess their own health and health-related quality of life. PROMs data can help clinicians and patients make decisions about treatment options and may also inform disease management and wider health policy.2

Advances in the endovascular stenting of aortic aneurysms have resulted in the reduction in the use of open surgical repair. Frailer patients with multiple co-morbidities, who previously would not have been suitable for surgical intervention, can now have their aneurysms treated. However, deciding which technique is better for individual patients remains challenging and PROMs may help with these difficult decisions.

Traditionally PROMs have been collected by form filling or via telephone, which can be slow, labour intensive and expensive.

Ownership of the mobile phone has become virtually universal and automated short message services (SMS) are widely used. In healthcare, automated SMS systems are used to collect PROMs data in orthopaedic and medical patients, with evidence that they improve response rates and provide timely feedback.

Our primary aim was to assess the feasibility of introducing an SMS PROMs system for patients having aortic surgery and to determine whether response rates to SMS PROMs were at least equal to the response rates to a standard pen and paper version.

Our secondary aim was to begin gathering comparative health-related quality of life data from patients following open or endovascular repair of aortic aneurysms.

We carried out a prospective randomised controlled trial of response rates to PROMs surveys in adults undergoing aortic surgery. Recruited patients completed a baseline EQ-D5? questionnaire and then randomly assigned to either pen and paper (P&P) or SMS follow-up. Follow-up PROMs were collected at intervals of 6 weeks, 12 weeks, 6 months and 1 year after surgery. Response rates for each PROMs modality were compared at each time point and the estimated cost of each method calculated. EQ-D5? scores were also recorded at each time point for each patient.

48 patients undergoing FEVAR, EVAR and open repair of aortic aneurysms were recruited (mean age: 72 years, M: F/41:7). 24 patients were randomised to each group. Overall response rates for P&P vs. SMS were 73.6% vs. 63.5% (p=0.18). Financial costs per patient were 472p in the P&P group compared to 38p in the SMS group.

There was no significant difference in response rates between SMS and P&P PROMs in patients undergoing complex aortic surgery. SMS PROMs cost a twelfth of the pen and paper version. Automated SMS systems provide immediate data that can be easily exported for analysis. Further work is needed to adapt PROMs questionnaires for SMS format however the introduction of SMS PROMs should be made standard practice to improve collection of surgical outcome data.

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The effect of mode of anaesthesia on outcomes after elective endovascular repair of abdominal aortic aneurysm in the UK National Vascular Registry

Richard Armstrong, Bristol Royal Infirmary

Endovascular aneurysm repair (EVAR) is the most commonly used method to repair abdominal aortic aneurysm and can be performed using a variety of anaesthetic techniques including general, local and regional anaesthesia (GA, LA and RA respectively). Non-randomized studies have suggested potential patient benefit when local and/or regional techniques are used (1,2). A recent systematic review examining mode of anaesthesia for EVAR (39,744 patients from 22 non-randomized studies) reported a lower unadjusted risk of death after emergency EVAR with LA compared to GA, but trends in elective EVAR were less clear (3). There are no randomized controlled trials to guide practice in this area therefore the best choice of anaesthetic technique remains unknown. The aim of this study was to quantify the use of different modes of anaesthesia for elective EVAR across all UK vascular centres, and to assess the effect of anaesthetic technique on early clinical outcomes.

The UK National Vascular Registry was interrogated for patients undergoing elective, standard infra-renal EVAR between 1st January 2014 and 31st December 2016. Patients with a symptomatic aneurysm treated semi-electively were excluded. The primary outcome was in-hospital death within 30-days of surgery. Secondary outcomes included postoperative complications and length of hospital stay. Time-to-event outcomes were compared using Cox Proportional Hazards regression adjusted for confounders including British Aneurysm Repair score and chronic lung disease.

A total of 9,783 patients received an elective, standard infra-renal EVAR (7,069 GA; 2,347 RA; 367 LA) across 89 hospitals. RA and/or LA was used in 82 hospitals. There were 64 in-hospital deaths within 30-days: 50 in the GA group (0.9% mortality at 30-days, 95% confidence interval [0.7-1.2%]), 11 in the RA group (0.6% [0.3-1.1%]) and 3 in the LA group (1.5% [0.5-4.7%]). The mortality rate differed between groups (p=0.03) and was significantly lower in the RA group compared to the GA group (adjusted hazard ratio RA/GA: 0.37 [0.17-0.81]; LA/GA: 0.63 [0.15-2.69]). The median length of stay was 2 days for all modes of anaesthesia, but patients were discharged from hospital more quickly in the RA and LA groups compared to the GA group (adjusted hazard ratio RA/GA: 1.10 [1.03-1.17]; LA/GA: 1.15 [1.02-1.29]). Overall, 20.7% of patients experienced one or more complications (GA group: 22.1%; RA group: 16.8%, LA group: 17.7%). Pulmonary complications were recorded most frequently and occurred with similar frequency in the three groups (overall 2.4%, adjusted odds ratio RA/GA: 0.93 [0.66, 1.32]; LA/GA: 0.82 [0.41, 1.63]) (Figure 1).

30-day mortality was lower with RA compared to GA, but mode of anaesthesia was not associated with increased complications for patients undergoing elective, standard infra-renal EVAR. This work is valuable in demonstrating the equipoise surrounding the choice of anaesthetic technique for elective EVAR and the need for a high quality randomized controlled trial comparing the different anaesthetic techniques.

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This study was supported through an Infrastructure grant from the David Telling Charitable Trust.

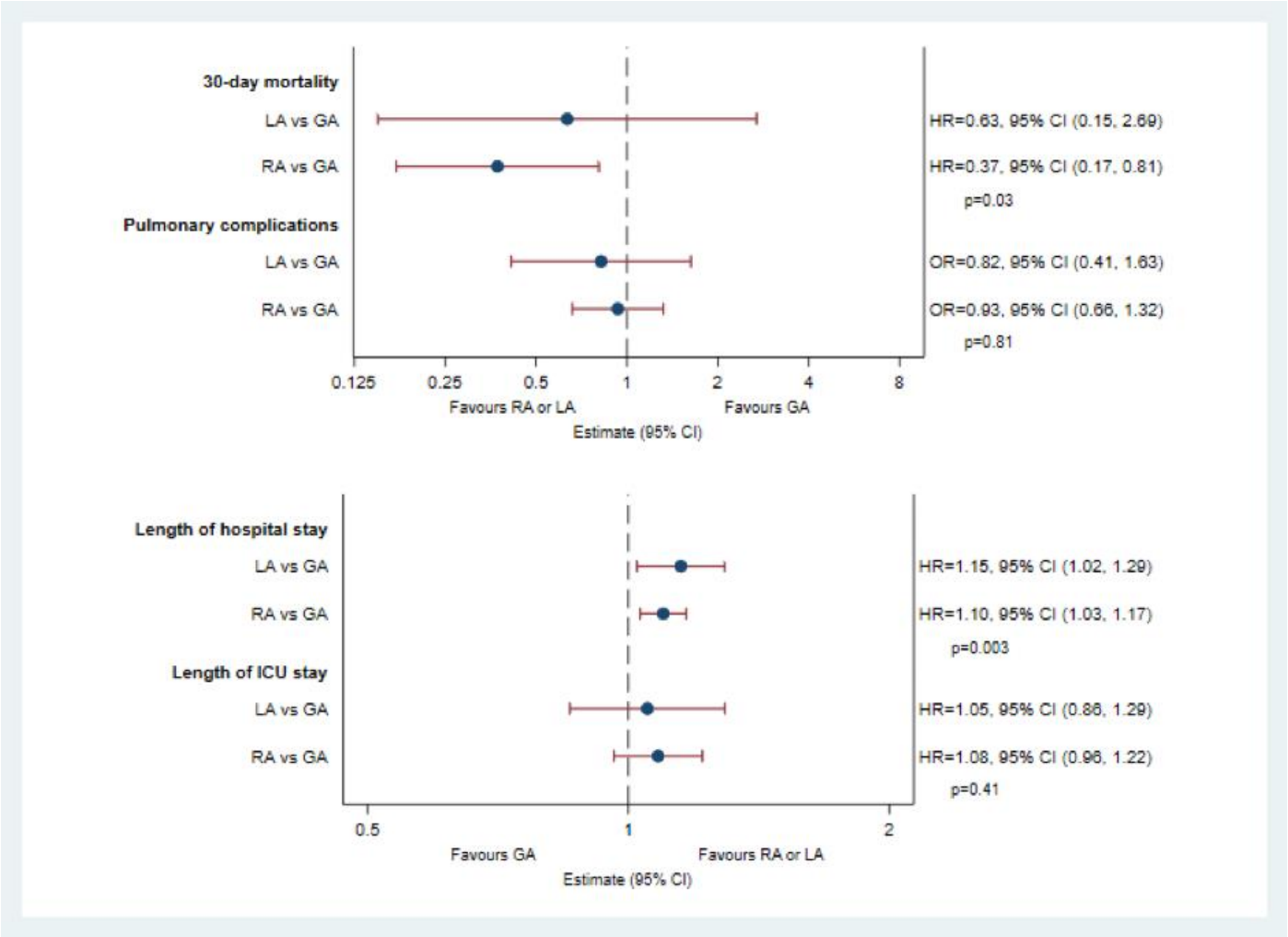

Figure 1: Comparison of outcomes between groups

Feasibility and Reliability of Clinical Frailty Scale in Patients Scheduled for Arterial Vascular Surgical Procedure

Reema Ayyash, South Tees NHS Foundation Trust

Background: Frailty is a multifactorial clinical syndrome that results in higher morbidity and mortality rates and a reduction in return to functional status [1]. It is prevalent among the vascular population [1]; however routine assessment is not common despite national guidance [2]. Several tools are available but are time and resource intensive in a pressured environment. Edmonton Frailty Scale (EFS) is a validated tool, but feasibility in this population with functional disability, hearing/visual impairments may make it difficult. The primary aim was to investigate the feasibility and reliability of Clinical Frailty Scale (CFS) for assessing frailty in patients scheduled for arterial vascular surgery attending the preassessment clinic (PAC). Secondary outcome measures included: surgical procedure, length of critical care/hospital stay, postoperative morbidity, 30-day readmission and 30-day in-hospital mortality.

Methods: This was a prospective, observational, multicentre observer-blinded study. EFS was used as the reference tool against which CFS was compared. Frailty assessment using EFS was performed by the researcher. The CFS was performed in the PAC by a consultant (expert) and nurse (novice) who were blinded to EFS scores. Frailty was defined as EFS rating 7-17, and CFS rating ≥5. We evaluated the inter-rater reliability of CFS using Cohen's Kappa Coefficient and a measure of percentage agreement (PA). Comparisons were made between expert/novice CFS scores and EFS score, and between expert and novice CFS scores. Descriptive analysis was performed for secondary outcome measures.

Results: 97 patients were included (median (IQR) age 72 (60-92) years). Linear Kappa was 0.527 (87.6% PA) and 0.499 (87.6% PA) between EFS and expert CFS ratings, and EFS and novice CFS ratings respectively, indicating a moderate level of agreement between assessors and reference tool, Figure 1. Kappa statistic was 0.606 (89.7% PA) for expert and novice CFS ratings indicating a substantial level of agreement, Figure 2. Expert CFS ratings were used for secondary analysis; 81 non-frail and 16 frail patients. 71 non-frail and 5 frail patients were suitable for a surgery. Of those, 63 non-frail and 3 frail patients underwent a surgical procedure. The IQR and mean (SD) duration of admission to ICU (1-1.73 days, 2.92(3.28)), HDU (0.2-13.2 days, 2(3.27)) and total length of hospital stay (1-29 days, 7(5.13)) were significantly higher in the non-frail group. Higher rates of postoperative morbidity (grade 3A to 5, n=12), 30-day readmission (n=5) and 30-day in-hospital mortality (n=2) were seen in the non-frail group.

Conclusions: We identified a substantial level of agreement using CFS for routine frailty assessment in PAC. CFS is a more practical tool compared to EFS in this population. There are minimal barriers to implementation; no prior training is needed and can be used even if disability is present. The CSF is neither resource nor time intensive. Utility of CFS in predicting postoperative outcomes was difficult to ascertain due to small numbers in the frail group, but this reflects surgical selection. Further research is required. VASGBI funded.

References

1) Partridge JS, Fuller M, Harari D et al. Frailty and poor functional status are common in arterial vascular surgical patients and affect postoperative outcomes. *Int J S* 2015;18:57-63
2) British Geriatric Society – Fit for frailty. https://www.bgs.org.uk/resources/resource-series/fit-for-frailty

Correlation of EFS and CFS Assessment Scores

Paired Background	Percentage Agreement P(a)	Kappa Statistics (k)	Z	P-Value
Researcher (EFS) and Expert Clinician (CFS)	87.60%	0.527	0.52	<0.001
Researcher (EFS) and Nurse (CFS)	87.60%	0.499	4.92	<0.001

Figure 1 – *Agreement and inter-rater reliability of frailty assessments EFS against the expert clinician CFS and nurse CFS across both hospital sites of older vascular patients in the preassessment clinic. Values are presented as numbers*

Correlation of Expert Clinician CFS and Nurse CFS Assessment Scores

Paired Background	Percentage Agreement P(a)	Kappa Statistics (k)	Z	P-Value
Expert Clinician CFS and Nurse CFS	89.70%	0.606	5.99	<0.001

Figure 2 – *Agreement and inter-rater reliability of CFS frailty assessment ratings between the expert clinician and nurse CFS across both hospital sites of older vascular patients in the preassessment clinic. Values are presented as numbers.*

Figure 1 - Agreement and inter-rater reliability of EFS against expert and novice CFS ratings
Figure 2 - Agreement and inter-rater reliability between expert and novice CFS ratings