GENERAL PRINCIPLES Of CRITICAL CARE MANAGEMENT

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" 'Life Saving' is the First Priority "

" 'Try to Avoid Iatrogenic Trauma' is the Must"

Introduction

- With a projected increase in the world population from 7.2 billion currently to 9.6 billion by 2050, the population of the 49 least developed countries is expected to double From 900 million in 2013 to 1.8 billion.

- As such, the number of patients who may need critical care will increase substantially, with a majority of these in resource-restricted settings. Coupled with an ageing global population, the complexity of the challenge will be enormous.

Introduction

The aging population and the increasing trend to provide medical and surgical services to patients with higher acuity of illness and co-morbidity is already resulting in a higher demand for ICU care, yet intense care currently provide care to only 10 percent of all ICU patients in the Bangladesh, mostly in larger hospitals and teaching institutions.

Critical illness

Critical illness is a life-threatening condition that requires critical care intervention in order to ensure a patient's survival. A critically ill patient who may have multiple organ failures requires timely specialty intervention and multi-organ treatment and support.

Critical and Care

Critical care refers to two related processes.

Firstly, ‘critical’ refers to discernment or recognition of a crucial and a decisive turning point, a potentially life-threatening deterioration of the patient’s condition,

Secondly, by ‘care’ i.e. intervention including resuscitation and transport to a critical care service. Critical care resuscitation and treatment interventions include a complex range of general and specialty procedures, supports and diagnostic procedures, which may succeed in helping the patient to survive.

Level of Care

Acute care	Level O	Hospital ward clinical management
	Level 1	Higher level of observation
Critical care	Level 2	Active management by critical care team to treat and support critically ill patients with primary single organ failure
	Level 3	Active management by critical care team to treat and support critically ill patients with two or more organ failure
	Level 3s	Level 3 with regional/National service

Objectives

- The rational of ABCDE
- The process of primary & secondary survey
- Recognition of life threatening events
- Treatment of life-threatening conditions
- Handover

Traditional medical approach

History

Examination

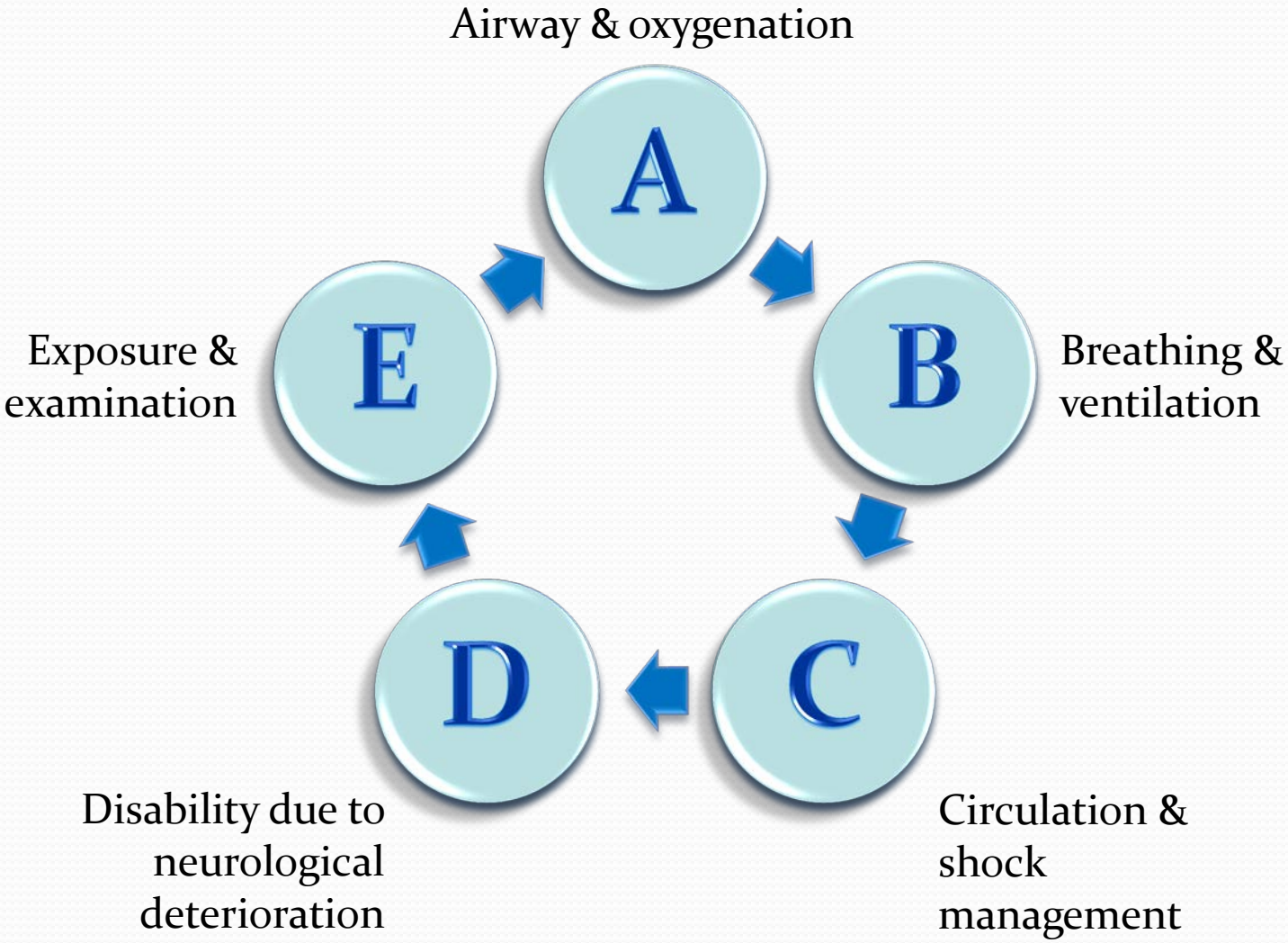
Differential

Investigations

Diagnosis

Treatment

The ABCDE approach



The principles

- Perform primary ABCDE survey (5 min)
- Instigate treatment for life threatening conditions as you find them
- Reassess when any treatment is completed
- Perform more detailed secondary ABCDE survey including investigations
- If condition **deteriorates** repeat primary survey

The primary survey

- ABCDE assessment looking for immediately life threatening conditions
- Rapid intervention usually includes max O_2, IV access, fluid challenge +/- specific treatment
- Should take no longer than 5 min
- Can be repeated as many times as necessary
- Get experienced help as soon as you need it
- If you have a team delegate jobs

Airway - causes

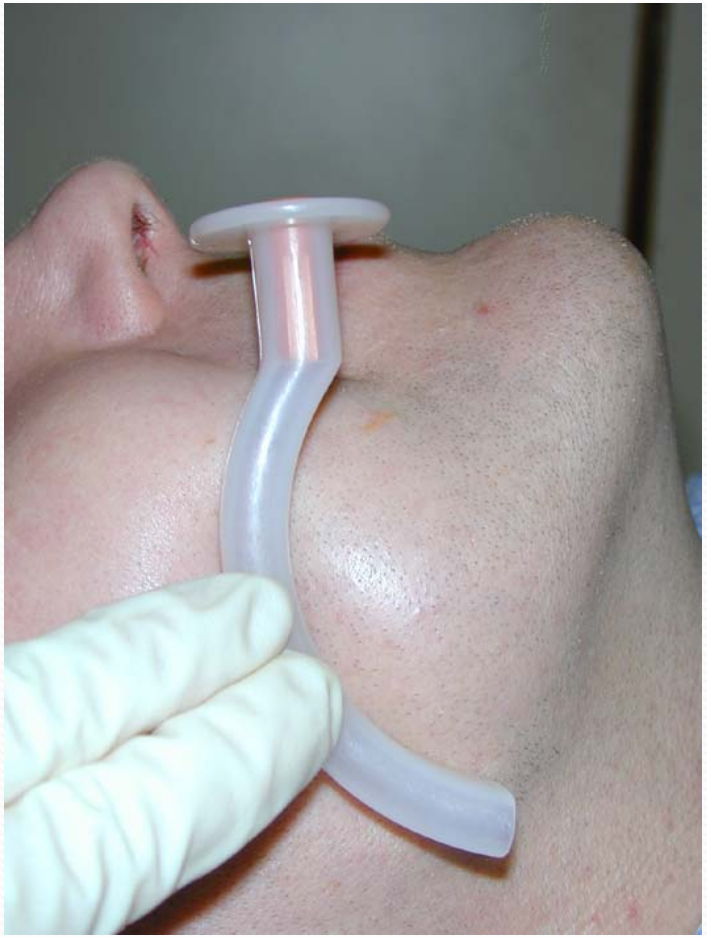
- ↓ GCS
- Body fluids
- Foreign body
- Inflammation
- Infection
- Trauma

Airway - assessment

- Unresponsive
- Added sounds
  - Snoring, gurgling, wheeze, stridor
- Tracheal tug
- Accessory muscles
- See-saw respiratory pattern

Airway – interventions (basic)

- Head tilt chin lift
- Jaw thrust
- Suction
- Oral airways
- Nasal airways



Airway – interventions(advanced)

- GET HELP!!!
- Nebulised adrenaline for stridor
- LMA (laryngeal mask airway)
- Intubation
- Cricothyroidotomy
  - Needle or surgical

Once airway open…

A

- Give 15 litres of oxygen to **all** patients via a non-rebreathing mask
- For COPD patients re-assess after the primary survey has been complete & keep Sats 90-93%

B

Breathing - causes

- ↓ GCS
- Resp depressions
- Muscle weakness
- Exhaustion
- Asthma
- COPD
- Infection
- Pulmonary oedema
- Pulmonary embolus
- ARDS
- Pneumothorax
- Haemothorax
- Open pneumothorax
- Flail chest

Breathing - assessment

- Look
  - Rate (<10 or >20), symmetry, effort, SpO_2, colour
- Listen
  - Taking: sentences, phrases, words
  - Bilateral air entry, wheeze, silent chest other added sounds
- Feel
  - Central trachea, Percussion, expansion

B

Breathing – interventions

- Consider ventilation with AMBU™ bag if resp rate < 10
- Position upright if struggling to breath
- Specific treatment
  - i.e.: β agonist for wheeze, chest drain for pneumothorax

Circulation - assessment

C

- Look at colour
- Examine peripheries
- Pulse, BP & CRT
- Hypotension (late sign)
  - sBP< 100mmHg
  - sBP < 20mmHg below pts norm
- ↓ Urine output
- Consider compensation mechanisms

Circulation – shock

C

Inadequate tissue perfusion

- Loss of volume
  - Hypovolaemia
- Pump failure
  - Myocardial & non-myocardial causes
- Vasodilatation
  - Sepsis, anaphylaxis, neurogenic

BP = HR x SV x SVR

Circulation - interventions

- Position supine with legs raised
  - Left lateral tilt in pregnancy
- IV access - 16G or larger x2
  - +/- bloods if new cannula
- Fluid challenge
  - colloid or crystalloid?
- ECG Monitoring
- Specific treatment

Disability - causes

- Inadequate perfusion of the brain
- Sedative side effects of drugs
- ↓ BM
- Toxins and poisons
- CVA
- ↑ ICP

Disability - assessment

D

- AVPU (or GCS)
  - **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive
- Pupil size/response
- Posture
- BM
- Pain relief

Disability - interventions

- Optimise airway, breathing & circulation
- Treat underlying cause
  - i.e.: naloxone for opiate toxicity
  - Caution if reversing benzo's
- Treat ↓ BM
  - 100ml of 10% dextrose (or 20ml of 50% dextrose)
- Control seizures
- Seek expert help for CVA or ↑ICP

E

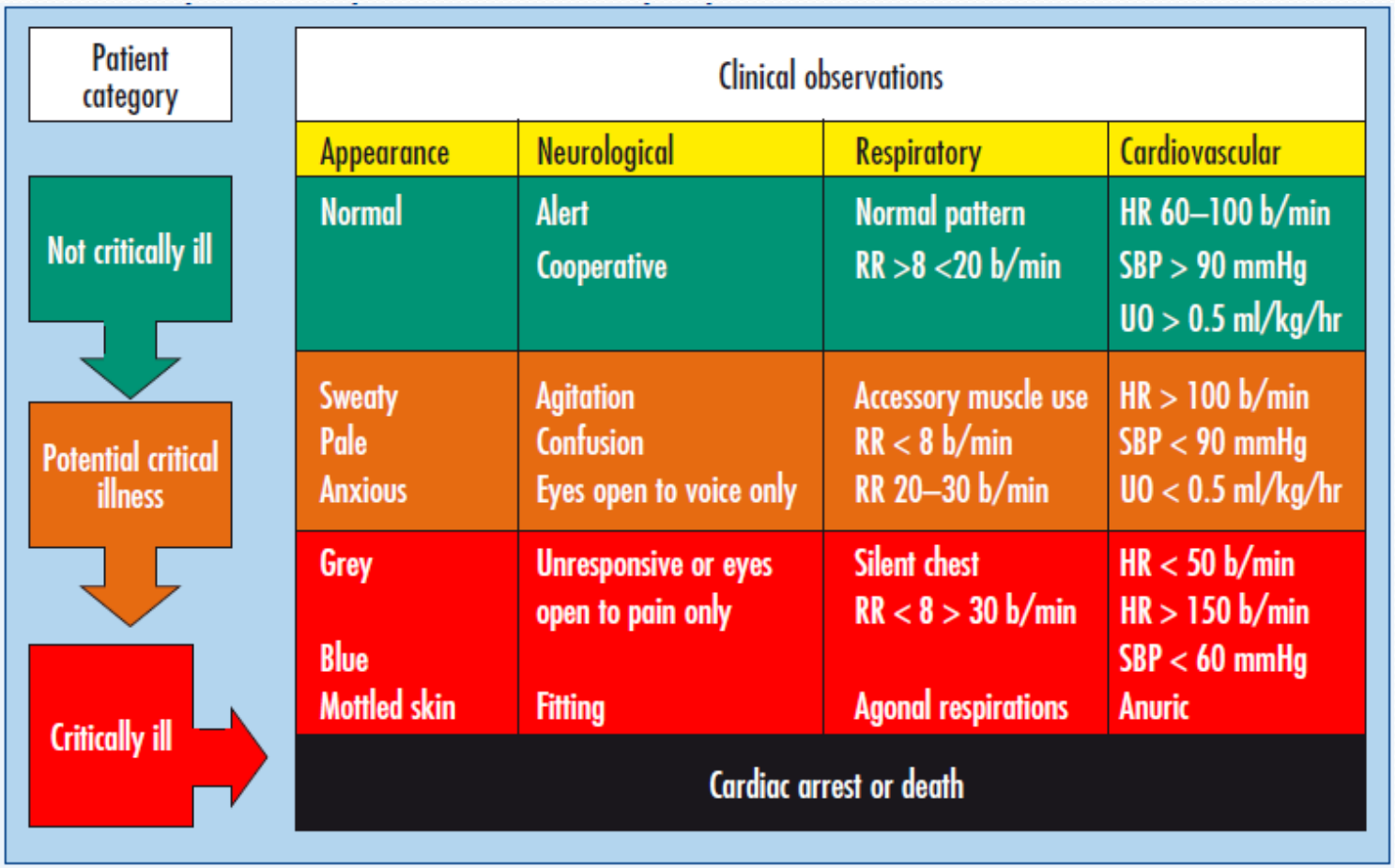
Exposure

- Remove clothes and examine head to toe front and back
  - Haemorrhage (inc concealed), rashes, swelling etc
- Keep warm (unless post cardiac arrest)
- Maintain dignity

The secondary survey

- Performed when patient more stable
- Get a brief relevant HPC & Hx
- More detailed examination of patient (ABCDE)
- Order investigations to aid diagnosis
- IF PATIENT DETERIORATES RETURN TO PRIMARY SURVEY

Bedside examination for cardinal features of critical illness



Patient category	Clinical observations			
	Appearance	Neurological	Respiratory	Cardiovascular
Not critically ill	Normal	Alert Cooperative	Normal pattern RR >8 <20 b/min	HR 60–100 b/min SBP > 90 mmHg UO > 0.5 ml/kg/hr
Potential critical illness	Sweaty Pale Anxious	Agitation Confusion Eyes open to voice only	Accessory muscle use RR < 8 b/min RR 20–30 b/min	HR > 100 b/min SBP < 90 mmHg UO < 0.5 ml/kg/hr
Critically ill	Grey Blue Mottled skin	Unresponsive or eyes open to pain only Fitting	Silent chest RR < 8 > 30 b/min Agonal respirations	HR < 50 b/min HR > 150 b/min SBP < 60 mmHg Anuric
	Cardiac arrest or death			

RECOGNISING THE CRITICALLY ILL PATIENT-**Recognition of severity of illness**

The immediate appearance of the patient yields a wealth of information.

- The airway (for patency and noises, e.g. stridor, snoring, gurgling, none)
- Breathing (rate, symmetry, work of breathing including accessory muscle use, paradoxical or seesaw pattern)
- Peripheral circulation (temperature of the extremities)
- Conscious level (the response of the patient).

Tachypnoea is often the earliest physiological abnormality to appear and the most sensitive to a worsening clinical state, but is the least well documented.

Standard Early Warning System

- A number of approaches have been adopted to improve the recognition of critical illness, including the use of early warning scores and charts such as the Standard Early Warning System (**SEWS**).
- This alerts staff to severely ill patients, complements clinical judgment and facilitates the prioritisation of clinical care.
- A patient with a SEWS score of 4 or greater requires urgent review and appropriate interventions to be commenced. An elevated score correlates with increased mortality.

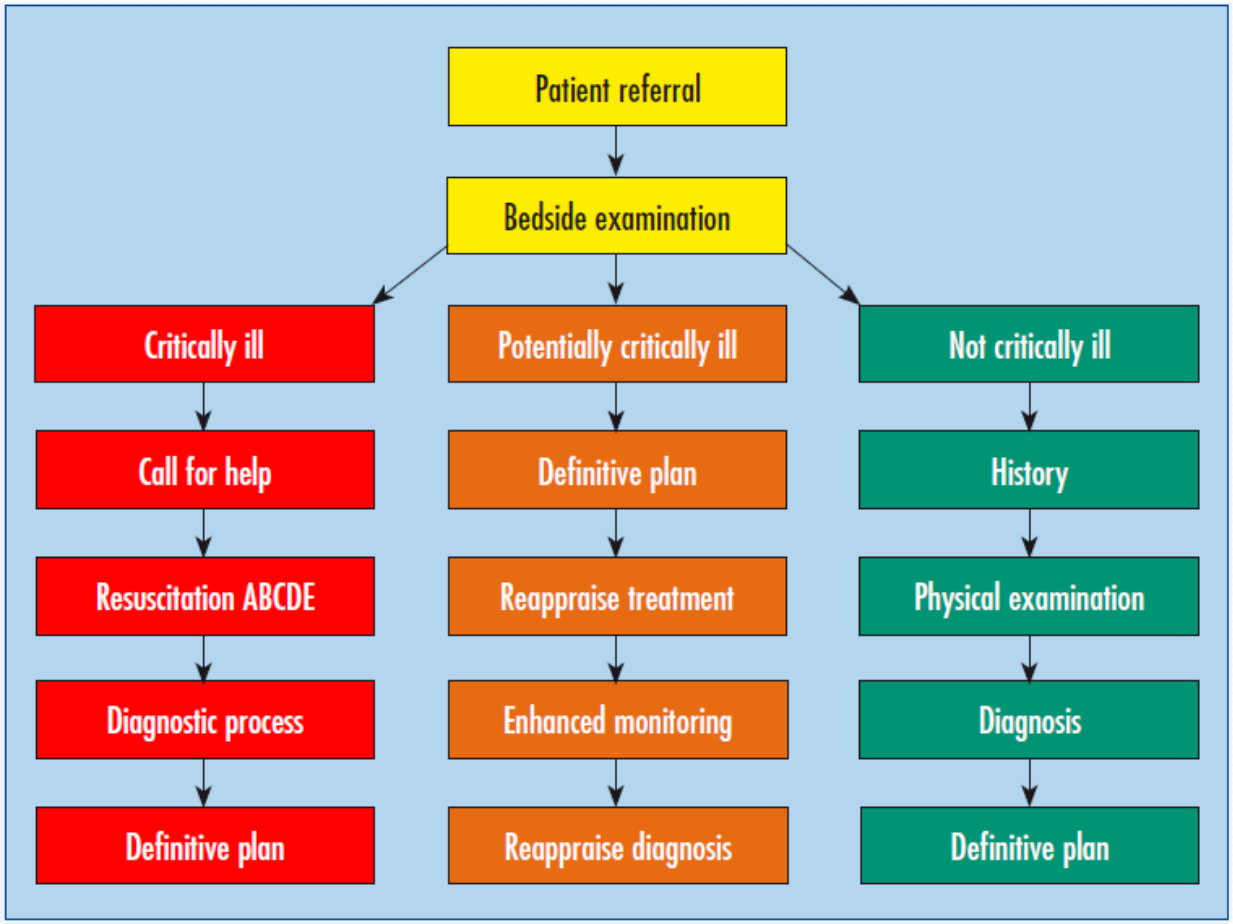
Recognition of critical illness: early warning scores

- Record standard observations:
  - Respiratory rate
  - SpO_2
  - Temperature
  - Blood pressure (BP)
  - Heart rate
  - Neurological response
- Note whether the observation falls in a shaded 'at-risk zone'
- Add the points scored and record total SEWS score on chart
- Do not add 'Pain' score to SEWS score

If SEWS score ≥ 4, a doctor should assess the patient within 20 mins.

If SEWS score ≥ 6, a senior doctor should assess the patient within 10 mins.

Recognition and early management of critically ill patient



Clinical decisions in the critically ill

- **How ill is the patient?**
- **How much help is needed and how quickly?**
- **Where would the patient be best managed?**
- **When should the patient be moved?**

All critically ill patients require an **appropriately trained escort during transfer**

Clinical decisions in the critically ill

- What is required before transporting the patient?
  - ABCDE resuscitation ± endotracheal intubation and ventilation
  - Monitoring, including invasive arterial ± CVP
  - Volume resuscitation and vasoactive support
  - Imaging/diagnostic processes

Clinical decisions in the critically ill

- Is specialist involvement required?

  (e.g. transfer to specialist liver, burns, neurosurgical or cardiac surgical units or for specialised investigations The urgency of specialist treatment needs balanced against the patient's condition; it may be necessary to stabilise the patient in the ICU first)

Admission criteria for intensive care (ICU)

ICU:

- Patients requiring/likely to require endotracheal intubation and invasive mechanical ventilatory support
- Patients requiring support of two or more organ systems (e.g. inotropes and haemofiltration)
- Patients with chronic impairment of one or more organ systems (e.g. COPD *or severe ischaemic heart disease) who* require support for acute reversible failure of another organ

Admission criteria for high-dependency units (HDU)

HDU:

- Patients requiring detailed observation or monitoring that cannot be provided at ward level
  - Direct arterial BP monitoring
  - CVP monitoring
  - Fluid balance
  - Neurological observations, regular GCS recording.
- Patients requiring support for a single failing organ system, excluding invasive ventilatory support:
  - CPAP *or NIV*
  - Moderate inotropic or vasopressor support
  - Renal replacement therapy in an otherwise stable patient
- Step down from intensive care

KEY POINTS

- General ward patients who develop critical illness are often sub-optimally managed.
- Cardiac arrest is often preceded by unrecognized physiological deterioration.
- A bedside examination based on observation and simple physiological measurements can be used to rapidly screen for critical illness.
- In critically ill patients dysfunction of the airway, breathing or circulation can lead to immediate death and so assessment and treatment should focus on these systems.
- Potentially critically ill patients need diagnostic reappraisal, enhanced monitoring and regular review.
- Help from a senior doctor should be sought early to refine the diagnosis, treatment and resuscitation status.

ICU Success

- **Three L's to NOT DO:**
  - Lie (especially parts of physical exam that you did not do)
  - Be Lazy
  - Be Late
- **These are the habits to ICU success:**
  - Be Organized
  - Be Involved
  - Be Efficient
  - Be Thorough
  - Take Initiative
  - Take Ownership of Your patients

Daily routine / Patient care

Here is a checklist that should be followed for every ICU patient:

Daily Checklist

Every day each person should have the following addressed:

1. Code Status
2. Sedation (held in am, when stopping, etc.)
3. GI Prophylaxis (most important when intubated)
4. DVT Prophylaxis
5. Fluid, electrolytes, nutrition
6. Disposition

Daily routine / Patient care

Other daily tasks to always keep in mind:

- Monitor I/O on EVERY PATIENT with 24h totals
- Know their IV access including dates central lines have been placed
- Duration of abx use
- Duration of steroid use for shock patients

Daily routine / Patient care

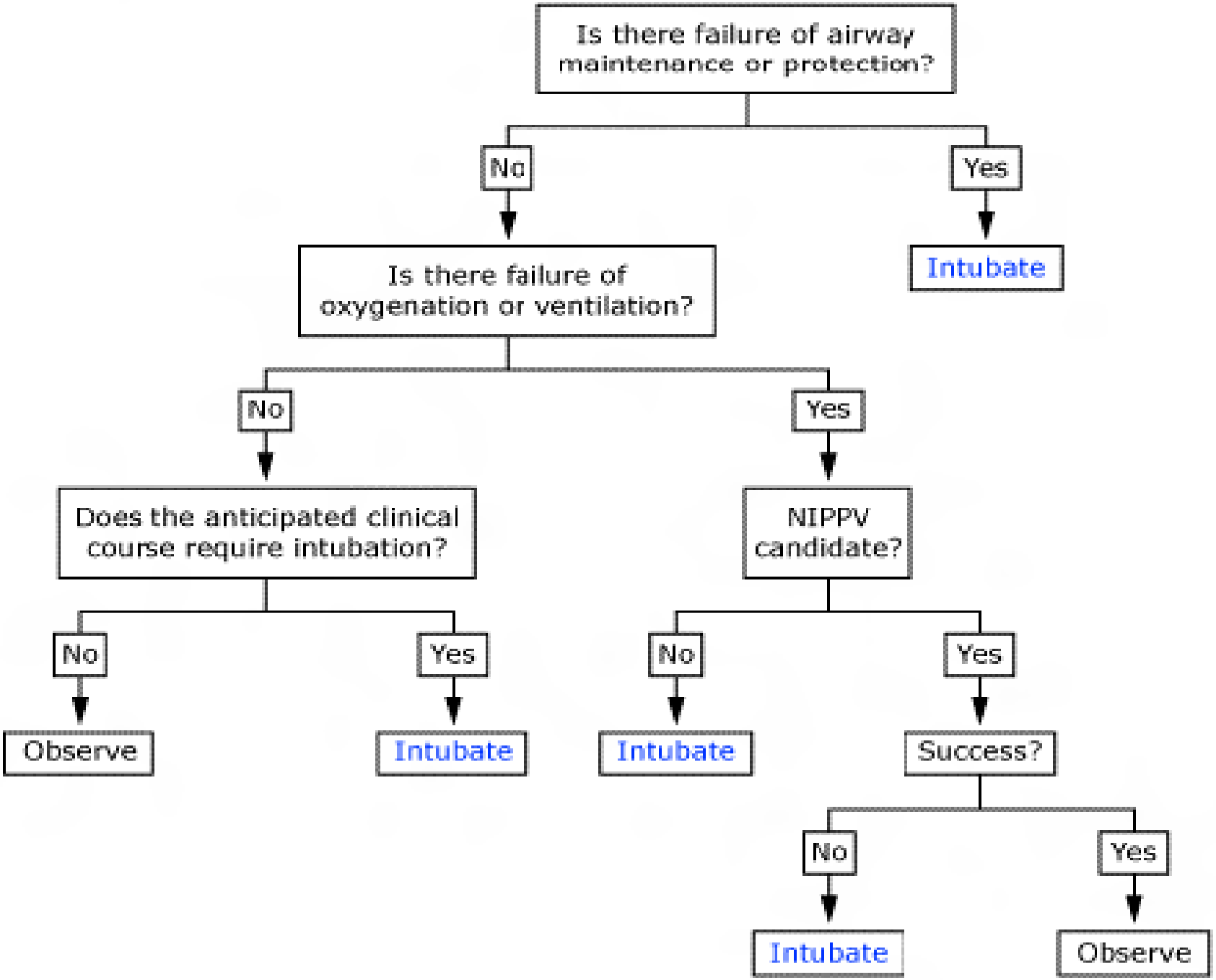
For Mechanically Ventilated Patients, always know the following:

- Date Intubated
- Size of Tube
- Vent Settings (mode/rate/volume/pressure/PEEP/FiO_2)
- Peak/Plateau Pressure

Decision to intubate

Concerning levels from an ABG & VS that may suggest future need for intubation:

* *PaO_2/FiO_2 <300-200*
* *Increased $PaCO_2$ + tachypnea*
* *RR >30-35*
* *PaO_2<50 on 50% or greater FiO_2*
* *$PaCO_2$ >55 w/ nL lung fxn (I.e no COPD, fibrotic lung dz)*
* *pH <7.3*


Is there failure of airway maintenance or protection?
No
Yes
Intubate
Is there failure of oxygenation or ventilation?
No
Yes
Does the anticipated clinical course require intubation?
NIPPV candidate?
No
Yes
No
Yes
Observe
Intubate
Intubate
Success?
No
Yes
Intubate
Observe

Weaning/Extubation

Weaning Trial Criteria

- $FiO_2 < 0.4$ with $pO_2 > 60$ and PEEP < 8
- The patient can take spontaneous breaths over the vent with RR < 20
- SBP > 90 without pressors
- The initial indication for intubation is resolving

Weaning/Extubation

Extubation criteria

- Minute ventilation < 10 L/min.
- **Tobin index (Rapid Shallow Breathing Index) : spontaneous RR ÷ TV in L < 105**
- Dead space < 50%.
- MIF (maximal inspiratory force) < – 20 (the more negative, the better)

Failure to wean:

F *Fluid overload® diurese if indicated.*
A *Airway resistance® check endotracheal tube; is it obstructed or too small?*
I *Infection® treat as indicated.*
L *Lying down, bad V/Q mismatch® elevate head of bed.*

T *Thyroid, toxicity of drugs® check TFT's, check med list.*
O *Oxygen ® increase FiO2 as patient is taken off ventilator.*

W *Wheezing ® treat with nebs.*
E *Electrolytes, eating ® correct K/Mg/PO4/Ca; provide adequate nutrition.*
A *Anti-inflammatory needed? ® consider steroids in asthma/COPD.*
N *Neuromuscular disease, neuro status compromised ® think of myasthenia gravis, ALS, steroid/paralytic neuropathy, etc; assure that patient is in fact awake and alert.*

Supplemental O2

Supplemental Oxygen

- Nasal Canula > Simple face mask > Venturi-mask > non-rebreathing mask
- Nasal Canula
  - 1L ~ 0.24 **FiO_2**
  - Each additional liter ~ adds 0.04 **FiO_2**
- Venturi mask
  - Precise administration of O_2
  - Usual preset values of **FiO_2** of 24%, 28%, 31%, 35%, 49% and 50%
- Nonrebreathing mask
  - 0.80 to 0.90 **FiO_2**

Central line

A central line is useful for many interventions. Consider central line placement in **any critically ill patient being admitted to the ICU; however, the benefits and risks of central line placement always need to be considered.**

- **Specific Indications:**

•Venous access is needed for intravenous fluids or antibiotics and a peripheral site is unavailable or not suitable

•Central venous pressure measurement

•Administration of chemotherapeutic drugs or total parenteral nutrition (TPN)

•For hemodialysis or plasmapheresis

Central line

Contraindications:

- Uncooperative patient
- Uncorrected bleeding diathesis
- Skin infection over the puncture site
- Distortion of anatomic landmarks from any reason
- Pneumothorax or hemothorax on the contralateral side

Central line

Complications:

- Pneumothorax (3-30%)
- Hemopneumothorax
- Hemorrhage
- Hypotension due to a vasovagal response
- Pulmonary edema due to lung re expansion
- Spleen or liver puncture Air embolism Infection

Factors associated with higher mortality from critical illness

- Older age
- Significant pre-existing comorbidities, especially liver disease, severe cardiorespiratory disease, malignancy, immunosuppression and chronic renal failure
- Poor pre-existing nutritional state and/or general physical condition
- Higher illness severity at ICU admission, measured with the APACHE or SAPS score
- Worse or multiple acute organ failures during ICU (especially shock, respiratory failure and acute renal failure)

Antimicrobials

Quick empiric choices:

- Meninges – Ceftriaxone/Vancomycin, consider Ampicillin
- Aspiration – Cover for anaerobes, clindamycin
- GU – FQ, bactrim, amp/gent
- Skin – think community acquired MRSA: clindamycin, vancomycin
- GI – FQ, metronidazole, pip/tazo
- Lines – Vancomycin

Antibiotics for COPD Exacerbations:

Step 1 Assessment of antibiotic indications for COPD

- Three cardinal symptoms
- Increased dyspnea, increased sputum volume, increase sputum purulence
- Require mechanical ventilation

Step 2 Antibiotic Choices:

- High Risk: Levofloxacin
- Low Risk: Azithromycin, Doxycycline

Step 3 Thorough Evaluation for Other Causes of Exacerbation

- Drugs
- Arrythmias (Afib)
- Coronary Ischemia
- Pneumothorax
- Viral Infection
- Pulmonary embolism

Management of Fungal Infections:

- Major risk factors for fungemia-
  - Recent use of broad-spectrum antibiotics (allow fungal overgrowth) ·
  - Colonization of fungus in normal sterile location (ie-candiuria*)
- Minor risk factors for fungemia-
  - Central venous catheter (TPN, chronic infusion therapy, hemodialysis) ·
  - Multiple abdominal surgeries ·
  - Critically ill patient ·
  - Immunosuppression, steroid use

Management of Fungal Infections:

- Common Yeast Pathogens ·
- Candida Albicans –Pathogen in 70-80% of fungemias, highly susceptible to fluconazole ·
- Non-albicans species ·

  C. glbrata – Dose-dependent susceptibility to fluconazole ·

  C. krusei – Must use micafungin, voriconazole to treat ·

  C. parapsilosis – Resistant to micafungin and other echinocandins

Management of Fungal Infections:

- Treatment options for disseminated candidiasis ·
- Hemodynamically stable patient: Fluconazole 6 mg/kg (400-800 mg) IV/PO q24 (renal dose CrCL<50) ·
- Hemodynamically unstable patients: Micafungin 100 mg IV q24 (or other echinocandin) ·
- Ophthalmic examination to rule out endophthalmitis if documented fungemia
- *Current IDSA guidelines recommend against the treatment of asymptomatic fungal cystitis unless high risk for developing disseminated candidiasis (neutropenic, urologic procedure)

Double coverage of Gram Negative Organisms:

- **Rationale: Utilizing two different antimicrobial classes will increase the likelihood of active antimicrobial therapy in critically ill patients.**
- **Should only be used for empirical therapy. Discontinue after microbiological susceptibilities are reported.**

- **Patients to consider double coverage** (Clinicians should be selective in application!)
  - Patients with febrile neutropenia (follow current U of I hospital guidelines) ·
  - Patients with little physiologic reserve ·
  - Severe sepsis and septic shock ·
  - ARDS from infections cause ·
  - Patient with significant exposure to anti-pseudomonal beta-lactam agents ·
  - Patients with late onset (>14 days) nosocomial infections ·
  - MDR organisms: Psuedomonas, Acinetobacter, KPC Klebsiella pneumoniae

How to double cover Gram-negative:

- Aminoglycosides (Amikacin, Gentamicin, Tobramycin) are preferred over quinolones ·
- A single dose of an aminoglycoside has not been shown to increase the risk of AKI in septic shock patients ·
- Quinolones add little additional coverage to anti-pseudomonal beta-lactam agents

Duration of treatment:

An 8 day course was shown to be non-inferior to an 15 day course (mortality)

There was more relapse with a short course in patients with Psuedomonal/Acinetobacter pneumonia when treated with a short course

Consider 15 day course in patients with:

- ***MDR (High MIC) Psueomonas or Acinetobacter pneumonia***
- ***Patients with slow clinical response (>4 days)***
- ***Patients with severe hypoxia***

Conclusion

The journey toward excellent global critical care in BD is unlikely to be easy but is certainly going to be an exciting and interesting one. A comprehensive multifaceted approach is needed to improve the delivery of critical care globally, and such efforts are likely to translate to major improvement in patient outcome.

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THANK YOU