CG026 Acute Cardiac Failure

1. Key Recommendations for operational use		
For use by: Medical teams **Internet:** Yes		
1	Indications for Retrieval	• Patients with acute cardiac failure unresponsive to initial measures: - +/- specific intervention required. - appropriate for treatment escalation.
2	Assessment	• ECG for arrhythmia / ischaemia: - if ECG shows STEMI / equivalent, prioritise revascularisation and discuss with primary PCI centre. • Aim to determine the most likely cause: - acutely decompensated heart failure (in 50-70% of cases) - acute coronary syndrome. - hypertensive emergency - arrhythmia. - mechanical dysfunction: eg valve disease,VSD. - pulmonary embolism - infections: eg myocarditis - tamponade. - also consider drug effect or acute cardiomyopathy (peripartum, stress etc).
3	Monitoring / Investigations	• Strongly consider arterial line: - avoid the right radial artery if coronary angiography is a possibility. • Insert urinary catheter and monitor urine output. • As available: - Chest X ray. - Blood tests: ABG, FBC, U&E, CRP, troponin, lactate. - Echocardiogram and Lung Ultrasound can assist in confirming diagnosis and determining the underlying cause.
4	General interventions	• Elevate head of bed +/- sitting position if BP allows. • Provide titrated oxygen therapy if SpO2 <90%. • Do not use opioids routinely but consider small single dose morphine (2.5mg) with severe pain, agitation or distress.
5	Treat specific causes	• Arrhythmia: refer to **CG016 Periarrest Arrhythmia.** - discuss urgent angiography / PCI if recurrent arrhythmia provoked by ischaemia. - avoid beta blockers / calcium channel blockers. • Acute coronary syndrome: refer to **CG008 Acute Coronary Syndromes.** • Tamponade: - give fluid bolus as required. - arrange pericardiocentesis with LA / sedation if feasible prior to transfer. - positive pressure ventilation may worsen haemodynamic compromise.

6	Management: No cardiogenic shock	• If signs of congestion / fluid overload, give Furosemide IV bolus: - 20-40mg or 1-2 times usual oral dose IV. - aim UO >100ml/h over next 6h. - repeat at double the dose if required. • IV vasodilators (GTN) should be considered if hypertensive and may be considered if systolic BP>110mmHg: - avoid in RV infarction, caution if fixed cardiac output eg aortic stenosis, LV hypertrophy or tamponade. - can initially be given sublingually (2 puffs). - commence IV infusion (see **CG011 Adult Drug Infusions**). - titrate up by 1ml/h every 10 mins to physiological improvement, avoiding sBP <110. • With respiratory distress, provide non-invasive positive pressure ventilation. - e.g. using NIV machine, Oxylog ventilator or BVM with PEEP valve.
7	Management: with cardiogenic shock (systolic BP<90 or hypoperfusion)	• Insert arterial line for continuous BP monitoring. • Avoid excessive PEEP as can this drop BP. • IV fluid challenge (250ml) if no signs of fluid overload. • Commence vasopressor / inotrope if SBP<90mmHg with hypoperfusion, unresponsive to fluid challenge: - start with Noradrenaline (exception: Takotsubo syndrome). - if giving peripherally, use the 4mg/50ml dilution and monitor the infusion site. - consider adding an inotrope (dobutamine) with demonstrable systolic dysfunction without dysrhythmia. - optimal combination of agents depends on nature of cardiac dysfunction: seek advice where necessary. - target SPB>90mmHg or MAP 60-65mmHg. • Cardiogenic shock carries a very poor prognosis - consider if transfer is appropriate.
8	If intubation required	• Consider intubation with progressive respiratory failure, reduced consciousness or exhaustion. • Minimise risk of cardiovascular collapse on induction: - stop GTN infusion 5 mins before induction. - consider fluid bolus prior to induction. - reduce dose of induction agent. - have push-dose vasopressor available to hand (e.g. metaraminol). • Standard ventilation settings.

9	Destination	• Consider need for specialist intervention and discuss with regional cardiology centre: - PCI (ACS including NSTEMI, refractory arrhythmia). - Mechanical circulatory support (MCS) for reversible cardiogenic shock (includes intra-aortic balloon pump, Impella, VA-ECMO). - Valve surgery. - Renal replacement therapy for volume / metabolic optimisation. - Pacemaker insertion. • In addition to the regional centre, consider discussing with the Scottish National Advanced Heart Failure Service patients with demonstrable LV systolic dysfunction and refractory cardiogenic shock who may require MCS or transplant: on call Heart Failure page via GJNH switchboard (0141 951 5000).
10	Transport considerations	• Ensure defibrillator pads accessible. • NIV has specific transport implications (**CG024 NIV**): - consider remaining on scene to allow medical therapies to take effect. - consider intubation or form a backup plan in case of deterioration in transit. - ensure adequate O_2 supply - NIV uses considerable volumes.

2. Document History			
Reference Number	CG026		
Version	1		
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		EMRS North	✓
		Paediatric	X
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	Tayside Trauma Team		X

3. Scope and purpose

- Overall objectives:

The aim of this guideline is to support clinicians in the management and transfer of patients with acute cardiac failure.

- Statement of intent:

This guideline is not intended to be construed or to serve as a standard of care. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. Clinicians using this guideline should work within their skill sets and usual scope of practice.

- Feedback:

Comments on this guideline can be sent to: sas.CPG@nhs.scot

- Equality Impact Assessment:

Applied to the ScotSTAR Clinical Standards group processes.

- Guideline process endorsed by the Scottish Trauma Network Prehospital, Transfer and Retrieval group.

4. Explanatory Statements		
4.1 Indications for Retrieval	**Authors' recommendation**	**Level [Reference]**
• *Patients with acute cardiac failure unresponsive to initial measures:* - *+/- specific intervention required* - *appropriate for treatment escalation* Acute cardiac failure will often respond well to initial treatment and can be managed in an in an ordinary hospital ward without the need for critical care retrieval. Consider the need for time-critical transfer if reversible cause is present (e.g. STEMI, valve rupture requiring surgery, tamponade).	Good practice point (GPP)	Guideline [1] 4 [2]
4.2 Assessment		
• *ECG for arrhythmia / ischaemia:* - *if ECG shows STEMI / equivalent, prioritise revascularisation and discuss with primary PCI centre.*	Strong	Guideline [1,3]
• *Aim to determine the most likely cause:* - *acutely decompensated heart failure (in 50-70% of cases)* - *acute coronary syndrome.* - *hypertensive emergency* - *arrhythmia.* - *mechanical dysfunction: eg valve disease,VSD.* - *pulmonary embolism* - *infections: eg myocarditis* - *tamponade.* - *also consider drug effect or acute cardiomyopathy (peripartum, stress etc).*	Conditional	Guideline [1]
4.3 Monitoring / Investigations		
• *Strongly consider arterial line:* This is not routine for patients with acute heart failure but is recommended for patients with cardiogenic shock [3] and may be preferable to NIBP if the patient is on a GTN infusion, especially during transport to conserve the monitor battery.	GPP	4 [2]
- *avoid the right radial artery if coronary angiography is a possibility.* The right radial artery is the preferred cannulation site for angiography [4] due to reduced adverse events including all cause mortality reduction [5].	Strong	Guideline [4] 1++ [5]
• *Insert urinary catheter and monitor urine output.* A urinary catheter is specifically recommended in cardiogenic shock or with oliguria or acute kidney injury [3, supplement]	GPP	

	Authors' recommendation	Level [Reference]
• *As available:* - *Chest X ray* - *Blood tests: ABG, FBC, U&E, CRP, troponin, lactate* - *Echocardiogram and Lung Ultrasound can assist in confirming diagnosis +/- underlying cause.*	Conditional	Guidelines [1,3,6]
4.4 General Interventions		
• *Elevate head of bed +/- sitting position if BP allows.* This will optimise ventilation and minimise preload.	GPP	
• *Provide titrated oxygen therapy if SpO2 <90%.*	Strong	Guideline [1]
• *Do not use opioids routinely but consider small single dose morphine (2.5mg) in severe pain, agitation or distress.* There is some observational evidence that morphine can worsen outcomes in patients with acute decompensated heart failure but high doses were administered in this study [6]. The ESC [1] and NICE [5] guidelines specifically advise against routine use. Used carefully opioids remain a useful adjunct for certain patients.	Conditional	Guidelines [1,6] 2+ [7]
4.5 Treat specific causes		
• *Arrhythmia: refer to **CG016 Periarrest Arrhythmia.***	-	-
- *discuss urgent angiography / PCI if recurrent arrhythmia provoked by ischaemia*	Strong	Guideline [1]
- *avoid beta blockers / calcium channel blockers* Although beta blockers are used to treat chronic stable heart failure [5], as negative inotropes they should be avoided in acute / decompensated heart failure.	Strong	Guideline [8]
• *Acute coronary syndrome: refer to **CG008 Acute Coronary Syndromes***	-	-
• *Tamponade:* - *give fluid bolus as required* - *arrange pericardiocentesis with LA / sedation if feasible prior to transfer* - *positive pressure ventilation may worsen haemodynamic compromise.*	GPP	4 [2]

4.6 Management: no cardiogenic shock	**Authors' recommendation**	**Level [Reference]**
• *If signs of congestion / fluid overload, give Furosemide IV bolus:* - *20-40mg or 1-2 times usual oral dose IV.* - *aim UO >100ml/h over next 6h.* - *repeat at double the dose if required.*	Strong	Guidelines [1,6]
• *IV vasodilators (GTN) should be considered if hypertensive and may be considered if systolic BP>110:* - *avoid in RV infarction, caution if fixed cardiac output eg aortic stenosis, LV hypertrophy or tamponade.* ESC suggest vasodilators as a IIb (may be considered) if SPB>110 and should be considered if hypertensive to reduce congestion and improve symptoms. Routine use of nitrates is however cautioned against by NICE [6]. Closely monitor blood pressure.	Conditional	Guidelines [1,6,9]
- *can initially be given sublingually (2 puffs).*	GPP	
- *commence IV infusion (see **CG011 Adult Drug Infusions**)*	Conditional	Guideline [1]
- *titrate up by 1ml/h every 10 mins to physiological improvement,* Starting low and up-titrating is recommended by the ESC guideline [1]. Desired arterial vasodilatory effect only occurs at higher concentrations. The recommended starting dose is 20 - 25 micrograms/min. This may be decreased to 10 micrograms/min, or increased in steps of 20-25 micrograms/min every 15 - 30 minutes until the desired effect is obtained [9]. 1ml/hr of 1mg/ml concentration equates to 16.67micrograms/min.	Conditional	Guideline [9]
- *avoid systolic BP <110*	Conditional	Guideline [1]
• *With respiratory distress, provide non-invasive positive pressure ventilation.* Do not use routinely [5] but with distress, dyspnoea, acidaemia.	Conditional	Guideline [1,3,6]
- *e.g. using NIV machine, Oxylog ventilator or BVM with PEEP valve.*	GPP	
4.7 Management: with cardiogenic shock (systolic BP<90 or hypoperfusion)		
• *Insert arterial line for continuous BP monitoring.*	Strong	Guideline [3]
• *Provide an IV fluid challenge (250ml) if no signs of fluid overload.*	Strong	Guidelines [1,3]

• *Commence vasopressor / inotrope if SBP<90mmHg with hypoperfusion, unresponsive to fluid challenge:* - *start with Noradrenaline (exception: Takotsubo syndrome).* - *if giving peripherally, use the 4mg/50ml dilution and monitor the infusion site.* - *consider adding an inotrope (dobutamine) with demonstrable systolic dysfunction without dysrhythmia.* - *optimal combination of agents depends on nature of cardiac dysfunction: seek advice where necessary.* - *target SPB>90mmHg or MAP 60 to 65mmHg.* Do not use routinely [6] but where there is hypotension or features of shock. Noradrenaline is the preferred first line agent. Takotsubo syndrome is exacerbated by catecholamines; seek expert advice.	Conditional	Guidelines [1,3]
• *Cardiogenic shock carries a poor prognosis – consider if transfer is appropriate.*	GPP	4 [2]
4.8 If intubation required		
• *Consider intubation with progressive respiratory failure, reduced LOC or exhaustion.*	Conditional	Guideline [1,6]
• *Minimise risk of cardiovascular collapse on induction:* - *stop GTN infusion 5 mins before induction.* - *consider fluid bolus prior to induction.* - *reduce dose of induction agent.* - *have push-dose vasopressor available to hand (e.g. metaraminol).*	GPP	
• *Use protective lung ventilation settings; PEEP may be not be tolerated*	Conditional	Guideline [3]

4.9 Destination	Authors' recommendation	Level [Reference]
• *Consider need for specialist intervention:* - *PCI (ACS including NSTEMI, refractory arrhythmia)*	Strong	Guideline [1]
- *Mechanical circulatory support (MCS) for reversible cardiogenic shock (includes intra-aortic balloon pump, Impella, VA-ECMO).* - *Valve surgery* - *Renal replacement therapy for volume / metabolic optimisation.* Consider for patients with established renal failure and fluid overload. Consider ultrafiltration for patients with diuretic-resistant pulmonary oedema. [6] - *Pacemaker insertion*	Conditional	Guidelines [1,3,6]
• *In addition to the regional centre, consider discussing with the Scottish National Advanced Heart Failure Service patients with demonstrable LV systolic dysfunction and refractory cardiogenic shock who may require MCS or transplant: on call Heart Failure page via GJNH switchboard (0141 951 5000).*	GPP	
4.10 Transport considerations		
• *Ensure defibrillator pads accessible.* • *NIV has specific transport implications (**CG024 NIV**):* - *consider remaining on scene to allow medical therapies to take effect.* - *consider intubation or form a backup plan in case of deterioration in transit.* - *ensure adequate O_2 supply - NIV uses considerable volumes.*	GPP	4 [2]

5. References

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