Lessons Multimodal Debate:
Its Medical Complications: Anesthesia is the Key

Dr Mike Scott MB ChB FRCP FRCA FFICM
Professor in Anesthesiology
Divisional Lead for Critical Care Medicine
VCU Health System, Richmond, VA

Adjunct Professor in Anesthesiology
Perelman School of Medicine
University of Pennsylvania, Philadelphia, PA

Improving Surgical Care and Recovery Collaborative
Hawaii September 2019

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How can you tell if patients are on an Enhanced Recovery Pathway?

- Within 24 hrs:
  - Drinking
  - Eating
  - Mobilizing
  - Sleeping

Optimal analgesia to restore function

2

ERAS Implementation Follows the Surgical Patient's Journey

Surgery Clinic → **PACE Clinic** → **PSU / OR: ERAS Elements – Reducing Injury; Fluids; Surgery; Analgesia; ERAS Elements – Improving Recovery** (TRIAGE) → **PACU** → Low Risk → **Acute Care Unit** → **Discharge**; High Risk → **ICU** → **Acute Care Unit**

Surgery Clinic:
- eClipboards for health histories, new patient information
- Pharmacy tech phone appointments
- Orders to Scheduling

PACE Clinic:
- Redesigned processes and tools to support patient optimization plan development

ERAS Elements:
- Normothermia
- Multimodal pain regimen
- Standard analgesia and fluid management pathways
- Early recovery elements

ICU:
- Fluids
- Analgesia
- Insulin
- Vasopressors

- Postoperative interventions to support ERAS principles

Registries and Audit Systems
- ISCR - NSQIP

Patient Education – Expectation Setting – Patient Reported Outcomes – Long Term Outcomes
- PACE Patient handouts
- Surgical packet updates
- Specialty patient education updates
- Patient Engagement in Education Technology

Care Management Across the Continuum
- Standardized VCUHS model for patient-centered approach
- Roles and responsibilities
- Communications and handovers
- Multi-phase PowerPlan initiative

VCUHealth.

Perioperative Quality, Safety & Regulatory Steering Subcommittee

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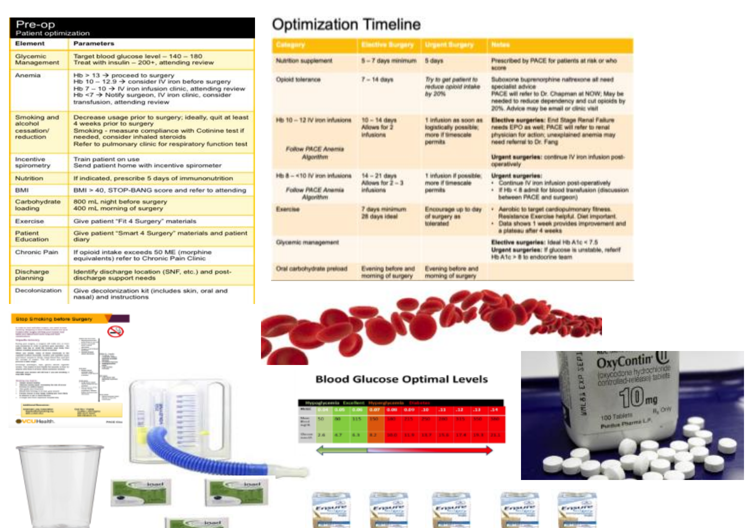
Modifiable Risk Factors now addressed in PACE Clinic

The Big Five
1. Anemia (IV Iron)
2. Glycemic Management
3. Nutrition (supplements)
4. Chronic Opioid Use
5. Hydration / Carbohydrate Loading

Hard stops
Interventions to
CHANGE OUTCOMES



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ERAS Update

February 28, 2019

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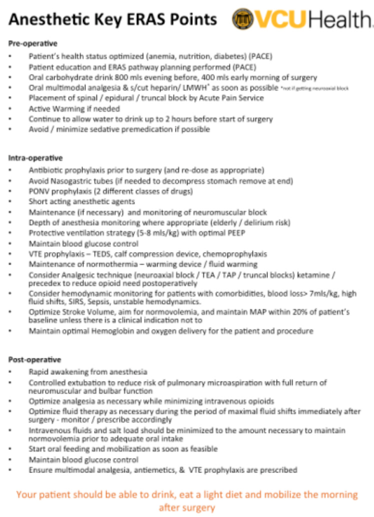
Anesthetic Key ERAS Points



Anesthetic Key ERAS Points VCUHealth

Pre-operative

- Patient's health status optimized (anemia, nutrition, diabetes) (PACE)
- Patient education and ERAS pathway planning performed (PACE)
- Oral carbohydrate drink 800 mls evening before, 400 mls early morning of surgery
- Oral multimodal analgesia & s/cut heparin/ LMWH* as soon as possible *not if getting neuroaxial block
- Placement of spinal / epidural / truncal block by Acute Pain Service
- Active Warming if needed
- Continue to allow water to drink up to 2 hours before start of surgery
- Avoid / minimize sedative premedication if possible

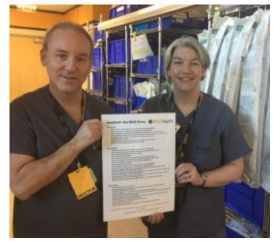
Intra-operative

- Antibiotic prophylaxis prior to surgery (and re-dose as appropriate)
- Avoid Nasogastric tubes (if needed to decompress stomach remove at end)
- PONV prophylaxis (2 different classes of drugs)
- Short acting anesthetic agents
- Maintenance (if necessary) and monitoring of neuromuscular block
- Depth of anesthesia monitoring where appropriate (elderly / delirium risk)
- Protective ventilation strategy (5-8 mls/kg) with optimal PEEP
- Maintain blood glucose control
- VTE prophylaxis – TEDS, calf compression device, chemoprophylaxis
- Maintenance of normothermia – warming device / fluid warming
- Consider Analgesic technique (neuroaxial block / TEA / TAP / truncal blocks) ketamine / precedex to reduce opioid need postoperatively
- Consider hemodynamic monitoring for patients with comorbidities, blood loss> 7mls/kg, high fluid shifts, SIRS, Sepsis, unstable hemodynamics.
- Optimize Stroke Volume, aim for normovolemia, and maintain MAP within 20% of patient's baseline unless there is a clinical indication not to
- Maintain optimal Hemoglobin and oxygen delivery for the patient and procedure

Post-operative

- Rapid awakening from anesthesia
- Controlled extubation to reduce risk of pulmonary microaspiration with full return of neuromuscular and bulbar function
- Optimize analgesia as necessary while minimizing intravenous opioids
- Optimize fluid therapy as necessary during the period of maximal fluid shifts immediately after surgery - monitor / prescribe accordingly
- Intravenous fluids and salt load should be minimized to the amount necessary to maintain normovolemia prior to adequate oral intake
- Start oral feeding and mobilization as soon as feasible
- Maintain blood glucose control
- Ensure multimodal analgesia, antiemetics, & VTE prophylaxis are prescribed

Your patient should be able to drink, eat a light diet and mobilize the morning after surgery



Visual Reminder / Checklist Every Operating Room

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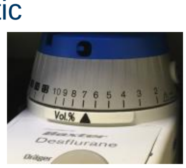
Operating Room Elements

Depth of Anesthesia

- Elderly
- Reduce POCD

Short Acting Anesthetic Agents

- Timing
- Compliance



Glycemic Control

- Maintain glucose in target range

Fluids / Hemodynamics

- Optimize Flow
- Optimize Pressure

Opioid Sparing Analgesia

- Epidural / Spinal / Blocks
- Lidocaine Infusions
- Dexmedetomidine
- Ketamine

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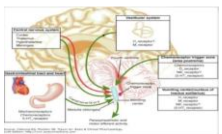
Operating Room Elements

PONV
- Universal prophylaxis
- Compliance



Antibiotic Prophylaxis
- Timing & Compliance

Neuromuscular Block
- Monitoring
- Reversal - Sugammadex

Hypothermia
- Accurate temps
- Efficacy
- Compliance

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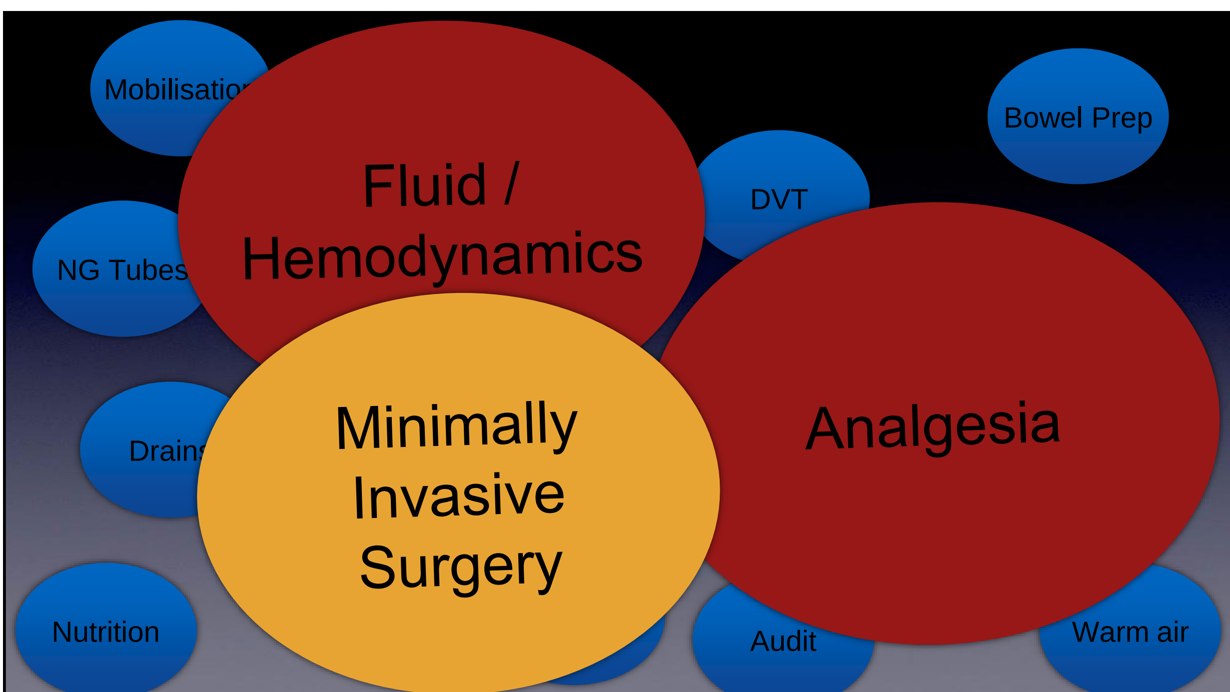

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ERAS AND FLUID THERAPY

RATIONALE

Enhanced Recovery after Surgery

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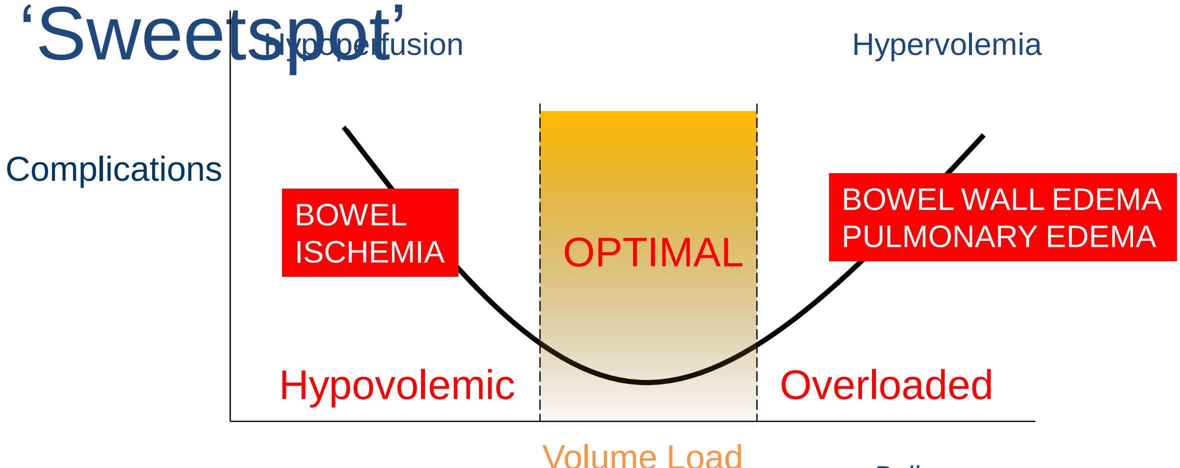
Optimal Fluid Therapy 'Sweetspot'



Bellamy
British Journal of Anaesthesia 2006

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ERAS Fluid Therapy - Overview

Avoid Fluid Shifts

Avoid bowel prep

Oral carbohydrate drink upto 2 hours preop

Reduction of bowel handling and tissue injury– laparoscopic or laparoscopic assisted surgery

Reduce blood loss

Individualised goal directed fluids to

Maintain normovolemia
Maintain hematocrit
Optimise DO2i
Maintain MAP >65-70mmHg

Postoperative

- Restrict salt and IV fluid
- Maintain normovolaemia
- Early enteral feeding

The following significantly effect fluid shifts / requirements:

- open surgery / prolonged surgery
- blood loss
- prolonged SIRS, or sepsis

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~~Restricted or Liberal Fluids?~~

Optimal Fluid Therapy is:

Right Amount
Right Fluid
Right Time

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BJA Advance Access published January 13, 2015

British Journal of Anaesthesia Page 1 of 10
doi:10.1093/bja/aeu452

BJA

Variability in practice and factors predictive of total crystalloid administration during abdominal surgery: retrospective two-centre analysis

M. Lilot[1,2], J. M. Ehrenfeld[3], C. Lee[1], B. Harrington[1], M. Cannesson[1] and J. Rinehart[1*]

Over 5000 patients
Intra-abdominal procedures
2009-2012
UC Irvine and Vanderbilt
No departmental guidelines on fluid administration

Lilot BJA, 2015. doi:10.1093/bja/aeu452

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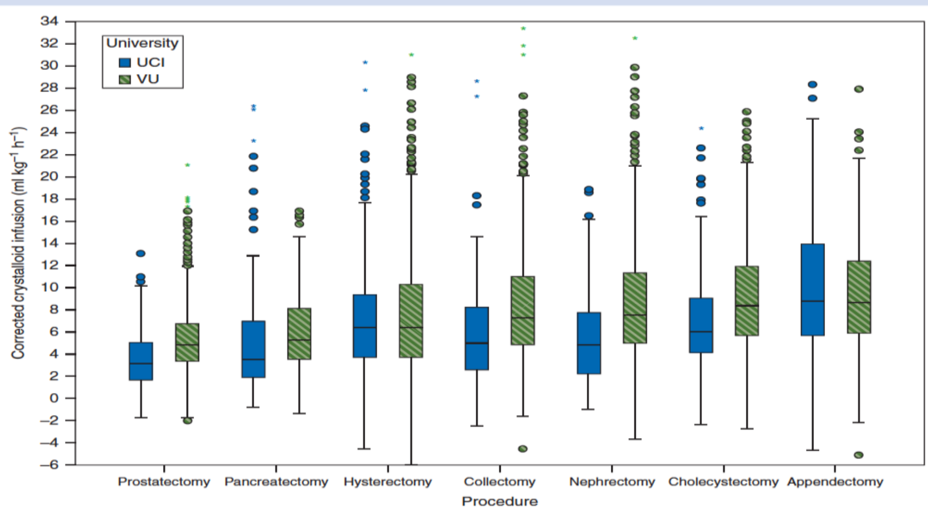

Fig 3 Fluid administration by surgical procedures. Corrected crystalloid infusion rates for procedures at both UCI and VU. Each boxplot is the median and range. For most procedures, about 50% of patients received between 4 and 10 ml kg^{-1} h^{-1} crystalloid; the other 50% obviously fell outside this wide range. Of note, UCI has a specific protocol for crystalloid administration during prostatectomies, and this group had the smallest range of any of the analysed procedures, suggesting that directed protocols can be effective in reducing variability.

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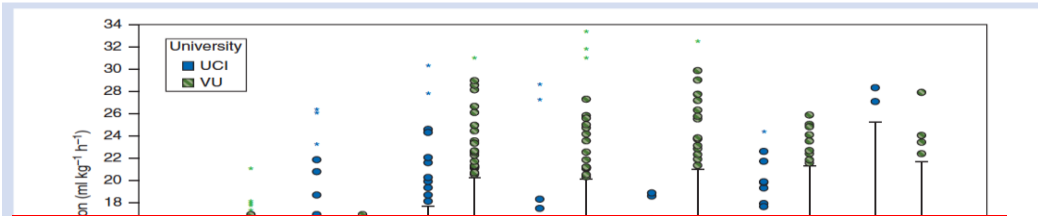

Strongest Predictor of how much fluid given: Anaesthesiologist giving the Anaesthetic

Fig 3 Fluid administration by surgical procedures. Corrected crystalloid infusion rates for procedures at both UCI and VU. Each boxplot is the median and range. For most procedures, about 50% of patients received between 4 and 10 ml $kg^{-1} h^{-1}$ crystalloid; the other 50% obviously fell outside this wide range. Of note, UCI has a specific protocol for crystalloid administration during prostatectomies, and this group had the smallest range of any of the analysed procedures, suggesting that directed protocols can be effective in reducing variability.

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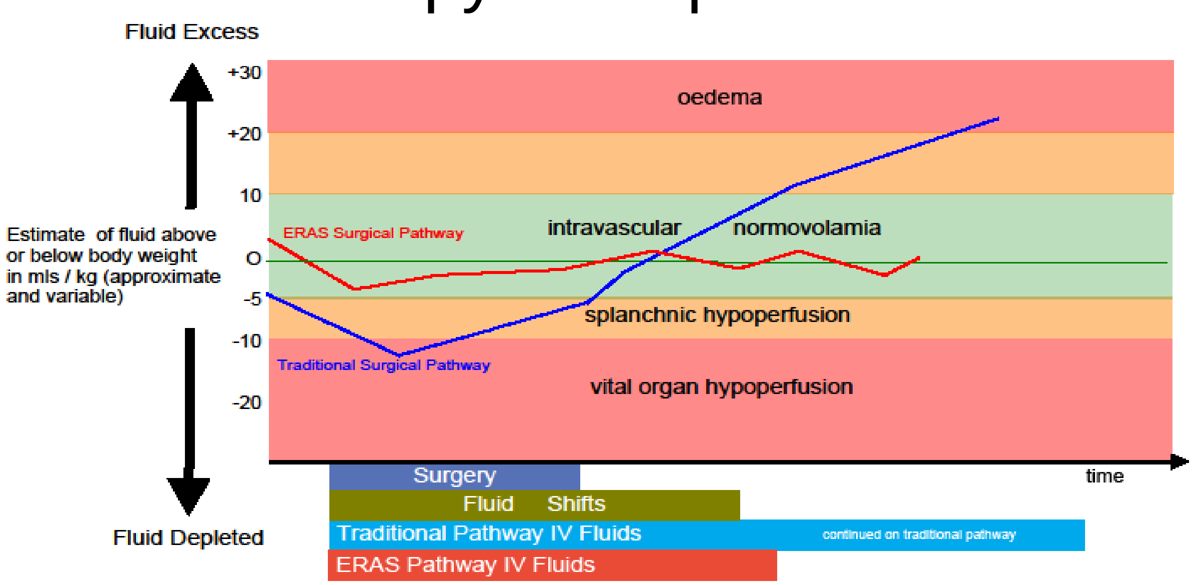
Fluid Therapy Principles



Anesthesiology Clinics March 2015

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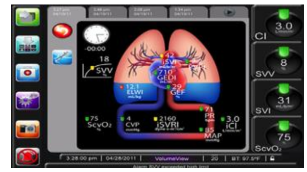
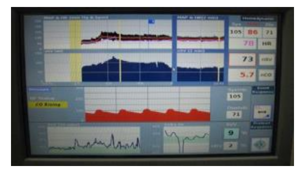
Advanced Hemodynamic Monitoring and Dynamic Parameters



- Esophageal Doppler
- Pleth Variabiliy Index
- Pulse Contour Wave Analysis
- Pulse Power Analysis
- PPV / SVV
- Bioreactance



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Mortality in Major Surgery

High Risk patients represent 80% of the mortality

ICNARC dataset

Of 67,555 surgical admissions to the ICU, there were 59,424 general surgical admissions with 11,398 deaths (19%). Of these deaths, 4,653 (40.8%) occurred after initial discharge from the ICU; 3,529 patients were subsequently readmitted to the ICU, with 1,332 deaths (37.7%). The median age was 68.7 (56.3–76.8) years, and 35,156 patients were male (59.2%). There were 56,397 admissions directly to the ICU: 31,633 following elective surgery, with 3,199 deaths (10.1%), and 24,764 following emergency surgery, with 7,084 deaths (28.6%) (Figure 1). A further 3,027 patients were admitted to the ICU following initial postoperative care on a standard ward. Of these, 1,766 followed elective surgery, with 643 deaths (36.4%), and 1,261 followed emergency surgery, with 472 deaths (37.4%) (Figure 1).

Critical Care Vol 10 No 3 Pearse *et al.*

Research **Open Access**

Identification and characterisation of the high-risk surgical population in the United Kingdom

Rupert M Pearse[1], David A Harrison[2], Philip James[3], David Watson[1], Charles Hinds[1], Andrew Rhodes[4], R Michael Grounds[4] and E David Bennett[4]

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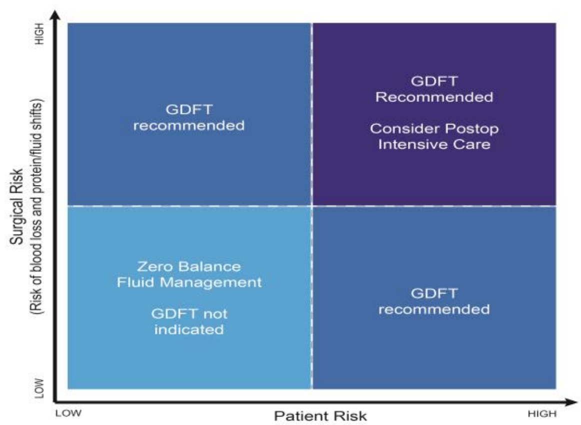
Can J Anesth/J Can Anesth
DOI 10.1007/s12630-014-0266-y

REVIEW ARTICLE/BRIEF REVIEW

Fluid management and goal-directed therapy as an adjunct to Enhanced Recovery After Surgery (ERAS)

Miller TE, Mythen. Canadian Journal of Anesthesiology. 2015; 62: 158-168.



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Restrictive versus Liberal Fluid Therapy for Major Abdominal Surgery

P.S. Myles, R. Bellomo, T. Corcoran, A. Forbes, P. Peyton, D. Story, C. Christophi, K. Leslie, S. McGuinness, R. Parke, J. Serpell, M.T.V. Chan, T. Painter, S. McCluskey, G. Minto, and S. Wallace, for the Australian and New Zealand College of Anaesthetists Clinical Trials Network and the Australian and New Zealand Intensive Care Society Clinical Trials Group*

The NEW ENGLAND JOURNAL *of* MEDICINE
ESTABLISHED IN 1812 JUNE 14, 2018 VOL. 378 NO. 24

BACKGROUND
Guidelines to promote the early recovery of patients undergoing major surgery recommend a restrictive intravenous-fluid strategy for abdominal surgery. However, the supporting evidence is limited, and there is concern about impaired organ perfusion.

METHODS
In a pragmatic, international trial, we randomly assigned 3000 patients who had an increased risk of complications while undergoing major abdominal surgery to receive a restrictive or liberal intravenous-fluid regimen during and up to 24 hours after surgery. The primary outcome was disability-free survival at 1 year. Key secondary outcomes were acute kidney injury at 30 days, renal-replacement therapy at 90 days, and a composite of septic complications, surgical-site infection, or death.

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RESULTS

During and up to 24 hours after surgery, 1490 patients in the restrictive fluid group had a median intravenous-fluid intake of 3.7 liters (interquartile range, 2.9 to 4.9), as compared with 6.1 liters (interquartile range, 5.0 to 7.4) in 1493 patients in the liberal fluid group (P<0.001). The rate of disability-free survival at 1 year was 81.9% in the restrictive fluid group and 82.3% in the liberal fluid group (hazard ratio for death or disability, 1.05; 95% confidence interval, 0.88 to 1.24; P=0.61). The rate of acute kidney injury was 8.6% in the restrictive fluid group and 5.0% in the liberal fluid group (P<0.001). The rate of septic complications or death was 21.8% in the restrictive fluid group and 19.8% in the liberal fluid group (P=0.19); rates of surgical-site infection (16.5% vs. 13.6%, P=0.02) and renal-replacement therapy (0.9% vs. 0.3%, P=0.048) were higher in the restrictive fluid group, but the between-group difference was not significant after adjustment for multiple testing.

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Table 2. Blood Loss and Administered Intravenous-Fluid Volumes.*

Variable	Restrictive Fluid (N=1490)	Liberal Fluid (N=1493)	P Value
During surgery			
Median intraoperative blood loss (IQR) — ml	200 (100 to 400)	200 (100 to 500)	0.14†
Median intraoperative fluid administration (IQR) — ml			
Crystalloid	1677 (1173 to 2294)	3000 (2100 to 3850)	<0.001
Colloid‡	500 (250 to 800)	500 (400 to 1000)	0.01
Median infusion rate (IQR) — ml/kg/hr	6.5 (5.1 to 8.4)	10.9 (8.7 to 13.5)	<0.001
In PACU§			
Median administration of fluid (IQR) — ml			
Crystalloid	160 (90 to 302)	300 (160 to 500)	<0.001
Colloid‡	400 (250 to 500)	500 (250 to 500)	0.27

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Postoperative day 1, post-PACU			
Median administration of fluid (IQR) — ml			
Crystalloid	1556 (1200 to 1960)	2600 (2052 to 3150)	<0.001
Colloid‡	500 (250 to 1000)	500 (400 to 750)	0.89
Median infusion rate (IQR) — ml/kg/hr	0.9 (0.7 to 1.2)	1.5 (1.2 to 1.7)	<0.001
At 24 hr after surgery			
Median cumulative total for intravenous fluids (IQR) — ml	3671 (2885 to 4880)	6146 (5000 to 7410)	<0.001
Median fluid balance (IQR) — ml¶	1380 (540 to 2338)	3092 (2010 to 4241)	<0.001†
Median weight gain (IQR) — kg‖	0.3 (−1.0 to 1.9)	1.6 (0.0 to 3.6)	ND

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Subgroup	Restrictive Fluid (no. of patients/total no.)	Liberal Fluid (no. of patients/total no.)	Hazard Ratio (95% CI)	P Value	P Value for Interaction
All patients	271/1490	262/1493	1.05 (0.88–1.24)	0.61	
Age					0.46
≤60 yr	66/441	70/435	0.93 (0.66–1.30)	0.68	
61–70 yr	74/367	60/380	1.32 (0.94–1.86)	0.11	
71–75 yr	43/308	47/313	0.93 (0.62–1.41)	0.74	
>75 yr	88/374	85/365	1.01 (0.73–1.36)	0.94	
Sex					0.03
Male	119/771	138/783	0.86 (0.67–1.10)	0.24	
Female	152/719	124/710	1.25 (0.99–1.58)	0.07	
ASA status					0.89
1 or 2	75/567	70/561	1.07 (0.78–1.49)	0.67	
3	174/849	172/868	1.05 (0.85–1.29)	0.68	
4	22/74	20/64	0.91 (0.50–1.66)	0.75	
Body-mass index					0.78
≤18.5	5/30	5/26	0.85 (0.25–2.94)	0.80	
>18.5–25.0	70/343	60/349	1.23 (0.87–1.73)	0.24	
>25.0–30.0	62/392	69/390	0.89 (0.63–1.26)	0.51	
>30.0–35.0	59/298	56/293	1.03 (0.71–1.48)	0.87	
>35.0	74/426	72/434	1.06 (0.76–1.46)	0.75	
Country					0.047
Australia	152/836	159/841	0.96 (0.77–1.20)	0.75	
New Zealand	14/46	3/48	5.59 (1.61–19.5)	0.007	
Hong Kong	16/111	9/116	1.92 (0.85–4.34)	0.12	
United Kingdom	28/141	36/134	0.71 (0.43–1.16)	0.17	
Italy	4/32	5/32	0.80 (0.22–2.99)	0.74	
United States	14/74	11/75	1.33 (0.61–2.94)	0.48	
Canada	43/250	39/247	1.12 (0.73–1.73)	0.61	
Colorectal surgery					0.68
Yes	133/646	125/651	1.09 (0.85–1.39)	0.51	
No	138/844	137/842	1.05 (0.80–1.28)	0.93	
Planned GD device					0.83
Yes	31/185	32/190	0.99 (0.61–1.63)	0.98	
No	240/1305	230/1303	1.05 (0.88–1.26)	0.58	
Planned destination					0.74
ICU or HDU	125/429	122/422	1.01 (0.78–1.29)	0.97	
Ward	146/1061	140/1071	1.07 (0.85–1.34)	0.59	
Duration of surgery					0.43
≤2.5 hr	85/436	73/410	1.11 (0.81–1.51)	0.53	
>2.5–3.5 hr	61/416	66/412	0.92 (0.65–1.31)	0.65	
>3.5–4.5 hr	34/253	51/312	0.81 (0.52–1.25)	0.34	
>4.5 hr	91/385	72/359	1.20 (0.88–1.64)	0.24	

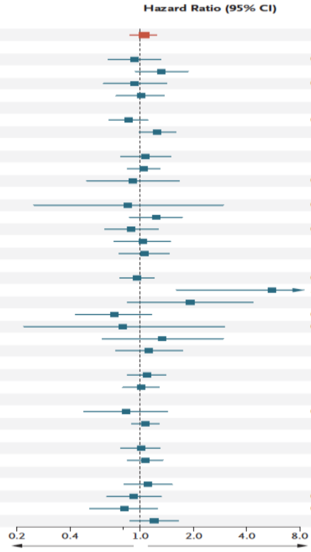

Figure 2. Hazard Ratios for Death or Disability in Prespecified Subgroups.

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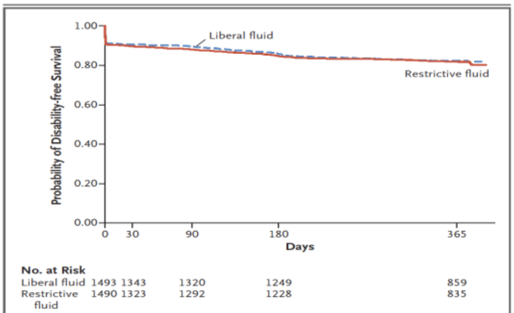

Figure 1. Probability of Freedom from Death or Persistent Disability 1 Year after Surgery.

With a median follow-up of 366 days, the rate of disability-free survival at 1 year was 81.9% in the restrictive fluid group and 82.3% in the liberal fluid group (hazard ratio for death or disability, 1.05; 95% confidence interval, 0.88 to 1.24; P=0.61).

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CONCLUSIONS

Among patients at increased risk for complications during major abdominal surgery, a restrictive fluid regimen was not associated with a higher rate of disability-free survival than a liberal fluid regimen and was associated with a higher rate of acute kidney injury. (Funded by the Australian National Health and Medical Research Council and others; RELIEF ClinicalTrials.gov number, NCT01424150.)

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Table 1. Demographic and Perioperative Characteristics of the Patients at Baseline.*

Characteristic	Restrictive Fluid (N=1490)	Liberal Fluid (N=1493)
Mean age ±SD — yr	66±13	66±13
Male sex — no. (%)	771 (51.7)	783 (52.4)
Median body weight (IQR) — kg	84 (68–102)	83 (69–102)
ASA physical status — no. (%)†		
1	25 (1.7)	21 (1.4)
2	542 (36.4)	540 (36.2)
3	849 (57.0)	868 (58.1)
4	74 (5.0)	64 (4.3)

At 24 hr after surgery			
Median cumulative total for intravenous fluids (IQR) — ml	3671 (2885 to 4880)	6146 (5000 to 7410)	<0.001
Median fluid balance (IQR) — ml¶	1380 (540 to 2338)	3092 (2010 to 4241)	<0.001†
Median weight gain (IQR) — kg‖	0.3 (−1.0 to 1.9)	1.6 (0.0 to 3.6)	ND

Fluid Balance at end of 24 hours	3.6 mls/kg	19.2 mls/kg

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Fluid Balance at end of 24 hours	3.6 mls/kg	19.2 mls/kg

My Interpretation:

Study does not show near zero balance increases AKI because starting point and perioperative optimization above the risk zone of AKI was not mapped

Study does reinforce that provided patient lands below 20mls /kg zone increased complications are not an issue

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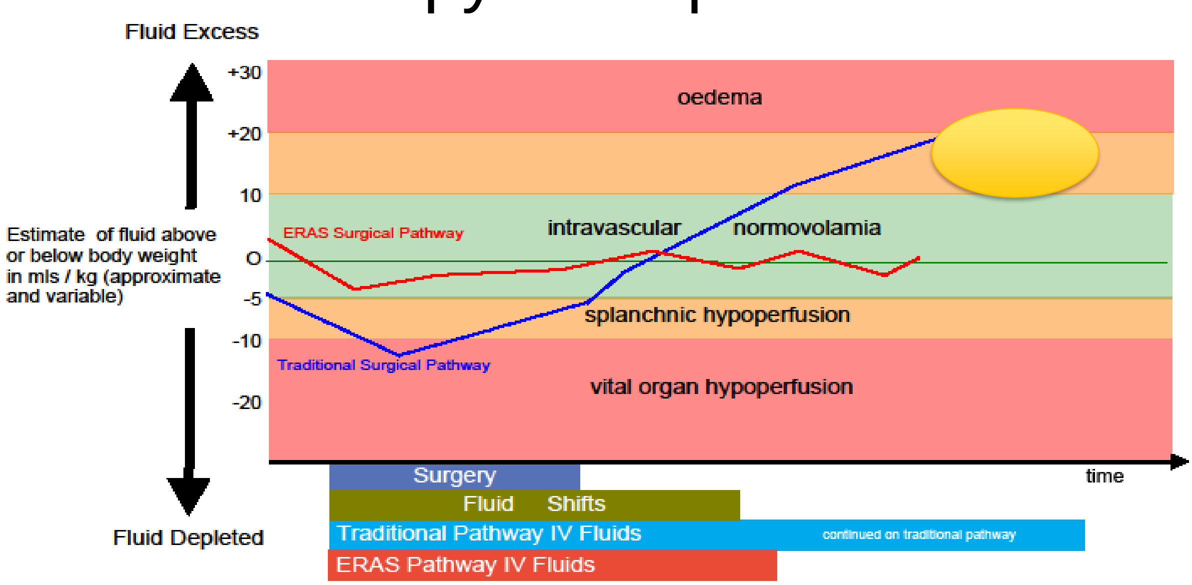
Fluid Therapy Principles



Anesthesiology Clinics March 2015

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WHAT MEAN ARTERIAL PRESSURE MATTERS?

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Relationship between Intraoperative Hypotension, Defined by Either Reduction from Baseline or Absolute Thresholds, and Acute Kidney and Myocardial Injury after Noncardiac Surgery

A Retrospective Cohort Analysis

Vafi Salmasi, M.D., Kamal Maheshwari, M.D., M.P.H., Dongsheng Yang, M.A., Edward J. Mascha, Ph.D., Asha Singh, M.D., Daniel I. Sessler, M.D., Andrea Kurz, M.D.

ABSTRACT

Background: How best to characterize intraoperative hypotension remains unclear. Thus, the authors assessed the relationship between myocardial and kidney injury and intraoperative absolute (mean arterial pressure [MAP]) and relative (reduction from preoperative pressure) MAP thresholds.

Methods: The authors characterized hypotension by the lowest MAP below various absolute and relative thresholds for cumulative 1, 3, 5, or 10 min and also time-weighted average below various absolute or relative MAP thresholds. The authors modeled each relationship using logistic regression. The authors further evaluated whether the relationships between intraoperative hypotension and either myocardial or kidney injury depended on baseline MAP. Finally, the authors compared the strength of associations between absolute and relative thresholds on myocardial and kidney injury using C statistics.

Results: MAP below absolute thresholds of 65 mmHg or relative thresholds of 20% were progressively related to both myocardial and kidney injury. At any given threshold, prolonged exposure was associated with increased odds. There were no clinically important interactions between preoperative blood pressures and the relationship between hypotension and myocardial or kidney injury at intraoperative mean arterial blood pressures less than 65 mmHg. Absolute and relative thresholds had comparable ability to discriminate patients with myocardial or kidney injury from those without.

Conclusions: The associations based on relative thresholds were no stronger than those based on absolute thresholds. Furthermore, there was no clinically important interaction with preoperative pressure. Anesthetic management can thus be based on intraoperative pressures without regard to preoperative pressure. (ANESTHESIOLOGY 2017; 126:47-65)

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MAP and Myocardial Injury (MINS)

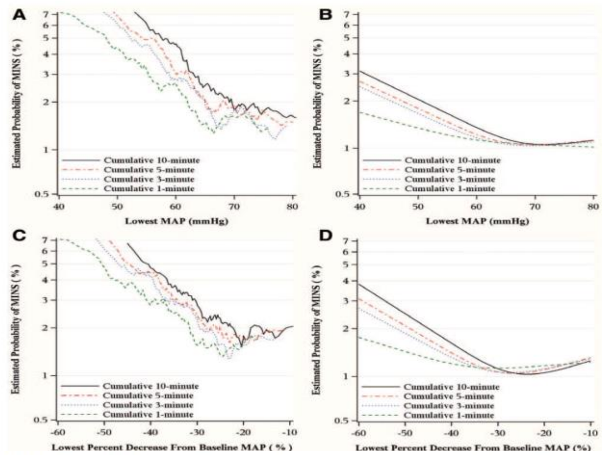

Fig. 2. Lowest mean arterial pressure (MAP) thresholds for myocardial injury after noncardiac surgery (MINS). Univariable and multivariable relationship between MINS and absolute and relative lowest MAP thresholds. (*A*) and (*C*) Estimated probability of MINS were from the univariable moving-window with the width of 10% data; (*B*) and (*D*) were from multivariable logistic regression smoothed by restricted cubic spline with three degrees and knots at 10th, 50th, and 90th percentiles of given exposure variable. Multivariable models adjusted for covariates in table 1. (*A*) and (*B*) show that there was a change point (*i.e.*, decreases steeply up and then flattens) around 65 mmHg, but 20% was not a change point from (*C*) and (*D*).

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MAP and Kidney Injury (AKI)

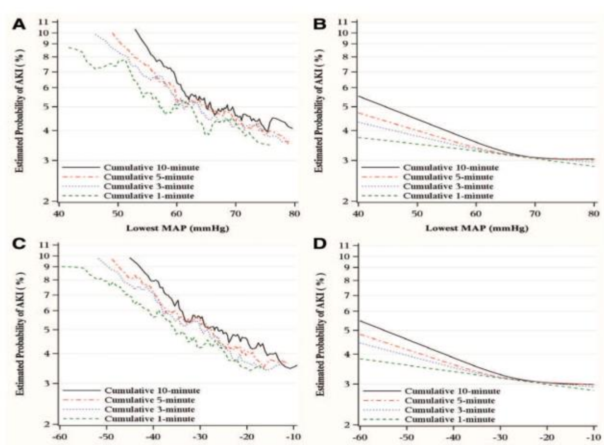

Fig. 3. The lowest mean arterial pressure (MAP) thresholds for acute kidney injury (AKI). Univariable and multivariable relationship between AKI and absolute and relative lowest MAP thresholds. (*A*) and (*C*) Estimated probability of AKI were from the univariable moving-window with the width of 10% data; (*B*) and (*D*) were from multivariable logistic regression smoothed by restricted cubic spline with three degrees and knots at 10th, 50th, and 90th percentiles of given exposure variable. Multivariable models adjusted for covariates in table 1. (*A*) and (*B*) show that there was a change point (*i.e.*, decreases steeply up and then flattens) around 65 mmHg, but 20% was not a change point from (*C*) and (*D*).

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JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Individualized vs Standard Blood Pressure Management Strategies on Postoperative Organ Dysfunction Among High-Risk Patients Undergoing Major Surgery

A Randomized Clinical Trial

Emmanuel Futier, MD, PhD; Jean-Yves Lefrant, MD, PhD; Pierre-Gregoire Guinot, MD, PhD; Thomas Godet, MD, PhD; Emmanuel Lorne, MD; Philippe Cuvillon, MD, PhD; Sebastien Bertran, MD; Marc Leone, MD, PhD; Bruno Pastene, MD; Vincent Piriou, MD, PhD; Serge Molliex, MD, PhD; Jacques Albanese, MD, PhD; Jean-Michel Julia, MD; Benoit Tavernier, MD, PhD; Etienne Imhoff, MD; Jean-Etienne Bazin, MD, PhD; Jean-Michel Constantin, MD, PhD; Bruno Pereira, PhD; Samir Jaber, MD, PhD; for the INPRESS Study Group

IMPORTANCE Perioperative hypotension is associated with an increase in postoperative morbidity and mortality, but the appropriate management strategy remains uncertain.

OBJECTIVE To evaluate whether an individualized blood pressure management strategy tailored to individual patient physiology could reduce postoperative organ dysfunction.

DESIGN, SETTING, AND PARTICIPANTS The Intraoperative Norepinephrine to Control Arterial Pressure (INPRESS) study was a multicenter, randomized, parallel-group clinical trial conducted in 9 French university and nonuniversity hospitals. Adult patients (n = 298) at increased risk of postoperative complications with a preoperative acute kidney injury risk index of class III or higher (indicating moderate to high risk of postoperative kidney injury) undergoing major surgery lasting 2 hours or longer under general anesthesia were enrolled from December 4, 2012, through August 28, 2016 (last follow-up, September 28, 2016).

INTERVENTIONS Individualized management strategy aimed at achieving a systolic blood pressure (SBP) within 10% of the reference value (ie, patient's resting SBP) or standard management strategy of treating SBP less than 80 mm Hg or lower than 40% from the reference value during and for 4 hours following surgery.

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RESULTS Among 298 patients who were randomized, 292 patients completed the trial (mean [SD] age, 70 [7] years; 44 [15.1%] women) and were included in the modified intention-to-treat analysis. The primary outcome event occurred in 56 of 147 patients (38.1%) assigned to the individualized treatment strategy vs 75 of 145 patients (51.7%) assigned to the standard treatment strategy (relative risk, 0.73; 95% CI, 0.56 to 0.94; P = .02; absolute risk difference, −14%, 95% CI, −25% to −2%). Sixty-eight patients (46.3%) in the individualized treatment group and 92 (63.4%) in the standard treatment group had postoperative organ dysfunction by day 30 (adjusted hazard ratio, 0.66; 95% CI, 0.52 to 0.84; P = .001). There were no significant between-group differences in severe adverse events or 30-day mortality.

CONCLUSIONS AND RELEVANCE Among patients predominantly undergoing abdominal surgery who were at increased postoperative risk, management targeting an individualized systolic blood pressure, compared with standard management, reduced the risk of postoperative organ dysfunction.

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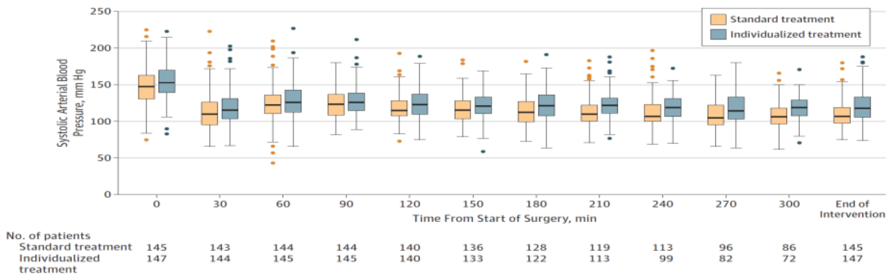
Figure 2. Systolic Arterial Blood Pressure in the Individualized and Standard Treatment Groups Over the Intervention Period



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Acute kidney injury according to RIFLE criteria, No. (%)[d]							
Risk	23 (15.7)	36 (24.8)	−9 (−18 to 0)	0.63 (0.39 to 1.00)	.05	0.73 (0.47 to 1.14)	.17
Injury	16 (10.9)	26 (17.9)	−7 (−15 to 1)	0.61 (0.34 to 1.08)	.09	0.61 (0.34 to 1.08)	.09
Failure	9 (6.1)	9 (6.2)	0 (−6 to 5)	0.99 (0.40 to 2.41)	.98	0.97 (0.40 to 2.34)	.95
Use of renal replacement therapy, No. (%)	4 (2.7)	5 (3.5)	0 (−5 to 3)	0.79 (0.22 to 2.88)	.72	0.81 (0.22 to 2.97)	.76
Acute heart failure, No. (%)	1 (0.7)	0	1 (−1 to 2)				
Myocardial ischemia or infarction, No. (%)	0	1 (0.7)	−1 (−2 to 1)				
Altered consciousness, No. (%)[e]	8 (5.4)	23 (15.9)	−10 (−17 to −3)	0.34 (0.16 to 0.74)	.007	0.34 (0.16 to 0.75)	.007
Stroke, No. (%)	0	0					
Coagulation SOFA score ≥2, No. (%)	16 (11.0)	11 (7.6)	3 (−3 to 10)	1.44 (0.69 to 3.01)	.33	1.47 (0.07 to 2.23)	.07
Hypoxemia, No. (%)	21 (14.3)	33 (22.8)	−8 (−17 to 0)	0.63 (0.38 to 1.03)	.07	0.64 (0.40 to 1.03)	.07
Pneumonia, No. (%)	4 (2.7)	11 (7.6)	−5 (−10 to 0)	0.36 (0.12 to 1.10)	.07	0.36 (0.12 to 1.10)	.07
ARDS, No. (%)	7 (4.8)	7 (4.8)	0 (−5 to 5)	0.99 (0.35 to 2.74)	.98	0.98 (0.35 to 2.67)	.95
Reintubation, No. (%)	10 (6.8)	15 (10.3)	−4 (−10 to 3)	0.66 (0.31 to 1.42)	.28	0.66 (0.31 to 1.42)	.28
Need for noninvasive or invasive ventilation, No. (%)	25 (17.0)	36 (24.8)	−8 (−17 to 1)	0.68 (0.43 to 1.08)	.10	0.71 (0.45 to 1.11)	.13
SOFA score, median (IQR)[f]							
Day 1	1 (0-3)	1 (0-3)			.31		.36
Day 2	1 (0-2)	2 (0-3)			.19		.21
Day 7	0 (0-1)	0 (0-1)			.66		.68
Sepsis, No. (%)	13 (8.8)	23 (15.9)	−7 (−15 to 0)	0.56 (0.29 to 1.06)	.07	0.55 (0.29 to 1.04)	.07
Severe sepsis or septic shock, No. (%)	13 (8.8)	13 (9.0)	0 (−6 to 7)	0.99 (0.47 to 2.05)	.97	1.01 (0.49 to 2.11)	.97

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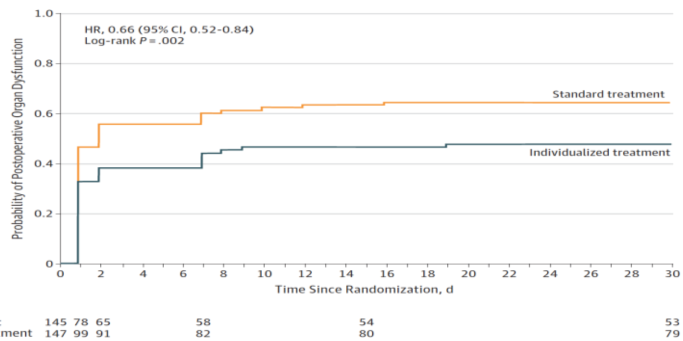
Figure 3. Kaplan-Meier Estimates of the Probability of Postoperative Organ Dysfunction by Day 30 After Surgery



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Summary - MAP

If MAP is reduced below 65mmHg there is an increase risk of:

Kidney Injury / AKI

Delirium

Myocardial Injury / MINS

(Infection)

The effect is increased by duration and magnitude below 65mmHg

An individulaised MAP target may be beneficial but flow must be optimized first (so may not be just a pressure effect)

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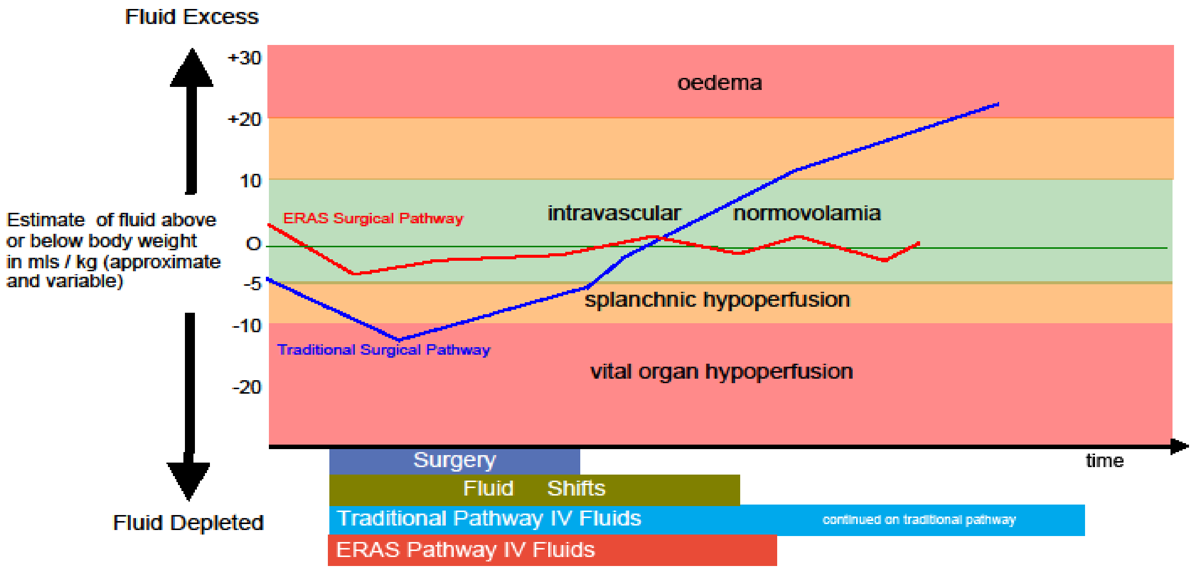
Fluid Therapy Principles



Anesthesiology Clinics March 2015

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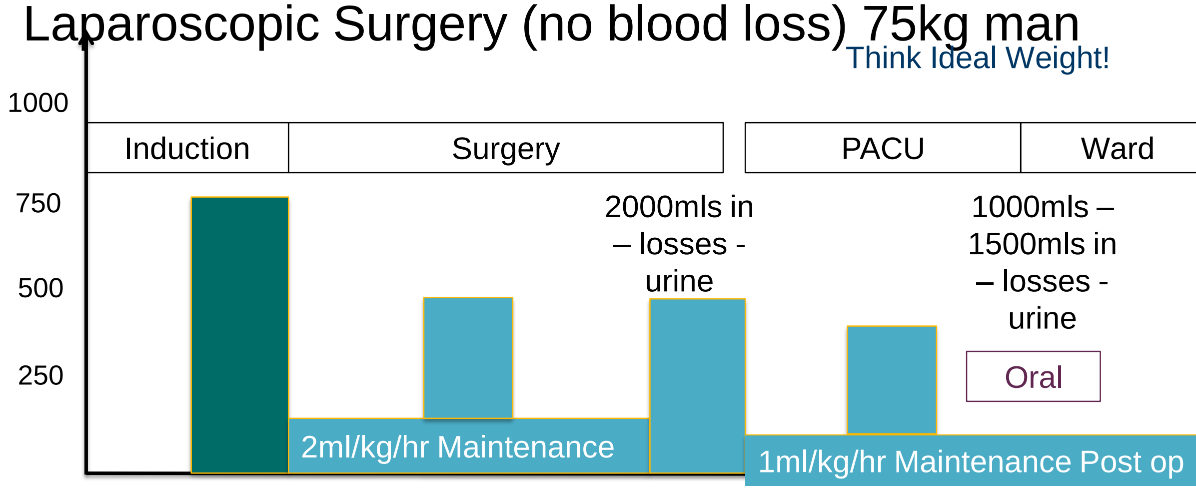
Average Fluid Volume Administration – Laparoscopic Surgery (no blood loss) 75kg man

Think Ideal Weight!



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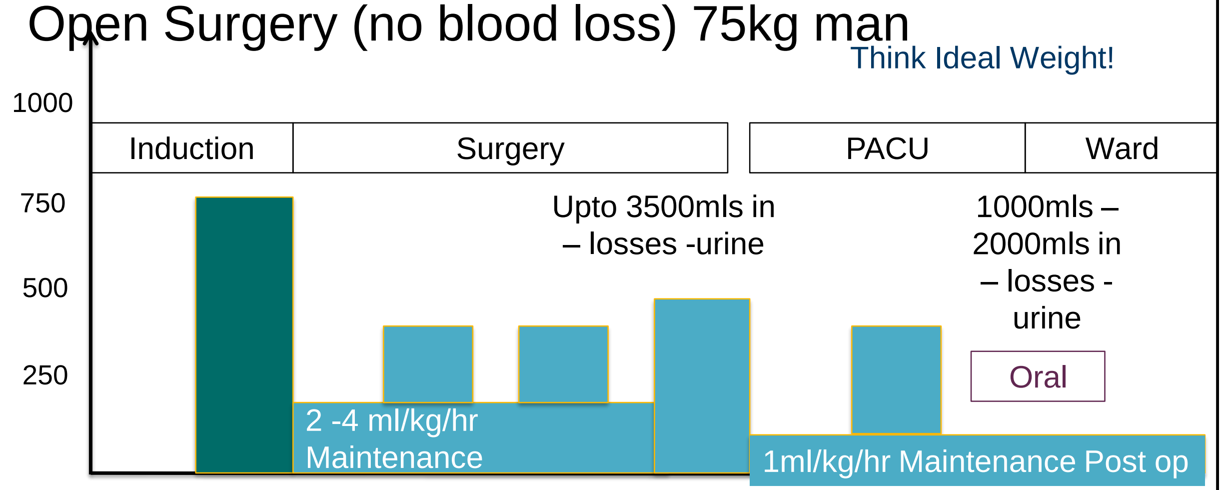
Average Fluid Volume Administration – Open Surgery (no blood loss) 75kg man

Think Ideal Weight!



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Summary - ERAS Fluid 'Road Map'

Euvolemia at start of surgery – carbohydrate loading

Use hemodynamic monitors to ensure patient's intravascular volume is optimized after induction of anesthesia prior to surgery +/- pneumoperitoneum

Range 7-12mls/kg

Set your starting Stroke Volume as baseline and Cardiac Output with Heart Rate = flow = oxygen delivery

Then set MAP with low dose vasopressors

Maintainance at 2-4ml/kg / hour

Replace blood volume

Reoptimize stroke volume at end of surgery– back to your starting Stroke volume

Targeted fluid boluses in post operative 6 hours +/- low dose vasopressors if needed (if high blood loss, SIRS or epidural)

IV maintenance of balanced IV fluid at 1ml/kg /hour until morning of
POD 1 – then take IVI down as patient should be drinking

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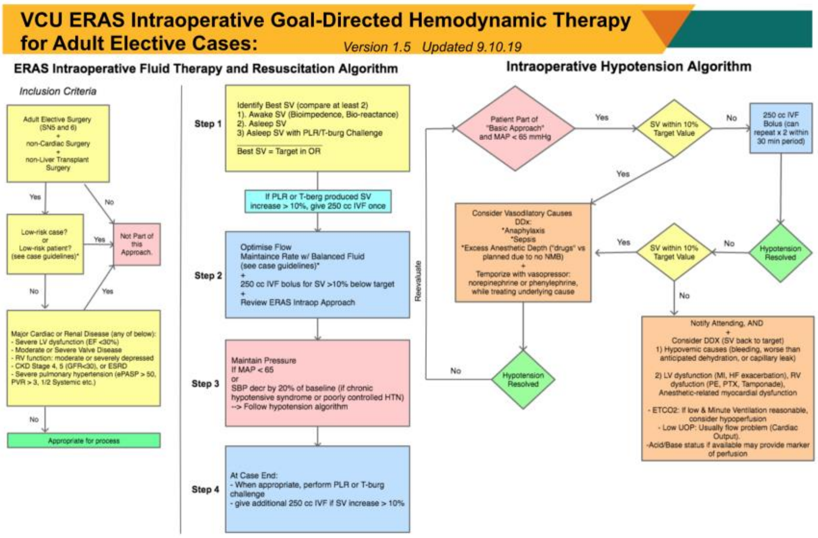
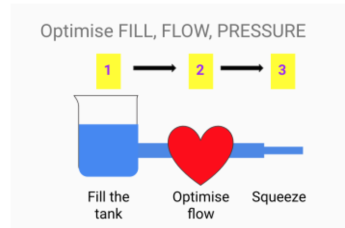
Fluid and Hemodynamics – Fill, Flow, Pressure





Reduction in:

- AKI
- Myocardial Injury
- Delirium
- Sepsis
- SSI
- Pulmonary Complications
- Reintubation and Prolonged Ventilation

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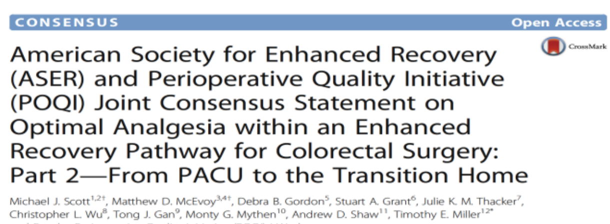
PeriOperative Quality Improvement POQI Group: Analgesia within a Colorectal Surgery ERP


CONSENSUS Open Access

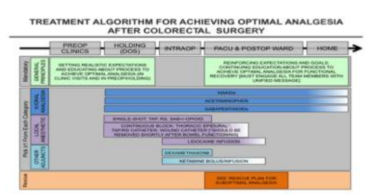
American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on optimal analgesia within an enhanced recovery pathway for colorectal surgery: part 1—from the preoperative period to PACU

Matthew D. McEvoy[1†], Michael J. Scott[2,3,4†], Debra B. Gordon[5], Stuart A. Grant[6], Julie K. M. Thacker[7], Christopher L. Wu[8], Tong J. Gan[9], Monty G. Mythen[10], Andrew D. Shaw[11], Timothy E. Miller[12*] and For the Perioperative Quality Initiative (POQI) I Workgroup


CONSENSUS Open Access

American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) Joint Consensus Statement on Optimal Analgesia within an Enhanced Recovery Pathway for Colorectal Surgery: Part 2—From PACU to the Transition Home

Michael J. Scott[1,2†], Matthew D. McEvoy[3,4†], Debra B. Gordon[5], Stuart A. Grant[6], Julie K. M. Thacker[7], Christopher L. Wu[8], Tong J. Gan[9], Monty G. Mythen[10], Andrew D. Shaw[11], Timothy E. Miller[12*] and For the Perioperative Quality Initiative (POQI) I Workgroup



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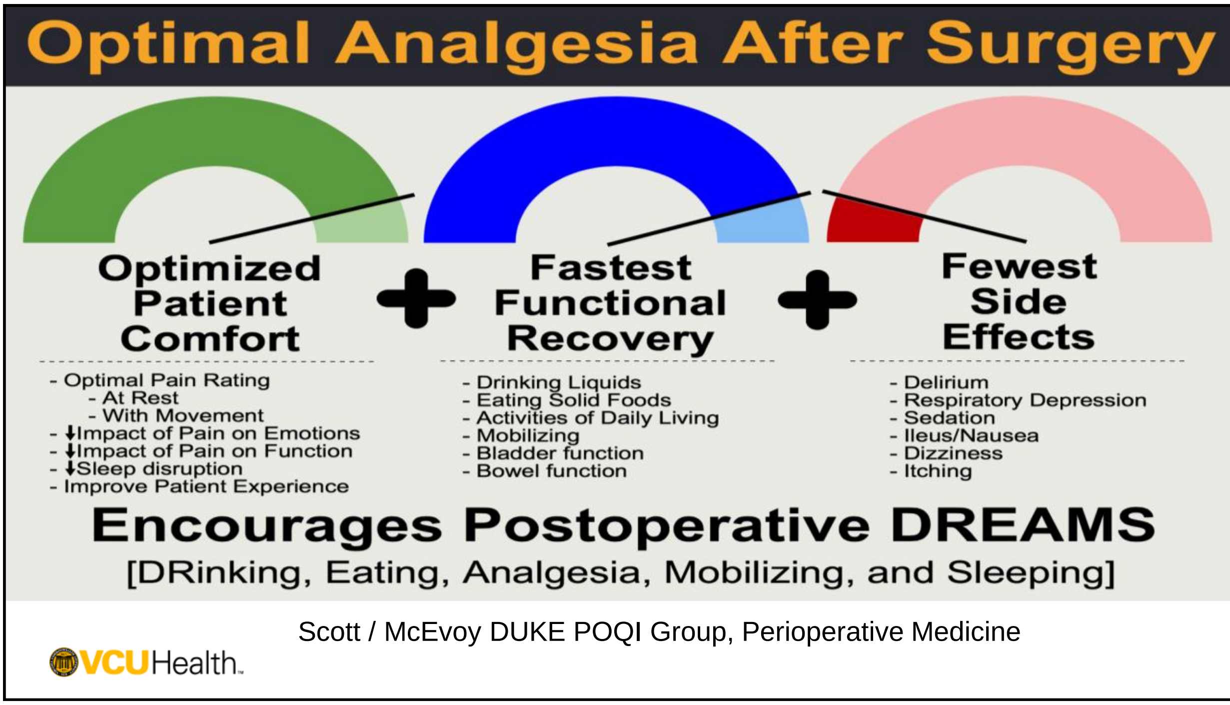

Optimal Analgesia After Surgery
Optimized Patient Comfort
- Optimal Pain Rating
- At Rest
- With Movement
- ↓Impact of Pain on Emotions
- ↓Impact of Pain on Function
- ↓Sleep disruption
- Improve Patient Experience
Fastest Functional Recovery
- Drinking Liquids
- Eating Solid Foods
- Activities of Daily Living
- Mobilizing
- Bladder function
- Bowel function
Fewest Side Effects
- Delirium
- Respiratory Depression
- Sedation
- Ileus/Nausea
- Dizziness
- Itching
Encourages Postoperative DREAMS
[DRinking, Eating, Analgesia, Mobilizing, and Sleeping]
Scott / McEvoy DUKE POQI Group, Perioperative Medicine
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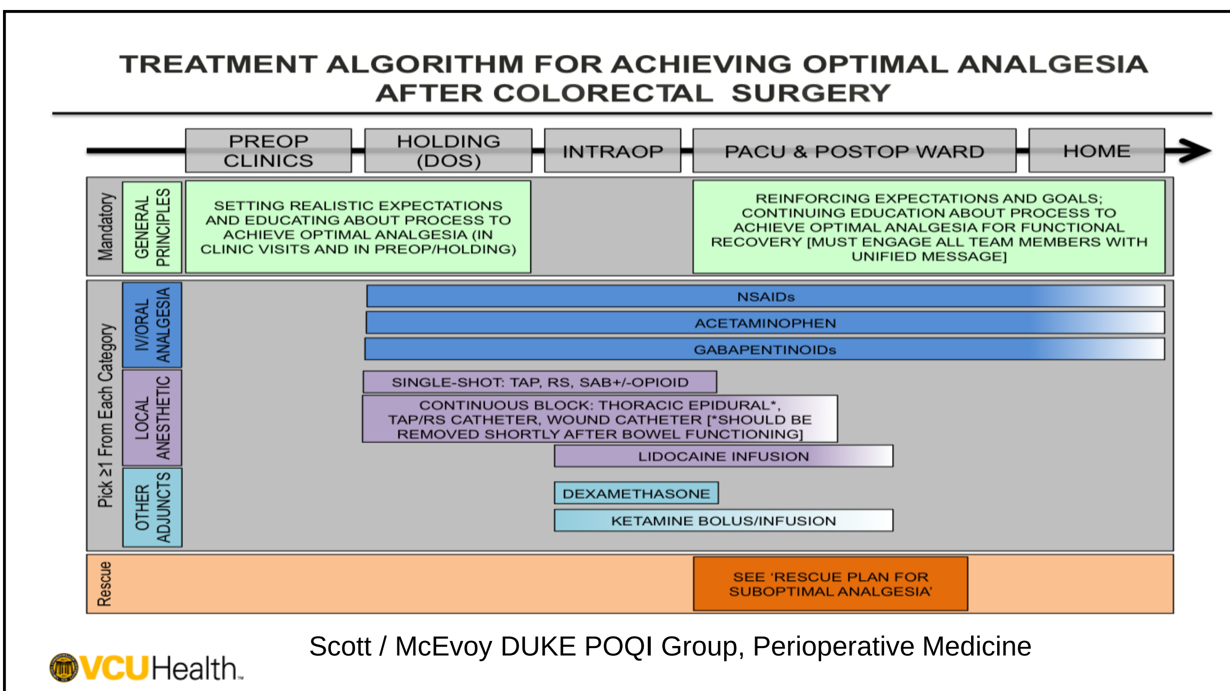

TREATMENT ALGORITHM FOR ACHIEVING OPTIMAL ANALGESIA AFTER COLORECTAL SURGERY
PREOP CLINICS
HOLDING (DOS)
INTRAOP
PACU & POSTOP WARD
HOME
Mandatory
GENERAL PRINCIPLES
SETTING REALISTIC EXPECTATIONS AND EDUCATING ABOUT PROCESS TO ACHIEVE OPTIMAL ANALGESIA (IN CLINIC VISITS AND IN PREOP/HOLDING)
REINFORCING EXPECTATIONS AND GOALS; CONTINUING EDUCATION ABOUT PROCESS TO ACHIEVE OPTIMAL ANALGESIA FOR FUNCTIONAL RECOVERY [MUST ENGAGE ALL TEAM MEMBERS WITH UNIFIED MESSAGE]
Pick ≥1 From Each Category
IV/ORAL ANALGESIA
NSAIDs
ACETAMINOPHEN
GABAPENTINOIDs
LOCAL ANESTHETIC
SINGLE-SHOT: TAP, RS, SAB+/-OPIOID
CONTINUOUS BLOCK: THORACIC EPIDURAL*, TAP/RS CATHETER, WOUND CATHETER [*SHOULD BE REMOVED SHORTLY AFTER BOWEL FUNCTIONING]
LIDOCAINE INFUSION
OTHER ADJUNCTS
DEXAMETHASONE
KETAMINE BOLUS/INFUSION
Rescue
SEE 'RESCUE PLAN FOR SUBOPTIMAL ANALGESIA'
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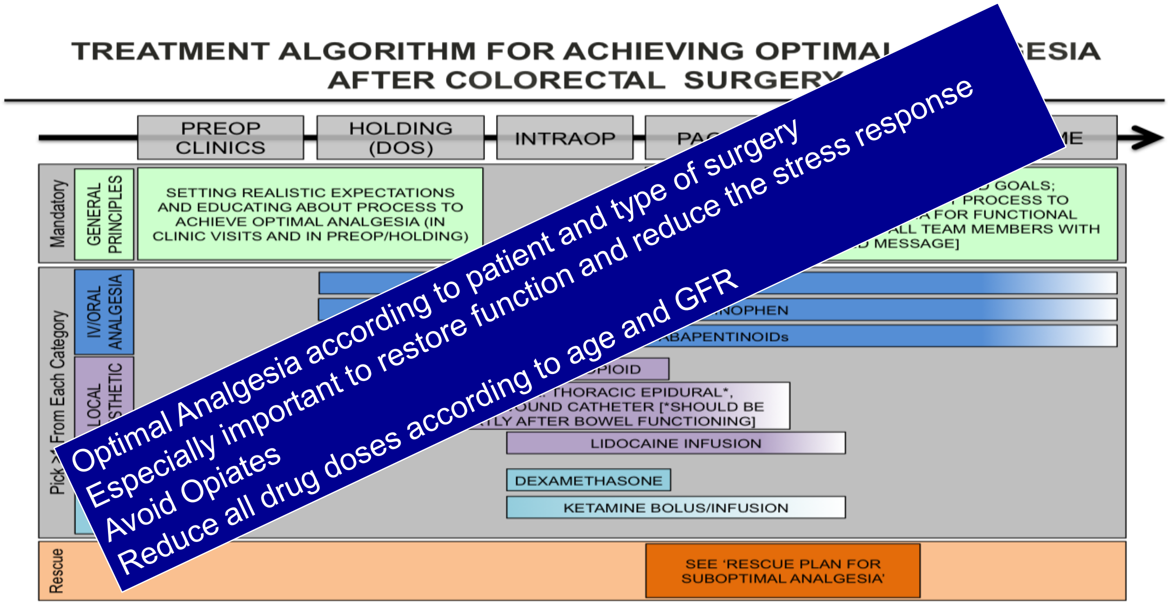

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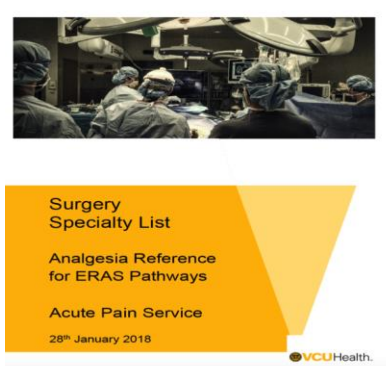
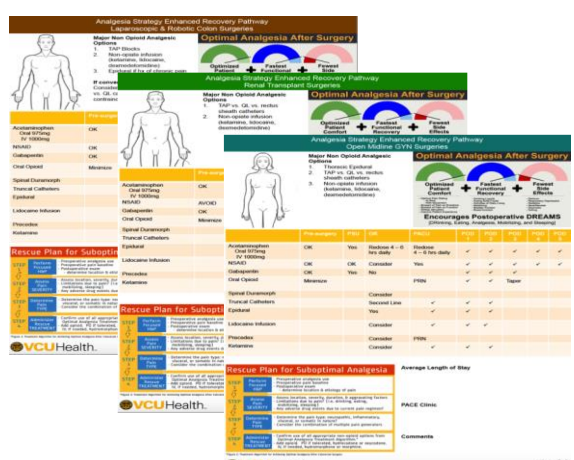
Peri & Post Operative Analgesia



Opioid Sparing Analgesia Pathways for 32 Different Surgical Procedures



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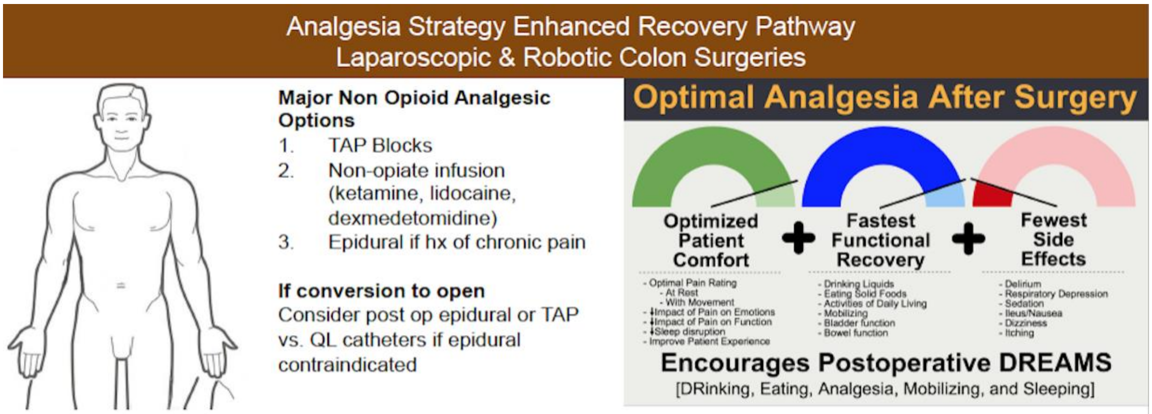
Major Opioid Sparing Technique



At least 2 opioid sparing techniques – Single shot, catheter or infusion

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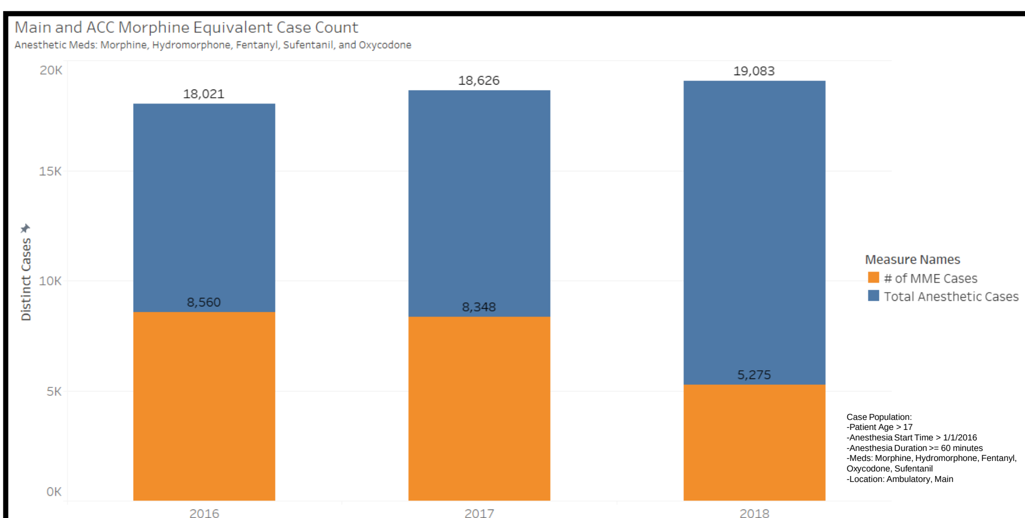
OR Morphine Equivalent Usage

42% Opioid Reduction
(Morphine Equivalents)



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Summary

1. Enhanced Recovery after Surgery (ERAS)pathways mitigate many factors to reduce complications
2. The anesthesiologist / CRNA plays a key role in:

- Preoperative Optimization
- Standardized
- Goal Directed Hemodynamic Strategy
- Opioid Sparing Analgesia

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VCU Virginia Commonwealth University Medical Center

VCU Virginia Commonwealth University Medical Center

Dr Mike Scott MB ChB FRCP FRCA FFICM
Professor of Anesthesiology
Divisional Director for Critical Care Medicine
Virginia Commonwealth University Medical Center
Richmond, Virginia, USA
michael.j.scott@vcuhealth.org

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