

Pulmonary Oedema & Cardiac Failure

Dr Graham Tanswell
MBBS FRACP FCSANZ
Consultant Cardiologist
Specialist Services

What Is Pulmonary Oedema

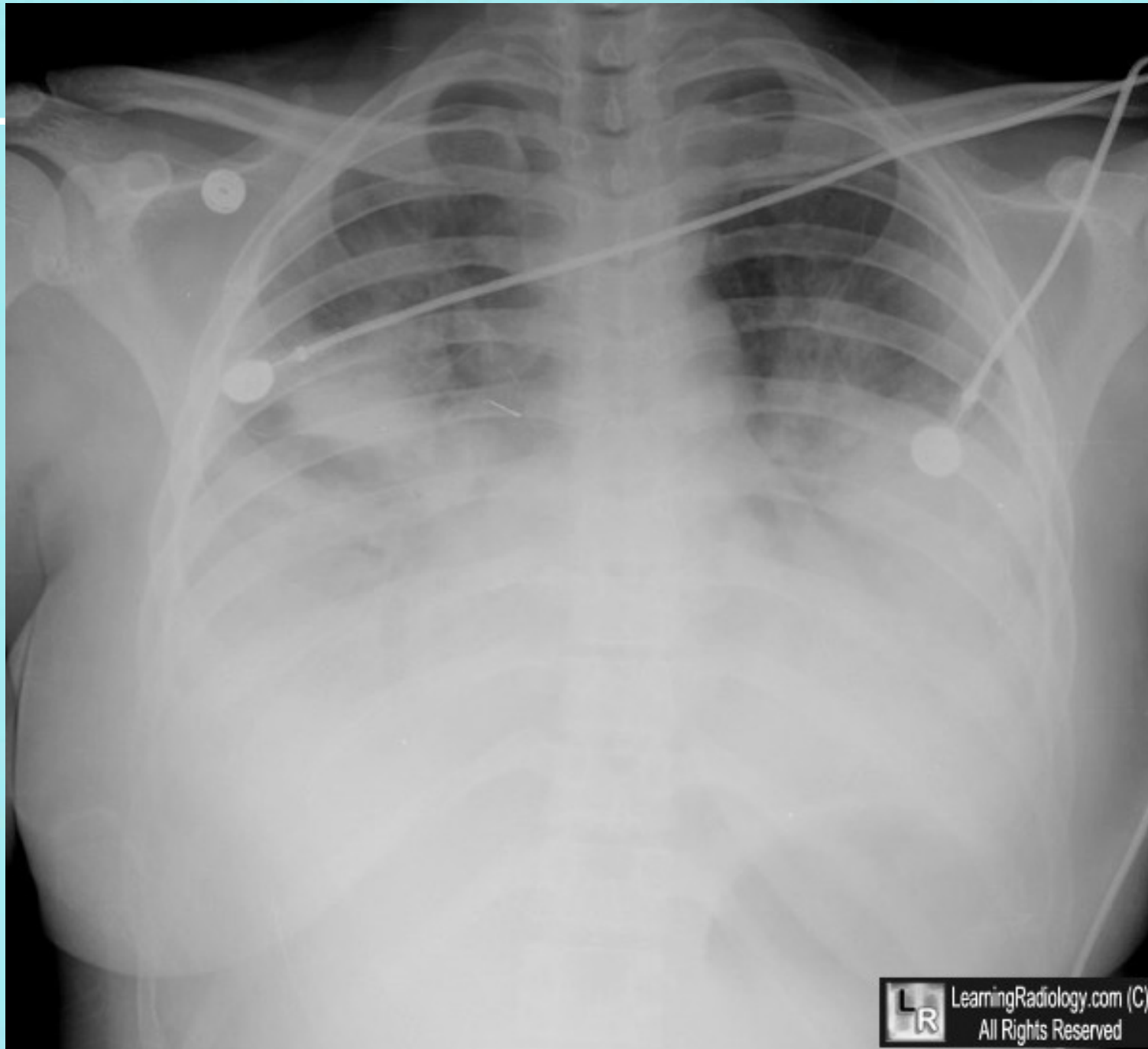
- * Pulmonary oedema is the abnormal accumulation of fluid in the alveoli of the lungs resulting in shortness of breath

Diagnosis

- * Clinical: Chest auscultation revealing creps
- * Arterial blood gas
- * CXR
- * Additional; ECG, Troponin, Septic screen, Echo

Differential Diagnosis

- * Bronchospasm
- * Exacerbation COPD
- * Pneumonia
- * Pulmonary Embolus



Causes Of Pulmonary Oedema

* Cardiac

- * Ischaemia
- * Arrhythmia
- * Cardiomyopathy
- * Valvular
- * Hypertension

* Non-cardiac

- * Altitude Sickness
- * Neurogenic
- * Sepsis

Pulmonary Oedema Treatment

- * Acute

- * Diuretics

- * Oxygen

- * Morphine

- * Nitrates

- * Non Invasive Ventilation

- * Ventilation

Morphine

- * Mechanism of action not known
- * Probably works by venodilation
- * May reduce afterload by dilating resistance vessels
- * Works centrally to reduce dyspnoea & produce euphoria
- * Need to monitor for central nervous system depression
- * No evidence for improvement in outcome

Diuretics (Frusemide)

- * Initially has a venodilating effect (Occurs in 5-15 min)
- * Diuresis occurs by 30- min with peak naturesis at 60min
- * Diuresis lowers cardiac filling pressure lowering intravascular pressure permitting mobilisation of interstitial fluid
- * Usual starting dose is 40-100 mg

Nitrates

- * Nitrates are potent venodilators
- * They increase cardiac output and reduce both afterload and preload
- * Can be given intravenously, topically or sublingually
- * Randomised studies have shown increased survival to hospital discharge in patients treated with high dose nitrates

Prognosis Of Cardiogenic Pulmonary Oedema

- * 12 to 21% in hospital mortality
- * 40% 1 year mortality

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Predictors Of In -hospital Mortality

- * Diabetes
- * Orthopnoea
- * Depressed LV systolic function
- * Acute myocardial infarction
- * Hypotension/ shock
- * Need for mechanical ventilation

Cardiac Failure



Prevalence

- * 6.3 % in an Australian study
- * 21% had structural heart disease
- * Estimated to cost over \$1000 million in Australia in 2000

NYHA Classification

- * I: No symptom limitation with ordinary physical activity
- * II: Ordinary activity somewhat limited by dyspnoea
- * III: Exercise limited by dyspnoea with moderate workload
- * IV: Dyspnoea at rest or with minimal exertion

ACC/ AHA Classification

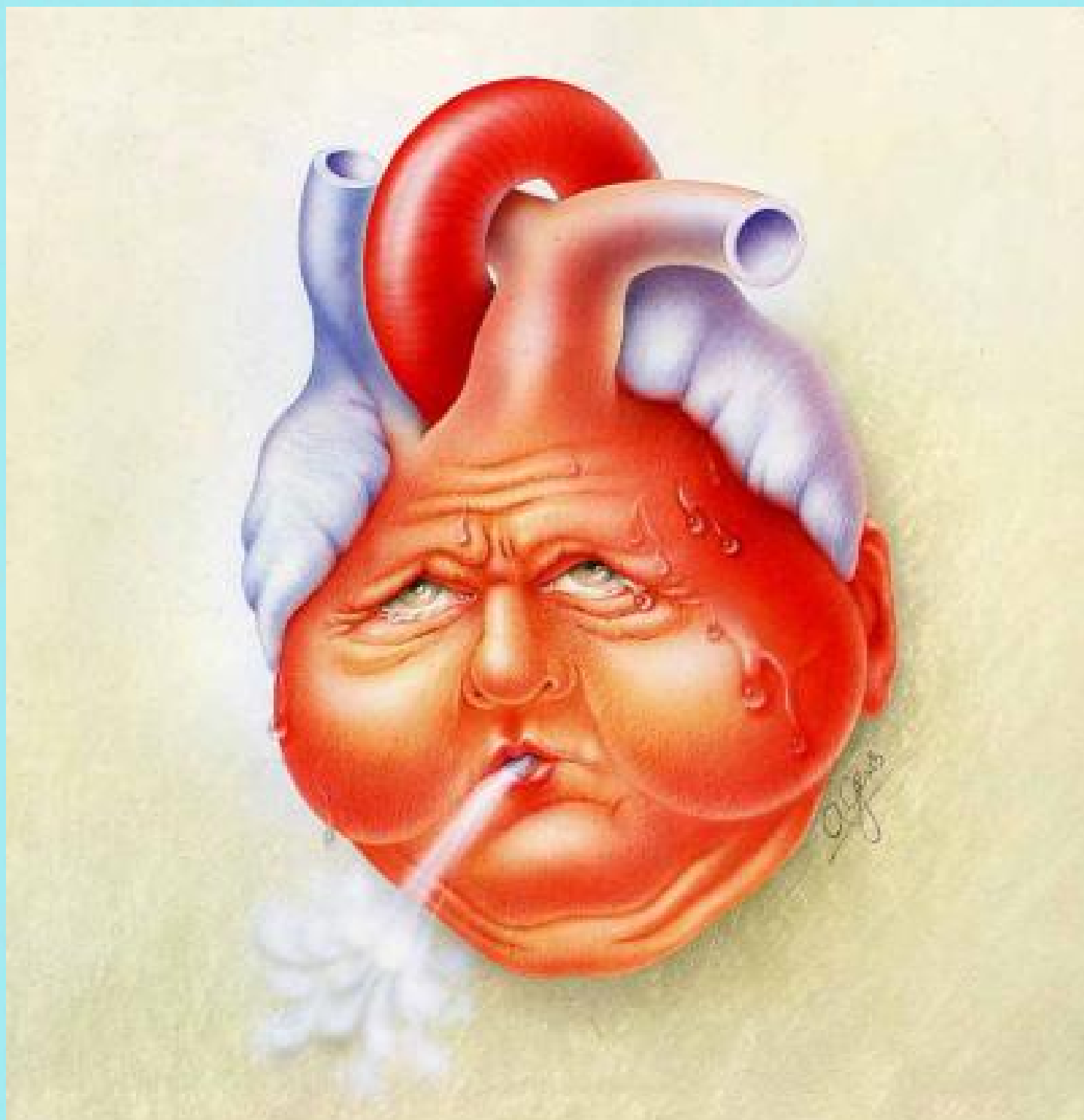
- * Stage A: At risk of heart failure but without structural heart disease or symptoms of heart failure
- * Stage B: Structural heart disease without signs or symptoms of heart failure
- * Stage C: Structural heart disease with prior or current symptoms of heart failure
- * Stage D: Refractory heart failure requiring specialised intervention

Brain Natriuretic Peptide

- * BNP is a natriuretic hormone that participates in the control of renal and cardiovascular function
- * It is not expressed in normal myocardium
- * In heart failure ventricular cells are recruited to secrete BNP in response to the high ventricular filling pressures
- * A plasma BNP >100 pg/mL has a 90% sensitivity, 76% specificity & 83% predictive accuracy
- * BNP is elevated in both diastolic & systolic heart failure

Systolic heart Failure Treatment

- * ACE Inhibitors
- * ARBs
- * Aldosterone blockers
- * Beta blockers
- * Digoxin
- * Diuretics
- * Resynchronisation therapy
- * Ventricular assist devices & Transplantation



Diastolic Cardiac Failure

- * Also known as preserved ejection fraction heart failure
- * Has a 5 year survival of 40% which is equivalent to heart failure with reduced ejection fraction
- * 1/3rd of patients with heart failure have normal or near normal ejection fraction
- * The prevalence of diastolic heart failure is highest in people over 75 years old

Characteristics of Diastolic Heart Failure as Compared with Those of Systolic Heart Failure

Table 1. Characteristics of Diastolic Heart Failure as Compared with Those of Systolic Heart Failure.*

Characteristic	Diastolic Heart Failure	Systolic Heart Failure
Clinical features		
Symptoms (e.g., dyspnea)	Yes	Yes
Congestive state (e.g., edema)	Yes	Yes
Neurohormonal activation (e.g., brain natriuretic peptide)	Yes	Yes
Left ventricular structure and function		
Ejection fraction	Normal	Decreased
Left ventricular mass	Increased	Increased
Relative wall thickness†	Increased	Decreased
End diastolic volume	Normal	Increased
End diastolic pressure	Increased	Increased
Left atrial size	Increased	Increased
Exercise		
Exercise capacity	Decreased	Decreased
Cardiac output augmentation	Decreased	Decreased
End diastolic pressure	Increased	Increased

* The clinical features of diastolic heart failure are similar to those of systolic heart failure, but left ventricular structure and function are distinctly different.

† The descriptor of left ventricular geometry is the relative wall thickness, defined as the ratio of left ventricular wall thickness to the radius of the left ventricular cavity.

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Diastolic Heart Failure

- * Diagnosis is based on finding the typical symptoms & signs of heart failure in patients who have been shown to have normal left ventricular ejection fraction & no valvular abnormalities on echocardiography
- * The documentation of an ejection fraction over 40% is necessary for the diagnosis

Management

- * Initial management is aimed at reducing venous pressure & congestion & usually requires diuretics
- * No long term management has been demonstrated to reduce mortality in a double blind trials

Management Principles for Patients with Diastolic Heart Failure

Table 2. Management Principles for Patients with Diastolic Heart Failure.

Goal	Treatment*	Daily Dose of Medication†
Reduce the congestive state	Salt restriction	<2 g of sodium per day
	Diuretics	Furosemide, 10–120 mg Hydrochlorothiazide, 12.5–25 mg
	ACE inhibitors	Enalapril, 2.5–40 mg Lisinopril, 10–40 mg
	Angiotensin II-receptor blockers	Candesartan, 4–32 mg Losartan, 25–100 mg
Maintain atrial contraction and prevent tachycardia	Cardioversion of atrial fibrillation	
	Sequential atrioventricular pacing	
	Beta-blockers	Atenolol, 12.5–100 mg Metoprolol, 25–100 mg Verapamil, 120–360 mg
	Calcium-channel blockers Radiofrequency ablation modification of atrioventricular node and pacing	Diltiazem, 120–540 mg
Treat and prevent myocardial ischemia	Nitrates	Isosorbide dinitrate, 30–180 mg Isosorbide mononitrate, 30–90 mg
	Beta-blockers	Atenolol, 12.5–100 mg Metoprolol, 25–200 mg
	Calcium-channel blockers	Diltiazem, 120–540 mg Verapamil, 120–360 mg
	Coronary-artery bypass surgery, percutaneous coronary intervention	
Control hypertension	Antihypertensive agents	Chlorthalidone, 12.5–25 mg
		Hydrochlorothiazide, 12.5–50 mg
		Atenolol, 12.5–100 mg
		Metoprolol, 12.5–200 mg
		Amlodipine, 2.5–10 mg
		Felodipine, 2.5–20 mg
		Enalapril, 2.5–40 mg
		Lisinopril, 10–40 mg
		Candesartan, 4–32 mg
		Losartan, 50–100 mg
Measures with Theoretical Benefit in Diastolic Heart Failure		
Promote regression of hypertrophy and prevent myocardial fibrosis	ACE inhibitors	Enalapril, 2.5–40 mg
		Lisinopril, 10–40 mg
		Ramipril, 5–20 mg
Angiotensin-receptor blockers	Captopril, 25–150 mg	
	Candesartan, 4–32 mg	
Spironolactone	Losartan, 50–100 mg 25–75 mg	

* Treatments listed for the first four goals are those generally used in clinical practice. Angiotensin-converting-enzyme (ACE) inhibitors, angiotensin-receptor blockers, and spironolactone inhibit the renin-angiotensin-aldosterone system and thus have a theoretical benefit, but more data are required to show that they reduce the risk of heart failure.

† The list of medications is not comprehensive but, rather, includes examples that are in common clinical use or have been included in studies of pathophysiologic mechanisms in diastolic dysfunction or heart failure or were included in larger trials that generally were not designed to assess outcomes in diastolic heart failure. Candesartan is the only agent studied in a randomized, controlled trial involving patients with diastolic heart failure.³⁹ A more exhaustive list of antihypertensive agents can be found in the guidelines of the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.⁴⁰

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