Critical Care Faculty Handbook 2014

Edited by Jacob S Dreyer

The Management of Surgical Emergencies
Critical Care Faculty Handbook 2014

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For Teaching the Critical Care Module of
ASGBI's course on the
Management of Surgical Emergencies
and in other Surgical Critical Care courses
sanctioned by Surgical Colleges and Societies in
East, Central, Southern and West Africa.

Alba Critical Care Course Design

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who made so much of this possible
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Acknowledgements

This project would not have happened without the trust and support of a number of people. It started with being a member of the Royal College of Surgeons of Edinburgh (RCSEd)'s rugby team for the first Park-Parker cup match against the England College in 2003, and then being invited to join the faculty for RCSEd's Early Trauma and Critical Care course (ETCC) on the way back from London on a bus. My thanks to Prof David Rowley, then director of education at RCSEd, for his trust in me as critical care course convenor at RCSEd, and to successive presidents of RCSEd, Mr John Smith and Mr John Orr, for permission to develop ETCC into a course for Africa. This started as a one-man course for health officers, who are non-physician surgeons, in Hawassa, Ethiopia, in 2009. A further Hawassa course for health officers was run in 2011 after a major rewrite, now with an anaesthetist and two trainees as additional faculty, all of who contributed to this book.

A major impetus to the programme came from Andrew Howard, Director of the Office of International Surgery at the University of Toronto, who asked us to write a series of review papers on essential critical care topics for the Ptolemy Project, an online learning resource delivered in partnership between the University of Toronto, the College of Surgeons of East, Central and Southern Africa (COSECSA) and the Canadian Institutes of Health Research. Writing the review papers brought in many more potential faculty for teaching and clarified what we wanted to teach. My sincere thanks to Dr Howard for the trust placed in me and the rest of our team.

There would have been no progress if it was not for the vision of Mr Bob Lane, past-president of ASGBI, in seeing the need for a course on managing surgical emergencies (MSE) for surgical trainees within the nine countries (now 10) of the COSECSA region. This vision was supported by strong leadership and perseverance to develop the MSE course with the support of COSECSA. I sincerely thank Mr Lane for asking me to develop the two day critical care curriculum and giving me a free hand to develop course content, delivery methods and assessment tools, and recruit co-authors and tutors.

My sincere thanks to all tutors who contributed to the contents of our critical care course and this book. Some are still trainees and obviously felt under pressure to deliver but all did an excellent job. My thanks also to all tutors who have travelled to teach on MSE and on independent critical care courses run for surgical societies in the COSECSA region. At the time of publication we have already run seven critical care courses in the region, of which three were for MSE. For the other four courses faculty had to pay their own travel, accommodation and subsistence expenses, which was a big commitment. Many also use
their annual leave to help to teach, which is commendable. It was to enable such travel for teaching for which Alba CCCD SCIO was founded and registered as a Scottish Charity; Alba CCCD was also registered as a publisher in the UK to facilitate publication of this and other handbooks at low cost. The MSE course is fully funded by the Surgical Foundation of ASGBI, mainly through a major grant from the UK government’s Department for International Development (DfID), which is much appreciated. Again Mr Lane played the major role in acquiring this grant.

My thanks to all the other faculty members on the MSE course who travelled to teach in the surgical specialties for their advice and support to help improve the critical care module. A special thank you to critical care faculty who have been there from the beginning, especially to Dr David Ball who has been part of this project since 2010 and who has been incredibly supportive during difficulties and refreshingly innovative when we had to move forward.

A word of thanks to Alba Printers Dumfries, who have no connection to Alba CCCD, for supporting printing in a cost-effective way and for doing extra to make this project possible. A very special word of thanks to the Rotary Club of Dumfries Devorgilla and to two anonymous donors who made it possible for us to deliver courses in Ethiopia and Rwanda, which were important steps in developing the course and producing this book.

Lastly, a special thanks to my family, who have allowed themselves to be pulled into this project in numerous ways, and for their ongoing support.

JS (Fanus) Dreyer

Dumfries, September 2013.
Foreword

The Managing Surgical Emergencies course has been developed through the Association of Surgeons of Great Britain and Ireland (ASGBI) for the College of Surgery of East, Central and Southern Africa (COSECSA).

This critical care module forms an integral part of the MSE course and has been designed specifically for surgical trainees in the early years of training (year 2-4), at the level where trainees are preparing to sit the MCS(ECSA) or MMed examinations.

This course fits in with the vision for trauma and critical care training at advancing levels of complexity in COSECSA, as discussed with Prof Chris Samkange, the President of COSECSA, in December 2011.

Aims of the course:

1. To support best possible care of critically ill surgical patients, using your eyes, ears, hands and brain without undue dependence on technology.
2. To give surgeons confidence in a structure of patient assessment and management of critically ill patients based on "ABCDE".
3. To help explain a common language for use by surgeons, trainees, anaesthetists, critical care nurses and other health professionals who work in critical care.
4. To provide surgeons with a framework for teaching critical care to trainees and nursing staff.
5. To encourage surgical trainees to become future trainers in critical care.

Contents:

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The principles of patient assessment in critical illness are universal but it has been documented in some detail for the CCrISP course (Care of the Critically Ill Surgical Patient, ©RCSEng). An assessment algorithm had been put in the public domain through CCrISP 1 and 2, but it is copyright protected in CCrISP 3. Although we taught the CCrISP algorithm at the start of teaching critical care in Africa we have withdrawn its use from all our courses and all printed material, such as this book. As an alternative an Assessment Checklist has been developed which covers the same universal principles of patient assessment; this checklist has been tested in teaching hospitals in Zambia and refined, and has therefore made its way into this course and handbook.

The resuscitation algorithms for basic and advanced life support are used with written permission from the Resuscitation Council (UK), obtained by Dr David Ball from Ms Sarah Mitchell, Director. Contents from RCSEd's old ETCC course has been adapted with permission. No copyright claims are made on photographs that are available to the public and used from open access internet sites. Pictures of patients have been used with their written consent to the use of their images in educational material.

Surgical trainees are "at the coalface" in managing surgical emergencies. Patients present with major injuries, post-operative complications or sepsis. These patients are critically ill and need rapid assessment, decision making and initiation of treatment; this process needs to be structured. Good communication is vital in asking for help and/or transferring patients to theatre, the intensive care unit (ICU) or another facility.

The aim of the course is not to teach ICU care. It is about recognising critical illness and physiological support before the patient needs the ICU. Teaching is based on learners’ needs and focuses on critical care (CC) situations that surgical trainees are often asked to deal with, usually as emergencies, often at night when little immediate help is available and with little time to prepare. Such situations include:

- Cardiac arrest or impending arrest
- Hypoxia/Breathlessness
- Hypotension/Tachycardia
The patient has collapsed
• Oliguria
• Pyrexia
• Confusion
• Pain relief
• The patient is dying
• To explain what is going on (to the patient, family or other staff).

The two-day critical care syllabus topics have been selected to reflect this need and have been tested in a number of courses in East and Central Africa. The syllabus is related to that taught in similar courses in the UK.

**Faculty:**

Faculty were selected on enthusiasm, commitment and clinical and teaching experience. All visiting faculty regularly work with critically ill surgical patients in their clinical appointments within the NHS, Scotland, Wales and England. All faculty also teach critical care regularly through established courses e.g. ALS, APLS, CCrISP, FSCC (RCSEd), ALERT. Prospective local tutors are selected on similar criteria and all attend a Training the Trainers course before becoming part of teaching faculty.

We trust that the critical care module will make a constructive contribution to improving surgical trainees' knowledge, technical and non-technical skills, and so improve judgement and decision making when faced with critically ill surgical patients.

[Signature]

Jacob Stephanus Dreyer

Dumfries, September 2013.
MSE Critical Care Syllabus 2013:

Registration 08h10-08h40

1.1 Welcome & Introduction 08h40

1.2 Introduction to Critical Care: 09h10

1.3 Assessment of Critically ill surgical patient 09h30
  - A. Practical demonstrations by faculty (20 min)
  - B. Lecture (20 min)

1.4 CPR (A) BLS/ALS tutorial and (B) BLS demonstration 10h10-10h45

Tea 10h45-11h05

1.5 ALS Practical 11h05-11h50
Practice CPR in groups of 3 under guidance

1.6 ALS in Children (tutorial) 11h50-12h15

Lunch 12h15-13h00

Meet with Mentors 13h00-13h15

AIRWAY, BREATHING: Rotate through 3 tutorials (30 min each) 13h15-14h45
  - 1.7 Advanced Airway management
  - 1.8 Trauma causes of breathlessness: life threatening chest injuries
  - 1.9 Post-operative hypoxia in surgical patients

Tea 14h40-15h05

CIRCULATION: Rotate through 3 tutorials (35 min each with 5 minute break between each rotation) 15h05-17h00
  - 1.10 Shock and Haemorrhage
  - 1.11 New approaches to fluid therapy and Oliguria
  - 1.12 Cardiac complications in surgical patients
Feedback with Mentors 17h00-17h20

END OF DAY 1

**DAY 2: 2.1 Introduction** 08h00

**DISABILITY: Rotate through 3 tutorials (30 min each)** 08h10-09h40

- 2.2 Confusion in surgical patients
- 2.3 Head injuries
- 2.4 Spinal injuries and patient transfer

2.5 **Practical: Log roll, transfer etc** 09h40-10h10

Tea 10h10-10h30

**Rotate through 3 tutorials (35 min each)** 10h30-12h15

- 2.6 Surgical Sepsis
- 2.7 Obstetric critical care for surgeons
- 2.8 Emergency care of Burns

Lunch 12h15-13h00

**Rotate through 3 tutorials (30 min each):** 13h00-14h30

- 2.9 Anaesthesia for surgeons: Ketamine; Local and Regional anaesthesia
- 2.10 Pain management
- 2.11 Monitoring in critical care

Tea 14h30-14h50

**EXTRAS: Rotate through 3 stations (30 min each):** 14h50-16h20

- 2.12 SBAR Communication intro + scenarios (2 tutors): PRACTICAL
- 2.13 Quality control in critical care (tutorial)
- 2.14 End-of-life care in critical illness (tutorial)

10 minute break

**TEST: MCQs and EMQs** 16h30-17h00

2.15 **Course Summary and Feedback** 17h00-17h20

END OF CC COURSE
1.1 - 1.2 Introduction

The course starts with a 10 minute welcome to course participants and faculty and a general introduction. This includes an explanation of procedure in case of fire or other emergencies. The introduction is done either by the convenor of the MSE course or of the critical care course.

Hereafter the critical care course convenor leads the introduction of faculty and participants. Everyone introduce themselves by stating who they are, what they do, where they work and something else that is interesting about themselves.

The generic introduction leads naturally into an Introduction to Surgical Critical Care, a short lecture that explains the principles of critical illness and the aims of management of such patients. Participants are told what they should expect to learn and how they are expected to participate in the 2-day course. The assessment framework is also explained and what requirements they have to meet for successful completion. MSE is a "pass/fail" course and participants have to meet minimum standards in both continuous and summative assessment to pass the course. Ample time should be left for questions and discussion at the end, and participants should be assured that the course is run in a relaxed non-judgemental environment with open discussions.

Core message of introduction: Critical care is about "Air going in-and-out and Blood going round-and-round to keep the Tissues alive".
1.2

Management of Surgical Emergencies
Part 1 : Critical Care

Introduction to Critical Care

INTRODUCTION

• 2 DAYS
• Covers some advanced concepts in managing critically ill surgical patients.
• Teaching material has been adapted from the RCSEd’s ETCC and FSCE, and CCrISP (©RCSEng), with permission.
• Developed since 2009 (7 CC courses)
• Related to CC series on www.ptolemy.ca Dec 2012 to April 2013.
• Relax and Enjoy: This is a tie-free zone.

Learning Outcomes:
In these two days we will discuss:
1. How to define and recognise aspects of critical illness in surgical patients.
2. A system of assessment based on ABCD-T.
3. A system for rapid but systematic decision making and management.
4. Principles of management applicable to all categories of surgical patients.
5. Emergency procedures to support the critically ill surgical patient.

Methods

• Interactive Lectures: Q's & A's – Participate!!
• Open discussion on aspects of CC that surgeons feel uncomfortable with.
• Practice in e.g. CPR and Communication.
• Discuss images.
• Discuss case studies.
• Role play.
• Frank and open discussion regarding everyone’s strong and weak points (including faculty!).

Assessment

1. Attendance all 4 sessions.
2. Satisfactory CPR practice.
3. Active participation and openness.
4. Satisfactory continuous assessment scores.
5. Written test (Complex MCQs, EMQs).

YOU WILL PASS THE CRITICAL CARE MODULE IF YOU MEET THESE ASSESSMENT CRITERIA.
What is Critical Care?

1. Good clinical observations.
2. Rapid clinical assessment of deteriorating patients, using ABCDE.
3. Emergency support of ABCD to allow time for more thorough assessment and treatment.
4. Thorough further assessment using all available information.
5. Effective decision making at different levels.
6. Specific interventions to support critical organ function and prevent physiological deterioration.

For ALL patients – Prevention is Better than Cure

Prevent morbidity by:
• prediction
• repeated clinical assessment
• early detection of deterioration or failure to progress

Which patients are we talking about?

• Trauma
  − Multiple injuries e.g. RTA
  − Burns
  − Penetrating injuries to body cavities
  − Extensive soft tissue injuries
• Post-operative after major surgery
  − Entry of thorax, abdomen or pelvis
  − Major limb surgery (orthopaedics or reconstructive)
  − Obstetric and Paediatric patients need special attention due to differences in physiology
• Surgical sepsis

REMEMBER

• The physiological pathway of deterioration is the same in all these patients.
• The principles of physiological support is therefore similar.
• Questions:
  1. What is the physiological pathway?
  2. What are the principles of physiological support?

Most of us manage unexpected events badly

Prompt, simple actions save lives and prevent complications.

* A systematic approach maximises success.
The course should

- Help you to *think* straight under pressure in the clinical arena.
- Provide you with knowledge, skills and communication to facilitate successful care.

Any Questions?

**SUMMARY**

- Basic Critical Care = good clinical observation and effective decision making, leading to rapid intervention to support organ function and prevent further physiological deterioration.
- In patients who had major surgery, with serious trauma or surgical sepsis the physiological pathways of deterioration are the same and therefore the principles of physiological support is similar.
- Physiology is different in pregnancy, young children and the elderly.
1.3 Assessment

This section consists of two parts: 1.3A is a practical demonstration by faculty on practical patient assessment, firstly how NOT to do it and then how to do it, followed by discussion after each demonstration. This is followed by 1.3B, a 20 minute lecture on the principles of patient assessment as followed in this course, originally based upon the CCrISP© system of patient assessment but modified for the African health care environment.

1.3A Demonstration

If enough faculty would be available, demonstrate patient assessment (you need a patient, a nurse, a surgeon and a narrator):

Step 1: 5 minutes PRACTICAL DEMONSTRATION: How NOT to do it, so overplay the roles and bring in enough humour so that participants relax:

The surgeon breezes through the ward, late for theatre, and says "hi" to the nurse “I assume all my patients are OK?"; the nurse says she is worried about the patient who had a colectomy 5 days ago because he doesn’t look right (nothing more specific); surgeon goes to patient, who lies in a bundle, lifts bed sheet briefly and asks patient “are you ok?”, patient nods but doesn’t speak. Surgeon tells nurse to get patient out of bed and give him something more than water per mouth ("he can eat"); says to nurse “you know, he was a bit pathetic when he came in, all he needs is a bit of motivation". Nurse replies "he did have a fever in the night"; Surgeon “it’s probably from his lungs because he is just lying in bed all the time, make sure you get him out of bed before he gets pneumonia”; “I’ll pop in again after theatre” and surgeon leaves the room; “If we’re lucky” mumbles the nurse.

Step 2: 5 min DISCUSSION: What should the surgeon have done? What could the nurse have said? Specifically ask about poor non-technical skills that were displayed.
Step 3: 10 min DEMONSTRATION: surgeon enters ward and greets nurse (friendly but with authority); then asks “can we please see my patients?”; Nurse says that she is worried about the patient because he does not look right; surgeon asks what she means with “not right”; nurse replies “he had a fever in the night, he does not want to eat and he is lying still in bed”. Then the surgeon speaks to the patient and waits for a reply to thus check airway, breathing and circulation to brain. He then checks observation chart, operation and other notes, any results available (this will depend on location and vary a lot), and systematically examines patient. He says to nurse “He might have developed an anastomotic leak” and then says to patient “You have become quite unwell overnight. I want to check that there is not a problem where we joined the bowel together and we need to do ...(tests or another operation, depending on local circumstance). In the meantime you cannot eat or drink but we will give you some intravenous fluid, oxygen (if available) and something for pain, and get the nurses to give you special attention.” Can then further discuss moving the patient to HDU/special care (if available) and tell nurse if he will get an AXR/CXR or contrast study or go back to theatre. Lastly asks nurse to inform the relatives what will happen or speak to the guardian directly if present.

1.3B Lecture
This is a 15 minute lecture, with 5 minutes for questions and discussion at the end. core message = Ask yourself "Is the patient stable or unstable?"

1.4-1.5 Advanced Life Support

1.4 BLS/ALS Lecture and Demonstration
This starts with a short (10 min) lecture on recent changes in CPR technique, with 5 minutes for questions. Thereafter faculty do a 10 minute demonstration of current CPR practice on a manikin. Main learning points = "30:2" and 100-120/min compressions.

Participants are asked to use the TEA break to organise themselves in groups of three for CPR practice.
1.5 CPR Practice

Participants practice BLS and discuss ALS in groups of three, under direct supervision of tutors, which would preferably include at least one anaesthetist or emergency medicine specialist. If two manikins are available, these can be placed in opposite ends of the same room and each group of three will have 15 minutes to practice. Most learning benefit comes from allowing each group 10 minutes to practice, rotating roles, and at the end have another 5 minute burst after they have observed their colleagues. A relaxed atmosphere of trial-and-error has to be maintained by tutors and lots of talking, laughing and shouting, questions and open discussion are allowed.

1.6 Paediatric ALS

This is presented as a short lecture. Different teaching methods have been tried for this topic over various courses but feedback from participants is that they prefer this to be a lecture where they are told how to adapt for children. Main learning point = "Children are not small adults".

1.7 Advanced Airway Management

Interactive tutorial of 35 minutes, with 5 extra minutes at the end for open discussion. Basic, advanced and surgical airway techniques are discussed, with lots of photographs. Main learning point = "Have a Plan A, Plan B, Plan C" when dealing with Airway. The tutorial is run on a laptop and is best delivered by an anaesthetist, intensivist or emergency room specialist.

This tutorial forms part of a group of three (the others being for "Breathing" topics) through which course participants rotate in small groups of maximum 6 participants each. Each group might have a nurse observer and new faculty observer attached. It is important that course participants sit closest to the tutor and are asked questions continuously; each participant should be asked a question or invited into the discussion at least twice during the tutorial as they are given formative scores for each tutorial throughout the course.
Management of Surgical Emergencies
Part 1 : Critical Care

Patient Assessment

Learning Outcomes
1. You learn FOUR critical steps in assessment.
2. You will understand that ABCDE is important to support tissue oxygenation and organ function.
3. You will learn a structured approach to thorough secondary assessment.
4. You will learn to make decisions and plan management depending on your assessment of whether the patient is stable or unstable.
5. You will learn an algorithm of assessment that you need to memorise.

Four Essential Steps
1. Primary Survey
2. Resuscitation
3. Secondary Survey
4. Decide

Primary Assessment = ABCDE
A = Airway (protect C-spine as necessary)
B = Breathing with adequate ventilation and oxygenation
C = Circulation including haemorrhage control
D = Disability (Central Nervous System)
E = Exposure as appropriate
RESUSCITATION

⇒ BLS / ALS

To be addressed in next session

Secondary Assessment
A: History:
1. Check the case notes: current notes, previous history, drug history.
2. Speak to the patient.
3. Speak to nurses/guardian if an in-patient or to relatives/ambulance staff/police.

Secondary Assessment
B: Check the Charts:
• Observation chart/HDU/A&E Charts.
• Fluid balance chart: Intake-Output; think of unrecorded or hidden losses.
• Check the trends, not single values.
• Drug chart: Did the patient receive the prescribed drugs? At the correct time? Is the dose correct? What is the risk of interaction or side effects (look it up in the formulary!).

Secondary Assessment
C: Examination:
• Examine the patient systematically (head to toe) yourself.
• Remember spinal column and rectal examination in trauma.
• Remember to look at drains and bags.
• Think what you are looking for and why.

Secondary Assessment
D: Extra Information:
1. Check on all results yourself (Imaging, biochem, haematology, microbiology).
2. Speak to colleagues: microbiology, labs, radiology, pharmacy.
3. Recheck the charts for missing information.
4. If things don’t fit, re-examine the patient or ask for senior review.

If at any time the patient’s condition deteriorates you must go back to the start and

Re-assess the ABCs
DECIDE and PLAN:

Is this patient
STABLE
or
UNSTABLE?

And manage accordingly

If STABLE:

You must write a management plan for the day
• e.g. Diet, fluids, drugs, mobilisation
• Other health team members
• Discharge planning
• Where you will be or whom to contact if necessary

AND
YOU MUST TELL THE PATIENT/GUARDIAN WHAT IS HAPPENING NEXT

If UNSTABLE or if you are UNSURE:

1. Make a Diagnosis: i.e. WHY is the patient unstable or are things not clear?
   • Get the quickest and simplest investigation to give a definite answer.
   • Ask for help: senior review, other specialties.

2. Definitive Treatment:
   Drugs/Surgery/Drainage/Refer/Transfer.

Questions

Assessment Checklist A:

- Did I complete primary survey (ABCDE)?
- Have I completed resuscitation?
  - O₂?
  - IV fluids?
- Did I complete secondary assessment?
  - History (Notes; Reports)?
  - Thorough examination?
  - Chart review [Vital signs/MEWS; Fluid balance; Drugs]
  - Results?
  - Anyone I still wanted to speak to?

Assessment Checklist B:

- Is my patient...
  - STABLE?
  - UNSTABLE?
  - Am I unsure?
- Is the problem...
  - Diagnostic
  - Therapeutic
  - Both
- Do I need to intervene...
  - Diagnostic?
  - Therapeutic?
  - Ask for help?
- Meanwhile, am I supporting ABC-T optimally?
1.4

Management of Surgical Emergencies
Part 1: Critical Care

Advanced Life Support:
Principles & Recent Changes

Aims

• Principles
• Changes in ALS
• Post-resuscitation care
• BLS demonstration

Resuscitation - Futile or not?

• May be inappropriate due to injury, pre-existing conditions or lack of available resources – senior clinician involvement
• Not always futile
• Potentially reversible and treatable conditions especially in context of trauma
• Good quality ALS buys time

Principles of ALS

• Early recognition of the deteriorating patient
• Early decision making – appropriate?
• Usually predictable
• Structured assessment – A,B,C,D,E
• Good quality BLS - chest compressions, oxygenation and ventilation
• Reversible causes?
• Post-resuscitation care - A,B,C,D,E
BLS

- Collapsed patient - SAFE approach
- Unresponsive - get help
- Responsive - A,B,C,D assessment
- Open airway - head tilt, chin lift / jaw thrust
- Airway adjunct
- Look, listen, feel 10s. Signs of life?
- No signs of life - start chest compressions

Recent changes

- Check for signs of life or breathing
- Compressions:
  - Centre of chest
  - 5-6cm depth - allow chest to expand fully
  - Rate 100-120 per minute
  - Ratio 30:2 i.e. 30 compressions to two breaths
- Ventilation:
  - Ideally with airway adjunct and BVM; pocket mask
- Once definitive airway inserted:
  - Continuous compressions - 10 breaths per minute

Monitor or Defibrillator (if available)
Assess Rhythm

Shockable (VF/VT)

- Single DC shock (360J mono, 150J biphasic)
- CPR
- 1mg Adrenaline & 300mg Amiodarone (after 3rd shock)
- Adrenaline every 4 mins

Non-shockable (PEA/Asystole)

- Continuous CPR
- Rhythm check every 2 minutes
- Adrenaline every 4 minutes
- During CPR:
  - Secure airway;
  - Consider reversible causes
### Reversible causes

- 4 H’s
  - Hypoxia
  - Hypovolaemia
  - Hypothermia
  - Hypo/hyperkalaemia

- 4 T’s
  - Tension
  - Pneumothorax
  - Tamponade
  - Thromboembolism

### Special Circumstances

- Poisoning
- Hyperkalaemia
- Hypothermia
- Drowning
- Electrocution
- Anaphylaxis
- Asthma
- Pregnancy

### Difficult Decisions

- Continue or stop
- Clinical judgement - past medical history
- Assessment of likelihood of achieving ROSC
- Confirm death - absence of central pulse on palpation. Absence of heart sounds on auscultation.

### Post-resuscitation Care

- **Aims:**
  - Brain – prevention of secondary injury
  - Heart - stabilise rhythm and function
  - Organs - optimise perfusion
  - Anticipate SIRS type response
  - Management of precipitating pathology
  - Reduce morbidity
  - Consider active cooling (reduce secondary injury)

### Post-resuscitation Management

- **Airway**
  - Protected?
  - Consider intubation
- **Breathing & ventilation**
  - Ensure adequate Oxygenation
  - Ventilate to Normocapnia
- **Circulation**
  - Manage Arrhythmias
  - Optimise cardiac dysfuction
  - Monitoring
- **Disability**
  - Sedation and seizure control
- **Exposure**
  - Temperature
  - Glucose control
- **Cooling** - out of hospital VF arrest

### Quality & Human Factors

**Quality cardiac arrest management requires:**

- Leadership
- Task identification, delegation & prioritisation
- Task familiarisation
- Team work
- Manage conflict
- Manage relatives
- Debrief
- Audit & Quality Improvement
Questions?

Summary

- Deterioration usually predictable
- Structured approach to assessment
- Quality BLS & ALS may be appropriate and buy time
- Changes in delivery of BLS
- Consider reversible causes
- Post-resuscitation care

BLS Demonstration
Adult Advanced Life Support

Unresponsive? Not breathing or only occasional gasps

Call resuscitation team

CPR 30:2
Attach defibrillator / monitor
Minimise interruptions

Assess rhythm

Shockable (VF / Pulseless VT)

1 Shock

Immediately resume CPR for 2 min
Minimise interruptions

Non-Shockable (PEA / Asystole)

Return of spontaneous circulation

Immediately resume CPR for 2 min
Minimise interruptions

During CPR
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Correct reversible causes

Reversible Causes
- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis - coronary or pulmonary
- Tamponade - cardiac
- Toxins
- Tension pneumothorax
UNRESPONSIVE?

Shout for help

Open airway

NOT BREATHING NORMALLY?

Call 999

30 chest compressions

2 rescue breaths
30 compressions
In-hospital Resuscitation

Collapsed / sick patient

Shout for HELP and assess patient

NO

Call resuscitation team

CPR 30:2
with oxygen and airway adjuncts

Apply pads / monitor
Attempt defibrillation if appropriate

Advanced Life Support when resuscitation team arrives

YES

Signs of life?

Assess ABCDE
Recognise and treat
Oxygen, monitoring, IV access

Call resuscitation team if appropriate

Handover to resuscitation team

2010 Resuscitation Guidelines
Resuscitation Council (UK)
Management of Surgical Emergencies
Part 1: Critical Care

Paediatric Resuscitation: Special aspects

Aims
To understand differences in paediatric resuscitation

Prompt, simple actions save lives and prevent complications.

A systematic approach maximises success.

Children are different

• Physical
• Physiology
• Psychology
• Pathology

Physical differences

• Weight
  Weight (kg) = 2 (age in years + 4)
  between 1 and 12 years

• Size
• tracheal tube diameter (mm) = (age in years / 4) + 4
  between 1 and 12 years

Shape: Different anatomy
Body surface area changes

Physiology differences
- Cardiovascular
- Respiratory
- Immune

Psychology differences
- Communication
- Cooperation
- Companions

Pathology differences
Causes of Arrest: 4H and 4T
- Hypoxia
- Hypovolaemia
- Hypokalemia
- Hypothermia
- Tension
- Tamponade
- Toxins
- Thromboembolism

Choking child: treatment
Any Questions?

?  

SUMMARY

• Children are different:
  • Physical size and shape
  • Physiology
  • Psychology
  • Pathology

Prompt, simple actions save lives and prevent complications.

*A systematic approach maximises success.*

THANK YOU
Paediatric Advanced Life Support

Unresponsive?
Not breathing or only occasional gasps

CPR
(5 initial breaths then 15:2)
Attach defibrillator / monitor
Minimise interruptions

Call resuscitation team
(1 min CPR first, if alone)

Assess rhythm

Shockable
(VF / Pulseless VT)

1 Shock
4J/kg
Immediately resume CPR for 2 min
Minimise interruptions

Non-Shockable
(PEA / Asystole)

Return of spontaneous circulation
Immediate post cardiac arrest treatment
Use ABCDE approach
Controlled oxygenation and ventilation
Investigations
Treat precipitating cause
Temperature control
Therapeutic hypothermia?

Immediately resume CPR for 2 min
Minimise interruptions

During CPR
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Correct reversible causes

Reversible Causes
- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Tension pneumothorax
- Toxins
- Tamponade - cardiac
- Thromboembolism
Newborn Life Support

Dry the baby
Remove any wet towels and cover
Start the clock or note the time

Assess (tone), breathing and heart rate

If gasping or not breathing:
Open the airway
Give 5 inflation breaths
Consider SpO₂ monitoring

Re-assess
If no increase in heart rate
look for chest movement

If chest not moving:
Recheck head position
Consider 2-person airway control
and other airway manoeuvres
Repeat inflation breaths
Consider SpO₂ monitoring
Look for a response

If no increase in heart rate
look for chest movement

When the chest is moving:
If heart rate is not detectable
or slow (<60 min⁻¹)
Start chest compressions
3 compressions to each breath

Reassess heart rate every 30 s
If heart rate is not detectable
or slow (<60 min⁻¹)
consider venous access and drugs
Aims

• Know:
  1. The principles of airway management
  2. The practice of airway management
  3. How to prepare an Airway Management Strategy

1 Principles of Airway Management

1 Provision of:
   • gas exchange, Oxygenation, and Ventilation

2 Protection from:
   • Aspiration and injury

3 Permitting:
   • Safe surgery

2 Practice of Airway Management

• 1 Facemask ventilation with adjuncts
• 2 Airway clearance
• 3 Tracheal intubation
• 4 Supraglottic airway use
• 5 Subglottic approaches

Methods 1: Facemask Ventilation with adjuncts
Methods 2: Clearance

- Suction, debris and foreign body removal

Methods 3: Tracheal intubation

- Oral, nasal or submental intubation

Method 4: Supraglottic Airway

Method 5: Subglottic approaches

- Cricothyroidotomy or tracheostomy
- Note: for emergency subglottic management
- Fifth and final approach
- When other approaches failed
- Intended benefits greater than risks

Emergency Surgical Cricothyroidotomy

1

- Extend the head & neck (caution C spine injury)
- Identify the cricothyroid membrane
2  
• Immobilise the trachea with the non dominant hand  
• Horizontal 2.5 cm stab incision through skin and cricothyroid membrane (might need initial vertical one in obese patients)  
• Hold scalpel between thumb & index finger (limits insertion depth)

3  
• Keep the Scalpel in place  
• Introduce tracheal hook into the incision

4  
• Make sure of gentle caudal and anterior traction on the cricoid cartilage with tracheal hook prior to removing the blade

5  
• Maintain patency of incision with tracheal hook

6  
• Insert 5.0 mm cuffed tracheostomy tube over trochar  
• Gentle smooth motion

7  
• Traction maintained  
• Tube in place
8
- Take out trochar maintaining tube in place

9
- Take out trochar maintaining tube in place

10
- Inflate cuff

Alternative to tracheotomy tube
- Initial placement of introducer or gum elastic bougie through the incision

1
- Keep incision open with traction on cricoid cartilage by tracheal hook until bougie in place in trachea

2
- Ensure that there is no endobronchial intubation (the cuff should just go beyond the incision)
### Confirmatory signs of effective placement

- Capnography
- Visualisation & feeling of chest rise and fall
- Auscultation

### Complications

- **Immediate**
  - Bleeding
  - Laryngeal fracture (gentle technique/smaller tubes—minimise risk)

- **Late**
  - Subglottic Stenosis
  - Scarring
  - Voice changes

### 3 Prepare an Airway Management Strategy

"a logical, co-ordinated series of plans aimed at achieving good gas exchange and protection from aspiration"

(NAP4 (fourth National Airway Project, UK 2011)

**PLAN A, PLAN B, PLAN C**

### Preparing a Strategy: the “5 As”

A, B, C planning?

- Assess? (1 anatomy, 2 aspiration risk, 3 anoxia risk)
- Above or below the cords?
- Awake or asleep?
- Afterwards?

### Scenario 1

- Young patient for laparotomy
- Anaesthetist worried about airway

### Scenario
Consider the Aims

- Principles of airway management
- Practice of airway management
- Preparation of airway management strategy

One option

- “Retrograde epidural catheter "pull through"

Questions?

Summary

- Know:
  1. The principles of airway management
  2. The practice of airway management
  3. How to prepare an Airway Management Strategy
Breathing

1.8 Chest Trauma
A 30 minute tutorial (25 min to complete the presentation plus 5 minutes for extra discussion) on major causes of breathlessness after chest trauma. This discusses respiratory and major cardiac or mediastinal injuries that can cause rapid death. Main learning point = rapid recognition, decision making and intervention.

1.9 Hypoxia
A 30 minute tutorial (25 + 5 min) that focuses on the causes of post-operative hypoxia and how to think physiologically in planning emergency and supportive management. The aim is not to get to ventilation techniques or ICU management but to discuss with participants how they manage patients in ward areas and before or during transfer to HDU or another hospital. Main learning point = think through the whole oxygen transport and utilisation pathway.

Meetings with Mentors
Two such sessions are scheduled, both on Day 1. Each small group of 6 participants are allocated a faculty member as mentor, and these are colour coded. The aim of the first meeting is to ask whether participants have settled into the course and if they have specific learning needs or other concerns. This meeting occurs after the practical demonstrations, CPR practice and lunch and by now participants should buy into the open relaxed atmosphere of the course. The second meeting is at the end of Day 1 and more specific. Faculty can ask about the quality of course content and teaching. They should also explain more about the assessment process if participants are concerned about this. The mentors will by now have the first day's scores sheets for their group and can raise areas of excellence or concern, either generically with the whole group or confidentially to an individual if there are specific concerns.
Primary Assessment (Survey)

Rapidly identify immediate life threatening and reversible injuries

- Airway, Breathing, Circulation, Disability
- Treat problems as they are identified
- Systematic
- Repeatable

Primary Assessment:

Examine (remember the back)

- Look, feel, percussion, auscultation

Treat life threatening problems

Reassess following intervention

Vital Signs, oximetry and CXR (if available)

Primary Assessment:

- Airway Obstruction
- Tension Pneumothorax
- Open Pneumothorax
- Massive Haemothorax
- Flail Chest
- Cardiac Tamponade

ATOMiC

Primary Assessment:

Potentially life-threatening injuries to look out for:

(a) Penetrating chest injury:

- Tension pneumothorax
- Massive haemothorax
- Cardiac tamponade
- Open pneumothorax

Primary Assessment:

- Penetrating chest injury

Chest Trauma

Trauma causes of Breathlessness and Emergency Management

Learning Outcomes

1. Primary Survey
2. “B” - Breathing with ventilatory support
3. Life threatening breathing problems & Specific injuries
4. Features, signs and treatment
Diagnosis?

Tension Pneumothorax
- History of penetrating trauma, PPV or chronic airway disease

Common signs
- Air hunger (tachycardia, tachypnoea, agitation, cyanosis – Sats<92%, SBP<90, RR <10)

Late / rare signs
- Hyper-resonance, hypotension, neck veins, deviated trachea

Tension pneumothorax
- Clinical diagnosis
- X-ray not necessary
- Management — Immediate Needle Decompression
  - How, where
  - Intercostal drain

Needle decompression

Needle decompression

Haemothorax
- Up to 40% blunt injuries
- Up to 90% penetrating injuries
- Multiple sites
- Potential to bleed up to 50% of circulating volume into each hemithorax

- Massive Haemothorax = 1000-1500mL or 250ml/hour over next 3-4 hours
- 400mL – blunting of costophrenic angle
More than one pathology!

Chest Drain insertion

Open Pneumothorax
- Definition
- Pathophysiology?
- Wound diameter?
- Treatment?

Primary Assessment:
Specific, potentially life-threatening injuries to look out for:
- Blunt chest injury
  - Flail chest (90% associated with pulmonary contusions)
  - Ruptured aorta
  - Ruptured diaphragm

Multiple rib #s with flail segment

Flail chest
Wide mediastinum due to ruptured aorta

Ruptured left diaphragm

Act to fix what you find:
- Oxygen (if available)
- Needle decompression & secure
- Chest drain v non-tube thoracostomy
- ?Thoracotomy: Indications in haemothorax? Penetrating injury

NB: Getting a CXR and calling the surgeons are non-therapeutic manoeuvres

Summary:
- How to assess ‘B’ in primary survey
- Specific injuries to look for and how to recognise them
- Indications for chest drain
- Timing of the CXR
- Potential dangers of # ribs…
- Remember to look at patients back

Questions?
Learning Outcomes

1. Definition of hypoxia
2. Pathophysiology
3. How to assess Symptoms and Signs
4. Management protocols

Definition

Hypoxia is impaired tissue oxygenation

Hypoxia is one of the most common post-operative complications
Oxygen delivery is fundamental to managing sick patients.

**Oxygen Delivery = oxygen content x cardiac output**

Oxygen content = \((\text{Hb} \times 1.36 \times \text{SaO}_2) + (0.0032 \times \text{PaO}_2)\)

(At Hb=15 and SaO2=99 blood carries 200ml O2/liter)

\[ \text{CO} = \text{SV} \times \text{HR} \]
\[ \text{BP} = \text{CO} \times \text{PR} \]

Oxygen delivery depends on:

- **Airway**
- **Ventilation:**
  - Central drive, volume, rate, FRC
- **Oxygen availability:**
  - %, Pa (air and alveoli), pulmonary capillaries
- **Oxygen transport:**
  - Hb, Cardiac output, Peripheral resistance
- **Tissues:**
  - Oxygen release, Diffusion, Utilisation

What needs to be maintained to prevent tissue hypoxia?

1. Patent airway and effective ventilation
2. Effective gas interchange
3. Arterial oxygen saturation (SaO2)
4. Effective circulation (BP=COxPR)
5. Haemoglobin concentration and integrity
6. O2 release from Hb
7. Extracellular diffusion
8. Oxygen use by cells

Causes of Hypoxia:

1. ↓pAO2 or ΔFiO2
2. ↓V
3. ΔV/ΔQ
4. ↓Hb
5. ↓CO

Surgical patients at risk of Hypoxia:

- **Pre-op hypoxia**
  - Smokers, COPD
- **Reduced FRC**
  - Elderly, Obesity, Diabetes, GA
- **Surgical pathology**
  - Restricted ventilation, SIRS
- **Post-op Sedation**
- **Hypothermia**
- **Fluid overload**

Assessment:

- **History**
  - Risk groups, recent events, charts, medication
- **Examination**
  - Signs of organ dysfunction
- **Investigations**
  - Pulse oximetry
  - CXR
  - ABGs, Hb
  - ECG
Clinical signs of tissue hypoxia?

- Altered mental state
- Altered respiratory rate
- Arrhythmias
- Peripheral vasodilatation
- Systemic hypotension
- Cyanosis (?)

What does Pulse Oximetry measure?

- Gives an estimate of percentage saturation on oxygen binding sites on Hb
- NOT the same as PaO₂
- Related to PaO₂ through sigmoid shaped O₂-Hb dissociation curve

Oxygen dissociation curve

Pulse Oximetry

Remember:

95%–100% = normal
<93% = warning! (ask “Why?”)
<90% = patient in serious trouble (do something now)

Double check that you distinguish the SaO₂ from the pulse rate when looking at the monitor.

Error readings in pulse oximetry:

- Low cardiac output
- Vasoconstriction
- SaO₂ <70%
- Poor positioning
- Movement
- Hypothermia (often in trauma patients)
- Abnormal Hb (COHb, MetHb)
- Hyperthermic limb
- Dirty probe
- Black, blue or green nail polish
- External light
Error readings in pulse oximetry:
- Low cardiac output
- Vasoconstriction
- SaO2 <70%
- Poor positioning
- Movement
- Hypothermia (often in trauma patients)
- Abnormal Hb (COHb, MetHb)
- Hyperthermic limb
- Dirty probe
- Black, blue or green nail polish
- External light

Likely causes of Hypoxia
- Pulmonary oedema
- Bronchopneumonia
- Lobar pneumonia
- Pre-existent COPD
- Atelectasis with hypoventilation
- Pulmonary embolism
- ARDS

- Pulmonary Oedema
  - Diffusion barrier
  - "at risk" patient, fluid balance
  - CXR: diffuse bilateral changes

- Bronchopneumonia
  - Shunting
  - "at risk" patient
  - CXR: localised woolly unilateral shadowing

- Pulmonary Embolism
  - Ventilation/perfusion mismatch
  - "at risk" patient
  - CXR: usually normal

- ARDS
  - Shunting
  - "at risk" patient
  - CXR: bilateral widespread diffuse shadowing
Management

- Airway
- Oxygen
- Ventilation
- Circulation
- Other supportive
  - Physiotherapy; Bronchodilators; Mucolitics
- Specific
  - Antibiotics; Anti-coagulation

Questions?

Summary

- Aim to prevent hypoxia
- Thorough assessment of any postoperative hypoxic patient
- Think: Stable or Unstable/Unsure?
- Consider all factors in the oxygen delivery pathway.
- Think “Why?”
- Assessment guides Management
C Circulation

Course participants rotate in their small groups through three tutorials of 30 minutes each (25 + 5 min).

1.10 Shock
Focus is on haemorrhagic shock. Tutorial develops around case scenarios. Main learning points = CABCD, Rapid restoration of volume and "turning off the tap". For more advanced participants slides can be added from the Damage Control tutorial to discuss Damage Control Resuscitation and Damage Control Surgery (see section F).

1.11 Fluid Therapy and Oliguria
First aim is to teach an evidenced approach to fluid therapy, including new concepts in fluid therapy, e.g. preventing overloading with sodium and water. Second part teaches a physiological approach to the causes and management of oliguria. Main learning points = "There is nothing normal about Normal Saline" and "Oliguria is not due to frusemide deficiency".

1.12 Cardiac complications in surgical patients
This is traditionally a very difficult topic to teach; surgical trainees usually feel out of their comfort zone and find it especially difficult to understand arrhythmias. Some work in hospitals where they do not have access to 12-lead ECGs. The tutorial addresses the essentials of managing atrial fibrillation, a myocardial infarction and post-operative hypotension. A structured approach to diagnosis and treatment should be stressed.
1.10 Management of Surgical Emergencies
Part 1: Critical Care

SHOCK

Learning Outcomes
1. Define shock
2. Understand the pathogenesis
3. Recognise shock
4. Principles of management
5. Understand the need for speedy resuscitation, finding the cause and calling for help.

What is Shock?
Circulatory collapse leading to tissue hypoperfusion, cellular hypoxia, anaerobic metabolism and ultimately cell death.

Recognising shock?
- Pulse? Blood Pressure? Capillary Refill?
- Signs of poor organ perfusion:
  - Skin
  - Brain
  - Kidneys – reduced urine output
  - Gut
- Metabolic acidosis
- Central Venous Pressure?
Trauma Scenario

- 11 year old girl
- Fell 6 ft from swing, face down on concrete. Immediate pain LUQ, but subsided; then pain left shoulder.
- P 86/min, BP 150/90 mmHg; RR 18/min
- O/E: Mild tenderness LUQ, no guarding.
- Diagnosis?

30 minutes later: Pulse 120/min; BP 140/80 mmHg

- Ultrasound: free fluid in abdomen & pelvis; disruption of spleen architecture; ?tear.
- To theatre from A&E for laparotomy.
- Grade 3 Spleen Injury
- Had a Splenorrhapy
- HAEMORRHAGIC SHOCK

Principles

1. Tachycardia = earliest sign of shock (usually).
2. Any injured patient who is cool & tachycardic is in shock until proven otherwise.
3. Narrowed pulse pressure indicates significant blood loss.
4. Compensation can prevent systolic pressure drop (particularly in children)
5. Elderly patients can get early hypotension without tachycardia, and tolerate low BP poorly (beware B-blockers, pacemakers).

Types & Causes of Shock:

- Hypovolaemic
  - Haemorrhagic – blood loss (6 compartments)
  - Non-haemorrhagic – burns, D&V, pancreatitis
- Cardiogenic
  - Intrinsic – MI, LVD / LVF, Valve failure or stenosis, contusion
  - Obstructive – external compression of myocardium eg. Tamponade, tension pneumothorax, PPV
- Distributive
  - Septic – loss of SVR, peripheral pooling & reduced venous return
  - Anaphylactic – mast cell breakdown, vasodilation
  - Neurogenic – loss of autonomic control

Management of shock

Recognise the problem!

CABCDDE

Management of shock

Resuscitation

Reduce the flow, turn off the tap and replace some volume

1. What fluids?
2. What route?
3. When to give blood?
4. How much is enough?
Initial Fluid Therapy
1. Normal Saline / Ringer's Lactate (Hartmanns)
2. Adults: 1000-2000ml rapidly (profoundly shocked)
   (Non-compressible, ongoing bleeding: avoid rapid fluid replacement. 250ml aliquots titrates to radial pulse and cerebration)
3. Rough guide: 300ml for every 100ml blood loss
4. Children: 10ml/kg initial dose + 10ml/Kg
5. Early consideration for blood

Monitor
1. Cerebration
2. Vital signs: Pulse (rate and quality), Cap refill, Blood pressure, Respiratory rate
3. Skin colour and temperature
4. Urine output
5. Haemodynamic parameters: CVP; Cardiac output, SvO2, Exp CO2, ph/H+

Response to resuscitation
A. Rapid Responder
   • Vital signs return to normal – no signs of ongoing blood loss
   • Time for further assessment & treatment
B. Transient Responder
   • Initial improvement, but deteriorated again
   • Suggests ongoing blood loss
   • Needs blood replacement
   • Early intervention
C. Non-responder
   • Urgently needs blood
   • Intervention necessary as part of resuscitation to turn off the tap

Scenario 2
• 16 year old boy
• Admitted early evening with large volume fresh blood PR
• Shocked – rapid response.
• 3 hours later: further bleeding; now needs blood
• Further four episodes overnight
• Consultant never informed!
• 5 units blood overnight
• Consultant arrives on ward 07h45 during episode of bleeding; patient ashen faced, big silent eyes, extremities cold:
• What was his immediate decision?

Turn off the tap!
• Immediately to theatre - Resuscitative surgery
• Laparotomy: Bleeding Meckel’s diverticulum
• Rapid full recovery
• TRANSIENT RESPONDER – ongoing bleeding

Questions?
Summary

- Shock = Failure of tissue perfusion.
- Obvious signs may appear late.
- What is the cause?
- Management principles are the same irrespective of the cause of shock.
- Management:
  1. Resuscitation
  2. Treat Cause
  3. Regular re-assessment
  4. Manage secondary organ dysfunction due to hypoxia and acidosis
1.11

Management of Surgical Emergencies
Part 1: Critical Care

Fluid Therapy & Oliguria

Learning Outcomes
1. Understand "stress" response to surgery
2. Understand normal daily water, sodium and potassium requirements & the effects of surgery on these requirements
4. Understand and manage post operative oliguria effectively

Stress response to surgery

• Activation of the renin-angiotensin-aldosterone system and release of catecholamines
• Leads to salt and water retention
• Patients are slow to excrete an excess sodium load

What has changed in fluid prescription:

• Shift away from use of non physiological solutions like 0.9% saline towards more physiological solutions (Hartmanns etc.) for maintenance
• Avoidance of use of hypotonic solutions (5% dextrose) to correct fluid losses.
• Change in concept of "third space" losses to constituting less than 1ml/kg/hr in peri-op period.

Stress response to surgery

• Surgical patients require less water and less sodium for their maintenance requirements
• A initial reduced urine output immediately post surgery is a well recognised phenomenon and not necessarily due to fluid depletion
0.9% saline is not "Normal"

Results in volunteers given a bolus of ‘normal’ saline:
- Hyperchloraemic metabolic acidosis
- Strong Ion Difference
- Decreased GFR
- Delayed micturition
- Confusion
- Abdominal pain

Postoperative Fluids Should..

1. Provide maintenance requirements of water and electrolytes.
2. Replace other external fluid loss e.g. drains, nasogastric suction.
3. Correct any intravascular fluid loss i.e. blood loss.

However -

- Most commonly prescribed:
  - 0.9% saline & 5% dextrose
  - Ringer Lactate
- What we need for prescribing is:
  - Composition of the fluids we are prescribing
  - Daily water requirement
  - Daily sodium requirement
  - How these requirements are altered by surgery

Daily requirements of electrolytes

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Requirement</th>
</tr>
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<tbody>
<tr>
<td>Sodium</td>
<td>60 to 100 mmol/day</td>
</tr>
<tr>
<td>Potassium</td>
<td>40 to 80 mmol/day</td>
</tr>
<tr>
<td>Water</td>
<td>1.5 to 2.5 litres/day</td>
</tr>
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</table>

Hartmann’s solution

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>131 mmol/litre</td>
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<tr>
<td>Potassium</td>
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<tr>
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<tr>
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<tr>
<td>Chloride</td>
<td>111 mmol/litre</td>
</tr>
<tr>
<td>Glucose</td>
<td>0</td>
</tr>
</tbody>
</table>

0.9% saline

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>154 mmol/litre</td>
</tr>
<tr>
<td>Potassium</td>
<td>0</td>
</tr>
<tr>
<td>Calcium</td>
<td>0</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>0</td>
</tr>
<tr>
<td>Chloride</td>
<td>154 mmol/litre</td>
</tr>
<tr>
<td>Glucose</td>
<td>0</td>
</tr>
</tbody>
</table>
Postoperative requirements

1. Calculate Maintenance requirements for water and electrolytes (if NPO):
   • Use 4-2-1 formula (Holiday & Segar) for starvation period
   • Calculate fluid/electrolyte/glucose requirement
   • Use a combination of fluids to achieve the same

2. Replacement of other external fluid loss:
   • You need to know
     - The volume of fluid loss
     - The type of fluid
     - The electrolyte content of the fluid

3. Correction of any intravascular fluid loss:
   • Crystalloid (Hartmann’s rather than 0.9% saline)
   • Do not use hypotonic solutions for fluid bolus
   • 1:3 formula (blood loss to crystalloid) for correction
   • Guarded boluses in elderly patients
   • Colloid
     • Use 1:1 correction.
   • LMW starches have poorer outcome if associated sepsis
   • Blood and blood products

Table 3: Composition of some body secretions

<table>
<thead>
<tr>
<th>Body Secretion</th>
<th>Na(^{+}) mmol/L</th>
<th>K(^{+}) mmol/L</th>
<th>Cl(^{-}) mmol/L</th>
<th>HCO(_3) mmol/L</th>
<th>Volume L/24 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saliva</td>
<td>2.8-3.0</td>
<td>0.20</td>
<td>16.3-20</td>
<td>14</td>
<td>0.5-1.0</td>
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<tr>
<td>Gastric Juice</td>
<td>20-60</td>
<td>14</td>
<td>140</td>
<td>15</td>
<td>0-15</td>
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<tr>
<td>Pancreatic Juice</td>
<td>125-138</td>
<td>8</td>
<td>86</td>
<td>85</td>
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<tr>
<td>Bile</td>
<td>145</td>
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<td>105</td>
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<td>Jejunal Juice</td>
<td>140</td>
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<td>155</td>
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<tr>
<td>ileal Juice</td>
<td>140</td>
<td>5</td>
<td>125</td>
<td>30</td>
<td>0.8</td>
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<tr>
<td>Intercostal</td>
<td>50</td>
<td>4</td>
<td>25</td>
<td>-</td>
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<tr>
<td>Coliclysmia</td>
<td>60</td>
<td>15</td>
<td>40</td>
<td>-</td>
<td>0.1-0.2</td>
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<tr>
<td>Diarrhoea</td>
<td>30-140</td>
<td>30-70</td>
<td>20-80</td>
<td>Variable</td>
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<tr>
<td>Normal Blood</td>
<td>20-40</td>
<td>30</td>
<td>-</td>
<td>0.1-0.25</td>
<td></td>
</tr>
<tr>
<td>Sweat (glycolypa)</td>
<td>47-60</td>
<td>9</td>
<td>30-40</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Visible Sweat</td>
<td>50</td>
<td>10</td>
<td>45</td>
<td>-</td>
<td>0.5</td>
</tr>
</tbody>
</table>

4. "golden rules" of post-op renal dysfunction:

1. The kidneys cannot function without adequate perfusion.
2. Renal perfusion depends on an adequate blood pressure.
3. A surgical patient with poor urine output does not always require more fluid (remember Renin-Angiotensin System).
4. Absolute anuria is usually due to urinary tract obstruction (check catheter).
5. A thorough fluid status assessment (capillary refill, CVP) rather than frusemide is usually the answer.

Kidneys are Important!

- Fluid, electrolyte and hydrogen ion homeostasis.
- Excretion of water soluble waste products of metabolism (e.g., urea).
- Excretion of water soluble drugs.
- Endocrine functions – renin-angiotensin, erythropoietin, vitamin D.
Management of Postoperative Oliguria:

1. Patient assessment:
   a) ABCDE
   b) Charts/notes review

2. Use knowledge of pathophysiology to guide investigation and treatment.

Post-operative Oliguria

Mechanisms:

- Metabolic stress response
  - ↑ ADH secretion
  - ↑ aldosterone secretion
  - ↑ renal Na+ reabsorption
  - ↓ water excretion

- Inadequate renal perfusion
  - hypotension
  - abdominal tamponade

- Redistribution of fluid
  - capillary leak → oedema
  - ileus
  - reduced oral intake of fluid

Post-operative Oliguria

Classification:

- Prerenal
  - dehydration
  - blood loss
  - hypokalaemia
  - hypotension

- Renal

- Postrenal
Post-operative Oliguria

Classification:
- Renal
  - acute tubular necrosis
  - sepsis
  - trauma
  - NSAID’s
  - myoglobinuria
  - aminoglycoside

- Prerenal

- Renal

- Postrenal
  - urinary retention
  - blocked urinary catheter
  - bladder stone

Assessment:
- At risk?
- Fluid balance?
- Perfusion?

- major emergency / elective surgery
- minor surgery in high risk patients

Assessment:

Fluid balance
- fluid balance chart
- hourly urine volumes
- urine colour = dark (concentrated) or light (dilute)

- extrarenal losses
- fistula
- ascites

- blood pressure
- pulse
- CVP
- peripheral perfusion
  - warm, well perfused
  - cold, clammy
Questions?

Summary

- Tailor fluid therapy to patient and surgery
- Avoid non physiological solutions for maintenance
- Calculate daily water and electrolyte requirement and choose fluids accordingly
- Consider "stress" response to surgery and avoid overloading patients

Summary (contd...)

- Identify patients at risk of developing post-op renal dysfunction (elderly/major surgery & fluid shifts)
- Identify cause (pre-renal, renal or post renal)
- Collate all available information
- Treat according to algorithm.
1.12

Management of Surgical Emergencies
Part 1: Critical Care

Cardiac complications

Learning Outcomes

• Recognise the common cardiac complications post surgery
• Management of these situations

Arrhythmias

• Common post operatively
  – Atrial Fibrillation
  – A. Flutter
  – SVT
• Rare
  – VT/VF
  – Heart block

Arrhythmias clinical diagnosis

• History – PMH, onset, chest pain
• Examination – rate, rhythm / regularity, volume, capillary refill, BP
• Vagal manoeuvres

ECG

• Check details
• Rate
• Rhythm
  – Ask regular?
  – Regular irregular or irregularly irregular?
  – P waves for every QRS?
  – Width QRS?
• Axis
• P, QRS, T morphology
• Elevations, depressions
• Sinus tachycardia?
• AF
• SVT
• Atrial Flutter

Arrhythmias- the Basics
• Arrhythmias often occur due to multiple factors.
• Correct any electrolyte / physiological disturbance first
• Treating underlying cause may be successful and will increase chance of subsequent therapy being successful
• Exception if unstable can commence multiple therapies simultaneously

Arrhythmias – the Basics
• 1. History and examination
• 2) Oxygen if hypoxic, hypotensive or chest pain
• 3) Confirm venous access
• 4) Monitor Pulse BP, SpO₂, ECG
• 5) 12 lead ECG / rhythm strip if available
• 6) Bloods: FBC, U+E, Mg, Ca, consider others
• 7) Correct abnormal physiological states (hypovolaemia, abnormal electrolytes, anaemia, hypoxia etc)
• 8) Seek help if unsure or need specialist input

Treating AF
• Is there cardiovascular instability or ischaemia (and duration < 48hours)
  — Cardioversion
• If not this is not an emergency
  — Correct fluid balance, electrolytes (K, Mg), decrease sympathetic drive
  — THEN →Digoxin, amiodarone or beta blocker

Myocardial Ischaemia
• Imbalance of oxygen supply and demand
• 75% delivered oxygen extracted by the heart
• Increased demand requires increased blood flow
• Angina occurs when demand exceeds supply
• Limited ability to increase supply
• Usually have to decrease demand
• Differentiate stable angina from new onset ischaemia / infarction

Supply / demand myocardial oxygen
Increase Supply
• Treat anaemia
• Treat hypovolaemia
• Give Oxygen
• Increase diastolic time
Reduce Demand
• Stop shivering / exertion
• Treat pain
• Treat arrhythmias
• Slow heart rate
• Vasodilate
• All antianginals decrease myocardial oxygen consumption
Case study

• 64 yr old male post op left hemicolectomy
• Type II diabetes, no known IHD
• Difficult surgery 2 litres blood loss, 3 litres crystalloid given
• Now complaining of chest pain \(\rightarrow\) jaw and abdominal pain.

Examination

• P=120, BP=85/45mmHg, cap refill 4 seconds, cool peripheries, RR=30 shallow due to pain, oxygen saturation 92%
• 100ml blood in drains
• Hb=6.2g/dL
• ECG Widespread ST Depression, no elevation
• Diagnosis?

Management?

• Blood?
• Fluid?
• Nitrates?
• Morphine?
• Inotropes?
• Vasopressors?
• Aspirin?
• Heparin?
• Thrombolysis?

Management

• You transfuse four units of red cells rapidly, give oxygen to achieve a saturation of 99% and treat his pain with a carefully titrated 10 mg of morphine:
• The patient improves
• His observations are now: P=80, BP=125/70, RR=14
• He has no chest pain, and his ECG changes have resolved

Postoperative Hypotension

• One of the commonest post-operative complications
• Definition: Systolic BP < 90 mmHg
Or
30% reduction from “usual BP”
• Common causes post operatively
  – Hypovolaemia, epidural, sepsis
• Rarely
  – Ischaemia or failure, consider if history of IHD, current chest pain or ischaemic ECG

Inotropes
### Rules of using inotropes

\[ \text{maBP} = \text{CO} \times \text{SVR} \]

- **Rule 1.** Fill the patient (to normovolaemia)
- **Rule 2.** Fill the patient
- **Rule 3.** Fill the patient
- Only once you are sure cardiac preload is optimal should you consider commencing inotropes/vasopressors.
- Remember inotropes will easily produce a normal blood pressure but an inadequate cardiac output in a hypovolaemic patient.

### How to discern volaemic status

- **Examination**
  - Skin temperature, capillary refill, mucous membranes, pulse, BP, urine output, JVP, SVC saturation, swing
- **History**
  - Diarrhoea, vomiting, prolonged fast, bleeding,
- **Charts**
  - Fluids in/out, drains, drugs, temperature

### Fluid challenge the rules

- **Assess patient**
- **Give fluid bolus rapidly**
- **Assess effect**
  - Skin temp, cap refill, pulse BP etc
- **Repeat as necessary**

### Inotropes / vasopressors

- **Adrenaline / epinephrine**
  - Alpha and beta effects,
  - Low dose ↑CO, variable SVR, ↑BP
  - Medium dose ↑CO, ↑SVR, ↑BP
  - High dose ↔CO, ↑SVR, ↑BP
- **Noradrenaline / norepinephrine**
  - Predominantly alpha, slight beta effects
  - Low dose ↔CO, ↑SVR, ↑BP
  - High dose ↓CO, ↑↑SVR, ↑BP

### BP and heart rate CAN be poor predictors of cardiac output

- **MaBP=COxSVR**
- Possible to lose 30% circulating volume and have NO change in BP and HR.
Inotropes/vasopressors

- Decide if need increased SVR or CO or both
- If SVR only noradrenaline good choice
- If want increased CO use adrenaline
- If both / unsure use adrenaline

Questions?

Summary

- Cardiac complications in surgical patients are treated differently from medical patients.
- Understand the pathophysiological process and treat accordingly
- Normalise the physiology
- Hypovolaemia is the commonest cause of early postoperative hypotension
- Inotropes should only be considered once normovolaemia achieved
Disability

Disability is covered through two cycles of 3 small-group tutorials each, interrupted by a practical session on handling a patient with spinal injury (log-roll and transfer on a trauma board), followed with a further two tutorials relating to anaesthesia. Conditions in critical care that disable patients are confusion, head and spinal injuries, sepsis, burns, anaesthesia, pain, psychological complications and complications during pregnancy and childbirth. These are all addressed in this section.

All tutorials run for 30 minutes except those for sepsis, obstetric complications and burns; these need more time and are for 35 minutes each.

2.1 Introduction to Day 2

The course convenor checks that everyone is in, has signed the attendance sheet, is healthy and ready for the day. If the programme has to change, e.g. due to illness of faculty, this is explained to participants. Generic positive feedback makes everyone feel positive about the day e.g. say that faculty discussed course progression the previous evening and that they are all impressed with the participants' knowledge and/or attitude.

2.2 Confusion

This tutorial teaches a simple mnemonic to think of the main causes of post-operative confusion ("DIMTOP"); it is critical to consider hypoxia and hypoglycaemia. This section takes 10 minutes. The rest of the tutorial discusses psychological aspects of critical illness, especially delirium. If there is time one can briefly mention that critical illness and trauma also affects family members and staff so that participants realise that it is acceptable to be upset by traumatic events and patients that suffer.
2.3 Head Injuries

The first part of the tutorial briefly discusses the pathophysiology of primary, secondary and tertiary brain injury, and emergency and supportive management. Many trainees in Africa are more familiar with managing head injury than their counterparts in countries with more easily accessible specialist neuro-surgical services would be. If participants are confident about basic principles there is time to go through the scenario. If participants struggle to understand basic principles the scenario should not be rushed through and rather be omitted.

2.4 Spinal Injuries and Patient Transfer

The first part of the tutorial explains the pathophysiology and management of patients with spinal injury; this should take no more than 10-12 minutes. It is important for participants to understand the differences between neurogenic and spinal shock. The second part of the tutorial relates to safe transfer of patients with head or spinal injuries. Such transfer can be from a trolley to a bed or operating table, intra-hospital e.g. to the CT scanner or theatre, or inter-hospital by air or road transport. Main learning point = prepare for every transfer (mnemonic = "ESCAPE").

2.5 Practice log-roll and transfer with a trauma board

Participants should practice log-roll under supervision of faculty members to make sure they do this right. If extra faculty are available they can be the patients; it always produces a lot of banter and laughter which brings a welcome break into the morning. Participants are often tense at the start of Day 2 because of the test at the end and this session reminds them that the course is also supposed to be fun, that faculty are approachable and that everyone is part of one big team.

2.6 Surgical Sepsis

The aim of this tutorial is to teach a structured approach to managing sepsis: to think physiologically to recognise the level of a patient's illness, have a logical approach to
finding the source of sepsis, and treating patients aggressively from the start, in keeping with the Surviving Sepsis campaign. Use questions and answers throughout and the two scenarios to elucidate leaning points.

2.7 Obstetric critical care for surgeons

In many district hospitals in sub-Saharan Africa general surgeons will be responsible for doing Caesarean sections, often in patients with acute complications during the later stages of pregnancy or in labour. They might also be asked to deal with a pregnant patient who has critical illness for any other surgical reason e.g. trauma or non-obstetric sepsis. This tutorial focuses on the crises in Airway, Breathing and Circulation that a general surgeon in a district hospital might get involved with. Participants who are in early stages of training might not have been exposed to these situations at all and then the tutorial becomes more of a lecture, with the tutor having a more dominant teaching role. Main learning point = the principles of ABCD remain, but now you have to think of two patients, and know some techniques specific to the pregnant patient.

2.8 Burns

It is very difficult to judge which aspects of burns management should be included in a critical care course for surgeons. This tutorial focuses on emergency management in ABCDE while thinking of the pathophysiology of burn injury. In spite of being allocated 35 minutes, this tutorial can easily overrun, so strict timekeeping is important. For environments where burns have to be covered in greater detail there are two supplementary tutorials in section F, titled "Burns in Children" and "Burns Adjuncts" respectively (the latter addresses pain, infection, dressings, nutrition, compartment syndrome and contractures).

2.9 Anaesthesia for Surgeons

This tutorial briefly discusses anaesthetic aspects that a general surgeon might get involved with in a district hospital, focusing on the use of local anaesthesia and ketamine. The main focus of the tutorial is on safe administration to and monitoring of
patients, including careful dosage calculation and support of ABC during anaesthesia. This tutorial is best delivered by a specialist anaesthetist.

2.10 Pain Management
The tutorial discusses why pain management matters and a simple pain ladder of analgesia techniques that should be available in all hospitals that offer surgery, including those in low income settings. It is best delivered by an anaesthetist (if only one anaesthetist is available as member of faculty it is best for the anaesthetist to lead tutorial 2.9).
2.2

Causes of DISABILITY

1. Head Injuries
2. Confused patient = DIMTOP
3. Patient in Pain
4. Patient in Shock
5. Anaesthetised/Sedated patient
6. Septic patient

Management of Surgical Emergencies
Part 1: Critical Care

Causes of Confusion in surgical patients

“DIMTOP”

“D”
1. Diabetes Mellitus
   a) Hypoglycaemia
   b) Hyperglycaemic keto-acidosis
2. Drugs
   a) That you have given e.g. Midazolam
   b) Heroin, Cannabis, Glue, etc
   c) Alcohol

“I” = Infection
1. Meningitis
2. Encephalitis
3. Septicaemia
4. Malaria

“M” = Metabolic
1. Electrolyte disturbances
   a) Low Sodium
   b) High Sodium
   c) Low Magnesium (Eclampsia)
2. High Steroids
3. Hypothyroidism

“T” =
1. Toxic
   a) Industrial
   b) Smoke inhalation
2. Tumour
   a) Primary
   b) Metastases
   c) HIV
• “O” = Lack of Oxygen
  1. Give Oxygen
  2. Think of ALL causes of Hypoxia

• “P” = Psychiatric
  a) Psychosis
  b) Dementia
  c) Disorientation

---

Psychological factors

• Patients factors
  – Delirium
  – Long term cognitive deficit
  – Anxiety / depression
  – Post traumatic stress disorder

• Relatives
  – Stress
  – Demands
  – Expectations

---

Delirium is a real problem!

• Common condition: 25-82% of all ICU patients (65% of ventilated patients)\(^1\)\(^2\)
• Threefold increase mortality versus non delerious patients\(^2\)
• Increases ICU length of stay
• Increases ICU costs by 30%
• Linked to subsequent long term cognitive deficit

Partialy preventable


---

Delirium difficult to detect!

• Classical hyperactive delirium occurs in only 5-23% patients (agitation, restlessness, combativeness, attempts to remove lines etc)
• Hypoactive delirium (45-64%) apathetic, lethargic withdrawn state, patients may appear to be depressed tired or lack motivation
• Fluctuating

---

Pathophysiology

• Poorly understood, multiple competing theories
• Real changes on MRI scans brain
• Benzodiazepines are a major cause: 20 mg Lorazepam associated causes delerium in 100% of patients\(^1\)
• Increasing age, increasing apache scores, increasing blood urea, infection, metabolic acidosis, morphine, sedatives, urgent admission and if the patient is a medical, trauma or neurosurgical admission are all risk factors for developing delirium\(^2\)

\(^1\) Pratik Pandharipande et al, Lorazepam Is an Independent Risk Factor for Transitioning to Delirium in Intensive Care Unit Patients. Anesthesiology 2006;104:2166-72
\(^2\) M van den Boogaard et al. Development and validation of PREDELIRIC (PREdiction of DELIRium in ICu patients) delirium prediction model for intensive care patients: BMJ 2012;344:e420 doi: 10.1136/bmj.e420 (Published 9 February 2012)

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Delirium - Key features

• Primary brain dysfunction
• Onset acute – Hours to days
• Fluctuating level of consciousness
• Perceptual disturbances
• Hallucinations
• Delusions
• Disorientated to time and place
Diagnosis

- Inattention

And

- Disordered thinking OR altered consciousness level
- CAM-ICU

http://www.mc.vanderbilt.edu/icudelirium/assessment.html

Treatment

- Non pharmacological
  - regular orientation
  - glasses / hearing aids
  - consistency of nursing staff,
  - bed-space dark at night with minimal noise to encourage normal sleep patterns,
  - ambulate / keep patient active / stimulated during day,
  - maintain a normal body physiology by avoiding hypoxia, hypoglycaemia, uraemia, electrolyte abnormalities, dehydration

Treatment

- Pharmacological
  - Stop anticholinergic drugs if possible
  - Stop sedatives especially Benzodiazepines, if possible
  - Consider antipsychotics haloperidol or Quetiapine monitor QTc and beware extrapyramidal effects
  - Consider Dexmedetomidine as sedative
  - Beware vicious cycle of sedation leading to more delirium, sometimes just have to stop sedation and get patient through it

Long term cognitive deficit

- Common problems are poor memory, concentration, fine motor skills, executive function and verbal fluency
- 25% of ARDS patients have cognitive impairment at 6 years post discharge with only 46% of all patients having returned to full time employment
- 22% middle aged trauma patients have trouble with employment, managing financial affairs or making travel arrangements
- Duration of delirium is an independent predictor of worse cognitive performance at both 3 and 12 months follow up

Post traumatic stress disorder

- An ICU admission is an acute life threatening non escapable situation
- Nightmares and flashbacks
- Avoidance of flashbacks triggers
- Feelings of guilt, anger and irritability
- Hyper-arousal, depression, anxiety, insomnia, poor concentration
- Autonomic features:sweating, shaking, chest pains and GI disturbances.
- Commonly develop drug or alcohol misuse and relationship problems.
PTSD

- Prevention
  - Aim for awake calm orientated patients during ITU stay
  - Avoid / treat delerium
- Therapy
  - AVOID directly reliving the trigger event
  - Cognitive behavioural therapy
  - Psychotherapy.
  - Eye movement desensitisation and reprocessing
  - Antidepressants.

Anxiety

- Acute life threatening situation
- Patients personality
- Biggest fear is being left alone
- Patients have strange ideas – ask “most people in this situation have some worries or concerns, what are yours?”
- Tell them they are constantly monitored even if no-one by bed
- Tell them what to expect
- Appropriate reassurance from staff
- Good nursing care
- Distraction, music, television, books, relatives
- Rarely benzodiazepines but beware delerium

Depression

- Common
- Appropriate
  - life changing illness
  - loss of independence
  - anxiety regarding future
- Assess cognitive state
  - Can they see a future, do they value themselves?
  - Of concern if they have altered cognition. Do they feel “bad” “a burden” “better off dead”?

Depression - Treatment

- Pharmacotherapy plays only a very small role in treatment in the ICU
- Autonomy
  - Patient helps to plan day within reason, when to bathe, sit out, meals, visitors, physio.
- Alleviate boredom – books, television, trip outside
- Long stay patient for two years, biggest difference we made to him— sneaking his dog in for a visit!
- Post discharge depression common

Questions
2.3

Management of Surgical Emergencies
Part 1: Critical Care

Head Injury

Learning Outcomes
1. Primary and Secondary Assessment of “D”
2. Glasgow Coma Scale
3. Signs of head injury and their significance
4. X-rays
5. Discussion points

Primary Assessment:
- You must address A, B and C before you start on D.
- Altered consciousness can be due to A, B or C.
- Don’t assume it’s the drugs/alcohol.

Glasgow Coma Scale:
- Central or peripheral pain stimulus?
- What if the response is asymmetrical?
- Is that withdrawal or flexion?
- What if they’re intubated?

Glasgow Coma Scale
What are the components and point scores for best response?
- E – 4: spontaneous / speech / pain / none
- V – 5: oriented / confused / inappropriate / incomprehensible / none
- M – 6: obey / localizes / withdraws / flexes / extends / none

Do it!
Clinical signs of head injury:
1. Primary Survey:
   asymmetrical pupils + response
2. Secondary Survey:
   Eyes: racoon/panda
   Nose: CSF/blood
   Ear: CSF/blood/haemotympanum

Skull X-rays:
• Why bother?
• May be useful if:
  1. # overlying middle meningeal A.
  2. compound # (laceration over it)
  3. depressed #
  4. air within cranium (= compound)
  5. facial #

CT Scans:
• Indications:
  1. Skull # (including ?base of skull)
  2. GCS 13 or less
  3. Fall in GCS 2 points or more
  4. Focal neurological signs
Points for discussion:

- Other causes of ↓ conscious state apart from head injury?
- When to call neurosurgeons?
- The combative patient: when to paralyse & intubate
- Initial treatment for the head-injured patient

A: Other causes of ↓ conscious state apart from head injury?

1. Hypoxia from Airway or Breathing problem
2. Decreased cerebral circulation from Circulation problem
3. Drugs/alcohol
4. “Medical” causes e.g. hypoglycaemia, stroke, post-ictal….
Points for discussion:

B: When to refer to neurosurgeons?

1. Any intra cranial blood on CT
2. Compound or depressed skull #
3. A deteriorating patient
4. Before you administer mannitol (or equivalent) – to check indication (and dose)
5. Anyone you’re worried about!

Points for discussion:

C: Dealing with the combative patient?

1. Hypotensive / hypoxic / hypoglycaemic / acidotic / septic / toxic / alcohol / pain / missed other injury / brain injury?
2. ABC-T
3. Above ruled out +/- treated?
   • ? Sedatives – avoid**
   • Paralyse & ventilate – for their safety, not your peace.

Points for discussion:

D: Initial treatment:

Aim to prevent secondary brain injury by maximising delivery of oxygenated blood to the brain:

1. Clear the Airway
2. Normalise Breathing + give O2
3. Keep blood pressure up
4. Keep intracranial pressure down

Keeping ICP down:

a) Elevate head of bed
b) Avoid excessive crystalloid, esp. Dextrose
c) Modest hyperventilation
d) Mannitol? (discuss with neurosurgeons)

Summary:

1. D comes after A, B & C
2. Primary survey: GCS + pupils
3. Managing the combative patient
4. Secondary survey: GCS + head & face
5. Value of SXR, indications for CT
6. Different causes for ↓ conscious state
7. Prevent Z² brain injury

2008.12.15 - case

- 57M alcoholic. Fell backwards in his garden while intoxicated with alcohol and struck his occiput sustaining a scalp laceration. On arrival on the ward at midnight he is talking with comprehension but smelling strongly of alcohol. Occipital laceration has been sutured by A&E staff.
- There is no history of LOC / peri-event amnesia / chest pain / V. But positive for N, headache, and shoulder pain.
- T/P/BP/RR/O2 sats all WNL.
- GCS taken every 2 hours is persistently 14-15/15.

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</table>

- At 4am he gets up to go to the bathroom, without assistance, and falls in the bathroom.
- It is written in the case notes that he has had a vaso-vagal episode. P and BP are WNL.
- Two subsequent sets of neuro-obs are taken and recorded as:
  - 14 (5am) and 15 (7am).

- During the receiving ward round the patient soils the bed and has a seizure.
- The consultant tells YOU to sort it out.
- What do you do?

- A
- B
- C
- D
• **ABC:** He is breathing spontaneously and protecting his own airway with no vomit or evidence of secretions present. Chest auscultation is clear. Peripheries are well perfused; P124 reg, BP 124/57

• **Mx:** Raise the end of the bed, give oxygen, ensure adequate IV access.

• **D:** Pupils are equal in size, equally reactive to light but not accommodation. There is horizontal nystagmus with drift towards the right.

• He does not open his eyes to command or sternal rub but does make small upper limb withdrawal movements more with right arm to the pain stimulus. He makes no vocal response to pain.

• Bilateral up-going plantars.

• **Q:** What is his GCS?

• "Just an alcoholic seizure"? Can you argue for a CT scan?

• You arrange an urgent CT...

• …but your patient arrests when you return to the ward...

• Your patient is blue, motionless, and responseless. The nurses have pulled the bed out from the wall and brought the arrest trolley down.

• What do you do?

• The ITU and medical registrars arrive and decide that the patient has had a respiratory arrest (an output is present upon their arrival).

• The patient is intubated, given IV phenytoin, and taken to CT scan.

What is this view? Orientation of patient? What tubes or lines are present?
What are these views?
What do they show?

• Other than protecting the airway what is (are) the advantage(s) of ventilation?

• Your consultant is surprised (but hides it well) to hear the result of the CT scan. You are now told to ‘speak to the neurosurgeons’. What are you going to tell them?

• While waiting to hear the outcome of the discussion the ITU registrar orders a CXR and then is paged to recover a patient from theatre. The CXR was requested because after placing the ET-tube dirty brown secretions were aspirated from the patient’s chest. The ITU nurses show you the film…

What does the CXR show?

• Don’t forget to complete the secondary survey.
• Don’t forget multiple pathologies!

Questions?
Management of Surgical Emergencies
Part 1 : Critical Care

SPINAL CORD INJURIES &
TRANSFER OF PATIENTS WITH
SERIOUS HEAD OR SPINAL INJURY

Learning Outcomes

- Spinal Cord Injuries – Assessments, risks & complications
- Cord syndromes & Shock
- Transfer – approach and preparation
- Potential problems
- Special considerations

Spinal Cord Injury Assessment

- Tone
- Power
- Reflexes
- Sensation - Pain, temperature – ST tracts

Vibration, prop, fine touch - DWC

Types of Cord Injury

Complete –v- Incomplete

Complete injury - no function below the lowest level that has normal function.

- Incomplete injury retains some sensation or movement below the level of the injury.
- Incomplete injuries represented by the Cord Syndromes

Key dermatomes:
- C4 – Shoulder
- C7 – Middle Finger
- T5 – Nipple
- T10 – Umbilicus
- L1 – Groin
- L3 – Knee
- L5 – Outside of foot
- S2-4 - Perianal
Spinal Cord Syndromes

- **Central Cord Syndrome**: Upper limb affected more than lower. Proximal function preserved.
- **Anterior Cord Syndrome**: Injury to ant spinal artery. Preserved DWC, fine touch and proprioception. Poor motor recovery.
- **Posterior Cord Syndrome**: Compromised DWC. Loss of proprioception and fine touch.

Shock

- **Spinal shock**: Partial or complete - paralysis, loss of sensation and areflexia below level of injury; **flaccid bladder** and rectal tone. May return 24-48 hours – bulbocavernosus reflex first.

Risks & Complications

- **Airway**: Risk of obstruction
- **Breathing**: Aspiration; respiratory failure (high cervical). Cord and brain hypoxia
- **Circulation**: Hypotension; neurogenic shock; secondary organ, head and cord hypoperfusion; heat loss
- **Disability**: Secondary cord damage; spinal shock
- **Exposure**: Heat loss -> hypothermia; gastroparesis & paralytic ileus; atonic bladder; pressure sores; missed injuries

Scenario

- 34 year old worker. Fall from 3rd floor through scaffolding. Brought to hospital by workers
- Examination:
  - Self ventilating. Trachea Central. Comfortable
  - Bruised lateral chest wall. Normal air entry and percussion. Oxygen saturations 93% on room air. RR 8
  - HR 48, regular. Normal heart sounds. Bounding peripheral pulse. Regular. CR <2s. BP 82/44
  - Right sided temporal laceration. E4, M6, V4. PERL. Not moving arms or legs.
  - No abdominal pain or swelling. Obvious right femoral shaft fracture. Multiple lacerations to right side of body.
  - What type(s) of shock?

Spinal Injuries - Management

- **Airway maintenance with cervical spine control**
  - Appropriately sized hard cervical collar, head blocks and tape (secured to trolley), or MILS (Manual inline stabilisation)

- **Risk of regurgitation, vomiting and aspiration** – requires close observation
- **Avoid spinal board (extrication only – minimise time). Take off board ASAP. Keep on comfortable surface**
- **If vomiting -> log roll (4 people) -> maintaining spinal alignment. Log roll for any movements**
- **Consider early intubation and ventilation and orogastric tube**
• **Breathing** – Phrenic nerve injury & respiratory failure. Oxygen +/- ventilatory support.

• **Circulation** – Loss of sympathetic tone -> vasodilatation -> hypotension and Bradycardia, heat loss.

  Crystallized resuscitation – monitor fluid balance – central line & urinary catheter (CVP = 8cmH20)

  Inotropes

  • Consider other **causes of shock** eg hypovolaemia from pelvis, long bones, chest, abdomen etc

  • Spinal cord hypoperfusion and hypoxia -> further cord injury. Aim systolic BP 90mmHg

  • Monitoring

---

**Safe Transfer of patients**

• Safe transfer ensures that the:

  **Right** patient is taken by the **Right** people, at the **Right** time, to the **Right** place, using **Right** transport, receiving **Right** care throughout.

---

**Potential transfers**

• Primary transfer to hospital

• Transfers within hospital eg. to X-ray, Ward, Theatre

• Neurosurgical transfer for operative management or invasive monitoring

• Unstable spinal injuries & Spinal cord injuries requiring specialist intervention

• Use local proforma / aide memoire

---

**Preparing the Transfer - ESCAPE**

**Evaluate** (the situation) – Is transfer needed and if so how quick?

**Surveillance** – Survey the situation. Who is team leader. What tasks need completed pre-transfer. Who is doing them?

**Communication** – With receiving ward / hospital / organisation – Ensure they have the necessary resources

**Agree** – Agree with receiving team that transfer is required and that they are accepting the patient.

**Prepare**

  • Prepare & package patient – adequate resuscitation, secure airway, lines, trachea, accessible during transfer

  • Prepare equipment & drugs – required and available

  • Prepare personnel – safety clothing, food & money, route home, phone & enquiry numbers

  **Exit** – Ensure transport organised and correct route. Final push to transfer

---

**During the transfer**

• Patients prone to deterioration during transfer

• Disruption to normal autoregulatory control

• Appropriately treat pre-transfer - avoid hypoxia, hypotension, hypercapnia and hyperglycaemia

• Monitoring essential

• Cardiovascular control accompanies nervous system management (brain and spinal cord require higher MAP)

---

**Questions?**
ABCs of Brain & Spinal Injury

A. Maintain / secure clear airway
B. Avoid hypoxia and hypercapnia
C. Avoid hypotension and fall in MAP
D. Control seizures (increases met demands)
E. Avoid hypo- and hyperglycaemia (cause tissue acidosis - > arteriolar vasodilatation and tissue oedema)

Summary

• Consider the whole body with spinal injury
• Structured approach for all transfers – ESCAPE
• Use local proforma in preparation of transfer
• Prepare patient, equipment and personnel & package appropriately
• Transfer safely, monitoring throughout
• Anticipate and prepare for potential problems
2.6

Management of Surgical Emergencies
Part 1: Critical Care

Surgical Sepsis

Learning Outcomes:
1. To discuss common causes of pyrexia.
2. To recognise sepsis.
3. To have a system of looking for causes of sepsis.
4. To remember the basic principles of sepsis management.

SEPSIS in SURGERY

- Mortality of surgical patients with major sepsis around 50%
- Early recognition followed by early treatment is essential
- www.survivingsepsis.org

SIRS

= Systemic Inflammatory Response Syndrome

⇒ Two or more of:

- Temperature ≥38°C or ≤36°C
- Heart Rate ≥90 beats/min
- Respiratory Rate ≥20 breaths/min
- White Blood Cell count ≥12000 or ≤4000 or
  >10% immature neutrophils

- SIRS may be secondary to infection or inflammation e.g. trauma, surgery, pancreatitis
- SIRS is an alert that further deterioration may develop
**What is Sepsis?**

= SIRS + Infection.

- **What is Severe Sepsis?**
  = SIRS + Infection + Organ dysfunction or Tissue hypoperfusion.

- **What is Septic Shock?**
  = SIRS + Severe sepsis + Hypotension despite fluid resuscitation

---

**Principles of Management**

A. Resuscitation
B. Full patient assessment
C. Diagnosis
D. Remove the Source
E. Appropriate Antibiotics

---

**Resuscitation**

_Aim is to restore OXYGENATION and PERFUSION_

➔ the treatment that you initiate early can have a profound effect on outcome:

1. Airway
2. Oxygen
3. IV fluid resuscitation: Minimum challenge is 1000 ml crystalloid or 300-500 ml colloid in first 30 minutes.
4. If already apparent that patient is septic, give broad spectrum antibiotics.


---

**Full Patient Assessment:**

Ask yourself...

1. Are there signs of SIRS?
2. Is there evidence of infection?
3. Is there evidence of organ dysfunction?
4. If sepsis, where is it coming from?

---

**Specific Diagnosis and Treatment**

1. Identify source of infection: Where do you look?
   5 Basic sites:
   Lungs, Urine, Wound, "Inside", Other (e.g. DVT)

2. Investigations (e.g. CT) must NOT delay resuscitation or urgent obvious treatment.

3. If patient deteriorates ➔ go back to ABCs.
Scenario 1

- You are called during the night to the ward to see a patient with a fever of 38.9°C.
- She had a right subcostal incision and open cholecystectomy 16 hours ago.
- She is 54 years old, slightly obese and a smoker but otherwise have no other significant medical problems. There is no productive cough.
- She had paracetamol 3 hours ago but complains of pain in the RUQ.

Your initial clinical assessment:

P = 100 beats/min
BP = 130/85 mmHg
Resp. rate = 18
Decreased air entry in both bases. Unable to take a deep breath due to pain
Abdomen soft but generally a bit tender, wound unremarkable; normal bowel sounds.

- What is your diagnosis?
- What would you do next?

Scenario 1 (continued):

The patient stays in hospital and makes a slow recovery.

Three days later she has:
- Temp of 39°C
- P 110/min; BP 130/80; RR 22/min
- Abnormal breath sounds RLL

What is your diagnosis?
What would you do?

What is the treatment of Atelectasis?
1. Physiotherapy (What can you do at night?)
2. Pain relief

Scenario 2

34 yr man who is malnourished and could be immune compromised.
A dog bit him on the left inside thigh 10 days ago but the wounds seemed superficial and he did not seek medical help.
Noted abscess inside left thigh 4 days ago, now very painful and he is unable to walk.

O/E:
- Temp 37.9°C, P 91, BP 130/75.
- Left thigh: red, swollen from gluteal fold to calf; very tender; draining some pus through small wound posterior thigh.
Management:
1. Oxygen.
2. Fluid resuscitation.
3. Penicillin, Gentamycin, Metronidazole.
4. Theatre at 3 a.m: Drainage and Wide Debridement.
5. After 48h: 2nd debridement under GA.
6. After 96h: Change dressings under GA.
7. After 3 weeks: Skin graft with good result.

Questions?

SUMMARY
1. SEPSIS is a manifestation of mediator release with potentially high mortality
2. Early recognition is vital
3. What is done in the first 6 hours is vital:
   Oxygen; Do NOT be afraid of fluid.
4. Broad spectrum antibiotics
5. Full clinical assessment is mandatory
6. Monitor and reassess
7. Speak to seniors early
Differences

• Two patients
• Anatomy
• Physiology

These are time dependent

Similarities

• Systematic approach to critical care
  
  Supportive: A, B, C approach
  Specific: to the problem

Good technical skills
Good non-technical skills
Good teamwork

Two patients

Mother first
Foetus second

Anatomy and Physiology changes

To allow growth and maturation of fetoplacental unit

(endocrine and metabolic changes)
(time dependent)
(mixture of increases and decreases)
Anatomy

Aorto-caval compression

At term uterus with contents weighs ~ 7 kg
Compresses vessels (inferior vena cava +/- aorta)
Serious implications (syncope > seizures)
Also called: Supine hypotensive syndrome of pregnancy

Airway changes

Increased mucosal hyperaemia and swelling
Increased breast size
Increased obesity
→ risk of difficulty and obstruction during airway management
Higher gastric volume
Higher gastric acidity
Higher gastric pressure
Lower barrier pressure
→ pulmonary aspiration risks increased

Breathing changes

Increased minute ventilation
Reduced FRC (functional residual capacity)
→ dyspnoea common
Lower arterial CO₂ (metabolic alkalosis)

Circulation changes

Increased cardiac output
Increased blood volume
Increased plasma volume (decreased Hb)
Increased clotting factors: risk of thromboembolism
Decreased blood pressure
Decreased haemoglobin + haematocrit
→ High flow, hyperdynamic circulation
→ risk of aortocaval compression

Response to blood loss

<table>
<thead>
<tr>
<th>Blood Loss</th>
<th>Heart Rate</th>
<th>Systolic BP</th>
<th>Tissue Perfusion</th>
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<tbody>
<tr>
<td>10-15% (500-750 ml)</td>
<td>Increased</td>
<td>Normal</td>
<td>Postural hypotension</td>
</tr>
<tr>
<td>15-39% (750-1500ml)</td>
<td>Increased+</td>
<td>Normal</td>
<td>Peripheral vasodilation</td>
</tr>
<tr>
<td>30-49% (1.5-2 L+)</td>
<td>Increased ++</td>
<td>70-80 mmHg</td>
<td>Palor, oliguria, confusion, restlessness</td>
</tr>
<tr>
<td>50%+ (&gt;2 L+)</td>
<td>Increased +++</td>
<td>&lt;60 mmHg</td>
<td>Collapse, anuria, dyspnoea</td>
</tr>
</tbody>
</table>
## Obstetric Critical Care

- Complex, risky, uncertain, dynamic
- Teamwork
- Technical skills
- Non-technical skills: the “FIVE Rs”

### Obstetric Critical Care
- Pregnancy related
- Pregnancy unrelated
- Combination of both

### Obstetric critical care “5 Rs”

- **Recognise**: the problem
- **Review**: the situation quickly. Use A, B, C approach
- **Resuscitate**: A>B>C treat/prevent AC compression
- **Request**: help: Teamwork starts here!
- **Resources**: drugs, equipment, people, information
- *Essentially the same as any critical patient*

### Summary: general management

- Mother has priority
- Expert teamwork
- Technical and non-technical skills vital
- Management is specific and supportive
- Treat / prevent aortocaval compression

### Specific management: example

- **Peri-mortem section**
- **Scenario is**: maternal cardiopulmonary arrest unresponsive to resuscitation
- **Start within 4 minutes of maternal arrest** deliver rapidly, at scene, sterility not essential

### Airway problems

- Expert help
- Five step airway management approach
Breathing problems
- Venous thromboembolism
- Amniotic fluid embolism
- Pulmonary oedema
- Adult respiratory distress syndrome
- Infection: sepsis

Circulation problems

<table>
<thead>
<tr>
<th>Infarction</th>
<th>Intrapartum</th>
<th>Postpartum</th>
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</thead>
<tbody>
<tr>
<td>Placental abruption</td>
<td>Uterine rupture</td>
<td>Primary Postpartum Haemorrhage</td>
</tr>
<tr>
<td>Placenta previa</td>
<td>AFE</td>
<td>* Atonic uterus*</td>
</tr>
<tr>
<td>Severe chorioamnionitis, sepsis</td>
<td>Placenta accreta</td>
<td>* Genital tract trauma*</td>
</tr>
<tr>
<td>Severe pre-eclampsia and hepatic rupture</td>
<td>Ruptured vasa previa</td>
<td>* Coagulopathy*</td>
</tr>
<tr>
<td>Surgical complications – uterine incisions, tears</td>
<td></td>
<td>* Retained products of conception*</td>
</tr>
</tbody>
</table>

1 Massive obstetric bleeding
- > 2000 mls acute blood loss: leading to
  - hypovolaemia
  - hypothermia
  - hypocoagulopathy
  - hypotension of supine position

Massive haemorrhage step 1

1. Assess circulation
2. Large bore cannula
4. Start IV crystalloids to correct hypovolaemia

- Catheterise
- Replace hourly urine output

Massive haemorrhage step 2

- Medical management: 800mg Enprostine IV/IV (take care in hypertensive patients)
- 40-100mg Mesaprot/PRK
- 250mg Carprofen in high or already in hypocoagulation (1 hourly intervals up to 4 doses)
- Adequate analgesia
- Correct hydration: aim to correct the urine output
- uterine artery ligation
- Operative management: hysterectomy
- Uterine artery or external artery ligation
- Total or subtotal hysterectomy
Management of Surgical Emergencies
Part 1 : Critical Care

Emergency Management of Burns

Learning Outcomes
• Mechanisms
• Pathophysiology
• Assessment
  – Primary survey
  – Surface area
  – Depth of burns
  – High risk factors
• Management
  – Resuscitation
  – Physiological support
  – Recovery and Regeneration

Introduction
• Burns are unfortunately common
• 90% of burn injuries occur in poorer countries
• 70% are in children
• High rate of morbidity
• High rate of mortality – “40 000 deaths in Africa each year”

Mechanisms of Injury
• Explosion and Flame, including RTA
• Scald – hot oil and water
• Contact
• Electrical
• Chemical
• Friction
  • In children scalds are most common.
  • Carelessness, accidents, epilepsy and alcohol all increase the likelihood of burns injury.
  • Heating capacity and duration of contact are important determinants in extent of burn injury.

Pathophysiology
• Know the Anatomy of the Skin!
Pathophysiology

**General Response**
- Release of inflammatory mediators
- Capillaries become leaky
- Albumin into extra-vascular space
- Oedema
- Hypovolaemia
- Cortisol release and hypermetabolic state
- Affects temperature regulation, immune system, gut and lungs

**Airway Injury**
- above the larynx
  - hot gases result in oropharyngeal swelling
  (e.g. trapped in burning building or hot steam inhalation)
- below the larynx
  - inhalation of products of combustion result in bronchorrhea, alveolar collapse, pulmonary oedema, AROS
  - systemic intoxification
  - acid-base disturbance caused by carbon monoxide/cyanide

Case scenario:

- Burns are more than fire!
- A teenage boy is brought to the hospital having fallen face-first onto hot asphalt.
- What is your management approach???

Management of burns

**Essential management points:**
- Stop the burning
- Primary assessment: ABCDE
- Determine the severity of burn
  - Percentage surface area of burn (Rule of 9’s)
  - Depth
  - Other factors: extremes of age, co-morbidities, etc
- Good IV access and early fluid replacement.

Burns patients have the same priorities as all other trauma patients.

**ABCDE**

- **Airway**
  - Airway injury? (consider C-spine injury if RTA):
    - Speaking in sentences? Hoarse? Facial singeing? Stridor?
    - Early definitive airway and high flow oxygen.
- **Breathing**
  - Respiratory effort, rate, symmetry, trachea, air entry,
  - SaO2, blood gas and CO level
- **Circulation**
  - IV access, blood samples, IV fluids – how much?
  - Catheter
- **Disability and Environment**
  - Immediately cool burn if recent
  - Ensure patient is kept warm.
  - ?burn surface area
  - ?compartment syndrome risk

**A risks - Generalised Oedema**

Massive facial oedema can result.

Anticipate in large burns.

Definitive airway (preferably an endotracheal tube) should be placed where possible.
Breathing

- Assess rate & chest movements.
- Give high-flow oxygen if available.
- Circumferential burns may mechanically restrict chest movement.
- Differentiate breathing restriction due to lung injury vs. excursive restriction requiring escharotomy

Escharotomy indications

- Circumferential burns
- Suspect compartment syndrome and fasciotomy need:
  - Low temperature
  - Weak pulse
  - ↓ capillary refill
  - ↓ distal neurologic function
- Ventilation problems with chest-torso burns

Carbon Monoxide

- Released when there is fire in enclosed space.
- Produced by incomplete combustion.
- Colourless, odourless gas that diffuses rapidly into the blood stream and combines with Hb with a 240 times greater affinity than oxygen.
- Also binds to intracellular cytochrome system
- Reduces circulating oxygen and affects normal cellular functions.
- Confused, disorientated, appear intoxicated.
- Give high flow 100% oxygen.

Circulation

- In first few hours post-injury, hypovolaemic shock is rarely due to burns and indicates likely bleeding elsewhere.
- IV access should be obtained early and in a non-burned area if possible.

Disability & Exposure

- Disability: reduced consciousness?
  - hypoxia (smoke filled room may contain little oxygen and increasing CO)
  - head injury
  - hypovolaemia
- Exposure: be complete but careful
  - ‘Stop the burning’
  - Burns patients are even more sensitive to “environment control”
  - ? Other injuries

Fluid replacement

- Aim to maintain intravascular volume for end organ perfusion - brain, kidneys, gut and skin
- Fluid resuscitation:
  - Children >10% TBSA
  - Adults >15% TBSA (lower threshold in the elderly)
  - Hartmanns (Ringer’s lactate)
- Aim for Urine Output 0.5-1.0ml/kg/hr
  - (Children: 2ml/kg/hr)
Fluid Replacement

- Muscle injury from electrocution, trauma or compartment syndrome can cause haemoglobinurea or myoglobinurea.
- Deposition in the proximal tubules and result in acute renal failure.

Aim to increase urine output to 2ml/kg/h

Parkland formula

- Guides the fluid resuscitation for the first 24 hours starting from time of burn in addition to maintenance fluids:
  - Percentage burn x weight (kg) x 4 = fluid req (mls)
  - Give half of the volume in the first 8hrs and the second half over the following 16hrs

Assessing severity

- The severity of the burn is determined by:
  - Burned surface area
  - Depth of burn
  - Other considerations.

- Morbidity and mortality rises with increasing burned surface area. It also rises with increasing age so that even small burns may be fatal in elderly people.

- Burns greater than 15% in an adult, greater than 10% in a child, or any burn occurring in the very young or elderly are serious.

Surface Area Calculation

- Rule of 9s
- Palmar surface (excluding fingers)
- Lund Browder chart

What is the percentage burned surface area for this patient based on what you see here?

Half front torso (= 9) plus front of right thigh (= 4.5) gives total seen of 13.5%.
If she weighed 50kg what would her minimum supplementary 24h fluid req be?
• Parkland:
  \( \text{%burn} \times \text{kg.weight} \times 4 = \text{mls supplemental fluid} \)
  
  \[ 13.5 \times 50 \times 4 = 2,700\text{mls} \]

  • 1,350mls over 8hrs from time of burn
  • 1,350mls over next 16hrs.

Assessing severity: surface area in children

• The ‘Rule of 9’s’ method is too imprecise for estimating the burned surface area in children because the infant or young child’s head and lower extremities represent different proportions of surface area than in an adult.

Example

• A 100kg man is transferred to your hospital. He has sustained 50% TBSA mixed depth burns 8 hours ago when he was involved in a petrol explosion at his workplace.
  
  • He is intubated and canulated. How much fluid should you give him?
  
  • PARKLAND – 3-4ml/kg/TBSA
    
    \[ 4 \times 100 \times 50 = 20,000\text{ml} = 20\text{litres} \]

  • Give 10 litres now and the other half over the next 16 hours and continually monitor response

Assessing severity: depth

• It is important to estimate the depth of the burn to assess its severity and to plan future wound care. Burns can be divided into three types but are often present in combination.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Characteristic</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>First degree</td>
<td>- Erythema</td>
<td>Sunburn</td>
</tr>
<tr>
<td></td>
<td>- Pain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Absence of blisters</td>
<td></td>
</tr>
<tr>
<td>Second degree (partial)</td>
<td>- Red or mottled</td>
<td>Hot liquids</td>
</tr>
<tr>
<td></td>
<td>- Flash burns</td>
<td></td>
</tr>
<tr>
<td>Third degree (full thickness)</td>
<td>- Dark and leathery</td>
<td>Fire</td>
</tr>
<tr>
<td></td>
<td>- Dry</td>
<td>Electricity or lightning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prolonged exposure to hot liquids / objects</td>
</tr>
</tbody>
</table>
Assessing severity: depth

• It is common to find all three types within the same burn wound and the depth may change with time, especially if infection occurs. Any full thickness burn is considered serious.

Questions?

Summary - 1

• AcBCDE, consider protecting airway early
• Consider burn %TBSA
• Consider generalised effects
• Fluid resuscitation
• Parkland formula is only a guide
• Continually re-assess

Summary - 2

Serious burn requiring hospitalisation
- Greater than 15% burns in an adult
- Greater than 10% burns in a child
- Any burn in the very young, the elderly or the infirm
- Any full thickness burn
- Burns of special regions: face, hands, feet, perineum
- Circumferential burns
- Inhalation injury
- Associated trauma or significant pre-burn illness: e.g. diabetes
What is anaesthesia for?

PROVIDE:
- Conditions for safe surgery

PROTECT:
- Patients from surgery

What is anaesthesia?

TWO TYPES

LOCAL
- reflex suppression and conscious

GENERAL
- reflex suppression and NOT conscious

Management of Surgical Emergencies
Part 1: Critical Care

Anaesthesia for Surgeons
General anaesthesia
Reflex suppression
AND
not conscious

What reflexes are suppressed?

Motor: somatic reflexes
Autonomic: cardiovascular, respiratory reflexes

Safe anaesthesia: 3 technical factors

- Drugs
- Equipment
- Techniques

Safe anaesthesia: 3 non-technical factors

- Communication
- Teamwork
- Decision-making

Safe anaesthesia: 3 phases

- Preoperative
- Perioperative
- Postoperative

Drugs

Equipment
Techniques

• Airway
• Breathing
• Circulation

5 Techniques: Airway

1 Mask ventilation
2 Airway clearance: suction, foreign body removal
3 Use of devices: nasal, oral, laryngeal airways
4 Tracheal intubation: nasal, oral
5 “front-of-neck”: cricothyroidotomy, tracheostomy

1 Mask Ventilation

2 Clearance

Removal of:

Blood
Secretions
Pus
Foreign body

3 Airway devices

Oral airways
Nasal airways
Laryngeal Mask airways

4 Tracheal intubation
Laryngoscopes

5 “Front of Neck”
Cricothroidotomy Tracheostomy

Techniques: Breathing
• Two choices:
  • Spontaneous breathing
  • Controlled breathing
  • Manual or machine

Techniques: Circulation
• Fluid therapy
  • Intravenous route: peripheral or central
  • Intaosseus route

Techniques: drugs
• Induction
• Maintainence
• Recovery
• Single or multiple agents
Ketamine anaesthesia

• Oral
• Intramuscular
• Intravenous
• Rectal
  • Im dose 5-10 mg/kg bolus (~15 minutes)
  • Iv dose 1-2 mg/kg bolus (~15 minutes)
  • Infusion: “ketamine drip”

“Ketamine drip”

• Diazepam oral / im
• Atropine oral / im (20 µg/kg)
• Local/ regional anaesthesia
• Ketamine induction dose im / iv
  • 10-20 µg/kg/min
  • For operations < 2 hours


Ketamine drip For a 75 kg patient

1 Induction dose 150 mg iv. 750mg im.
2 Then, for about 10 µg/kg/min.....
Put 50mg ketamine in 500mls saline, give 75 ml over 10 mins
Or...for about 20 µg/kg/min....
Either double the dose or double the rate
  Give as infusion, not repeated boluses
  Continue infusion till end of surgery
  Alter for different patient weight
  Atropine 20 µg/kg im or iv before starting

Intermittent ketamine

• Atropine 20 µg/kg im/iv
• Induction dose 150 mg iv. or 750mg im.
  • Then:
  • 25 mg iv every 15 mins

Cautions with Ketamine

• Salivation (reduce with atropine 20 µg/kg im/iv)
• Increased muscle tone
• Sympathetic stimulation
• Mental disturbance post-op

Local anaesthesia

• Alone
• Combined with sedation
• Combined with general anaesthesia
Safe local anaesthetic doses

- No adrenaline used for finger/toe/penile surgery!
  Lignocaine (lidocaine) 4 mg/kg every 4 hours
  Bupivacaine (Marcain) 2 mg/kg every 4 hours
- Dose may be doubled if adrenaline used
- Reduce dose in old/frail/sick patients
- Overdose: CVS CNS toxicity

Sedation with local anaesthesia

Sedation

- What is sedation?
- Selective depression of central nervous system
- Awake
- Calm
- Verbal contact

Any Questions?

SUMMARY

- Anaesthesia is reflex suppression, awake or asleep
- Drugs, equipment and techniques are needed
- Airway, breathing and circulation are managed
- Sedation is selective depression of the nervous system. Patient is awake, calm and in verbal contact
Management of Surgical Emergencies
Part 1 : Critical Care

Pain Management

Aims
- What is pain?
- Why do we treat pain?
- How do we measure pain?
- Treatment of pain

What is pain?
Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Pain influenced by culture, beliefs, experience, support, coping mechanisms.

Pain Types
- Somatic pain is well localized and may be responsive to paracetamol (acetaminophen), cold packs, corticosteroids, localized anaesthetic (topical or infiltrate), NSAIDs, opioids and tactile stimulation
- Visceral pain is more generalized and is most responsive to opioid treatment
- Acute / Chronic

Pain is undertreated
- Moderate to unbearable pain was reported by 68.7% of 149 study patients at 24 hours and by 51.7% at 48 hours
- Patients under-report
- Doctors under-prescribe
- Nurses under-treat


Does pain matter – YES!
- Evidence complicated by concurrent surgery / analgesia but:
  - Electrical stimulation abdominal wall increases cortisol, catecholamine and glucagon levels, decreased insulin sensitivity
  - Sympathetic nervous system activated→ tachycardia, hypertension→ myocardial ischaemia
  - Poor cough, atelectasis
  - Suspicion regarding healing, immune system function
  - Humanitarian

Measuring pain

- **ASK THE PATIENT!!!**
- Look at the patient
- Scoring systems: visual analogue scale, verbal scale
- Ask pain on 1→10 scale
  (1 = no pain 10 = worst ever pain)
- Pain movement / rest / no pain
- Reassess after analgesia— is it better?

Treating pain

- Analgesics
- Local anaesthetics
- Non pharmacological

Paracetamol

- Paracetamol is effective in acute pain
- NNT 2.8 (3.4-4.4 for 50% pain relief moderate/severe pain)
- Centrally active, but mechanism undetermined
- Benefit in combination with other analgesics
- Beware other paracetamol containing medicines

**ANZCA Acute pain management: scientific evidence, third edition 2010**

NSAIDS

- BEST ANALGESICS FOR SOMATIC PAIN
- NNT Ibuprofen 400mg = 2.5 (2.4-2.7)
- Benefit in combination with other analgesics
- Peripheral action: Inhibits prostaglandin synthesis
- Adverse effects of NSAIDs are significant and may limit their use
- Increased risk ARF if: renal impairment, hypovolaemia, hypotension, concomitant nephrotoxic agents, ACE inhibitors

**ANZCA Acute pain management: scientific evidence, third edition 2010**

Opiates

- IM/oral/iv
- Good for visceral and somatic pain
- NNT 10mg IM morphine 2.9 (2.6-3.6)
- Intermittent subcutaneous morphine injections are as effective as intramuscular injections and have better patient acceptance--- Why not try?
- Intranasal opioids, in particular the more lipid-soluble drugs such as fentanyl, are effective for the management of acute pain
- Spinal opiates but beware late respiratory depression, must be preservative free

**ANZCA Acute pain management: scientific evidence, third edition 2010**

WHO pain ladder is overly simplistic

- **Mild** simple analgesics paracetamol, non-steroids
- **Moderate** simple analgesics + mild opioid (codeine)
- **Severe** strong opioid (morphine)
Combination therapy, better analgesia with less side effects

<table>
<thead>
<tr>
<th>Drug</th>
<th>Site of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opiate</td>
<td>Spinal cord &amp; some brain</td>
</tr>
<tr>
<td>NSAID</td>
<td>Periphery</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>Brain</td>
</tr>
</tbody>
</table>

Pain signal from peripheral to central with multimodal analgesia

How to prescribe

- Best practice is to prescribe regular analgesia PLUS an as required drug for breakthrough pain.
- i.e. Regular paracetamol and NSAID then prescribe codeine for breakthrough

LA blocks are magic not voodoo

- Infiltration
- Nerve block femoral, median, ulnar
- Regional ankle, axillary, interscalene
- Surgically sited TAP block
- Beware intravascular injection
- Beware overdose
- TRANSFORMS PATIENTS POST OPERATIVE EXPERIENCE

Local anaesthesia is fantastic!

- Infiltration of the wound with local anaesthetic agents provides good and long-lasting analgesia after ambulatory surgery
- Peripheral nerve blocks with long-acting local anaesthetic agents provide excellent postoperative analgesia after ambulatory surgery
- Femoral nerve block provides better analgesia compared with parenteral opioid-based techniques after total knee arthroplasty

ANZCA. Acute pain management: scientific evidence, third edition 2010

Non pharmacological approaches

- Reassurance / education
- Hot/cold packs
- TENS
- Distraction
- Visualisation
- Hypnosis
- Acupuncture

Chronic pain

- Very strange pains due to abnormally functioning and anatomically abnormal nervous system
- THE PAIN IS REAL
- Burning, shooting electrical pain
- Abnormal sensations (Dysesthesia)
- Non painful stimuli→pain (allodynia)
- Excessive pain (wind up)
Chronic pain

- Amitryptiline for burning pain, is cheap and partially effective
- Gabapentin for shooting/electric shock pain
- Physiotherapy
- Psychological approaches
- Surgery to treat chronic pain is ineffective and actually worsens the pain by producing further wind-up, AVOID.

Questions?

Summary

Look for pain

Measure pain

Treat pain—MULTIMODAL

Assess effects / monitor for side effects
2.11 Monitoring in Critical Care

Trainees are easily intimidated by complex monitoring in the ICU or, once they master the technology, can fall into the trap of depending on monitoring equipment rather than assessing the patient. Such technology is also not always available or functioning correctly due to poor maintenance. This tutorial therefore focuses on clinical monitoring in the first place, using eyes, ears and fingertips, and on interpreting signs in a structured way, e.g. reading trends rather than single values, and responding quickly if more than one parameter becomes abnormal, introducing the MEWS score for those who are unfamiliar with this concept.

2.12 SBAR Communication

This is a practical session that usually can become quite theatrical and produces lots of laughter; it is a welcome stress reliever as the end-of-course test comes nearer. In a way it forms the pinnacle of this critical care course. Participants have to understand that you cannot manage a critically ill surgical patient in isolation and that you need a structured method of communication in tense situations. SBAR is a system that is used widely in healthcare in the UK and in North America and presents a structure through which to be assertive, but not aggressive, when asking for help or handing over patient care. The SBAR system of "Situation", "Background", "Action" and "Result and/or Recommendation" is described to participants and then they are given scenarios in which they must use SBAR to communicate to colleagues in potentially stressful situations. All participants in the small group must be given a chance for role play, and nurse or faculty observers can also be used as call recipients. Trainees will initially often feel intimidated by the assertiveness required from them during role play, especially if they have studied and train in a strict hierarchical system, but they should loosen up as the session progresses. Many describe this session as an eye-opener. The scenarios have been carefully selected as being real situations trainees or surgeons might
encounter in Africa, and modified repeatedly through feedback from course participants and surgical colleagues who work in Africa.

2.13 Quality Control

In this tutorial the principles of audit and quality control are discussed, and how these improve patient safety. Vein catheters, medication checks, VTE prophylaxis and hand hygiene are specifically discussed. For many trainees in Africa some of these are very new concepts and then the tutorial becomes more of a lecture. It is important for the tutor to then go through the principles of patient safety and honest reporting/audit, and not try to cover all the individual QC indicators in too much detail, but briefly discuss these as examples of good QC only.

2.14 End-of-Life Critical Care

This is a very difficult topic to address due to natural reticence to discuss death and due to cultural differences. The tutor must have an open mind and not be prescriptive about methods to manage end-of-life care. The main learning point is for participants to realise that it is acceptable to talk about patients dying, to be honest when a patient will not survive and to realise the importance of supporting the dying patient and their families in a structured way, dealing with specific issues such as pain and fear.

2.15 Final course summary

This short lecture is delivered AFTER participants have done their written test. It is delivered by the critical care convenor while the rest of faculty go into a separate room to mark the written test sheets and collate all assessment scores (see Assessment section). After the course summary the convenor hands out course evaluation (feedback) forms to all participants to complete and then joins faculty to look at assessment scores and discuss any borderline candidates. All faculty then join course participants to give results, congratulate them, have a short open discussion about the course and usually get a group photograph taken. If some participants have not passed
the course congratulations are muted and senior faculty are asked to talk in confidence to such participants.
Learning Objectives

• Why monitor?
• Where should patients be monitored?
• When should patients be monitored?
• Methods of monitoring

Monitoring

• “Repeated or continuous observations or measurements of the patient, physiological function, and the function of life support equipment, for the purpose of guiding management decisions” [Hudson, 1985]

• Systematic approach to monitoring - A,B,C,D,E

Critical Care Monitoring

Why?
• Provide trends to identify improvement or deterioration in patient condition.
• Alert caregivers to potentially life-threatening events
• Early identification of deteriorating patient

Where?
• Critical Care environment
• HDU / ICU
• Theatre & recovery
• Emergency Department
• General ward???
Scenario

- 0230am – theatre recovery
- 31 year old male
- 3 day history of abdominal pain, nausea and anorexia
- Pyrexial, tachycardic. Peritonism.
- Laparotomy – perforated appendix abscess with contamination
- Extubated and self ventilating

AIRWAY MONITORING

Observation:
- Extubated and self-ventilating
  - Talking?
  - Listen – partial obstruction?
  - Clearing secretions?
- Intubated and ventilated
  - Capnography
  - Airway pressures
  - FiO2

BREATHING MONITORING

Observation:
- Respiratory rate, effort, accessory muscle use, colour, additional noises?
- Pulse oximetry and saturations – limitations
- ?Arterial blood gas – pH, PaCO2, PaO2
- ? Capnography – measure end-tidal CO2
- Oxygen requirements – FiO2

CIRCULATION MONITORING

- ECG monitoring – rate, rhythm
- Capillary refill
- Colour
- Non-invasive blood pressure
- Invasive blood pressure – beat to beat blood pressure (? ICU)
- Urine output

DISABILITY MONITORING

- GCS – Eyes, motor, verbal
  - Modifications for intubated patients or paediatric patients
- AVPU
- Pupil response
- EEG (specialist)
- ICP (specialist)

- Temperature – Core v periphery (less perfusion = cooler periphery)
- Blood sugar
- Lactate
- Urine output – 1ml/Kg/hour
- Drain output including surgical, chest drains and NG tubes
- Fluid balance charts
• Oxygen Saturation
  – SpO2, using a finger or other probe, measures the proportion of saturated to desaturated hemoglobin
  – Requires adequate perfusion for accuracy
  – Affected by light, jaundice etc
  – Not indicator of ventilation
  – COHb

MEWS
Modified Early Warning Scoring
Heart rate
Systolic Blood pressure
Respiratory Rate
Oxygen Satuations
Temperature
AVPU
• Score dependant upon patient physiology - more abnormal physiology = higher score
• Useful for identifying deteriorating patient (rising score)
• Improved decision making and standardisation of monitoring
• Improved clinical practice
• Prioritising patients (sicker = higher MEWS)

QUESTIONS

SUMMARY
• Monitoring does not always have to be technical - eyes, ears, hands & brain most useful
• Observation and vital signs recording most useful
• Easy to perform - untrained staff or family
• Trends more useful that single reading
• MEWS
• Don’t forget the patient!
2.12

Management of Surgical Emergencies
Part 1 : Critical Care

SBAR Communication

- Structured method of having potentially difficult conversations
- Allows to communicate without becoming angry
- Allows to remain focused in discussion

“SBAR”

“S” = Situation
“B” = Background
“A” = Assessment/Action
“R” = Recommendation/Result

SBAR Scenario 1

You are the resident on first call for surgery:
You have taken a patient to theatre for an appendicectomy and it is 1 a.m.
At operation you found that the patient had a perforated cancer.
You now have to phone your consultant to come and take over.

SBAR Scenario 2

You are the surgical resident on duty on Saturday:
On ward round you find that a patient with pancreatitis has deteriorated; he is elderly, has received 4 litres fluid overnight and has a high WCC. He is sweaty and his chest sounds wet. You give him oxygen but you are worried about further deterioration.
Please phone the ICU consultant to ask them to admit the patient.
**SBAR Scenario 3**
You work in a district hospital.
You have a patient with ruptured ectopic pregnancy who is in shock. You want to operate the patient now.
It is now 6 a.m. and theatre has been quite busy with two Caesarean sections overnight.
The theatre nurse has just gone to sleep and you have to ask her to come out again, and quickly.

**SBAR Scenario 4**
You work in a DGH and have a 10 year old boy with an open fracture of his tibia.
You have done a debridement and put on a back slab POP, but the patient needs transfer to an orthopaedic colleague.
You must explain this to the parents; the father is an important man in your community and can be quite difficult.

**SBAR Scenario 5**
You are the senior surgeon in a district hospital.
You have a shortage of bandages in your hospital because you get lots of patients with minor burns.
You are finally able to speak to a senior clerk in government stores. Explain why they need to send you more supplies.

**SBAR Scenario 6**
You have a meeting with the critical care nursing staff in your DGH.
You want to start a programme to do more complex surgery on your Tuesday lists but need senior nursing staff on duty those days in the surgical ward/HDU.
Explain this to the meeting.

**SBAR Scenario 7**
You are a young consultant.
You have an older colleague with a drinking problem.
Senior trainees have complained that he does not respond to requests for help and have asked you to go and talk to your medical director about this.
Try to explain the situation to the medical director.

**SBAR Scenario 8**
You have had a major argument with a consultant physician about a patient’s management (the patient was in the medical ward for days with bowel obstruction due to an incarcerated hernia that nobody recognised, developed dehydration and renal failure and died shortly after resuscitation and surgery).
The medical director has called you and the physician in to settle your differences in his office.
SBAR Scenario 9
Your most senior surgical colleague regularly pulls out of his on-call commitments and then you and one other surgeon have to cover. You have found out that he does this to do more private work and have now had enough. You are on your way to confront him about this.

SBAR Scenario 10
The government has promised to expand your very basic endoscopy service but now want to withdraw funding to put more money into "primary care". Your local MP has arranged a meeting with the health minister and you have a few minutes to state your case.
2.12b **SBAR Communication Scenarios:**

**Use SBAR to make your case in the following situations:**

1. **You are the resident on first call for surgery:** You have taken a patient to theatre for an appendisectomy and it is 1 a.m. At operation you found that the patient had a perforated cancer. You now have to phone your consultant to come and take over.

2. **You are the surgical resident on duty on Saturday:** On ward round you find that a patient with pancreatitis has deteriorated; he is elderly, has received 4 litres fluid overnight and has a high WCC. He is sweaty and his chest sounds wet. You give him oxygen but you are worried about further deterioration. Please phone the ICU consultant to ask them to admit the patient.

3. **You work in a district hospital.** You have a patient with ruptured ectopic pregnancy who is in shock. You want to operate the patient now. It is now 6 a.m. and theatre has been quite busy with two caesarean sections overnight. The theatre nurse has just gone to sleep and you have to ask her to come out again, and quickly.

4. **You work in a DGH and have a 10 year old boy with an open fracture of his tibia.** You have done a debridement and put on a back slab POP, but the patient needs transfer to an orthopaedic colleague. You must explain this to the parents; the father is an important man in your community and can be quite difficult.

5. **You are the senior surgeon in a district hospital:** You have a shortage of bandages in your hospital because you get lots of patients with minor burns. You are finally able to speak to a senior clerk in government stores. Explain why they need to send you more supplies.

6. **You have a meeting with the critical care nursing staff in your DGH.** You want to start a programme to do more complex surgery on your Tuesday lists but need senior nursing staff on duty those days in the surgical ward/HDU. Explain this to the meeting.
7. You are a young consultant. You have a more senior colleague with a drinking problem. Senior trainees have complained that he does not respond to requests for help and have asked you to go and talk to your medical director about this. Try to explain the situation to the medical director.

8. You have had a major argument with a consultant physician about a patient's management (the patient was in the medical ward for days with bowel obstruction due to an incarcerated hernia that nobody recognised, developed dehydration and renal failure and died shortly after resuscitation and surgery). The medical director has called you and the physician in to settle your differences in his office.

9. Your most senior surgical colleague regularly pulls out of his on-call commitments and then you and one other surgeon have to cover. You have found out that he does this to do more private work and have now had enough. You are on your way to confront him about this.

10. The government has promised to expand your very basic endoscopy service but now want to withdraw funding to put more money into "primary care". Your local MP has arranged a meeting with the health minister and you have a few minutes to state your case.
SURGICAL AUDIT

What is Audit?

What is Audit?

What is Clinical Audit?

“A process that improves the quality of patient care through systematic review of care against explicit criteria and supports changes in practice to meet those criteria.”

What is Audit as a Research technique?

“Asessing practice honestly enough to notice differences in outcome and report such data.”

What is Research and what is Audit?

• Audit = ask “what happens”?
• Research = ask “why” or “how” does it happen

Clinical Audit is the link from Surgical Research to Safe Surgery.
Advantages of Clinical Audit:

1. It is cheap.
2. It does not need ethics approval (you still need to write a proposal).
3. It is based on clinical work.
4. It improves practice and patient care.
5. It makes you used to analysing clinical outcomes and reporting these honestly.
6. It takes you away from a “blame culture” for mistakes and teaches you to analyse the cause of errors.
7. It can improve patient safety.

Questions to ask in Critical Care:

1. What preventable causes of mortality and morbidity can happen in our unit?
2. How do we monitor or measure for these?
3. How do we collect reliable data?
4. How do we respond to the data?

Causes of preventable morbidity and mortality:

- Hospital acquired infections.
- Errors with medicine.
- Venous thrombo-embolism.
- Poor communication and handover.

Hospital Acquired Infections (record all these for all patients):

- MRSA
- *Clostridium difficile*
- Pneumonia
- Catheter related
- Wound infection
- CVP lines
- Peripheral venous catheters

Central and Peripheral vein catheters

Central catheters
- Insertion bundle =
  - Checklist including operator competent, full documentation, strict aseptic technique, site selection
- Maintenance bundle =
  - Daily checks of requirement, ensure dressing intact and changed at 7 days, any manoeuvre aseptic technique

Central vein catheters: Insertion checklist:
Peripheral vein catheters:
- Maintenance: CHECK DAILY
  - Ask: is vein catheter really necessary?
  - Remove if any extravasation / inflammation
  - Check dressings: Intact? Clean?
  - Remove if >72 hours
  - Hand hygiene before and after every time you handle a vein catheter or dressing.

Medicine Reconciliation
- Provide safe and effective medicines management systems for:
  - High risk medicines – e.g. anticoagulation
  - High risk processes – transfer from one point of care to another

What is the Aim of Medicine Reconciliation?
1. Safer prescribing
2. Reduced adverse events
3. Improved communication
4. Improved quality of care
5. Improved patient safety

High risk processes – transfer of care
- Accurate drug history is essential for safe prescribing
- Lack of knowledge of patients’ medication at transition points = important cause of adverse events
- Check drugs at every transfer; Not just on admission

Improving prescribing on admission
- Complete medication history – write full list of all medicines on admission + allergies
- When writing Kardex/drug chart
  - check against drug history in notes AND with patient
  - not just rewriting of previous chart
- Document a plan for each medication
  - how long,
  - switch from IV to oral antibiotics
  - when to review AND who will review

VTE prophylaxis protocols
- Standardised assessment of risk for all
  - Age, other factors, procedure type
- Low risk – early ambulation
- Moderate risk
  - Low dose heparin/low molecular weight heparin/ aspirin/ elastic stockings/ intermittent pneumatic compression
VTE prophylaxis protocols 2

- High risk
  - General: Low dose heparin/low molecular weight heparin plus elastic stockings/intermittent pneumatic compression
  - IVC filter if proven clot/high risk trauma
  - Consider post-discharge treatment

Hand Hygiene and Dress Code

- Hand Hygiene
  - Everyone, every time for every patient

- Establish reliable practices
  - Staff knowledge
    - Infection
    - Transmission
    - Hand hygiene and washing technique

Hand Hygiene and Dress Code 2

- Ensure at the point of care
  - Hand washing facilities
  - Soap
  - Alcohol gel
  - Gloves

- Monitor and feedback
  - Infection data
  - Hand hygiene compliance

Hand Hygiene and Dress Code 3

- Create a culture that supports reliable hand hygiene
- Empower all to be actively involved

- Dress code
  - Bare below the elbows (except wedding ring)
  - No ties
  - Aprons as appropriate

Poor Communication:

- Proper handover between teams:
  - Shifts
  - After on-call
  - Weekends

- Morning team meetings.

- Write notes of all encounters with every patient (in case notes and/or on bed charts).

Summary: How to respond:

1. Have the will to do things right.
2. Buy-in from ALL: surgeons, anaesthetists/intensivists, nurses, therapists, pharmacy, managers.
3. Discuss all results openly without finger-pointing (Escape the culture of blame).
4. Publish results where it can be seen (ON THE WALL).
5. Clinical leadership.
6. Recognise and EMPOWER all team members (so that a student nurse can remind a surgeon to clean his hands).
Questions?
How would you like to die?

Define a bad death

How do people die in hospital?
- Good?
- Bad?

How can we improve the care of the dying patient?
- Recognition of dying patient
- Treatment limitation?
- Treatment withdrawal?
- Futility?
- Palliation
- Who decides
  - Not withdrawl of care but change in goals of care
What can you do

• **Relieve suffering!!!**
  – Painkillers, sedatives, fans
• Stop curative therapies?
• Dying wishes?
• Help with patients unresolved issues?

Good result

• Inevitability of dying process recognised
• Patient dies peacefully
• No suffering
• Family happy that patient had a comfortable and dignified death

When Should We Involve Families in Decisions about Life Support?

• Not after the ICU team has decided it is time to withdraw life support
• Discussions with ICU team should occur on ICU admission
  – Review prognosis and potential outcomes
  – Bring family along with us as things change
• Discussion with other clinicians should occur prior to ICU admission

VALUE: 5-step Approach to Improving Communication in ICU with Families

• V… Value family statements
• A… Acknowledge family emotions
• L… Listen to the family
• U… Understand patient as a person
• E… Elicit family questions

Tips for Talking with Family About Withdrawal of Life Support

• When life support is withdrawn, stress
  – “Care” will not be withdrawn
  – Aggressive palliation will be used
  – Avoid making firm predictions about the patient’s clinical course
  – Time to death variable
• Offer option of family being present
  – Family presence may be associated with higher PTSD
• Describe process so they know what to expect

Cultural Differences

• Try to understand & respect cultural differences
• Strike right balance in taking ethically right decisions and conforming with family wishes
• Ensure that any decision taken is finally in the patient’s benefit
Needs of the Patient

- Receiving adequate pain and symptom management.
- Avoiding inappropriate prolongation of dying
- Achieving a sense of control
- Strengthening relationships with loved ones.

Questions?

Summary: Ethical and Practical Issues in End-of-life Care on ITU

- Withdrawal of life support is not just a clinical procedure
- Decision-making about end-of-life care common in the ICU and should start early
- Shared decision-making as default
  - Need to adapt to individual patient and family
  - Consider discussion of organ donation early if appropriate
- Interdisciplinary communication essential
- Incorporate and honour cultural differences
2.15

Management of Surgical Emergencies
Part 1 : Critical Care

Final Course Summary

Learning Outcomes:
Did you learn something about?
1. Defining and recognising critically ill patients in Surgery.
2. A system of assessment based on ABCD-T.
3. A system for rapid but systematic decision making and management.
4. Principles of management applicable to all categories of surgical patients.
5. Emergency procedures to support the critically ill surgical patient.

Most of us manage unexpected events badly

Prompt, simple actions save lives and prevent complications.

A systematic approach maximises success.

For ALL patients – Prevention is Better than Cure

Prevent morbidity by:
• prediction
• repeated clinical assessment
• early detection of deterioration or failure to progress
Pathophysiology

- In patients who had major surgery, with serious trauma or surgical sepsis the physiological pathways of deterioration are the same and therefore the principles of physiological support is similar.
- Physiology is different in pregnancy, young children and the elderly.

What is Critical Care?

1. Good clinical observations.
2. Rapid clinical assessment of deteriorating patients, using ABCDE.
3. Emergency support of ABCD to allow time for more thorough assessment and treatment.
4. Thorough further assessment using all available information.
5. Effective decision making at different levels.
6. Specific interventions to support critical organ function and prevent physiological deterioration.

Four Essential Steps

1. Primary Survey
2. Resuscitation
3. Secondary Survey
4. Decide

DECIDE and PLAN:

Is this patient STABLE or UNSTABLE?

And manage accordingly

If at any time the patient’s condition deteriorates you must go back to the start and Re-assess the ABCs

Assessment Checklist A:

- Did I complete primary survey (ABCDE)?
- Have I completed resuscitation?
  - O₂?
  - IV fluids?
- Did I complete secondary assessment?
  - History (Notes; Reports)?
  - Thorough examination?
  - Chart review (Vital signs/MEWS; Fluid balance; Drugs)
  - Results?
  - Anyone I still wanted to speak to?
**Assessment Checklist B:**

- Is my patient...
  - STABLE?
  - UNSTABLE?
  - Am I unsure?
- Is the problem...
  - Diagnostic
  - Therapeutic
  - Both
- Do I need to intervene...
  - Diagnostic?
  - Therapeutic?
  - Ask for help?
- Meanwhile, am I supporting ABC-T optimally?

---

**NO more Questions please!!**

*Thank You Very Much*
The development of this critical care course started by teaching two groups of health officers (non-physician surgeons) in Hawassa, Ethiopia. Courses were also run for a mixture of consultant surgeons, surgical and anaesthetic trainees, anaesthetic assistants in Ethiopia and Rwanda, on invitation by their respective national surgical societies. For each of these courses the syllabi varied slightly to accommodate local preferences. The most relevant topics covered are represented in this section.

### 3.1 Damage control Resuscitation and Surgery

This is essential knowledge for all surgeons who work with major trauma. It is recommended that faculty read up the latest evidence before presenting this tutorial as this a rapidly expanding field of clinical research.

### 3.2 Paediatric head injuries

An important tutorial for those who deal with children; a reminder that they are not small adults.

### 3.3 Burns in Children

Again different principles apply to primary and secondary assessment, airway management, fluid therapy, nutritional requirements and recovery of children with burns.

### 3.4 Burns adjuncts

This tutorial briefly covers pain relief, preventing infection, dressings, nutrition, management of compartment syndrome, contractures and rehabilitation.
3.5 Snakebite
Snakebite is a neglected tropical disease. In low income countries anti-venom is generally not available. This tutorial discusses the pathophysiology of different venom types and how to manage the different clinical syndromes caused by envenomation.

3.6 Systemic complications of Musculo-Skeletal injuries
A concise tutorial to discuss the critical care aspects of fat embolism, compartment syndrome and myoglobinuria.

3.7 Post-operative Recovery in low resource settings
This tutorial has developed from a talk given by Dr Martin Clark to recovery room nurses and at a global surgery session at an ASGBI conference; contents is covered in a paper to be published in the ASGBI Journal of June 2014. It focuses on using simple ABCDE principles in monitoring a patient who has had an operation, especially after general anaesthesia, and in applying the same basic principles in decision making with any concerns about a post-operative patient.
3.1

Management of Surgical Emergencies
Part 1: Critical Care

Damage Control in
Emergency Surgery

Damage Control
• Developed in military surgery
• Damage control resuscitation
• Damage control surgery for trauma
  – Laparotomy
  – Orthopaedic
  – Neurosurgery
• Damage control surgery for sepsis

Lethal Triad
1. Coagulopathy
2. Hypothermia
3. Metabolic Acidosis

Coagulopathy
• 1 Early trauma induced coagulopathy
  – Up to 25% of traumas
  – Occurs immediately
• 2 Secondary
  – Continuing losses
  – Dilution with crystalloids
  – Tissue hypo-perfusion → acidosis and hypothermia
  – (Coagulation is enzymatic process - cooling alters enzyme function)

Hypothermia
• Loss of blood
• Vasoconstriction
• Decreased tissue perfusion and metabolism
• Exposure
• Resuscitation with cold fluids
<table>
<thead>
<tr>
<th>Metabolic Acidosis</th>
<th>DL Resuscitation for Rapid Blood Loss: Management principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Why?</td>
<td>• Avoid Lethal Triad</td>
</tr>
<tr>
<td>• Reduced tissue oxygenation</td>
<td>• Haemostatic resuscitation 1:1:1</td>
</tr>
<tr>
<td>• Anaerobic metabolism</td>
<td>• Tranexamic Acid????</td>
</tr>
<tr>
<td>• Lactic acid accumulation</td>
<td>• Hypotensive resuscitation = permissive</td>
</tr>
<tr>
<td>• Resuscitation with Saline &amp; PRC</td>
<td>hypotension (keep systolic ≤90 mmHg or to keep radial pulse</td>
</tr>
<tr>
<td></td>
<td>palpable and cerebration intact)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Damage Control Surgery for abdominal trauma: STEPS:</th>
<th>DCS 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Laparotomy:</td>
<td>2. In ICU:</td>
</tr>
<tr>
<td>• Four quadrant packing</td>
<td>• Warm patient up</td>
</tr>
<tr>
<td>• Clamp rapid bleeding</td>
<td>• Correct coagulopathy</td>
</tr>
<tr>
<td>• Shunts for major arterial injuries</td>
<td>• Wait for acidosis to reverse</td>
</tr>
<tr>
<td>• Staple or tie off or drain intestinal injuries</td>
<td>• Further DCR with blood products 1:1:1</td>
</tr>
<tr>
<td>• Leave abdomen open</td>
<td></td>
</tr>
<tr>
<td>Maximum 90 minutes from emergency room to ICU.</td>
<td>3. Back for definitive surgery after 12-24 hours.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DCS 3: Orthopaedic surgery:</th>
<th>DCS 4: Neurosurgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pelvis: stabilise with exoskeleton or tie up</td>
<td>• For head injuries in association with other major injuries where neurosurgery can have major impact on outcome:</td>
</tr>
<tr>
<td>• Long bones:</td>
<td>• Subdural</td>
</tr>
<tr>
<td>• Guillotine amputations</td>
<td>• Extradural</td>
</tr>
<tr>
<td>• Rapid exoskeleton</td>
<td></td>
</tr>
<tr>
<td>• Back slab</td>
<td>• Burr holes and evacuate clot.</td>
</tr>
<tr>
<td>• K-wires across the knee and vascular shunts</td>
<td></td>
</tr>
</tbody>
</table>
DCS 5: Cardio-thoracic injury

- Penetrating cardiac injury:
  - Thoracotomy/sternotomy
  - Incise pericardium
  - Evacuate clot
  - Staple knife wound with skin stapler.
- Severe lung injury:
  - Thoracotomy
  - Evacuate clot
  - Clamp lung hilum with soft bowel clamp
  - Staple or ligate lobe

DCS 6: Complex injuries

- Duodenum
- Pancreas
- Porta hepatis
- Oesophagus
- Pelvis
- IVC and Aorta

Damage Control Laparotomy for Sepsis
e.g. Perforated diverticulitis;
   Multiple bowel perforations with typhoid or lymphoma (after steroids):
   - Drain
   - Copious wash-out
   - Tie off small bowel or ileostomy
   - Colostomy

Questions?

Summary

- Do not be afraid to do minimum surgery to keep patient alive and to come back later.
- Teamwork and good communication essential (with anaesthetists, ICU, theatre staff, blood bank, labs, family).
3.2

Management of Surgical Emergencies
Part 1: Critical Care

PAEDIATRIC HEAD INJURIES

- Commonest cause of paediatric trauma death (1-15 years)
- Responsible for significant numbers of permanent brain injury
- In UK commonest causes are:
  - 1. RTC
    - Child as pedestrian
    - Child as cyclist
    - Child as passenger in vehicle
  - 2. Falls
  - 3. NAI (in infancy)

Pathology

- Primary brain injury - at time of accident
  - Cerebral contusion/lacerations
  - Diffuse axonal injury
  - Associated with subdural, extradural, intercerebral, subarachnoid haemorrhage
- Secondary brain injury
  - Sometime after primary insult - minutes, hours, .... days

Secondary brain injury

- Ischaemia
  - As a result of reduced CBF because of raised intracranial pressure
  - As a result of hypoperfusion (anaemia, hypotension)
- Metabolic insult (glucose)
- Hypoxia
- Fever
- Fits
- Infection

Raised Intracranial Pressure

- Children are especially prone to ICP rises
- Mainly due to cerebral oedema
- But also expanding intracranial lesions
- Take care with infants
  - Unfused sutures can allow significant intracranial expansion without initial symptoms/signs
  - Can be significant bleeding to cause Hb drop
  - Vascular scalp wounds can be source of hypovolaemia

- Pathology

- Primary brain injury - at time of accident
  - Cerebral contusion/lacerations
  - Diffuse axonal injury
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Raised Intracranial Pressure

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  - Can be significant bleeding to cause Hb drop
  - Vascular scalp wounds can be source of hypovolaemia
Significant head injury

- Pay attention to
  - mechanism of injury
  - ? LOC
  - reduced conscious level/not fully responsive in ED
  - Obvious neurological signs or symptoms (convulsions, headache)
  - Evidence of penetrating injury

Primary Assessment - ATLS principles

- A with cervical spine control
- B
- C
- D
  - AVPU initially
  - Formal GCS (see later)
  - Lateralising signs
  - Tone
  - Pupils
  - Signs of external head injury (contusions, lacerations, CSF leak, haemotympanum etc)
- E
  - Temperature and blood sugar level

Resuscitation - ATLS principles

- Prevent secondary brain injury
  - Avoid hypoxia
  - Avoid hypotension- (maintain CPP)
  - Maintain normoglycaemia
  - Maintain normothermia at least ( ? Role for controlled cooling not proven)
  - Maintain normocapnia

Investigations

- Bloods as per usual ATLS protocols
- ABG to assess ventilatory status
- SXR- decreasing role if not obsolete
- Other trauma x-ray views as appropriate
- Combined CT head and neck

Intubation/Ventilation

- Coma: GCS <8
- Loss of protective airway reflexes
- Ventilatory insufficiency
- Respiratory irregularity
- Agitation and requiring immediate CT- if skills exist
- Aim for normocapnia NOT hyperventilation

Immediate CT

- NICE/SIGN guidelines
  - Witnessed LOC >5mins
  - Retrograde/antegrade amnesia >5mins
  - > 3 episodes of discrete vomiting
  - GCS 13 or less (over 1 year old)
  - GCS 14 or less (under 1 year)
  - Abnormal drowsiness
  - Focal neuro deficit- including seizure
  - Any signs of depressed/open skull fracture
  - Any signs of basal skull fracture
  - If < 1 year and bruise, swelling or lac > 5cm
  - Dangerous mechanism of injury
Glasgow Coma Scale (4–15 years)

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye opening</td>
<td></td>
</tr>
<tr>
<td>Spontaneously</td>
<td>4</td>
</tr>
<tr>
<td>To verbal stim</td>
<td>3</td>
</tr>
<tr>
<td>To pain</td>
<td>2</td>
</tr>
<tr>
<td>No response to pain</td>
<td>1</td>
</tr>
<tr>
<td>Best motor response</td>
<td></td>
</tr>
<tr>
<td>Spontaneous normal facial/oromotor activity</td>
<td>5</td>
</tr>
<tr>
<td>Less than usual spontaneous ability or only response to touch stimuli</td>
<td>4</td>
</tr>
<tr>
<td>Vigorous grimace to pain</td>
<td>3</td>
</tr>
<tr>
<td>Mild grimace to pain</td>
<td>2</td>
</tr>
<tr>
<td>No response to pain</td>
<td>1</td>
</tr>
</tbody>
</table>

Child’s Glasgow Coma Scale (<4 years)

<table>
<thead>
<tr>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye opening</td>
<td></td>
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<tr>
<td>Spontaneously</td>
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</tr>
<tr>
<td>No response to pain</td>
<td>1</td>
</tr>
</tbody>
</table>

Best grimace response

• Best Grimace Response
• Can replace verbal score in preverbal children/intubated children

Spontaneous normal facial/oromotor activity | 5
Less than usual spontaneous ability or only response to touch stimuli | 4
Vigorous grimace to pain | 3
Mild grimace to pain | 2
No response to pain | 1

Deteriorating Conscious Level

• Rule out other causes but likely due to raising intracranial pressure
• Nurse in 20 deg head up
• Ventilate to low normocapnia (PaO2 4-4.5 kPa)
• Mannitol 0.5g/Kg IV over 20 mins (hypertonic saline alternative)

Signs/symptoms of rising ICP

• Uncal herniation- dilated unresponsive ipsilateral pupil
• Central herniation- respiratory irregularity including hyperventilation and hypoventilation
• Rising BP
• Dropping pulse rate
• Dropping GCS including abnormal posturing
• Seizure
• Increasing headache/vomiting
• Papilloedema not seen acutely

Neurosurgical consult

• Persisting reduced GCS
• Deteriorating GCS
• Positive CT scan finding
• Focal neurological deficit
• Definite or suspected penetrating injury/CSF leak
• Attention to SAFE and HIGH QUALITY transfer but some transfers are ‘time critical’ at the expense of quality (expanding intracranial haematoma)

Questions

• Uncal herniation- dilated unresponsive ipsilateral pupil
• Central herniation- respiratory irregularity including hyperventilation and hypoventilation
• Rising BP
• Dropping pulse rate
• Dropping GCS including abnormal posturing
• Seizure
• Increasing headache/vomiting
• Papilloedema not seen acutely
Learning Outcomes

- Differences between adults and children
- Mechanism of burns in children
- Management principles
- Fluid management

Differences between Children and Adults

- Body proportions
  - Larger body surface area:body weight ratio
  - Head larger in proportion to body
    - <1 year head = 18%
    - 1 - 2 year = 17%
    - 2 - 3 year = 16%

- Higher metabolic rate
- Increased heat loss
- Greater fluid requirement

- Thickness of skin – children's skin is thinner
- Avoidance reflexes are slower
- Social and emotional development, non accidental injury

Assessing severity: surface area in children

- The 'Rule of 9's' method is too imprecise for estimating the burned surface area in children because the infant or young child’s head and lower extremities represent different proportions of surface area than in an adult.

Differences in Surface Area

- The skin preservation of body surface area (% of body weight)
Mechanism of Burn

- Scald is most common form of burn in children.
- Protective reflexes not fully developed so contact time often longer.
- Consider non-accidental injury.

Fluid Resuscitation in Children

IV Fluids – place two large bore cannulae (or intra-osseous) in ALL Children > 10% TBSA.

PARKLAND FORMULA = 4ml/kg/TBSA as crystalloid. (Use colloid after first 12 hour to reduce risk of cerebral oedema).

FIRST HALF IN FIRST 8 HOURS FROM BURN
SECOND HALF IN SUBSEQUENT 16 HOURS
PLUS MAINTENANCE dextrose/Na+
- 100mg/kg/24h for first 10kg
- 50mg/kg/24h for 10 – 20kg
- 20 mg/kg/24h for 20-30kg

Use 4ml/kg rather than 3ml/kg when airway injury is suspected or associated co-morbidity demands increased urine output.

Example

MB fell into a puddle of hot oil that had been spilled. The accident happened 2 hours ago. She is 4 years old. She weighs 20kg. She has 30% TBSA mixed depth burns. The anaesthetist has intubated her but had to leave and has asked you to calculate fluid requirements.

Example

PARKLAND FORMULA
Crystallloid
4ml/kg/TBSA
= 4 x 20 x 30 = 2400ml in 24h
1st ½ (1200ml) in 1st 8h
1200ml in next 16h
PLUS
Maintenance at 100ml x 10 + 50ml x 10 = 1500ml/24h
= 62.5mll/h
How effective is your resuscitation?

- Patient GCS, irritation, mental state
- Urine output and colour
- HR and BP
- ABG
- U & Es

Questions?

Summary

- Children are physiologically different.
- Mechanism of burn is usually scald.
- Management principles are the same.
- Always start with ABCDE.
- Increased fluid requirements.
- Re-assess regularly to evaluate response to therapy.
3.4

Management of Surgical Emergencies
Part 1 : Critical Care

BURNS: Management adjuncts

Learning Outcomes

- Pain relief
- Preventing Infection
- Nutrition
- Compartment Syndrome
- Preventing contractures
- Rehabilitation

Pain Relief

- Burns are painful – even in full thickness burns the surrounding skin is sensate.
- Use IV access and opiate analgesia

Prevention of Infection

- The burn wound is susceptible to infection.
- Immediately wash the burn with antibacterial solution (soap and water) to remove debris.
- Use simple non-adhesive (preferably transparent) dressings should be applied for transfer to the hospital e.g. cling film or a clean clear plastic bag.
- Under aseptic conditions debride the burn wound of dead tissue and deroof large blisters.
- In hospital wash thoroughly with antibacterial solution (e.g. chlorhexidine).
- Re-assess burn depth at 48 hours.
- Tetranus prophylaxis.

Dressings

Clean superficial dermal burns
Deroof large blisters and prevent the underlying papillary dermis from becoming dried out/infected by using biologically compatible plastic film dressing e.g. opsite/tegaderm/jelonet.

Flamazine can be used to chemically deroof blisters that are a few days old. For large torso scald burns in children calcium alginate dressings may be used – change only every 3-5 days and are easily removed in the bath.

Infected/contaminated burns
- Should be dressed with anti-microbial agents e.g. silver sulphadiazine (SSD) or iodine based dressings – best changed daily, with sterile technique.
Nutrition

- Patient’s energy and protein requirements will be extremely high due to the catabolism of trauma, heat loss, infection and demands of tissue regeneration.
- Establish enteral feeding as soon as possible.
- If necessary, feed the patient through a nasogastric tube to ensure an adequate energy intake (up to 6000 kcal a day).
- The passage of food through the bowel prevents damage to the bowel wall and translocation of intestinal bacteria into the circulation.
- H2 receptor antagonist should be given to reduce the risk of gastric stress ulceration.
- Ileus may be occur, especially in burns >20%.

Nutrition [2]

- Anaemia and malnutrition prevent burn wound healing and result in failure of skin grafts.
- High protein, high calorie oral intake should be encouraged (regular small snacks).
- Eggs, milk and peanut butter are good.
- Think what other supplements are locally available.

Compartment Syndrome

Definition

- Raised pressure within a closed space to the extent that circulation and the function of tissues within that space is compromised.

Most common in the fascial compartments of the upper and lower limbs, but also in the face and abdomen. In burns it is caused by the leathery nature of full thickness burns combined with interstitial oedema. It may also occur due to muscle swelling following electrical burn.

Symptoms and signs = 5 P’s
- Pain aggravated by passive movement of the muscle group
- Paraesthesia
- Pulslessness
- Periarticularly cold
- Paralysis – usually a late finding and poor prognostic indicator

Fasciotomy is required if the swelling is confined to the fascial compartments.

Escharotomy is required if full thickness burns are the cause.

Preventing Contractures

Burns over joints and web-spaces. Deep burns and infected burns prone to hypertrophic scarring most at risk.

Start physiotherapy early (within first few days.) The position of comfort is the position of contracture. Maintain joints in positions which will prevent contracture by splinting and daily passive range of movement routines.

Take special care of pressure areas in the immobile patient.

Preventing Contractures: correct positions

- Neck – extension
- Axilla – abduction
- Elbows – extension
- Wrists – neutral/extension
- MCPJ – flexion
- IPJ – extension
- Knees – extension
- Ankles – 90° dorsiflexion

Rehabilitation

- Physiotherapy.
- Moisturising improves scar appearance.
- Antihistamines for itch
- Surgical correction of contractures – z-plasty and skin grafts.
- Cosmetic disability – multiple scar revision surgeries, camouflage
- Psychological and Spiritual support.
Questions?
Syndromic Management of Snake Bite

Stephan Dreyer
(Foundation Trainee, Edinburgh, Scotland)

Introduction

- Incidence around 30-80 per 100 000
- 40% do not identify snake
- Syndrome depends upon type of venom

Types of snake venom

- Cytotoxic
  - Puff adder, viper
- Neurotoxic
  - Mamba, Egyptian Cobra
- Mixed (cyto- and neurotoxic)
  - Spitting cobra
- Haemotoxic
  - boomslang

Cytotoxic

- Puff adder, Gaboan adder, Spitting Cobras
  - Local necrosis
  - Consumption coagulopathy
  - Severe local reaction
  - Leads to Painful Progressive Swelling
  - DO NOT use tourniquets/compression!!!
Neurotoxic

- Mamba, Egyptian Cobra
  - Causes Progressive Weakness
  - Dysfunction of smooth and skeletal muscle
  - Do have sensory function!!
  - Tongue weakness and eyelid paralysis
  - Can cause cardiotoxicity – arrhythmias

Haemotoxic

- Boomslang
  - Disseminated Intravascular Coagulation
  - Initially widespread thrombosis
  - Leads to bleeding from mucosal membranes

Treatment

- First Aid
- Antivenom
- Syndromic management
  - Safe and evidence-based
  - Anti-venom rarely necessary
  - Snake identification not essential

First Aid

- No definitive measure
- Sutherland Compression
- Tourniquets should not be used!!!
  - Except mamba/cobra bites!
- ABC principle in neurotoxic venom

Anti-venom

- Always confirm envenomation
- All Mamba bites!!
- Life threatening bites
  - Respiratory
  - Continued bleeding
- Limb threatening
  - Compartment syndrome

Anti-venom II

- Hospital setting
- Doctor/Surgeon present
- Treat anaphylaxis early
  - Adrenaline
  - Hydrocortisone - controversial
SYNDROMIC TREATMENT

Painful Progressive Swelling

- 90% of snake bites
- Due to superficial and deep necrosis
- May lead to Compartment syndrome (rare)
- Can cause coagulopathy (puff adder)
- DO NOT use a tourniquet!!

Painful Progressive Swelling II

- Local
  - Fluid resuscitation + Elevation + Analgesia
  - Blisters → leave alone
  - Deep haematoma → leave/aspirate/drain
  - Necrosis → debride after 5-7 days
- Antibiotics
  - Only if signs of infection
  - Gram negative cover

Painful Progressive Swelling III

- Compartment Syndrome
  - Fluid resuscitation + Elevation + Analgesia
  - Antivenom
  - IV Mannitol
  - Treat coagulopathy (if present)
  - Fasciotomy
Progressive Weakness
- Early recognition is key
  - Tongue and eyelid weakness
- Transfer early
  - Anti-Venom
  - Ventilation
  - Cardiovascular support
- Supportive care
- Self limiting

Bleeding
- Uncommon
- Consumption coagulopathy
  - Can be due to tissue necrosis
- DO NOT use Heparin!!
- Anti-venom

Questions?

Summary
- No definitive first aid
- Tourniquets should not be used if snake unknown
- Syndromic management is safe and effective
- Majority of bites do not need anti-venom
- Anti-venom must be given in a hospital

Summary II
- Antibiotics only indicated if signs of infection
- Do not use Heparin for consumption coagulopathy
- Puff adder bites cause most cases of bleeding
- Compartment syndrome is uncommon

Bibliography
- All photos courtesy of Google Images
Management of Surgical Emergencies
Part 1 : Critical Care

SYSTEMIC COMPLICATIONS
of
MUSCULOSKELETAL TRAUMA

Learning Outcomes

1. Fat Embolism
2. Compartment Syndrome
3. Myoglobinuria

Fat Embolism

• Fat droplets ➔ lungs: impair gas exchange
• Cause local inflammatory response ➔ ARDS
• Most establish within 48hrs of precipitating event (useful for distinguishing from VTE)

Causes

• Long bone fractures
  – High energy
• Pelvic fractures
• Polytrauma
• Instrumentation of medullary canal (inc elective surgery)
Criteria for Fat Embolism Syndrome by Gurd and Wilson

Major Criteria (1 of the following + 4 minor)
- Petechiae in a vest distribution
- Hypoxaemia with PaO2
- Central nervous system depression disproportionate to hypoxaemia
- Pulmonary oedema

Minor Criteria (4 of the following + 1 major)
- Tachycardia (heart rate > 110 beats per minute)
- Pyrexia (temperature ≥ 38.5°C)
- Emboli visible in retina
- Fat in urine
- Fat in sputum
- Unexplained drop in haematocrit or platelet count
- Increasing erythrocyte sedimentation rate

Treatment
- Supportive
  - May need ventilatory support
  - Haemodynamic support
- Stabilise fractures early (reduce incidence)
- Corticosteroids – no clinical evidence

Questions?
Compartment Syndrome

Pathophysiology:
- Pressure within a fascial compartment increases enough to compromise capillary pressure and tissue perfusion
  - Ischaemia
  - Necrosis.
- Usually happens in osteofascial compartments in limbs but can also happen in facial muscles and the abdomen.

Causes
- Trauma e.g. long bone fractures, crush injury, soft tissue contusion, electric shocks (traumatised tissue is more susceptible due to increased metabolic rate).
- Reperfusion injury e.g. after revascularisation for acute limb ischaemia.
- Tight casts / compression bandaging.
- Burns (circumferential!).
- Intra-compartmental bleeding.

Clinical Picture
- History:
  Severe progressive pain, more than expected for the specific injury.
- Examination:
  - A tense, tender muscle compartment.
  - Pain on passive stretch of muscles within the compartment.
- Classic 6 P's = late, unreliable.

Pitfalls
- Distal pulses often present during CS
- CS can occur in thigh, upper arm, hands, face (burns).
- Can occur after open fractures.
- Pain eventually decreases as nerves become ischaemic.
- Clinical signs not clear in impaired consciousness and in children – consider fasciotomy if unsure.
- Pulse oximetry is misleading with CS.
- Local anaesthesia may mask CS.
- Investigations (e.g. Compartment pressure usually not necessary and can give misleading results).

Treatment
- If Equivocal Signs and Reversible Cause:
  1. Fix the cause e.g.
     - Split cast and dressings
     - Do escharotomy
     - Evacuate deep haematoma
  2. Elevate
  3. Observe 30 minutes: If not significantly better, do fasciotomy.

- If established signs, or unsure:
  1. DO Fasciotomy = Open ALL osseofascial compartments through long skin incisions.
  2. Debride necrotic muscle.
  3. Delayed primary closure or Skin graft.
  4. Protect patient against reperfusion injury.
Leg compartments

Myoglobinuria

Reperfusion Syndrome with Rhabdomyolysis

Pathophysiology
- Ischaemia of striated muscle cells.
- Ultimately $\Rightarrow$ ATP depletion
  $\Rightarrow$ Na$^+$/K$^+$/ATPase malfunction
  $\Rightarrow$ NaCl/H$2$O influx $\Rightarrow$ osmotic swelling.
- $\Rightarrow$ Ca-ATPase malfunction $\Rightarrow$ Ca$^{2+}$ influx $\Rightarrow$
  activation of proteases and lipases.
- $\Rightarrow$ Cell death and disruption.
- $\Rightarrow$ Release of H$^+$, K$^+$, Mb when perfusion restored.

Causes
- Muscle ischaemia (Compartment Syndrome) with reperfusion.
- Muscle trauma (crush injury, burns).
- Infections with muscle necrosis.
- Drugs and toxins
- Excessive muscular activity
- Temperature extremes
- Prolonged immobilisation
- Genetic disorders
- Connective tissue disorders

Clinical Features
- Muscle pain / swelling / weakness
- Signs of underlying cause
- Tea coloured urine (Myoglobinuria)
- Acute renal failure
- Increased CK $>5x$
Complications

- Severe Metabolic Acidosis
- Hyperkalaemia → arrhythmias
- Hypocalcaemia
- Acute renal failure
  - Hypoperfusion (shock, dehydration)
  - Acidosis
  - Myoglobin can block distal tubules
- DIC
- Hepatic dysfunction

Management 1

- Treat ABC abnormalities (best HDU/ICU)
- Aggressive fluid resuscitation
  - 1.5L NaCl / hour
  - Aim urine output 200-300mls / hour
  - Avoid K+ and lactate containing fluids
- Correct Hyperkalaemia, Hypocalcaemia.

Management 2

- Mannitol
- Alcalinize urine (Bicarbonate)
- Treat cause early
  (Be aware – crush victims and compartment syndrome only develops rhabdomyolysis after compression is relieved!)
- Treat complications aggressively.

Questions?
Management of Surgical Emergencies
Part 1: Critical Care

Early Post-operative Care with limited resources

IF THEY ARE GOOD ENOUGH TO OPERATE ON THEY ARE GOOD ENOUGH TO CARE FOR AFTERWARDS

Scale of the problem – Uganda Anaesthetists

- Unavailable:
  - Pulse oximeter 74% (70% sub-sahara africa)
  - Tilt table 23%
  - Oxygen 22%
  - Tracheal tubes 22%
- Intermittent
  - Electricity 80%
  - Water 44%
  - IV fluids 30%

Unsafe Adult / Paediatric / Csection 77% / 87% / 94%

Hodges et al Anaesthesia 2007 62 4-11

Perioperative mortality

- Malawi
  - Maternal mortality 1.05%
  - 80% deaths postoperatively
- Togo
  - 2.57 peri-operative deaths / 100 pts (2.57%)
  - 93% avoidable

- Fenton et al BMJ 327 587-11
- Tropical doctor 2005 35 220-2

Lessons from real life

- Mulago Hospital, Uganda
- Has recovery with SpO2
- Didn’t trigger action
- Nurse patient ratio 1:90 on general wards

Kagando

Corridor
No staff
No oxygen
No monitors
What about ICU? More lessons from real life

- Capacity
- Expensive
- Intensivist 1/week, works for free, ignored
- Care poor
- FiO₂ = 1.0
- All patients pressure sores
- Suctioning dangerous
- Patients in own faeces
- Prescribed treatments not given
- Iatrogenic injuries

Problems

- Resources
- Staff
- Training

So what can we do? Good recovery

- Trained recovery nurse
- Empowered
- Communication
- Time
- Equipment

Recovery nurses UTH Zambia

- Power imbalance
- Could not recognise / treat airway obstruction
- Not treat hypoxia
- Not recognise / treat inadequate reversal
- Poor on hypotension

What you need to say to nurse

- If noisy / obstructed breathing → open airway
- If hypoxia give oxygen
- If not breathing / poor breathing → bag patient
- If hypotension / tachycardia give fluid
- Discharge criteria
- To anaesthetist “Don’t start next case till happy”
- CALL ME IF CONCERNS

What you say to relative / parent

- “Sit baby on lap and find me if they stop breathing”
- “Watch them and if they stop breathing come and find me”
- “Don’t leave for next 20 minutes till I come out again and find you”
Alternative Recovery easy as ABC

- ABCDE
  - Airway intubated / extubated / LMA
    - Remove airway once eyes open / hands go to tube
  - Patent / partially or fully obstructed?
    - If obstructed airway manoeuvres, suction, adjuncts
  - Give oxygen till fully awake
  - Monitor SpO2
  - SIT UP

Recovery

- Breathing
  - Rate, depth, symmetry
  - Too slow - opiates
  - Too fast - pain, lung pathology, acidosis
  - If not breathing adequately:
    - Give / turn up oxygen
    - Ventilate patient, bag mask, reintubate

- Circulation
  - Hypotension is due to hypovolaemia unless already septic pre op
  - Hypotension is a LATE SIGN of hypovolaemia!!!
  - Pre and intraoperative fluid losses
  - Ongoing losses
    - Drains, wounds, dressings
  - Assess peripheral skin temp, cap refill, pulse, BP
  - Fluid boluses as required
  - Assess effects

- Disability
  - Intubated patients will have been given a muscle relaxant
    - Assess ability to lift head off bed for 5 seconds, ability to grasp fingers, can they breath deeply and cough?
    - If no, consider inadequate reversal of muscle relaxant, assist ventilation, inform anaesthetist.
  - Confusion immediately on regaining consciousness is common, allow patient to come through it.

Exposure

- Exposure
  - Keep warm / warm up if cold
  - Monitor wound / drains
  - Monitor SpO2, heart rate, BP
  - Ensure post op instructions recorded in notes and handed over to ward nurse
Common problems

• Patient desaturates in recovery
  – Increase / apply oxygen,
  – Attach SpO2 monitor if not attached
  – If partial / full obstruction → airway manoeuvre
  – Is ventilation adequate? If not assist
    • Rate, depth, symmetry
  – If in doubt bag with 100% oxygen and call for help
  – Remember AIRWAY → OXYGEN → VENTILATE

• Hypotension
  – Due to hypovolaemia till proven otherwise
  – Give fluid and monitor effect
  – Is the patient bleeding?
    • Wound, drains, abdomen other hidden sources
  – Check charts / anaesthetic record
  – Spinal / epidural will not give new onset hypotension if BP OK in theatre.
  – Ask do I need a surgical / anaesthetic review?

Pain

• Titrate analgesia to effect
• Ensure patient can breathe deeply and cough

Ward handover

• Surgical / anaesthetic orders
• Is patient alert, comfortable, physiologically stable?
• Ensure theatre documentation filed in notes

The situation can improve

• Zambian recovery nurse on being given a scenario of inadequate reversal
• “I do not know what is wrong with the patient but I would bag the patient with oxygen and call for help”

Questions?
Assessment in Critical Care courses

Introduction

MSE is a Pass or Fail course. Course participants are expected to meet certain minimum criteria to successfully complete the course and receive a certificate. These criteria include attendance at all sessions, active participation in discussions and skills sessions, proficiency in cardio-pulmonary resuscitation (CPR) skills, satisfactory scores in continuous assessment and acceptable scores in written tests.

When the critical care course runs independently it depends on the organising body whether they would want to award a certificate for attendance or successful completion; if it is the latter, participants have to be assessed and scores recorded within the same assessment framework as used within the MSE course.

Please refer to the Assessment in MSE booklet, available for free from Alba CCCD to recognised faculty, for detail on the Assessment Framework and methods within the MSE course.
MSE Critical Care Module Registration & Attendance sheet.

**GROUP:**

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Continuous scoring system at all teaching stations in the critical care (CC) module of MSE (2013):

**Scoring system:**

Score participants as 0-4 where:

- 0 = absent
- 1 = clear fail
- 2 = borderline
- 3 = safe pass
- 4 = excellent

This generic scoring system will be applied to all teaching stations. Tutors must use their insight into teaching the relevant topic to decide whether they score for knowledge, judgement and decision making, practical skills, teamwork or communication.

ALS practice (CPR), airway management and spinal injury transfer are specific practical skills stations. All participants must demonstrate adequate CPR skills and must satisfactorily participate in the other two. Log roll will also test teamwork.

The SBAR communication station must give each participant the opportunity to demonstrate satisfactory communication skills and use of the SBAR system.
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Sum/10

Pass/Fail

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# Critical Care Participants' Feedback Form

**Date and Venue of course:**

Please circle the number that most accurately reflect your opinion where 1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied.

**How satisfied are you with what you learned on these topics:**

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**How did you find?**

**Assessment methods**

**Organisation and Faculty participation**

**What was very good?**

**What could have been better?**

**Other comments?**