Anaesthesia and the Elderly

Dr Mark Carrington
Anaesthesia/ICU Consultant
Royal Free Hospital
April 2013

Royal Free Hospital Hampstead

Our Theatres:

14 THEATRES

Case Mix:

- ENT/PAEDS
- GEN SURGERY/COLORECTAL
- HPB: OLT: 1/7 UK CENTRES
- RENAL: TRANSPLANTATION
- HPB: MAJOR RESSECTIONS
- VASCULAR: MAJOR COMPLEX EVAR
- GYNAE
- PLASTICS

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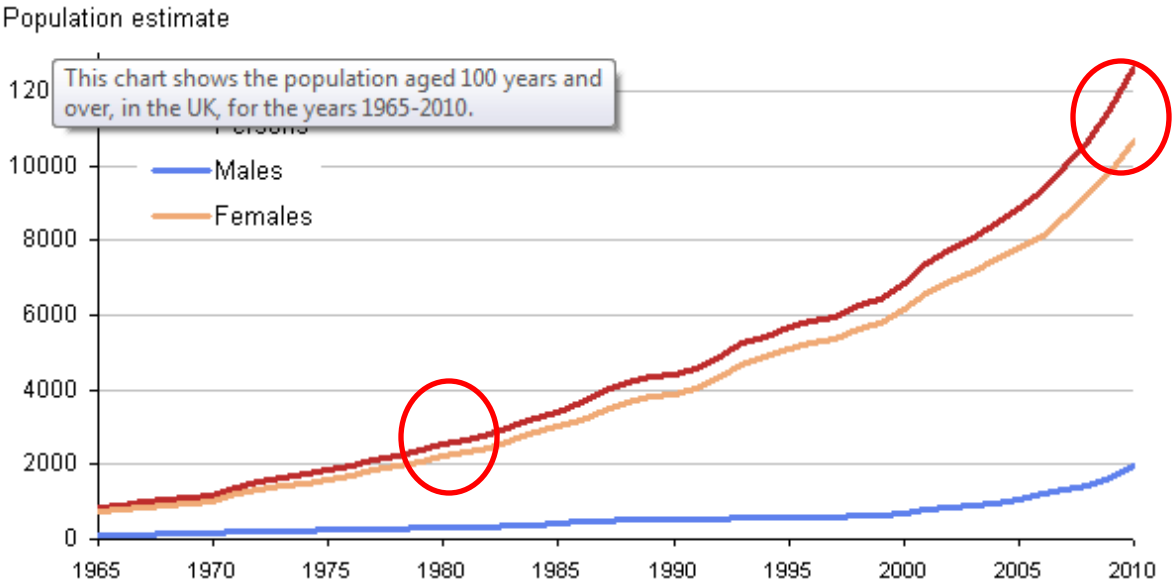
Anaesthesia and the Elderly

- Background Epidemiology
- WHO: Global AGEing and adult health
- Cardiovascular System
- Respiratory system
- Renal Dysfunction. Recognition and prevention: the role of team anaesthesia
- Summary
- Questions?

Office for National Statistics

56 Million

Population aged 100 years and over, UK, 1965-2010



Source: Office for National Statistics

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FACT FILE

World Health Organization

10 FACTS ON AGEING AND THE LIFE COURSE

Next

1 2 3 4 5 6 7 8 9 10

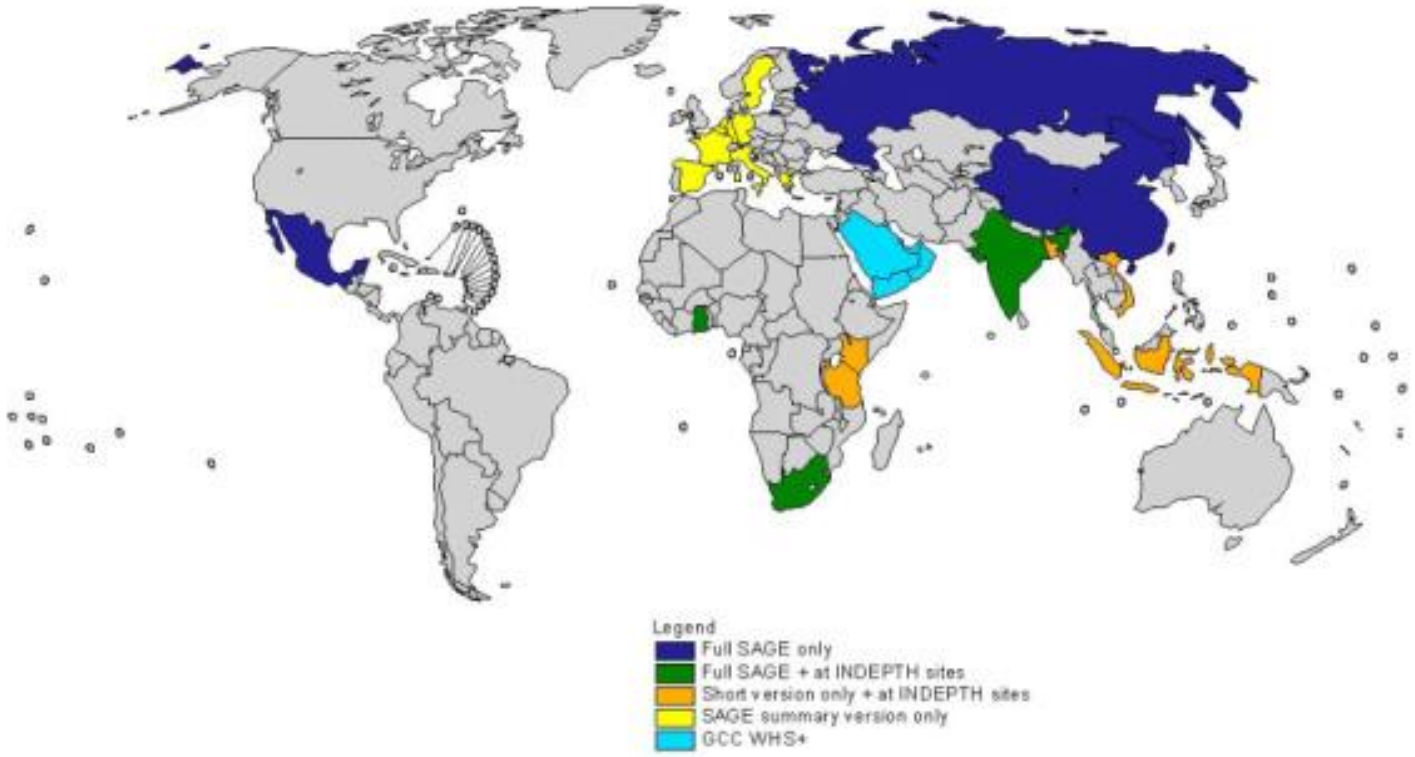
WHO/T. Halvari

The world population is rapidly ageing

Between 2000 and 2050, the proportion of the world's population over 60 years will double from about 11% to 22%. The number of people aged 60 years and over is expected to increase from 605 million to 2 billion over the same period.

World Health Organization

SAGE: WHO



World Health Organization

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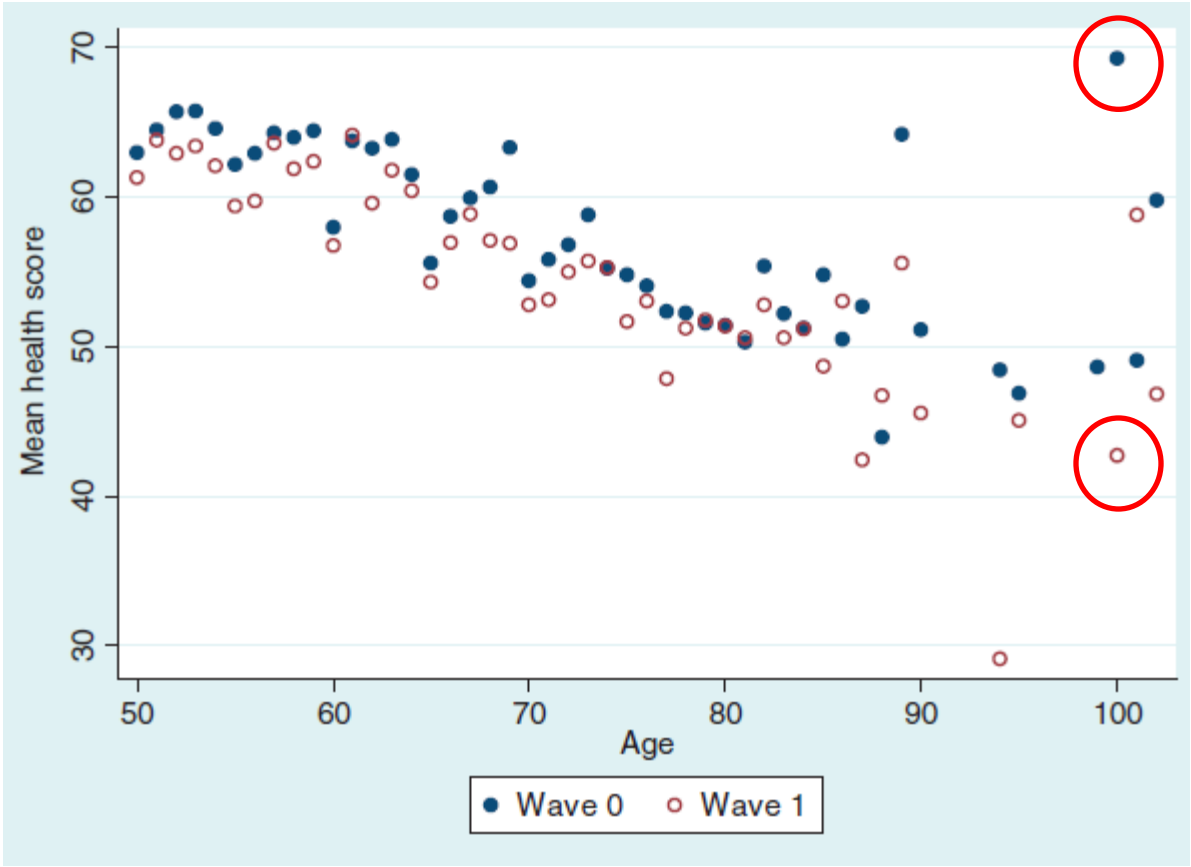
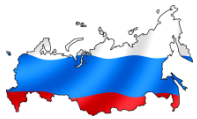
SAGE: What does it show?





World Health Organization

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SAGE

Age group	50–59			
	60–70		−3.86	<0.01
	70–80		−8.06	<0.01
	80+		−11.79	<0.01

Education	No formal education				
	Less than primary	0.41	0.55	−0.91	1.73

Chronic conditions[a]	None				
	1	−5.81	<0.01	−6.59	−5.04
	2	−8.29	<0.01	−9.44	−7.13
	3+	−9.46	<0.01	−11.30	−7.63
Alcohol[b]	No				
	Yes	−0.10	0.79	−0.90	0.69
Tobacco[c]	No				
	Yes	−1.21	<0.01	−2.02	−0.40
Country	[illegible]				
	Ghana	[illegible]	<0.01	[illegible]	[illegible]
	Russian Federation	−4.74	<0.01	−6.01	−3.47
Time	Wave 0				
	Wave 1	−0.39	0.17	−0.96	0.17
Constant		70.91	<0.01	69.28	72.53

Reference groups: Men, 50–59 year age group, no formal education, lowest income quintile, no chronic conditions, alcohol abstainer, non-smoker, Ghana, Wave 0.
[a]Angina, arthritis, asthma, diabetes and depression.
[b]Heavy alcohol use in the past week, 4+ standard drinks for women and 5+ standard drinks for men in any single episode.
[c]Current daily smoking.

Angina Asthma Diabetes Arthritis Depression

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Anaesthesia and the Elderly: Cardiovascular system

- **Cell death and its consequences**
- Appropriate pre assessment/optimisation
- Medications to Stop/continue
- Future directions re Surgery TAVI
- My practice at the Royal Free

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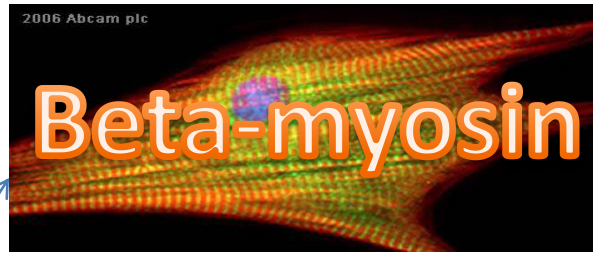
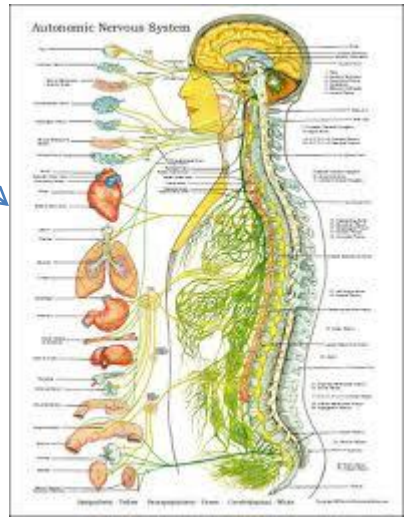
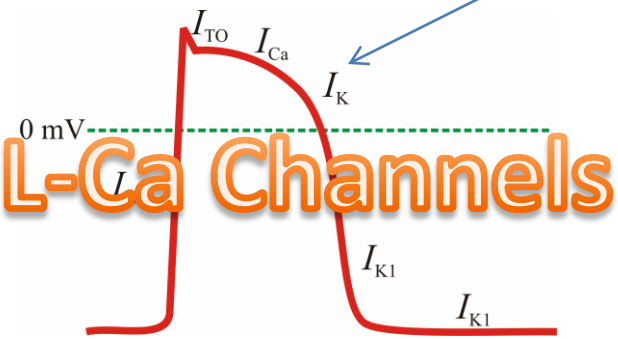
The Heart: Cell death and it consequences

Decreased numbers



Elderly Heart





L-Ca Channels

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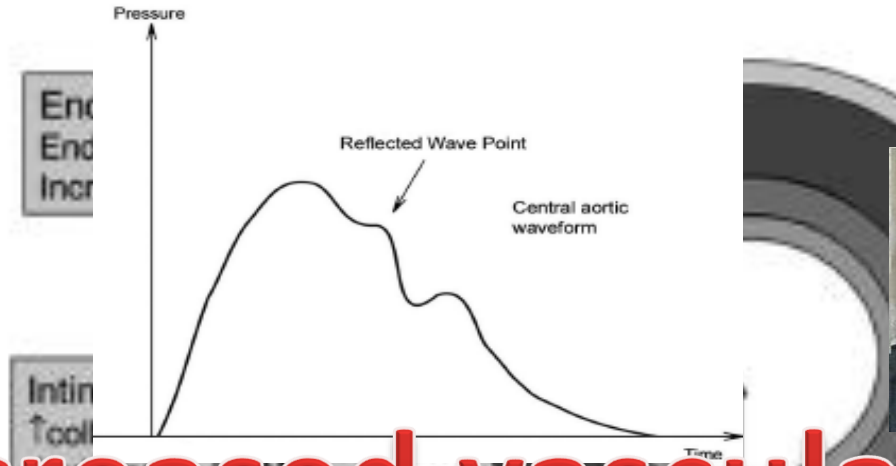
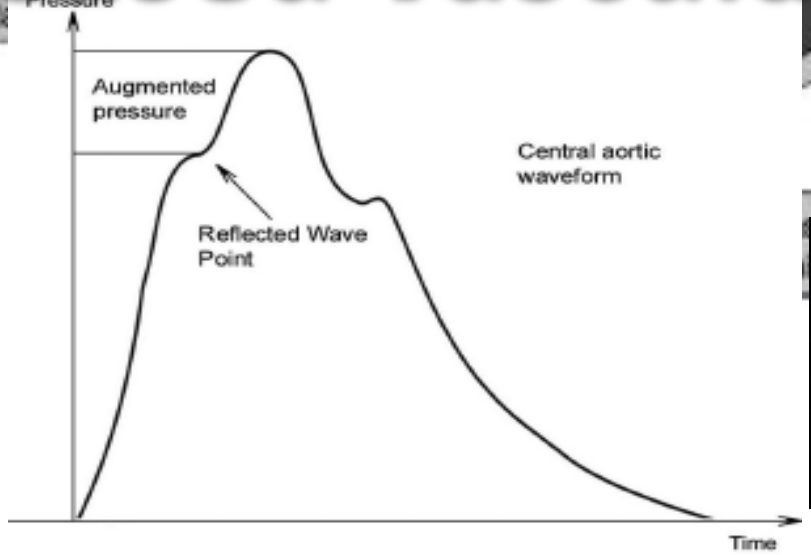
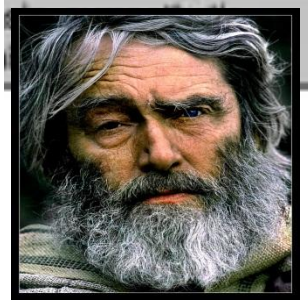
The Great Arteries:

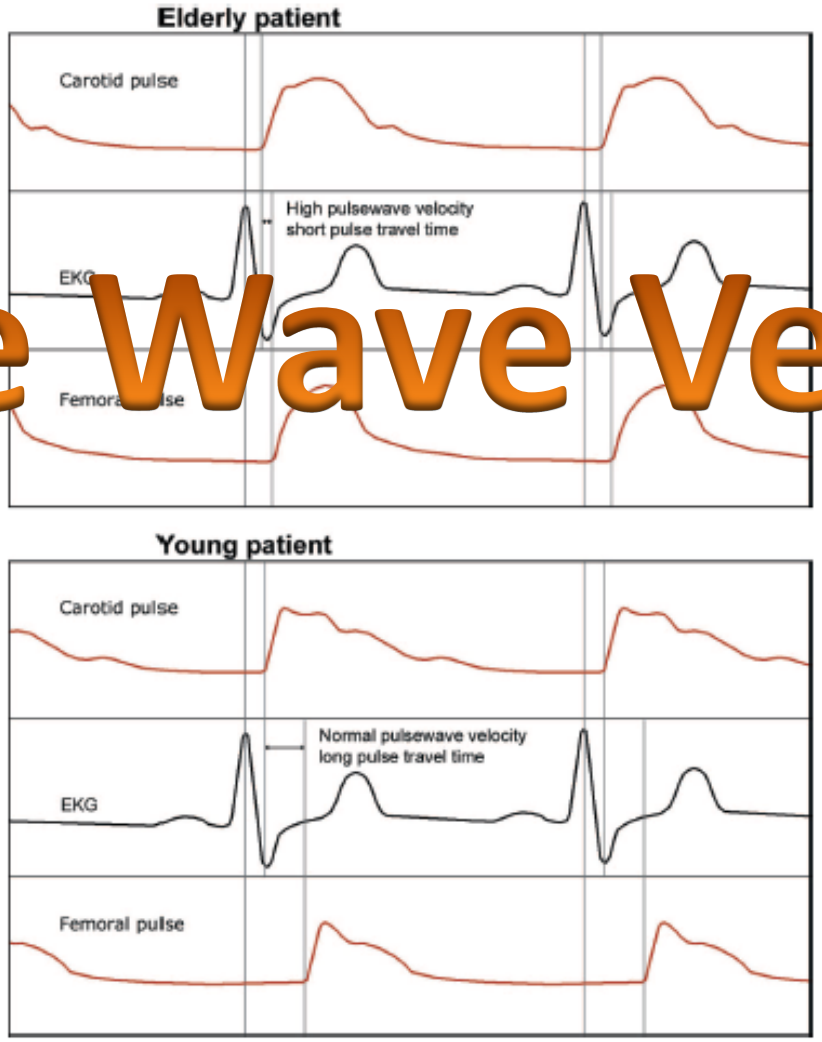


Increased vascular stiffness





Vascular stiffness



Pulse Wave Velocity

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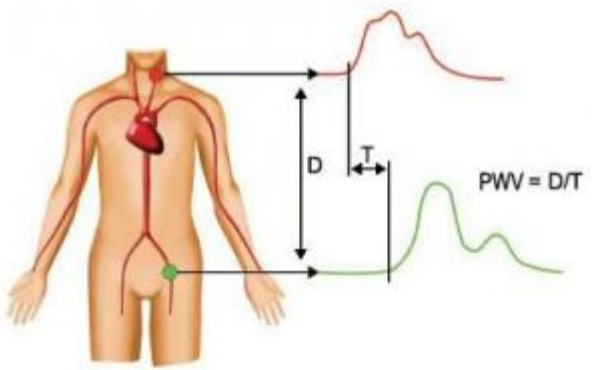
Table 2. Commercial Devices that Measure Central Arterial Stiffness

Device	Manufacturer	Measure	Pros	Cons
SphygmoCor	AtCor Medical (www.atcormedical.com)	PWV via applanation tonometry	Measures central PWV and AIx	Limited by technical difficulty in obtaining measurements
Colin VP-1000	Omron Healthcare (www.omronhealthcare.com)	PWV, AIx, ABI	Measures central AIx	Does not measure central PWV
HDI/PulseWave CR-2000 and CVProfilor DO-2020	Hypertension Diagnostics (www.hdi-pulsewave.com)	Large- and small-vessel elasticity (compliance)	Distinguishes stiffness of small and large peripheral arteries	Measures compliance expressed as elasticity, which is limited by variations in compliance throughout the arterial tree largely as a result of change in vessel size
Complior	Artech Medical (www.artech-medical.com)	PWV	Obtains central PWV, taking simultaneous measures at carotid and femoral sites	Digitized waveforms create difficulty in discerning "foot" (arrival time) of the wave
PulseTrace PWV and PCA 2	Micro Medical (www.micromedical.co.uk)	PWV via photoplethysmography	Measures central PWV	SI and RI lack reproducibility, outcome data

Implications of Vascular Ageing. Viachaslau et al. Anaesthesia-Analgaesia 112 (5) 2011



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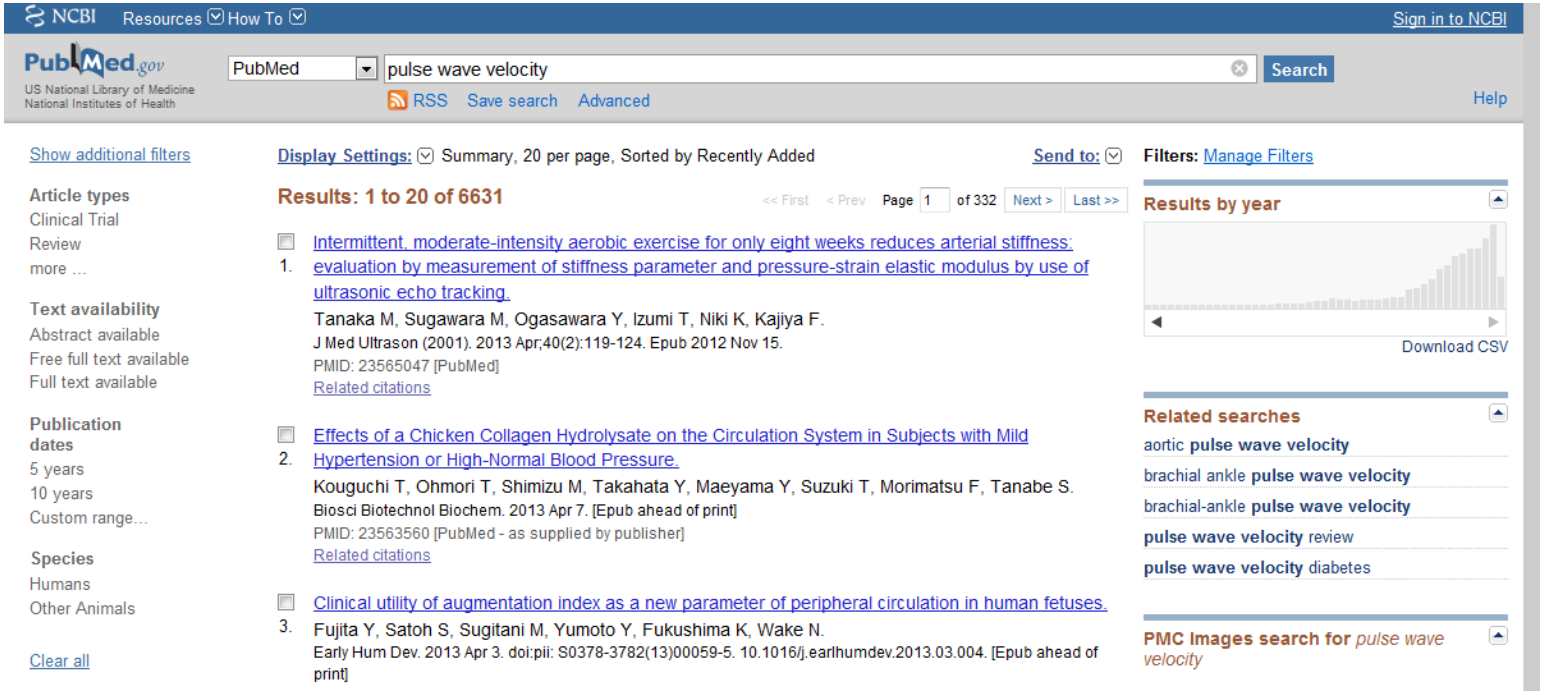
Pulse Wave Velocity



Net effects:

- Heart contracts longer and less forcefully
- Doesn’t relax as well
- More alpha than Beta responsive
- Altered relation between preload and peak systolic pressures
- Great vessel vascular stiffness: Marker of Vascular age
- Lots of valvular degeneration
- Lots of cardiac pathology

Anaesthesia and the Elderly: Cardiovascular system

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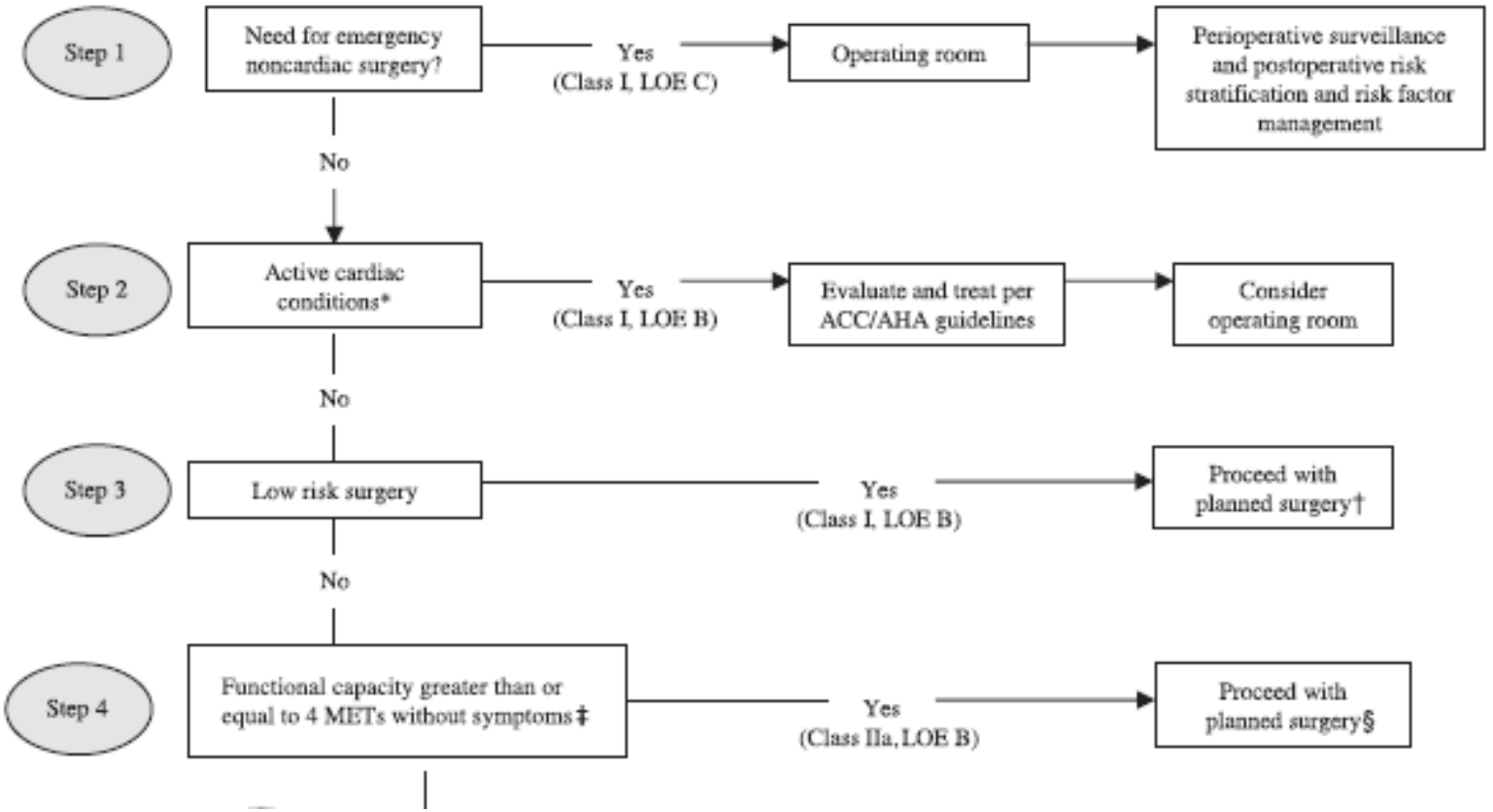
Step wise approach to CV patient

ACC/AHA GUIDELINE

ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery



CVS: Preassessment

TABLE OF CONTENTS

rative Guidelines. JACC 50 (17) 2007

CVS: Choice of anaesthetic agent…

8.1. Choice of Anesthetic Technique and Agent

Recommendations for Use of Volatile Anesthetic Agents

CLASS IIa

1. It can be beneficial to use volatile anesthetic agents during noncardiac surgery for the maintenance of general anesthesia in hemodynamically stable patients at risk for myocardial ischemia. (*Level of Evidence: B*)

ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery

Table 15. Randomized Clinical Trials of Volatile Anesthetics in Patients Undergoing Coronary Artery Surgery

Study, Year	n	Anesthetic	Control	Surgical Technique	End Point
Slogoff and Keats (451), 1989	1012	Enflurane Halothane Isoflurane	High-dose sufentanil	CPB	No difference in ischemia, MI, or death
Leung et al (452), 1991	186	Isoflurane	High-dose sufentanil	CPB	No difference in ischemia
Helman et al (453), 1992	200	Desflurane	High-dose sufentanil	CPB	Increased ischemia during induction of anesthesia
Belhomme et al (454), 1999	20	Isoflurane before aortic cross-clamping	No volatile anesthetic	CPB	No difference in TnI activation of PKC
Penta de Peppo et al (455), 1999	22	Enflurane before CPB	No volatile anesthetic	CPB	Improved LV function
Tomai et al (456), 1999	40	Isoflurane before CPB	No volatile anesthetic	CPB	Decreased TnI in subset of patients with EF less than 50%
Haroun-Bizri et al (457), 2001	49	Isoflurane before CPB	No volatile anesthetic	CPB	Improved LV function
De Hert et al (458), 2002	20	Sevoflurane	Propofol	CPB	Decreased TnI; improved LV function
De Hert et al (459), 2003	45	Sevoflurane Desflurane	Propofol	CPB; elderly; EF less than 50%	Decreased TnI; improved LV function
Julier et al (460), 2003, and Garcia et al (461), 2005	72	Sevoflurane before aortic cross-clamping	No volatile anesthetic	CPB	No difference in TnI at 72 hours; decreased BNP; decreased late cardiac events in the same study population
Conzen et al (462), 2003	20	Sevoflurane	Propofol	OPCAB	Decreased TnI
De Hert et al (463), 2004	320	Sevoflurane or desflurane	Propofol or midazolam	CPB	Decreased TnI; decreased ICU and hospital LOS
Forlani et al (464), 2004	60	Isoflurane before CPB	No volatile anesthetic	CPB	Decreased TnI and CK-MB
Bein et al (465), 2005	52	Sevoflurane	Propofol	MIDCAB	Improved LV function

REGIONAL ANESTHESIA
SECTION EDITOR
DENISE J. WEDEL

Perioperative Epidural Analgesia and Outcome After Major Abdominal Surgery in High-Risk Patients

Philip J. Peyton, MBBS, FANZCA, Paul S. Myles, MBBS, MPH, MD, FANZCA, Brendan S. Silbert, MBBS, FANZCA, John A. Rigg, MBBS, FANZCA, Konrad Jamrozik, MBBS, Dphil, FAFPHM, MFPHM, and Richard Parsons, MSc, PhD

Department of Anesthesia, Austin and Repatriation Medical Centre, Melbourne, Australia

In a primary analysis of a large recently completed randomized trial in 915 high-risk patients undergoing major abdominal surgery, we found no difference in outcome between patients receiving perioperative epidural analgesia and those receiving IV opioids, apart from the incidence of respiratory failure. Therefore, we performed a selected number of predetermined subgroup analyses to identify specific types of patients who may have derived benefit from epidural analgesia. We found no difference in outcome between epidural and control groups in subgroups at increased risk of respiratory or cardiac complications or undergoing aortic surgery, nor in a subgroup with failed epidural block (all $P > 0.05$). There was a small reduction in the duration of postoperative ventilation (geometric mean [SD]: control group, 0.3 [6.5] h, versus epidural group, 0.2 [4.8] h; $P = 0.048$). No differences were found in length of stay in intensive care or in the hospital. There was no relationship between frequency of use of epidural analgesia in routine practice outside the trial and benefit from epidural analgesia in the trial. We found no evidence that perioperative epidural analgesia significantly influences major morbidity or mortality after major abdominal surgery.

(Anesth Analg 2003;96:548–54)

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Drug	Recommendation
Beta blockers	Continue if Don't start if… Dose titration…
Statins	Cont
Ace inhibitors	Withold
ACE Receptor blockers	Withold
Alpha 2 blockers	Cont
Ca^{2+} channel blockers	Keep going. More studies needed

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- Case History

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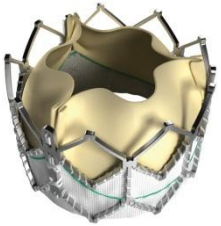
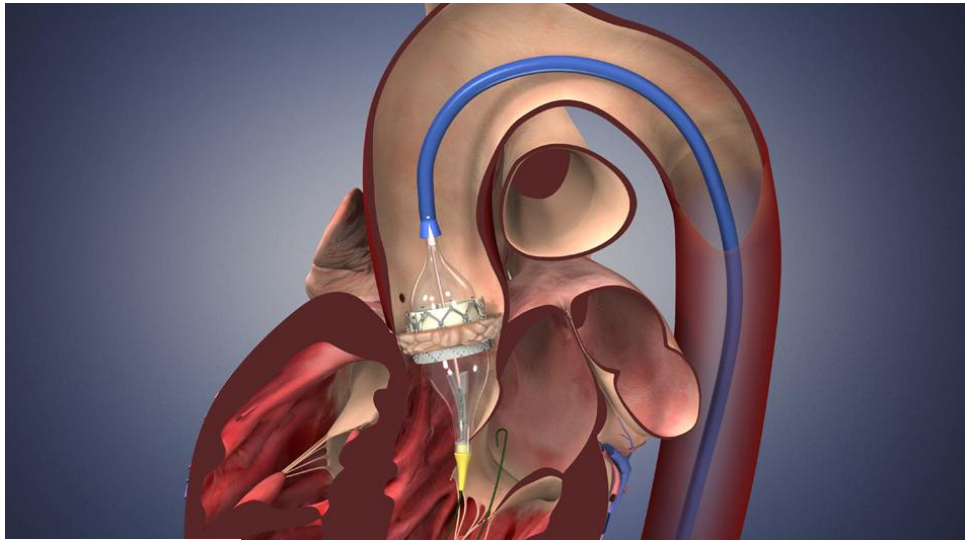
Transcatheter Aortic-Valve implantation. TAVI





The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 OCTOBER 21, 2010 VOL. 363 NO. 17

Transcatheter Aortic-Valve Implantation for Aortic Stenosis in Patients Who Cannot Undergo Surgery

Martin B. Leon, M.D., Craig R. Smith, M.D., Michael Mack, M.D., D. Craig Miller, M.D., Jeffrey W. Moses, M.D., Lars G. Svensson, M.D., Ph.D., E. Murat Tuzcu, M.D., John G. Webb, M.D., Gregory P. Fontana, M.D., Raj R. Makkar, M.D., David L. Brown, M.D., Peter C. Block, M.D., Robert A. Guyton, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Pamela S. Douglas, M.D., John L. Petersen, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart Pocock, Ph.D., for the PARTNER Trial Investigators*

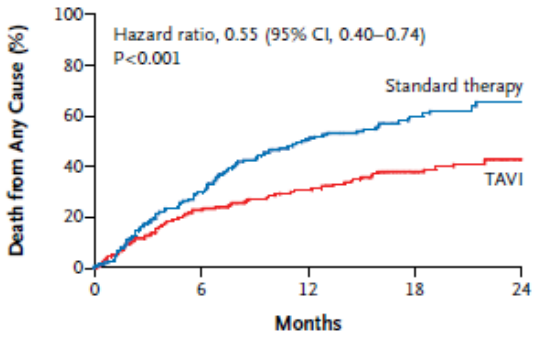
ABSTRACT

BACKGROUND

Many patients with severe aortic stenosis and coexisting conditions are not candidates for surgical replacement of the aortic valve. Recently, transcatheter aortic-valve implantation (TAVI) has been suggested as a less invasive treatment for high-risk patients with aortic stenosis.

METHODS

From Columbia University Medical Center/NewYork–Presbyterian Hospital, New York (M.B.L., C.R.S., J.W.M.); Medical City Dallas, Dallas (M.M., D.L.B.); Stanford University Medical School, Stanford (D.C.M.), and Edwards Lifesciences, Irvine (J.J.A., W.N.A.) — both in California; Cleveland



Leon et al NEJM 2010

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My Practice at RFH:

- Thorough pre op investigation
- Stopping appropriate medications
- Appropriate Post-op Planning
- Caution with preload in elderly
- Use of doppler CO monitoring
- Use of regional where apppropriate
- CPET for Higher risk cases
- Regional and sedation for Knee replacements

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Respiratory disease in the Elderly

- **Alterations in Physiology**
- Specific disease processes
- Optimisation
- GA versus regional?
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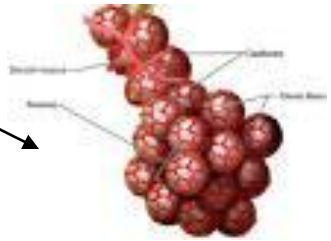
Alterations in Respiratory system

Chest wall

Cough

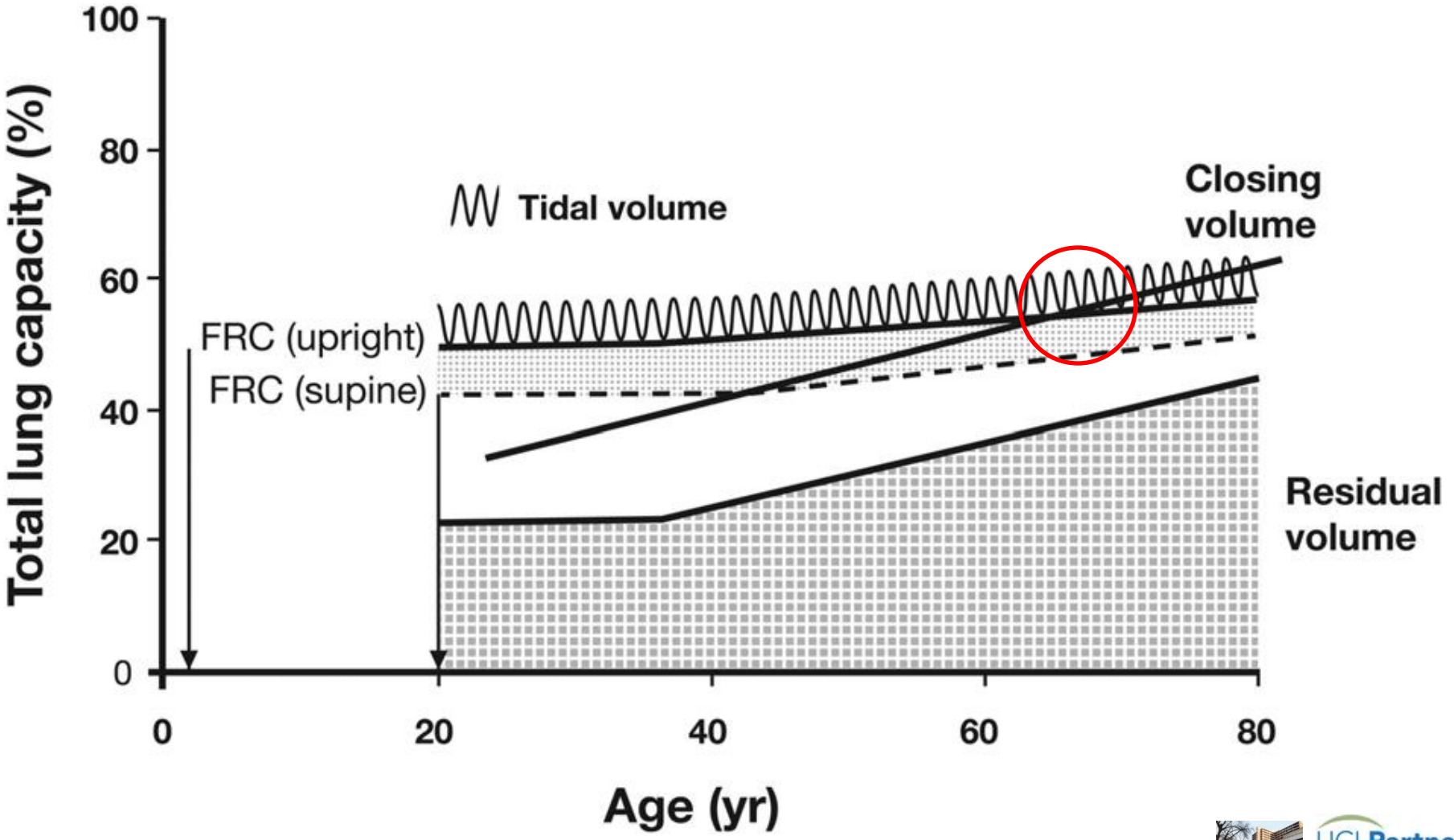
Elderly Lung

Muscle mass



Alveolar SA

Alterations in physiology



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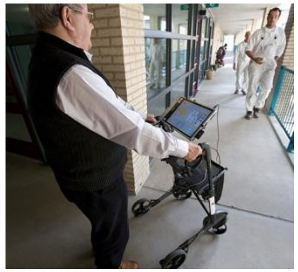
Specific disease processes

- COPD



Factors Associated with Postoperative Pulmonary Complications in Patients with Severe Chronic Obstructive Pulmonary Disease

David H. Wong, PharmD, MD, Erich C. Weber, MD, Michael J. Schell, PhD, Anne B. Wong, MD, Cynthia T. Anderson, MD, and Steven J. Barker, PhD, MD

Departments of Anesthesiology and Medicine, University of California at Irvine, and the Long Beach Department of Veteran's Affairs, Long Beach, California

37%

The purpose of this study was to dete[illegible] the incidence of different postoperative pulm[illegible] complications (PPCs) and their associated risk [illegible] patient[illegible] with severe chronic obstructive pulm[illegible] disea[illegible] (COPD) (forced expiratory volum[illegible] 1 s [illegible] ≤1.[illegible] and FEV_1/forced vital capacity ([illegible] <[illegible] under[illegible]ing noncardiothoracic operation[illegible]ne of [illegible] patients (37%) had one or more PP[illegible] ([illegible], pneumonia, prolonged intubation, refractory bronchospasm, or prolonged intensive care unit (ICU) stay). Thirty-eight of 39 patients (97%) with a PPC had an anesthetic duration >2 h. Our study patients had a 47% 2-yr mortality rate. We determined specific risk factors for each PPC [illegible]y an[illegible] [illegible]tial preoperative and intraoperative risk fa[illegible] [illegible]nary factors alone do not predict the likelihood of P[illegible]s i[illegible]vere COPD patients. Multiple logistic regre[illegible] [illegible]ied composite scoring systems, such as [illegible] p[illegible]cal status, as the best preoperative pred[illegible]ors [illegible] probably because they include both [illegible]ulm[illegible] [illegible]nd nonpulmonary factors. During th[illegible] [illegible]traop[illegible] period, avoiding general anesthesia with tracheal intubation may decrease the risk of postoperative bronchospasm. Shortening the duration of surgery and anesthesia may decrease the risk of prolonged ICU stay.

(Anesth Analg 1995;80:276–84)

During the intraoperative period, avoiding general anesthesia with tracheal intubation may decrease the risk of postoperative bronchospasm. Shortening the duration of surgery and anesthesia may decrease the risk of prolonged ICU stay.

Wong et al. Anesth Analg 1995;80:276-84)

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Respiratory optimisation

Recommendation

Annals of Internal Medicine | CLINICAL GUIDELINES

... Valerie A. Lawrence, MD; Gerald W. Smetana, MD; Kevin Weiss, MD, MPH; and Douglas K. Owens, MD, MS, for the Clinical Efficacy Assessment Subcommittee of the ...

... the risk for patients undergoing noncardiothoracic surgery. Post-operative pulmonary complications are as prevalent as cardiac complications and contribute similarly to morbidity, mortality, and length of stay. Pulmonary complications may even be more likely than cardiac complications to predict long-term mortality after surgery. The purpose of this guideline is to provide guidance to clinicians on clinical and laboratory predictors of perioperative pulmonary risk before noncardiothoracic surgery. It also evaluates strategies to reduce the perioperative pulmonary risk and focuses on atelectasis, pneumonia, and respiratory failure. The target audience for this guideline is general internists or other clinicians involved in perioperative management of surgical patients. The target patient population is all adult persons undergoing noncardiothoracic surgery.

Ann Intern Med. 2006;144:575-580. www.annals.org
For author affiliations, see end of text.

Qaseem et al. *Ann Intern Med.* 2006;144:575-580. 2006

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GA versus Regional?

Anaesthesia for hip fracture surgery in adults (Review)

Parker MJ, Handoll HHG, Griffiths R

PLAIN LANGUAGE SUMMARY

Anaesthesia for hip fracture surgery in adults

The majority of people with hip fracture are elderly and are treated surgically, which requires anaesthesia. The most common types of anaesthesia are 'general' and 'spinal'. General anaesthesia, which involves a loss of consciousness, typically includes inhalation of gases. Spinal (regional) anaesthesia involves an injection into the space around the spinal cord, to prevent pain in the involved limb. There was less mental confusion immediately after surgery in people given spinal anaesthesia, but there was not enough evidence to tell if regional anaesthesia was superior for any other outcome.

THE COCHRANE COLLABORATION®

ParkerMJ,HandollHHG, Griffiths R. Anaesthesia for hip fracture surgery in adults. *Cochrane Database of Systematic Reviews* 2004, Issue 4.

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My own practice

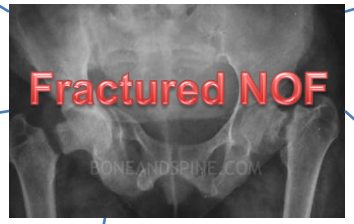
Acceptable	Unacceptable
• Haemoglobin concentration < 8 $g.dl^{-1}$.	• Lack of facilities or theatre space.
• Plasma sodium concentration < 120 or > 150 $mmol.l^{-1}$ and potassium concentration < 2.8 or > 6.0 $mmol.l^{-1}$.	• Awaiting echocardiography.
• Uncontrolled diabetes.	• Unavailable surgical expertise.
• Uncontrolled or acute onset left ventricular failure.	• Minor electrolyte abnormalities.
• Correctable cardiac arrhythmia with a ventricular rate > 120 $.min^{-1}$.	
• Chest infection with sepsis.	
• Reversible coagulopathy.	

AAGBI SAFETY GUIDELINE

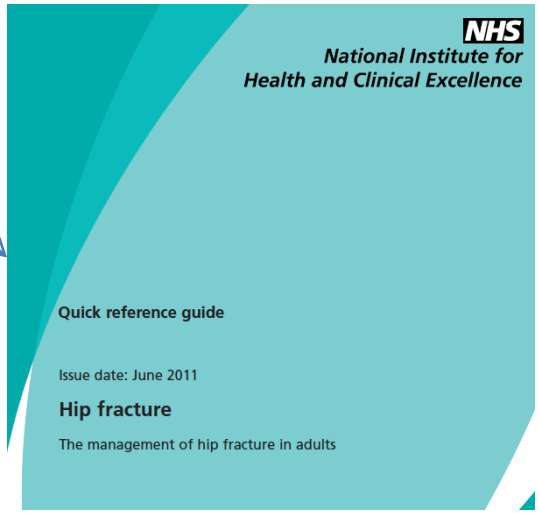
Management of Proximal Femoral Fractures 2011

National Hip Fracture Anaesthesia Network

The First Year
Richard Griffiths (Peterborough)
Kirsty Forrest (Leeds)
John Holloway (Poole)



SWIFT AUDIT



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Recommendations for anaesthesia

- Peri-op: Fluid status, analgaesia (multimodal)
- Review by Ortho geriatrician
- Timely surgery (once we've treated what's treatable)
- GA and or regional
- Intra operative CO monitoring
- Temp maintained
- Post op care: regular review/ pain team geriatrician..
- Consideration for HDU/ICU
- End of life care

Who's accessing HDU/Critical care with Fractured NOF?

NHS
London Health Programmes

Quality and Safety Programme
Fractured neck of femur

Case for change

February 2013

3.3. Poor utilisation of critical care resources

The benefits of pre- and post- operative optimisation by critical care for fractured neck of femur patients has been stated by the fractured neck of femur clinical expert panel as an **aspiration for best practice**. There is variation across London in the identification and use of critical care by different hospital pathways for fractured neck of femur pathways. With dedicated nursing for fragile patients, critical care has benefits to a patient's treatment and outcome that can not be delivered as consistently on a general ward.

Key message:

The use of critical care for pre- and post- operative optimisation varies across London despite clinical consensus that it would benefit fractured neck of femur patients.

Renal failure in the Elderly

- **Physiological changes**
- Biomarkers?
- Making the diagnosis of AKI AKIN/RIFLE and KDIGO
- Role of anaesthetic team in prevention of AKI

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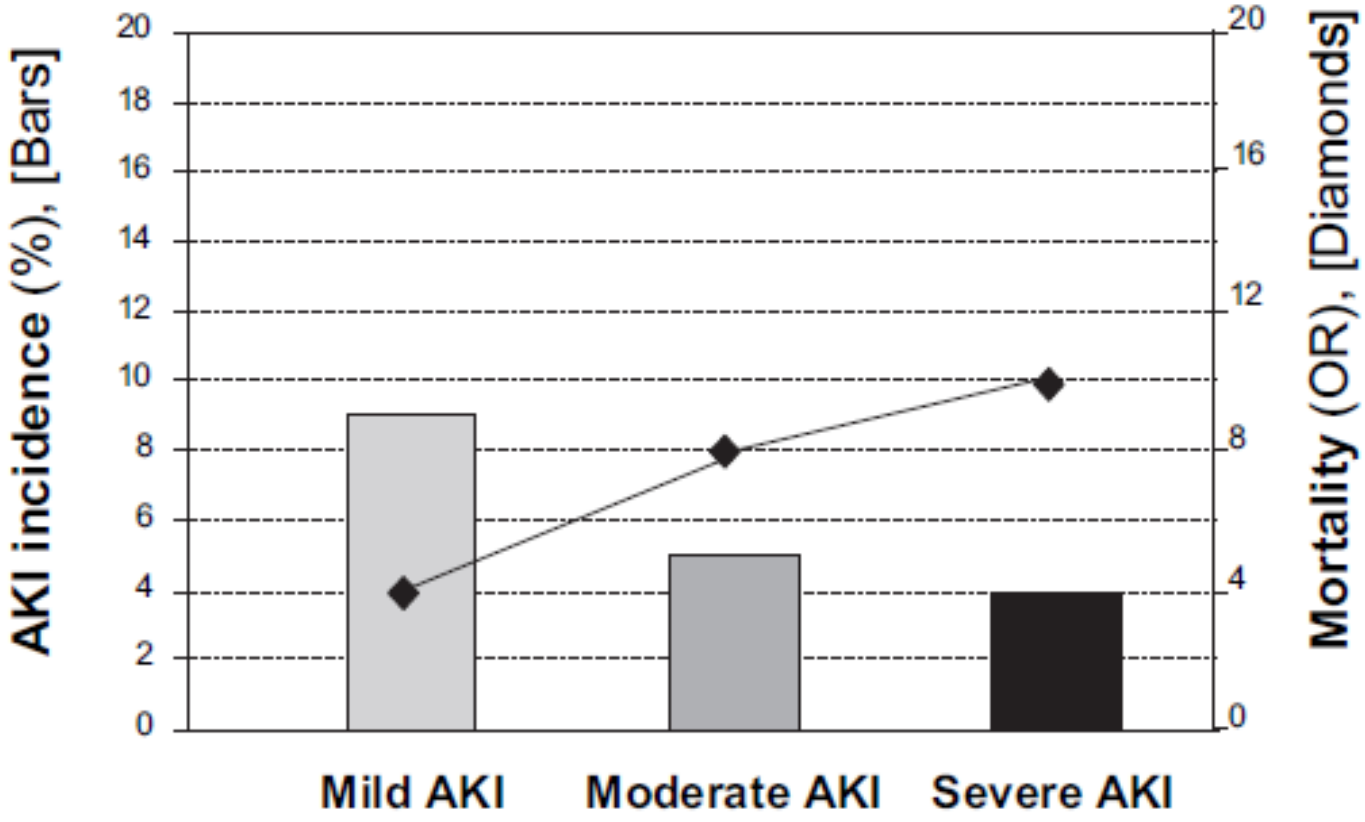
Physiological changes



Haase et al / best practice and Research Clinical Anaesthesiology 25 (2011)

Tubular injury

Renal failure in the Elderly

- Physiological changes
- **Biomarkers?**
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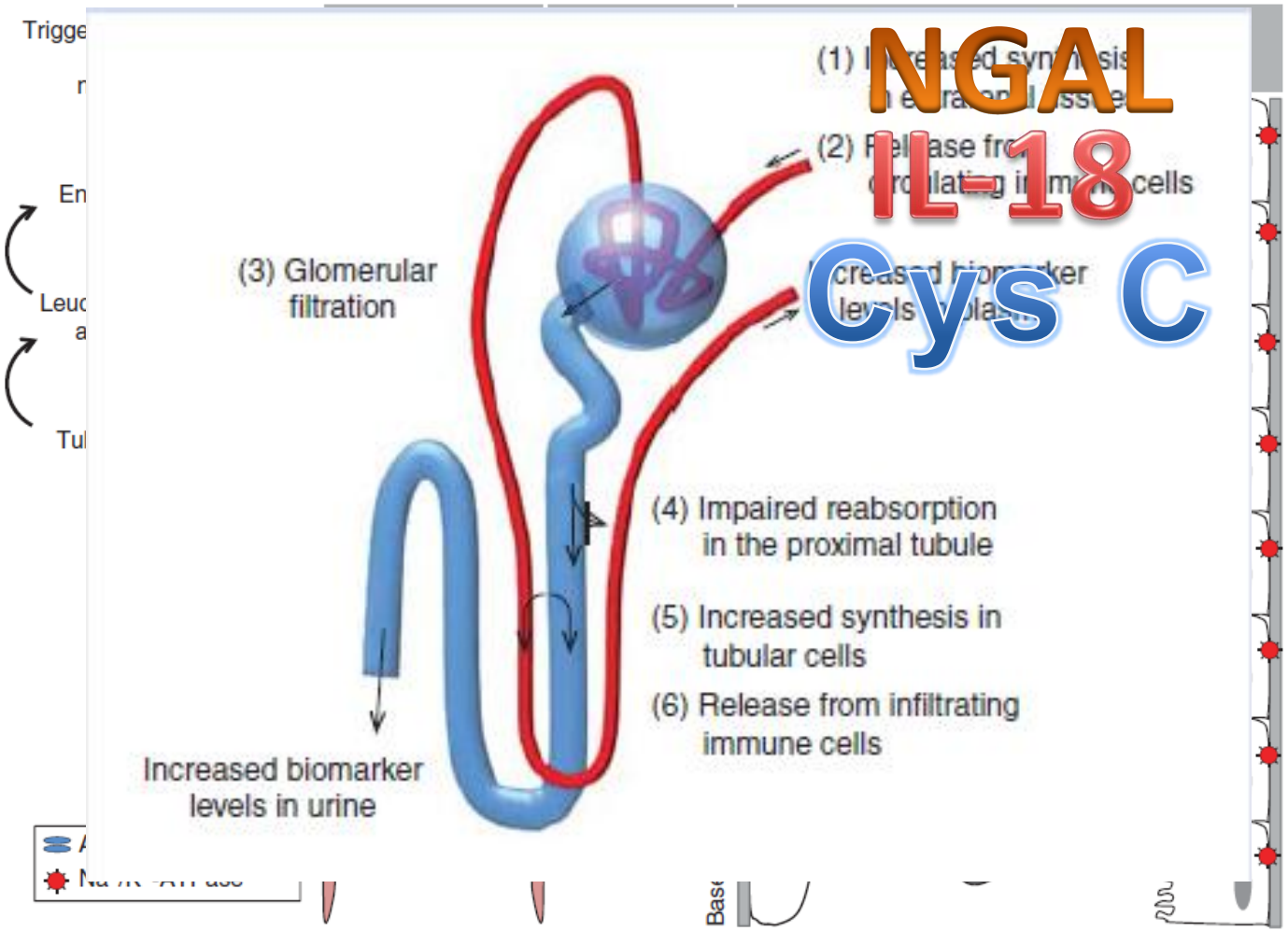
Bio markers?


NGAL
IL-18
Cys C
(3) Glomerular filtration
(4) Impaired reabsorption in the proximal tubule
(5) Increased synthesis in tubular cells
(6) Release from infiltrating immune cells
Increased biomarker levels in urine

Renal failure in the Elderly

- Physiological changes
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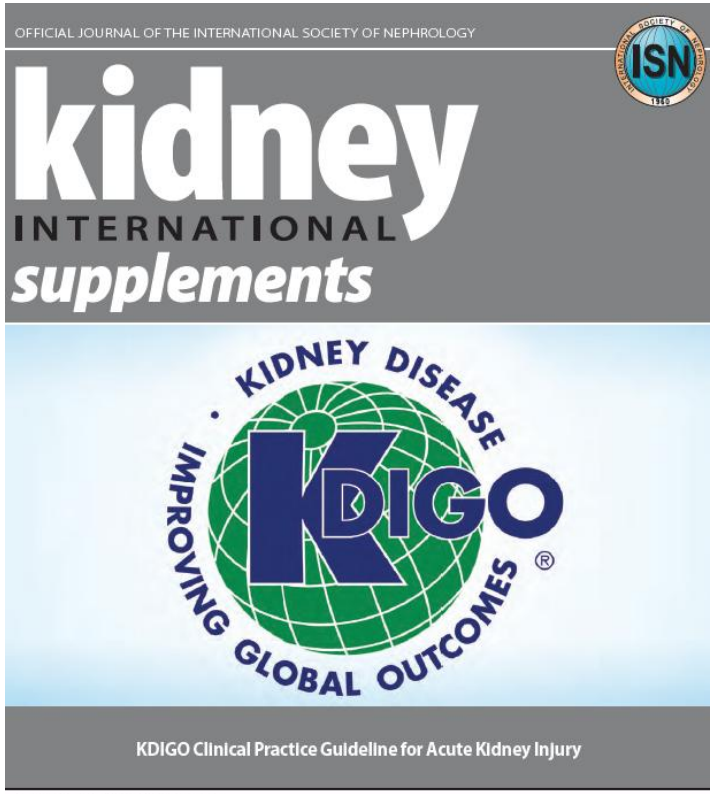
KDIGO



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National Kidney Foundation

Table 2 | Staging of AKI

Stage	Serum creatinine	Urine output
1	1.5–1.9 times baseline OR ≥0.3 mg/dl (≥26.5 μmol/l) increase	<0.5 ml/kg/h for 6–12 hours
2	2.0–2.9 times baseline	<0.5 ml/kg/h for ≥12 hours
3	3.0 times baseline OR Increase in serum creatinine to ≥4.0 mg/dl (≥353.6 μmol/l) OR Initiation of renal replacement therapy OR, In patients <18 years, decrease in eGFR to <35 ml/min per 1.73 m^2	<0.3 ml/kg/h for ≥24 hours OR Anuria for ≥12 hours

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Renal failure in the Elderly

- Physiological changes
- Biomarkers?
- Making the diagnosis of AKI AKIN/RIFLE and KDIGO
- **Role of anaesthetic team in prevention of AKI**

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kidney INTERNATIONAL supplements
KDIGO Clinical Practice Guideline for Acute Kidney Injury
VOLUME 2 | ISSUE 1 | MARCH 2012
FOUNDING SPONSOR National Kidney Foundation

So what for the anaesthetist?

3.1.3: We suggest using protocol-based management of hemodynamic and oxygenation parameters to prevent development or worsening of AKI in high-risk patients in the perioperative setting (*2C*) or in patients with septic shock (*2C*).

3.3.5: We suggest providing nutrition preferentially via the enteral route in patients with AKI. (*2C*)

3.4.1: We recommend not using diuretics to prevent AKI. (*1B*)

3.8.1: We suggest not using aminoglycosides for the treatment of infections unless no suitable, less nephrotoxic, therapeutic alternatives are available. (*2A*)

3.9.2: We suggest not using NAC to prevent AKI in critically ill patients with hypotension. (*2D*)

3.9.3: We recommend not using oral or i.v. NAC for prevention of postsurgical AKI. (*1A*)

Recommendations for anaesthesia

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Renal injury in the elderly: Diagnosis, biomarkers and prevention

Michael Haase, Associate Professor, Consultant Nephrologist [a,*],
David A. Story, Associate Professor, Head of Research [b],
Anja Haase-Fielitz, PharmD, Scientist [a]

[a] *Department of Nephrology, Hypertension, Diabetology and Endocrinology, Otto-von-Guericke University Magdeburg, Leipziger Str. 44, 39120 Magdeburg, Germany*
[b] *Department of Anaesthesia, Austin Hospital, Studley Road, Melbourne, Victoria 3084, Australia*

"Despite growing insight in the pathophysiology of AKI, there is still no effective prevention which has been established in current clinical practice"

Anaesthesia and Renal disease

- Stop/Minimise nephrotoxic medications: Contrast/Antibiotics/ACE ARBs…/NSAID
- Close attention to fluid balance
- Oliguria is bad news
- Intra operative CO monitoring
- Judicious use of PRBC: Free iron as a nephrotoxin
- Off pump work (KDIGO: risk of renal injury shouldn’t be sole reason)

Summary Lecture 1:

- There are lots more elderly patients in the world
- They get predictable changes in CVS/RS and Renal function sec to age (with whole raft of additional comorbidities thrown in)
- Pre-assessment for Cardio-vascular conditions is much more weighty than Respiratory complications (despite good evidence that PPCs cause significant morbidity/mortality)
- With renal disease there is closer inspection of pre and intra operative oliguria/newer consensus grp/AKI criteria
- A multimodal approach to the care of the elderly is required with team anaesthesia forming just one part of care…