Prescribing for Critically Unwell Children

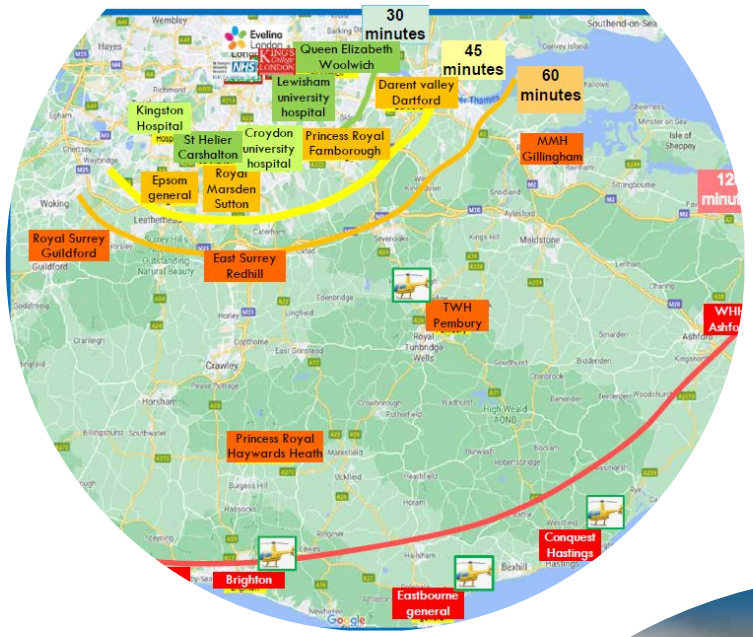
Catia Pinto, ACP

2023

Overview

- The role of the ACP in PICU and retrieval
- The differences prescribing in intensive care vs retrieval
- My typical day
- Case study-inotropic support for septic shock
- Some challenges (legal and non-legal) aspects of prescribing
- How prescribing enhances the role of the ACP

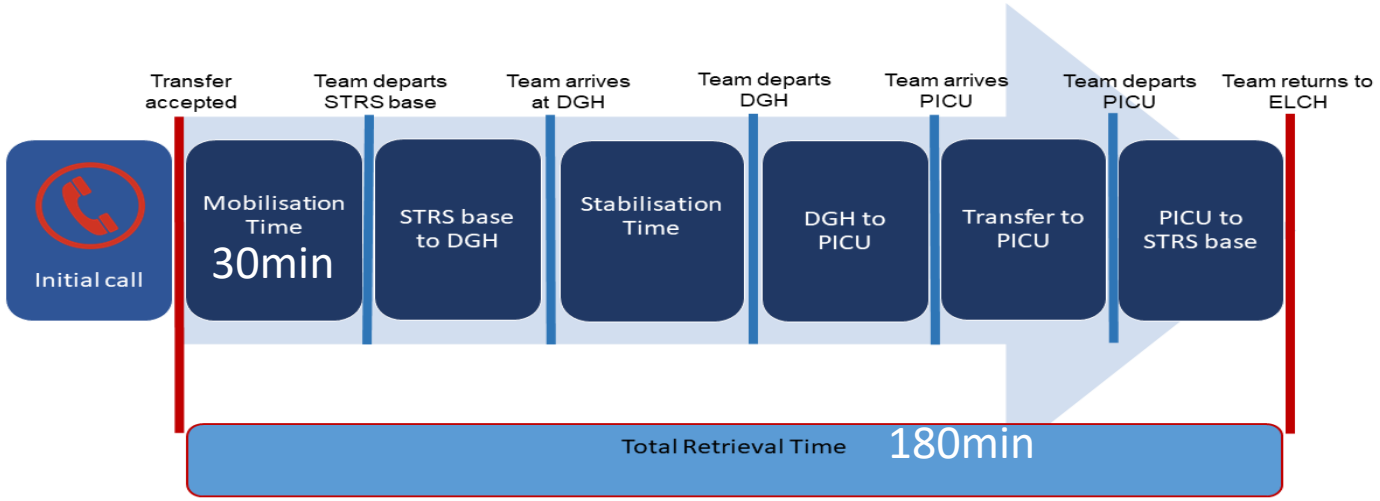
Retrieval Service



- Last year approximately 1700 calls, **900 activated**
- Advice or/and transfer request
- **60%** of the activated calls were **led by ACPs**
- Majority of the children retrieved were < 1year old with respiratory symptoms
- Daily interventions and prescriptions either advised or performed

Retrieval Service

- **Integrated** Service
- 13% of the time spent on **follow up referral calls**
- 63% of the time directly related to **patient care**
- 20% of the time supporting PICU activities

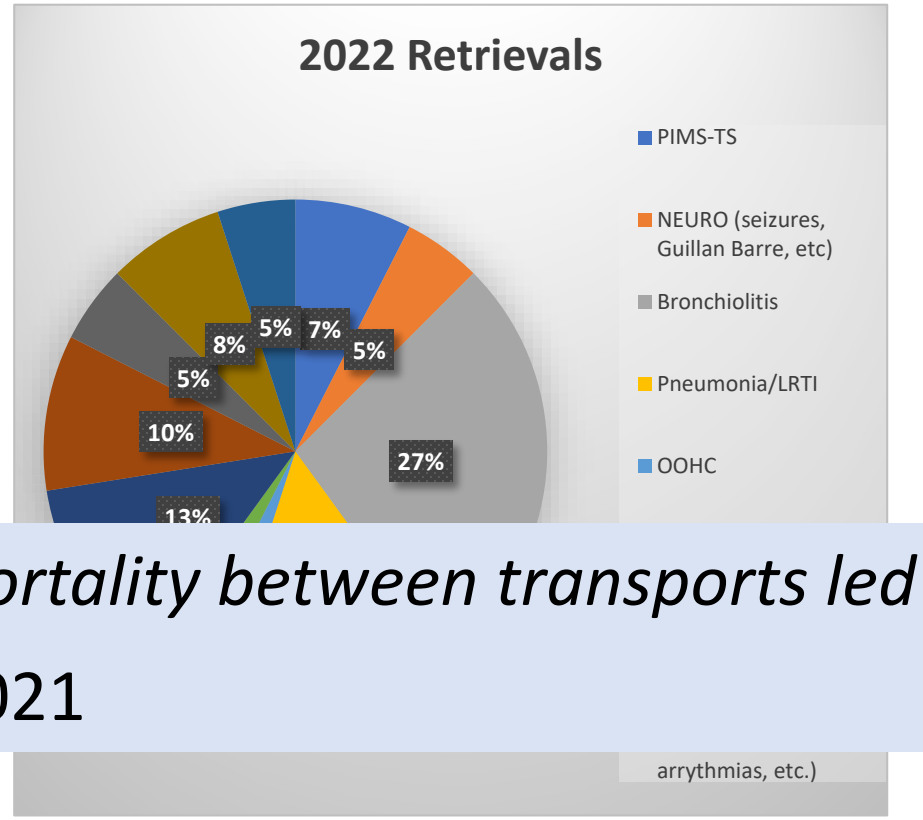


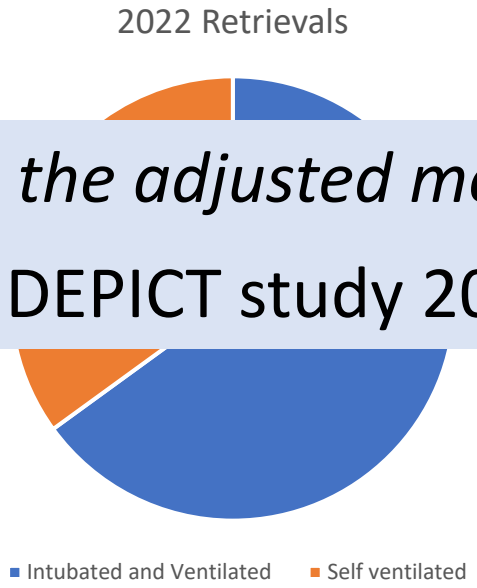
Examples of interventions

- Intubation/ Re-intubation
- Venous/arterial access
- Starting vasoactive infusions
- Chest drain insertion

My role as an ACP

- Initial management/advice over the phone
- Retrieval acceptance
- Stabilisation





"There were no differences in the adjusted mortality between transports led by ANPs and Junior Doctors " DEPICT study 2021

- Personal development
- Ongoing DGH teaching
- Link ACP for two hospitals of the region
- Case reviews/teaching locally

PICU – My role and an ACP

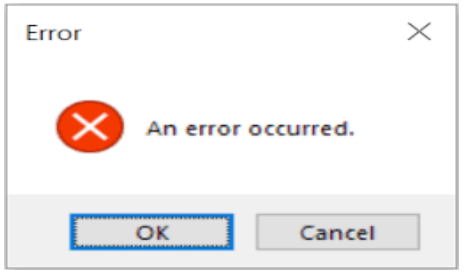
- Level 3 Advanced PICU
- Wide range of conditions and support
- Four pillars of advanced practice
- Assess, diagnose and make treatment plan

    -Advanced technical procedures

    -Communication skills

- Supervise junior doctors/other ACPs
- Teaching
- Part of working groups
- Continuous research

Prescribing in the critical care setting



Assessing medication prescribing errors in pediatric intensive care units*

Michael A. Cimino, RPh, MS; Mark S. Kirschbaum, RN, PhD; Linda Brodsky, MD; Steven H. Shaha, PhD, DBA; for the Child Health Accountability Initiative

Paediatric Critical Care Medicine, 2004

- **11.1%** incidence of prescribing errors
- Wrong dose was the most common error
- Only factor accounting for differences between units was the prescriber-patient ratio

Exploring the human factors of prescribing errors in paediatric intensive care units

Adam Sutherland,[1,2,3] Darren M Ashcroft,[1,3] Denham L Phipps[1,3]

British Medical Journal, 2019

- **18%** incidence of prescribing errors
- Cognitive burden was the main factor
- Themes:
  - -Individual factors
  - -Organisational factors
  - -Task related factors
  - -Team related factors
  - -Work related factors

PICU **vs** Retrieval

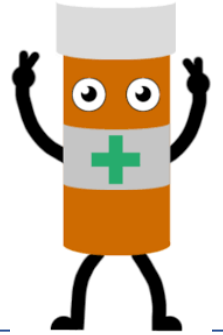
PROS

- Electronic system
- More resources
- Specialised nursing team
- Time to know patient

CONS

- More drugs
- Complex patients
- Higher workload (more than one patient)
- Variety of conditions

Prescribing as an ACP



A prospective audit of a nurse independent prescribing within critical care

Martin Carberry, Sarah Connelly and Jennifer Murphy

- Nursing in Critical Care, 2012
- 1418 prescriptions in total
- **2.8%** incidence of prescribing errors
- Error rate **0.6%** ACPs vs **3.4%** medical team

British Association of Critical Care Nurses position statement on prescribing in critical care

Kate Bray, Deborah Dawson, Vanessa Gibson, Heather Howells, Heather Cooper, Joanna McCormick and Catherine Plowright

- Nurse prescribing aim should be the improvement of care
- Not a substitute to medical prescribing practice
- Audit and continuous practice evaluation


Efficient clinical reasoning
Complexity of illnesses
Different underlining diseases
CHALLENGES
Dearth of paediatric evidence
Time pressure
Wide scope of practice

Case study

- 12-year-old, 48Kg
- Two-day history of fever and lethargy

<u>Observations:</u>

$SatO_2$ 94% on air
RR 25bpm
HR 110bpm
Normotensive

- Transferred to the ward
- Started on co-amoxiclav for chest cover

<u>24hours after</u>

- Hypotension and increased lactate
- Treated for sepsis
- Retrieval services contacted as the patient might need inotropes
- Received 30ml/kg fluid

- Medication advice:

-Change antibiotics to broad spectrum
-Prepare intubations drugs…

BNF Chapter 5 Infection

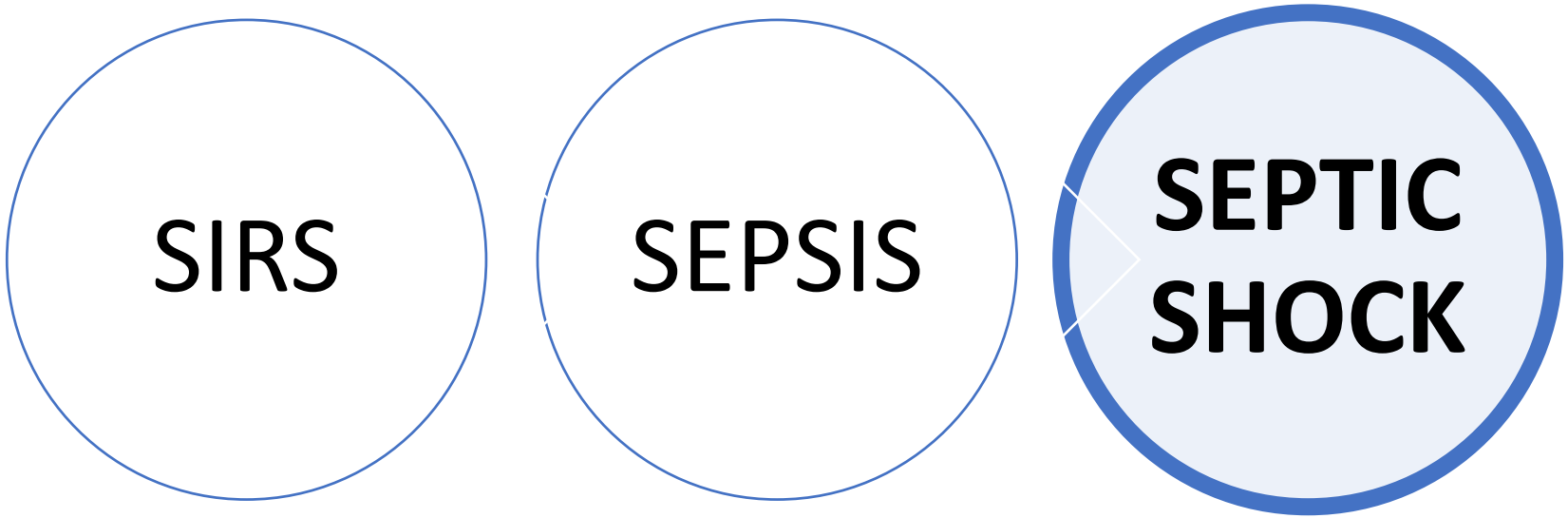
Case study

On arrival
Not intubated, preparing for intubation

Drugs requested:
Fentanyl 1-2mcg/kg carefully titrated: synthetic opioid with better cardiovascular stability
Ketamine 1-2mcg/kg: NMDA receptor antagonist preferred induction agent in shock or haemodynamic compromise
Rocuronium 1mg/kg: non depolarising neuromuscular blocking drugs
Morphine infusion starting at 30mcg/kg/hr
Adrenaline infusion 0.1mcg/kg/min already started peripherally
Noradrenaline infusion requested

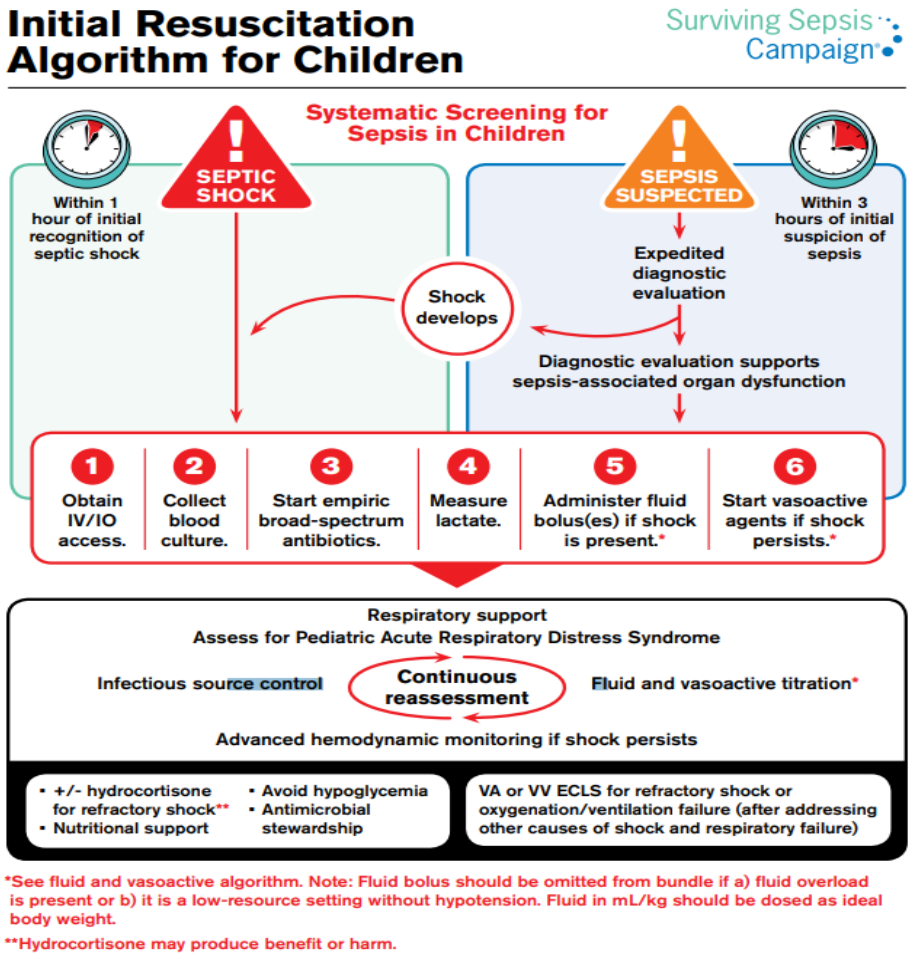
- BNF chapter 15 Anaesthesia
- BNF Chapter 4 Nervous system
- BNF Chapter 2 Cardiovascular system

Case study – Septic Shock



Case study – Sepsis

- **Sepsis** is a life-threatening organ dysfunction caused by a dysregulated host response to infection
- Worldwide leading cause of mortality and morbidity in children
- **Early recognition** is paramount
- Sepsis 6 campaign (senior clinician, oxygen , IV/bloods, antibiotics, fluid, early inotropes)
- Children compensate for longer, more difficult to know when unwell, more difficult to recognise shock



Case study – Septic Shock

Septic Shock is sepsis with cardiovascular organ dysfunction

A clinical syndrome of inadequate tissue perfusion

$$DO_2 < VO_2$$

- **Increased capillary permeability**
- **Dysregulation of vascular tone**
- **Depression of myocardial function**

Management principles

- Early recognition
- Fluid
- Early inotropes
- Early ventilation (unbalance DO2 and VO2)
- Find and address cause
- ANTIBIOTICS

Case study – Septic Shock

Clinical signs

"**WARM** shock"

- Tachycardia
- **Bounding peripheral pulses**
- **Flushed skin**
- **Increased pulse pressure**
- **Blushing capillary refill**
- Oliguria
- Altered mental status
- Tachypnoea
- Hypotension

VS

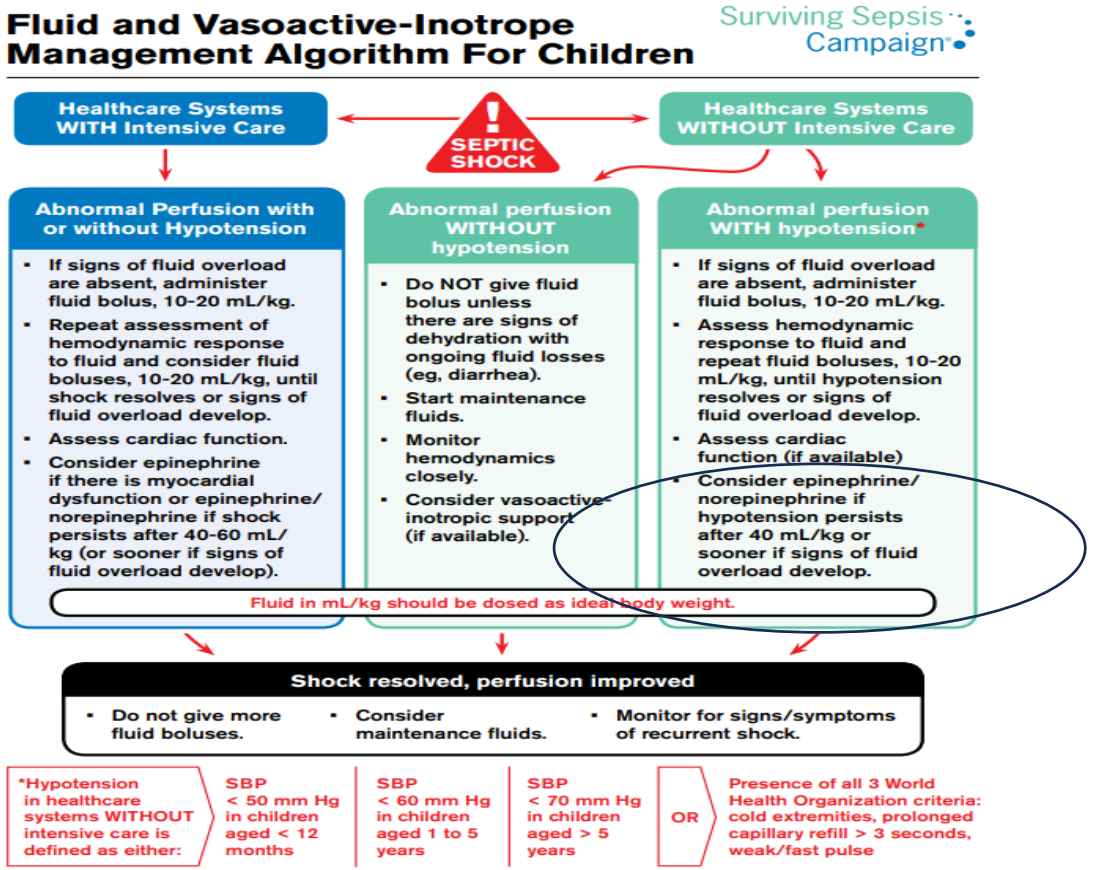
"**COLD** shock"

- Tachycardia
- **Peripheral pulses not palpable**
- **Cool peripheries**
- **Mottled skin / pallor**
- **Prolonged capillary refill time**
- **Reduced pulse pressure**
- Oliguria
- Tachypnoea
- Altered mental status
- Hypotension

Note: In intensive care there are other measures: CVP, SvO_2, NIRS, lactate trend, arterial vs venous CO_2, POCUS

Case study – Septic Shock

- How much to fill?
- How much to squeeze?
- How much to give?

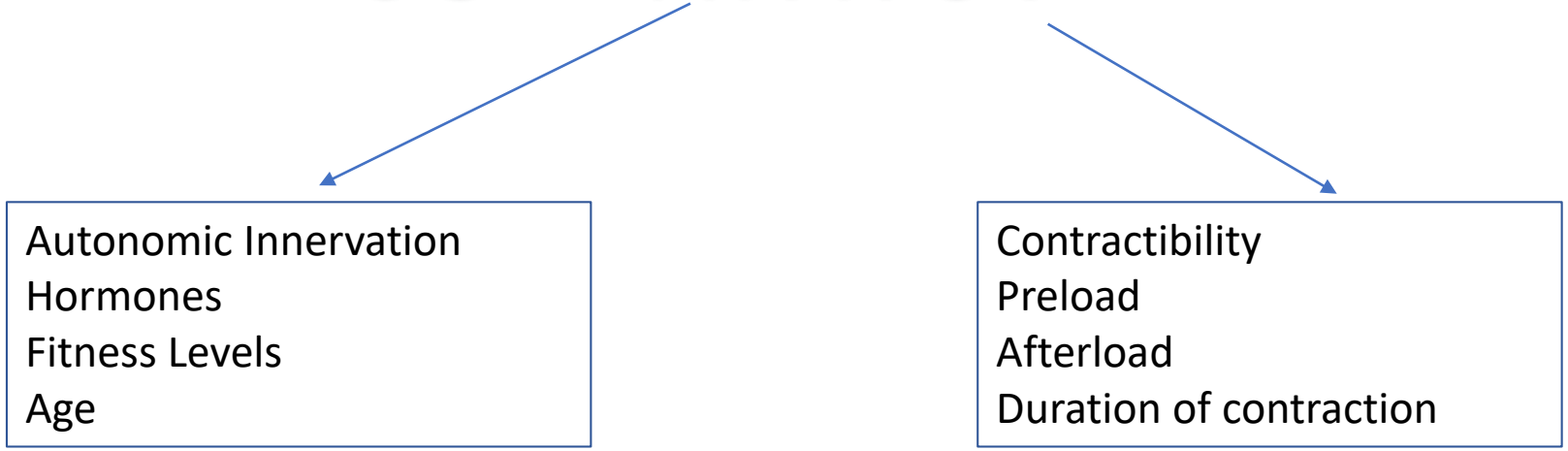


Case study – **Vasopressors/Inotropes**

- What do we want to achieve?

Tissue perfusion and oxygenation

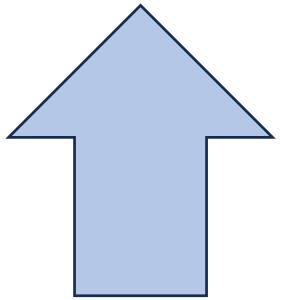
$$CO = HR \times SV$$



Case study – **Vasopressors/Inotropes**

- Classification of inotropic agents

Catecholamines	Phosphodiesterase Inhibitors	Calcium Sensitising Agents	Others
• Dopamine • Dobutamine • Adrenaline • Noradrenaline • Vasopressin • Phenylephrine • Isoprenaline	• Milrinone • Amrinone • Enoxemone	• Levosimendan	• Digoxin



Case study – **Vasopressors/Inotropes**

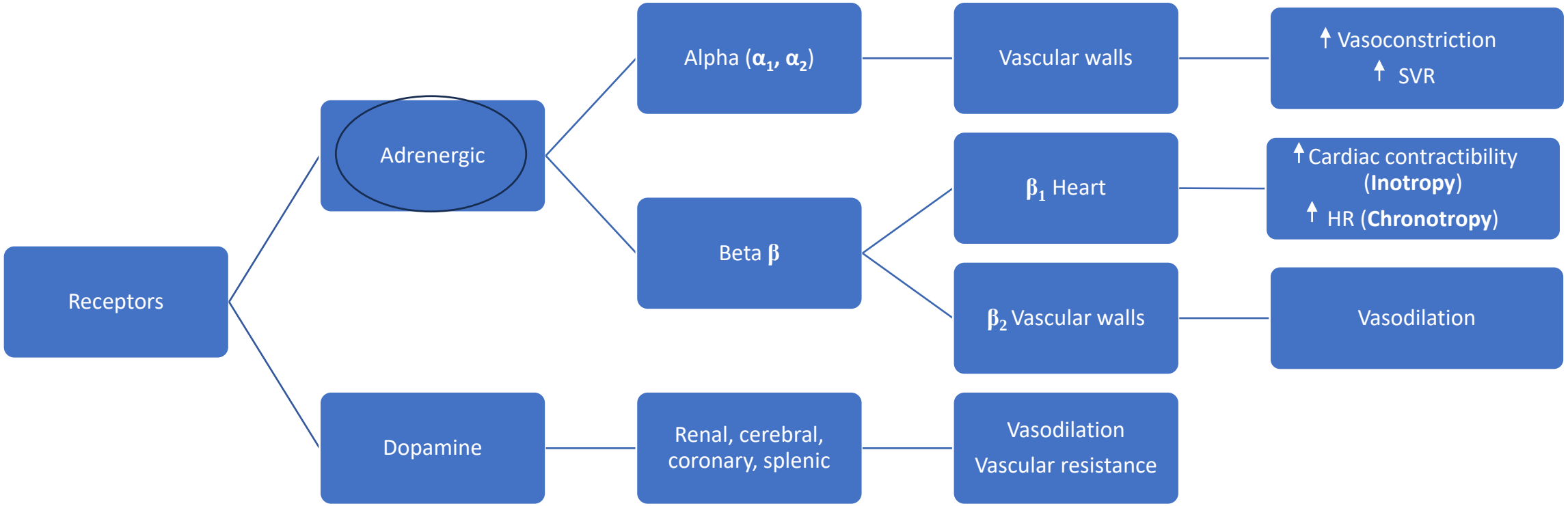
Catecholamines

- Act on sympathetic nervous system
- Individual drugs favour specific receptors
- The drug actions are determined by the receptors they act on
- Effects vary depending on dose

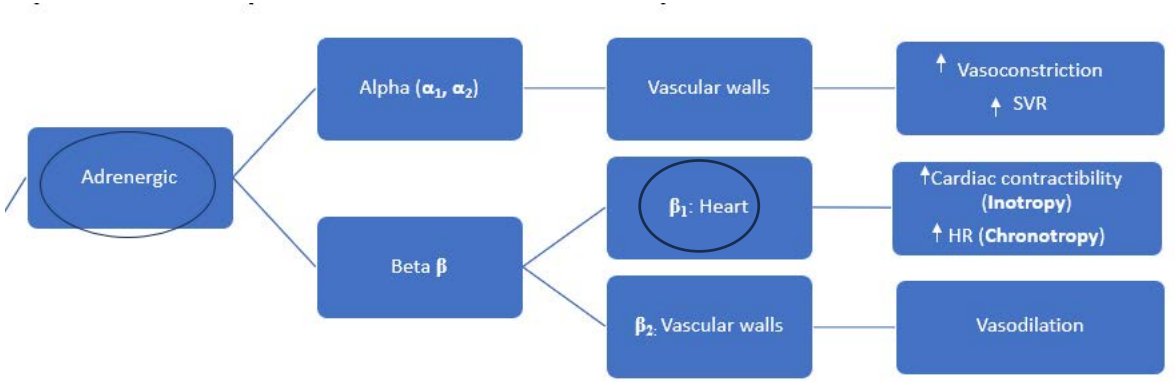
Pharmacokinetics/Administration

- Short half-life (approximately 2 minutes)
- Steady state reached in approximately 10 minutes
- Extravasation can result in tissue necrosis
- Different infusion concentrations depending on central or peripheral access

Case study – **Vasopressors/Inotropes**



Case study – **Adrenaline**



- Potent stimulator of β and α receptors
- Beta effects predominantly at lower doses
- Higher doses α > β
- β_2 effects balanced out with α effects

Other effects

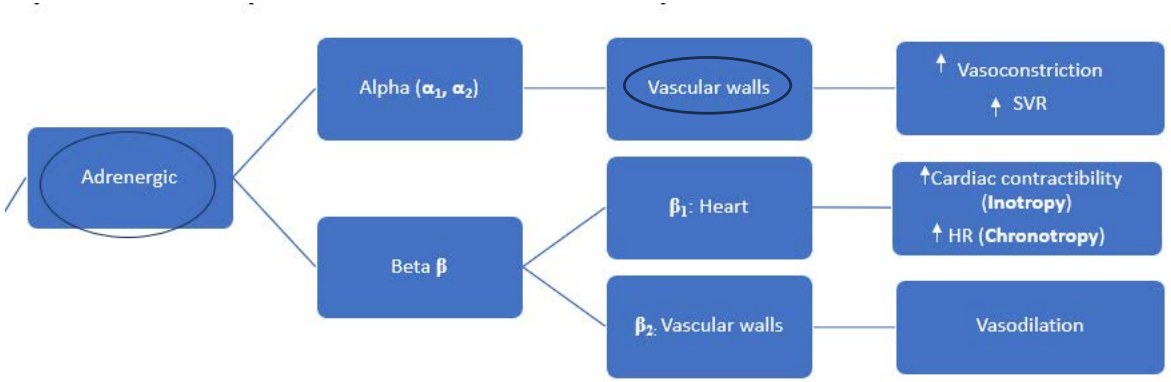
- Increased glucose production by hepatic glycogenolysis and gluconeogenesis
- Increased aerobic glycolysis leading to increased lactate production
- Increased myocardial oxygen consumption

Major side effects

- Extreme tachycardia
- Arrythmias
- Decreased tissue perfusion
- Decreased diastolic filling
- Decreased coronary perfusion

Case study – **Noradrenaline**

- Potent α_1 receptor agonist
- Modest β receptor activity
- Little chronotropic effects - balanced out with reflex bradycardia from α_1
- Augments diastolic pressure leading to increased coronary perfusion
- Good for vasodilatory shock
- Increases stroke volume



Major side effects

Peripheral digital ischaemia

Arrhythmias

Bradycardia

Case study – **Vasopressors/Inotropes**

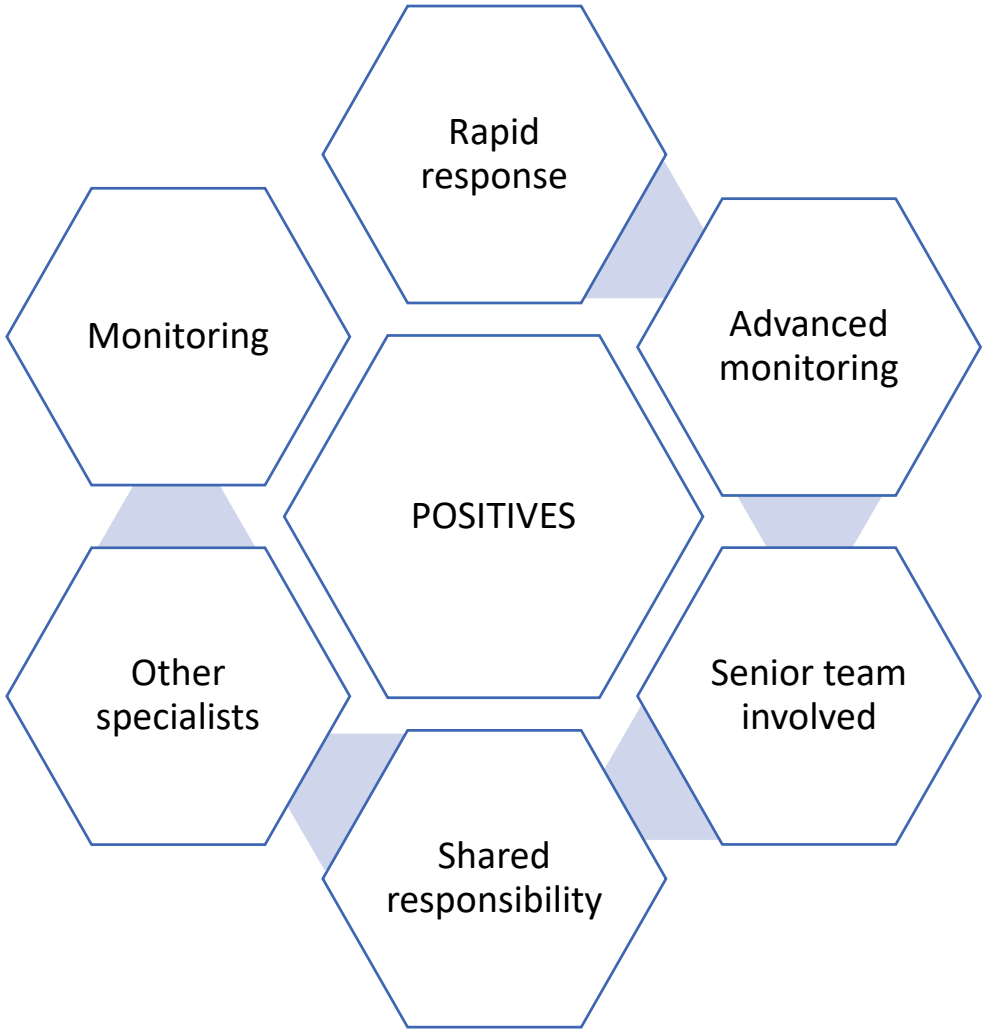
Table 4. Receptor actions of catecholamines

Drug	Receptor affinity	Action	Dose range (μg/kg/min)	Side effects
Noradrenaline	Mainly α1 agonist, some β1 agonist action	Vasoconstriction increasing systemic vascular resistance	0.03–0.2	Reduced renal perfusion as a result of vasoconstriction, increased afterload will reduce stroke volume and increase myocardial oxygen demand
Adrenaline	Low doses: β1 agonist	Increased heart rate, stroke volume and cardiac output	0.01–0.15*	Tachycardia and tachyarrhythmia, increased myocardial oxygen demand
	High doses: α1 agonist	Vasoconstriction at higher doses increasing systemic vascular resistance	0.01–0.15*	High concentrations can cause reduced cardiac output
Dobutamine	β1 agonist	Increased heart rate, increased cardiac output	2.5–25	Tachyarrhythmia, increased myocardial oxygen consumption
	β2 agonist	Vasodilatation and reduced systemic vascular resistance	2.5–25	Risk of hypotension
Dopamine	Low dose: dopamine receptor agonist	Vasodilatation of capillary beds, reduced systemic vascular resistance and increased cardiac output	1–3	Risk of tachyarrhythmia
	Medium dose: β1 agonist	Increases contractility, stroke volume and cardiac output	3–10	Previously used at low ('renal') doses to maintain renal perfusion and function
	High dose: α1 agonist	Vasoconstriction increasing afterload, peripheral resistance and mean arterial pressure	>10	No longer used as any benefit on renal outcome is caused by the increased cardiac output

* there is no strict cut off between high and low dose so dose range applies to both

British Journal of Hospital Medicine, 2012, Volume 73, No5


Obtaining informed consent
Accountability
Use of non-licensed drugs
CHALLENGES
Advice over the phone
Dearth of evidence
Dependent of clinical assessment


Rapid response
Monitoring
Advanced monitoring
POSITIVES
Other specialists
Senior team involved
Shared responsibility

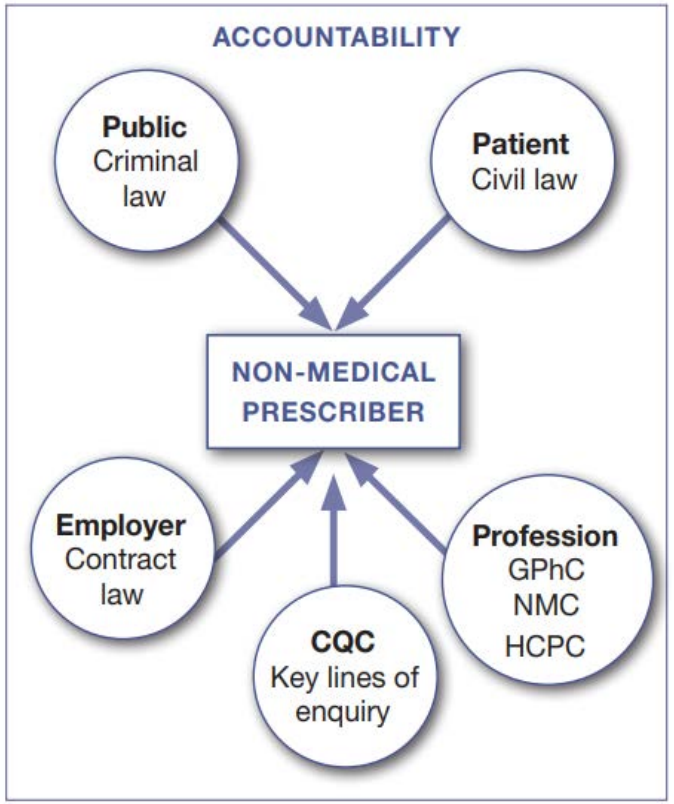


Figure 1. Prescribing accountability

Journal of Prescribing Practice, 2019, 1(8).

GOV.UK

Home > Drug Safety Update

Off-label or unlicensed use of medicines: prescribers' responsibilities

"Healthcare professionals may have more responsibility to accurately prescribe an unlicensed medicine or an off-label medicine than when they prescribe a medicine within the terms of its license".

Better Practice

Best practice in prescribing off-label medication for children

Michelle Bennett

- Ensuring the pillars of accountability are used even more important
- Patients need to be at the centre of the decision-making process

How does prescribing improves my practice?

- Autonomy
- Understanding physiopathology
- Multidisciplinary relationships
- Clinical assessment
- Differential diagnosis

- …

References

- APLS 6th edition
- Armstrong, A. (2019) Accountability and prescribing. *Journal of Prescribing Practice*, 1(8), pp. 406-410
- Aubugeau-Williams, P., Brierly, J. (2020) Consent in children's intensive care: the voices of the parents of critically ill children and those caring for them. *Journal Medical Ethics,* 46, pp.482-487
- Bennett, M. (2018) Best practice in prescribing off-label medication for children. *Nurse prescribing*, 16(5), pp. 234-237
- Christopher, B et al. (2008) Inotropes and Vasopressores: Review of Physiology and Clinical Use in Cardiovascular Disease. *Journal of the American Heart Association*
- Medicines and Healthcare products Regulatory Agency (2014) Off-label or unlicensed use of medicines: prescribers 'responsibilities
- Raman, S. (2021) Septic shock in children, in: *Challenging Concepts in Paediatric Critical Care. Cases with Expert Commentary*. Oxford: Oxford University Press, pp. 1-11
- Surviving Sepsis 2020

Questions?