

Cardiac Failure

Definition / Supporting Information

Congestive heart failure (CHF) is an inability to perfuse the body tissues adequately. Up to 90% of cases of CHF in childhood occur during the first year of life, most during the neonatal period.

Keywords / also known as: congestive heart failure, heart failure, weak heart

Essential History

Evaluation should only proceed after the ABCs (airway, breathing, circulation) of resuscitation have been addressed.

Ask about:

- Shortness of breath, or breathlessness (see [Dyspnoea](#))
- Feeding difficulties and / or breathlessness during feeding
- Sweating
 - Including sweating during feeding
- Listlessness, lethargy, irritability, and excessive tiredness
- Loss of interest in toys or favourite activities
- Change in colour
 - Cyanosis
 - Pallor
- Poor weight gain, poor growth (see [Faltering Growth](#)), weight loss
- Unexplained syncope or palpitations
 - Consider arrhythmias
- Known history of congenital heart disease or arrhythmias
- Cardiac surgery
- Kawasaki Disease
 - A young child with a history of Kawasaki Disease, who has had coronary artery aneurysms, might experience coronary thrombosis or myocardial ischaemia and may present with non-specific or poorly localised pain, unexplained crying, unusual pallor, restlessness or sweating
 - An older child may also have chest or arm pain, may be breathless and may be vomiting

'Red Flag' Symptoms and Signs

Ask about:

- Shortness of breath, or breathlessness (see [Dyspnoea](#))
- Difficulty in feeding and / or breathlessness during feeding
- Sweating
 - Including sweating during feeding
- Listlessness, lethargy, irritability, excessive tiredness
- Change in colour
 - Cyanosis
 - Pallor
- Unexplained syncope or palpitations
 - Consider arrhythmias
- Kawasaki Disease
 - A history of Kawasaki Disease with coronary artery aneurysms, whether resolved or persisting, increases the lifetime risk of major cardiac events

Look for:

- Evidence of respiratory distress
 - Shortness of breath (see [Dyspnoea](#))
 - Tachypnoea
 - Recession
 - Crepitations on auscultation
- Evidence of poor perfusion
 - Prolonged capillary refill time
 - Poor pulses
 - Mottled skin, cool extremities
 - Tachycardia
 - Hypotension with narrow pulse pressure
- Evidence of congestion (increased cardiac filling pressures)
 - Jugular venous distension
 - More difficult to assess in young children
 - Hepatomegaly
 - Peripheral oedema
 - Ascites
- Third heart sound 'gallop rhythm'
- Jugular venous distension
 - More difficult to ascertain in young children
- Hepatomegaly
- Peripheral [oedema](#) in older children

- See Fever in under 5s: assessment and initial management [[NICE clinical guideline 160, section 1.2.4, table 1](#)]
- Where a patient with a history of Kawasaki Disease, findings that suggest thrombosis or myocardial ischaemia
 - Chest, arm or abdominal pain
 - Unexplained crying
 - Unusual pallor
 - Restlessness
 - Sweating
 - Discolouration of skin

Differential Diagnosis / Conditions

The transition from foetal circulation to postnatal circulation requires precise steps, any of which may be compromised and lead to heart failure.

Prenatal period

- Infections (eg, parvovirus)
- Abnormalities of heart rhythm (eg, supraventricular tachycardia (SVT)) (see Cardiac Arrhythmias)
- Chronic or severe CHF is associated with increased risks of hydrops fetalis and death

First day of life

- Persistent foetal circulation or persistent pulmonary hypertension associated with:
 - Meconium aspiration
 - Neonatal acidosis
- Neonatal sepsis
 - Risk factors include:
 - Prolonged rupture of membranes
 - Maternal infection and associated findings
- Haematological or metabolic disorders
 - Polycythaemia resulting in sludging and hyperviscosity of blood
 - Most common in infants of mothers with diabetes
- Severe [anaemia](#)
 - Acute blood loss (eg, from placental abruption)
 - Chronic anaemia, such as that caused by Rh sensitisation
 - Intravascular volume may be high
 - Transfusion may worsen heart failure
- Metabolic causes of cardiomyopathy including:
 - Hypoglycaemia

- Hypocalcaemia
- Rare congenital heart defects, including:
 - Absent pulmonary valve
 - Free tricuspid orifice
 - Severe anomaly of the tricuspid valve associated with severe pulmonary stenosis
- Heart rate abnormalities (eg, SVT or bradycardia) (see Cardiac Arrhythmias)

Days 1–2 of life

- Obstructed total anomalous pulmonary venous return
 - Persistent or progressive tachypnoea and hypoxia, and
 - Chest radiographs showing a snowman or snowball pattern, with vessels radiating from a small cardiac silhouette
- Early identification is essential because surgery is the only effective intervention

Days 2–3 of life

- Ductus arteriosus-dependent lesions, including:
 - Right-sided obstructive lesions
 - Pulmonary atresia
 - Maximal tetralogy of Fallot
 - Tricuspid atresia
 - Transposition of the great arteries (the most common type of cyanotic heart disease)
 - Left-sided obstructive lesions
 - Hypoplastic left-heart
 - Critical aortic stenosis
 - Complex coarctation of the aorta
- Importance of patent ductus arteriosus
 - Reduces risk of CHF while patent
 - CHF may develop after closure
 - Especially in left-sided obstructive lesions

Days 3–7 of life

- Endocrine disorders
 - Congenital adrenal hypoplasia
 - Hyperthyroidism
- Renal disorders
 - Renal vein thrombus
 - Renal artery stenosis
 - Hypertension or oliguria of any cause

Weeks 1–2 of life

- Complex coarctation of the aorta or interrupted aortic arch
 - If cardiac output is low there may be no pulse differential between the upper and lower extremities

Months 1–2 of life

- Left-to-right shunt lesions
 - Ventricular septal defect
 - Atrial-level shunts
 - Atrial septal defect (rarely)
 - Complete atrioventricular canal defects
 - Great vessel-level shunts
 - Patent ductus arteriosus

Months 6–12 of life

- Metabolic, genetic, infectious, and inflammatory cardiomyopathies
- Children may exhibit faltering growth and hypotonia
- Glycogen storage diseases may also present in this way
- Infectious and inflammatory diseases can cause myocarditis at this age
 - Human immunodeficiency virus
 - Enterovirus infections
 - Kawasaki's disease

Years 1–18 of life

- Most common in children with comorbid severe or chronic illnesses
- Myocarditis due to infective or inflammatory diseases
- Older children with congenital heart disease, other than those who have had corrective surgery, rarely develop CHF

Investigations

Evaluation should only proceed after the ABCs of resuscitation have been addressed.

To be undertaken by specialist practitioners (eg, Neonatal / Emergency Department / Paediatric and / or Paediatric Cardiology Team(s)):

- Chest X-ray
- Pulse oximetry
- Full blood count
- Electrolytes
 - Glucose and calcium
- Blood gas

- Electrocardiography (ECG)
- Echocardiography
- Where a patient with a history of Kawasaki Disease
 - Full observations
 - 12 lead ECG
 - Troponin
 - Full blood count and blood chemistry
 - Obtain intravenous (IV) access

Treatment Approach

The treatment of CHF in children should be managed with advice from a Paediatric Cardiology Team.

To be undertaken by specialist practitioners (eg, Neonatal or Paediatric Intensive Care Unit (PICU) / Emergency Department / Paediatric and / or Paediatric Cardiology Team(s)):

- Treat underlying cause where indicated:
 - Antibiotics for sepsis
 - Blood transfusion for anaemia
 - Partial exchange for polycythaemia
- Judicious use of fluids, inotropes and oxygen for:
 - Persistent fetal circulation
 - Persistent pulmonary hypertension
- Infusions of prostaglandin E₁ (Alprostadil), to maintain patency of the ductus arteriosus for:
 - Duct-dependent lesions
 - Pulmonary atresia
 - Maximal tetralogy of Fallot
 - Tricuspid atresia
 - Transposition of the great arteries
 - Hypoplastic left-heart syndrome
 - Critical aortic stenosis
 - Complex coarctation of the aorta
- The four classes of drugs used most frequently (often in combination) in the management of CHF in children are:
 - Diuretics
 - Inotropes
 - Agents to reduce afterload (eg, hydralazine and calcium channel blockers)
 - β -adrenergic antagonists

- All paediatric patients with heart failure must be closely monitored for growth and development
- Where a patient with a history of Kawasaki Disease, specialist intervention will be required
 - Consult patient Person Specific Protocol (PSP) and specialist team

When to Refer

Refer (arrange emergency transport) to specialist practitioners (eg, PICU / Emergency Department / Paediatric and / or Paediatric Cardiology Team(s)):

- Any patient with 'red flag' signs or symptoms

Refer urgently to specialist practitioners (eg, PICU / Emergency Department / Paediatric and / or Paediatric Cardiology Team(s)):

- Any patient with suspected heart failure

Admit any patient with suspected heart failure for evaluation and management, and monitoring of their progress in consultation with the Paediatric Cardiology Team.

'Safety Netting' Advice

- All patients with congenital heart disease, with or without repair, must be monitored closely for symptoms.
 - Educate patients and parents on the early identification of symptoms of heart failure including:
 - Shortness of breath (see Dyspnoea)
 - Poor feeding (see Appetite Loss)
 - Poor weight gain (see Faltering Growth)
 - Listlessness and lethargy

Patient / Carer Information

**Please note: whilst these resources have been developed to a high standard they may not be specific to children.*

- [Heart failure](#) (Web page), the NHS website
- [Congenital heart disease in children](#) (Web page), Patient

Resources

National Clinical Guidance

[Chronic heart failure in adults: management](#) (Web page), NICE clinical guideline CG108, National Institute for Health and Care Excellence

Suggested Resources

**Please note: these resources include links to external websites. These resources do not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.*

[Captopril for heart failure](#) (Web page), Medicines for Children

[Cardiology information for parents and visitors](#) (Web page), Great Ormond Street Hospital

[Cardiac failure in children](#) (Web page), 17th Expert Committee on the Selection and Use of Essential Medicines, World Health Organization

[Carvedilol for heart failure](#) (Web page), Medicines for Children

[Heart failure](#) (Web page), British Heart Foundation

[Spotting the sick child](#) (Web page - requires log-in), Department of Health

[TEMPERS! Awareness Raising Leaflet](#) (PDF), SocietiTime to 'Think Kawasaki Disease' (Webinar), Royal College of Paediatrics and Child Health

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