

Cerner's mission is to contribute to the systemic improvement of health care delivery and the health of communities.

We are transforming health care by eliminating error, variance and waste for health care providers and consumers around the world. Our software solutions optimize processes for health care organizations ranging from single-doctor practices to entire countries, for the pharmaceutical and medical device industries, and for the field of health care as a whole. Our solutions are licensed by more than 9,000 facilities worldwide.

Working in Partnership



■ Cerner

- Provide Electronic Patient Records across the UK and Globally



■ BMJ

- Use the Electronic Patient Record to deliver decision support based on best evidence
- Information is delivered at the point of care

Evidence into Practice

- It took 200 years before the Royal Navy routinely used lemon juice to prevent scurvy. First study 1601 ¹
- Routine use of thrombolytic therapy in acute MI early 1990s. The first RCT that showed the benefit late 1950s ²
- Antenatal corticosteroid use in preterm labour - 22 years for international guidelines to first recommended after first evidence ³
- On average it takes 17 years for 14% of clinical research to become routine practice ⁴

1. *Mosteller, F. Innovation and evaluation. Science 1981,211,881-86.*

2. *Antman EM, Lau J, Kupelnick B, Mosteller F, Chalmers TC. A comparison of results of meta-analyses of randomized control trials*

3. *and recommendations of clinical experts: treatments for myocardial infarction. JAMA 1992;268(2):240-248.. Crowley, P. Prophylactic corticosteroids for preterm labour. The Cochrane Library 2000, Issue 1 (CDSR) Update software.*

4. *Westfall, J. M., Mold, J., & Fagnan, L. (2007). Practice based research - "Blue Highways" on the NIH roadmap. JAMA, 297(4), p. 403.*

The burden of evidence is significant

...although figures vary

- 35,000 biomedical journal articles published annually
- 150,000 articles / month
- 120,000 RCT/year
- 500,000 articles are indexed in PubMed every year

Patient Safety

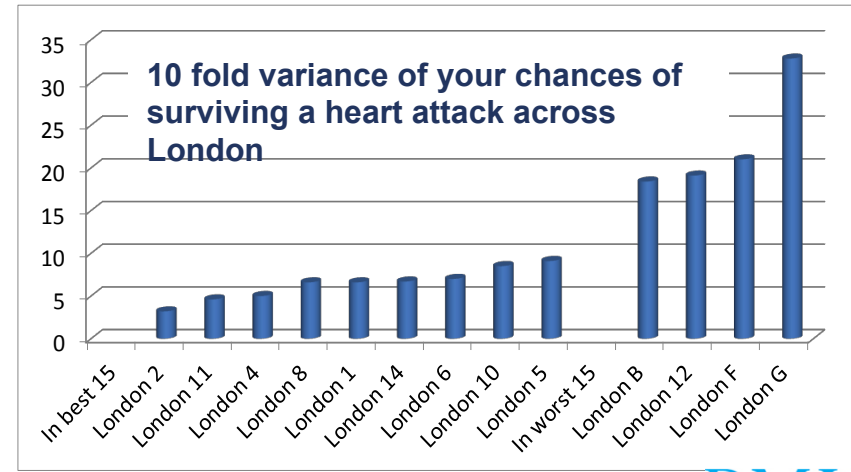
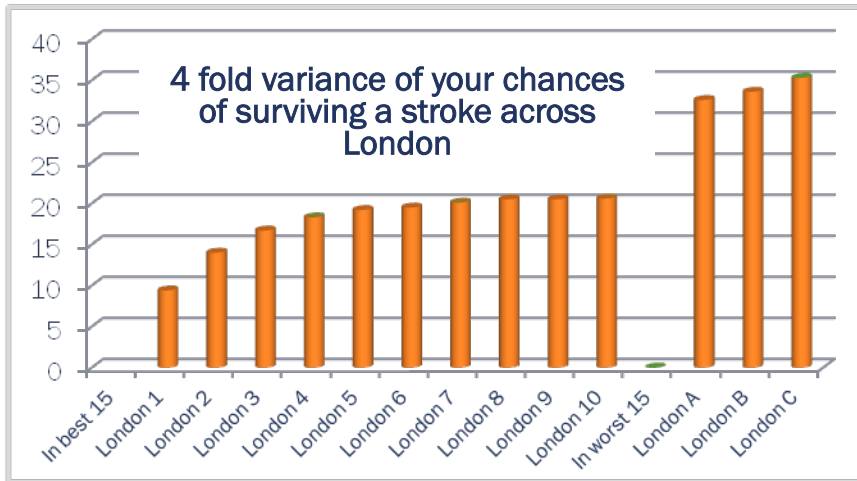
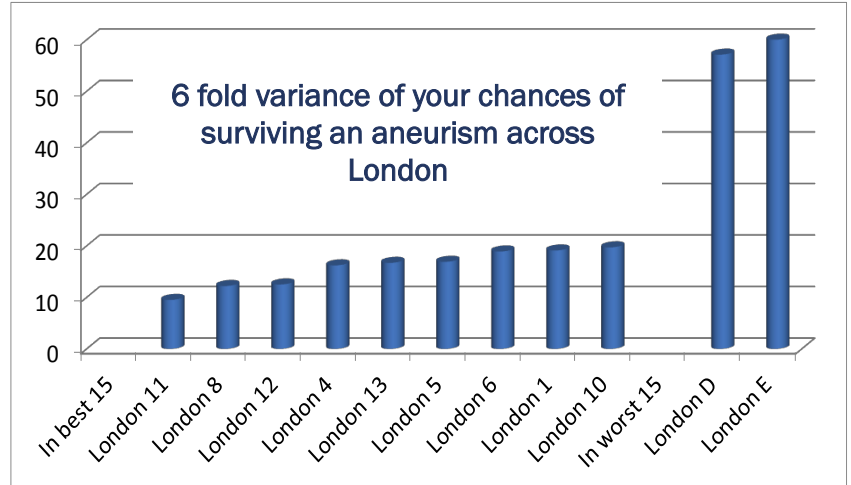
- Adverse event rate in UK hospitals as high as 10.8% ¹
- 190,000 deaths from adverse events in US annually ²
- Cost to the to our health system £650m annually
- Caused by slips, lapses, mistakes and non-uniform or poorly evidenced care
- Results in increased mortality, morbidity and a higher cost of care

1. Vincent C, Neale G, Woloshynowych M. Adverse events in British hospitals: preliminary retrospective record review. *BMJ (Clinical research ed.)*. 2001;322(7285):517-9.
2. HealthGrades Quality Study. Patient Safety in American Hospitals; 2004 http://www.healthgrades.com/english/pdf/hg_patient_safety_study_final.pdf

Manage Future Demand – EVIDENCE

We know there is a great deal of variation...

Despite 15 years of evidence based standardisation there is still wide variation in outcomes across the NHS



ActionSETS

CARE PROTOCOLS
FROM THE BMJ EVIDENCE CENTRE

- Lists of actions, tests or treatments required to diagnose and manage patients
- 523 sets covering over 150 conditions
- Evidence based **ClinicalEvidence** **BestPractice**
- Internationally peer reviewed
- Designed for CPOE / Order Comms systems but can also be used for paper processes

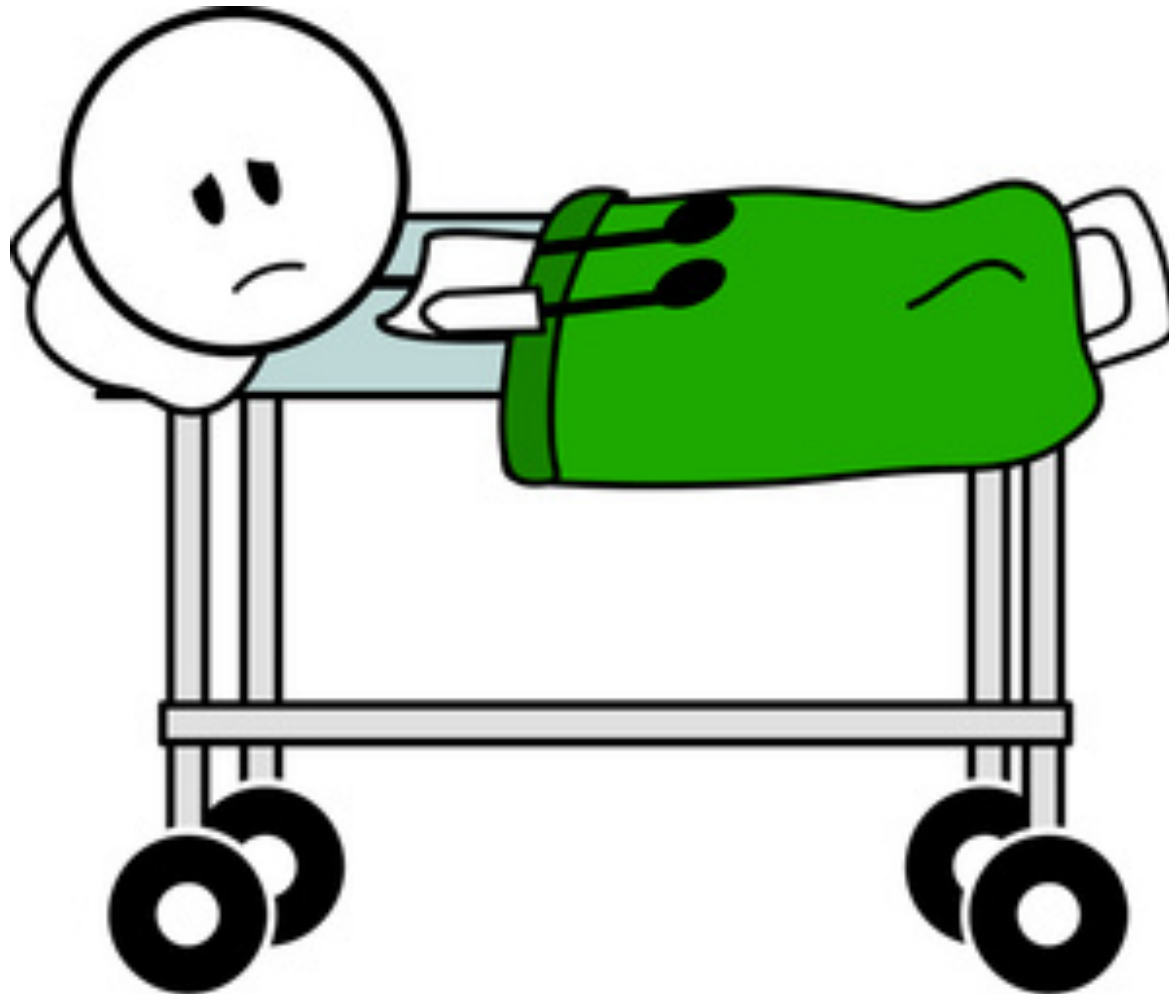
ActionSETS

CARE PROTOCOLS
FROM THE BMJ EVIDENCE CENTRE

- Phased to cover the whole care pathway divided into appropriate care settings
- Include International guidelines and drug database links
- Deep links to the evidence and learning resources
- Can be customised to meet local practice, formulary and guidelines
- Updated automatically as the evidence changes

BMJ^{Group}

 Cerner[®]



BMJ^{Group}

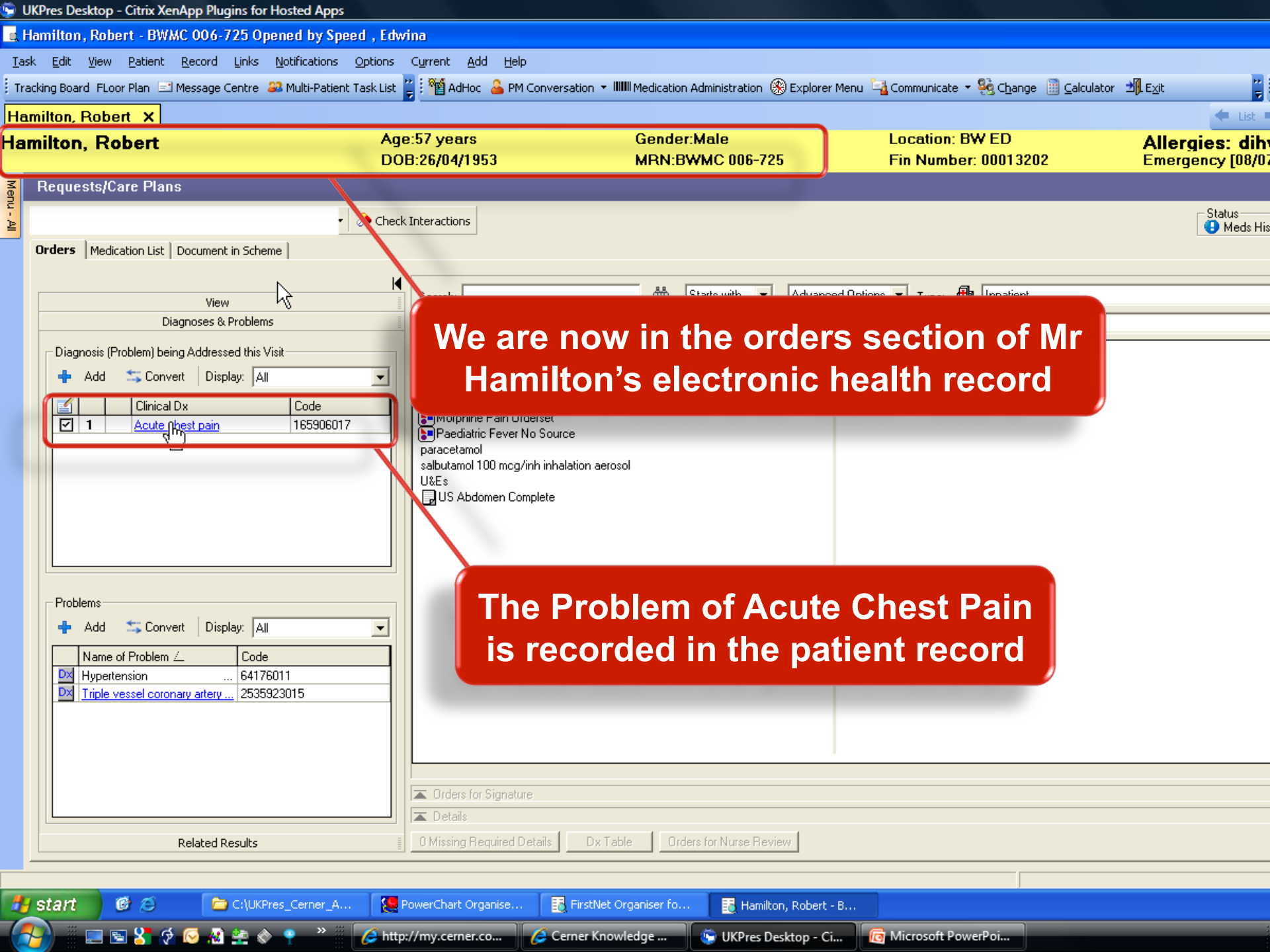


Tracking Board

All Beds All Patients Triage Doctor Nurse Provider Patients in X-ray
Patient: Bell, Ian Avg LOS: 1:43 Total: 5 WR: 0 Filter: A&E Trolley Bays

Alt	Trolley	TSP	Name	Age	Reason for Visit	Events	Investigations	RN	DR	LOS	Lab	Rad	Results	MAR	SBP	DBP
	01,A	2	Hamilton, Robert	57 y	Chest Pain- Cardiac					1:07					118*	74
	01,AH															
	02,A	4	Taylor, Helen	51 y	Abdo Pain					1:28					110*	70
	02,AH	4	Edwards, George	64 y	Laceration					1:56					120*	90
	03,A															
	03,AH															
	04,A	2	Jones, Paul	72 y	? Stroke											
	04,AH															
	05,A															
	05,AH															
	06,A	3	Bell, Ian	44 y	Abdo Pain											2* 79
	06,AH															
	07,A															
	07,AH															
	Trauma															
	Trauma															
	WR AE															

Mr Hamilton has been admitted to the Emergency Room with Chest Pain



Requests/Care Plans

Orders Medication List Document in Scheme

Diagnoses & Problems

Diagnosis (Problem) being Addressed this Visit
+ Add Convert Display: All

	Clinical Dx	Code
<input checked="" type="checkbox"/>	Acute chest pain	165906017

We are now in the orders section of Mr Hamilton's electronic health record

Problems
+ Add Convert Display: All

	Name of Problem	Code
<input checked="" type="checkbox"/>	Hypertension	64176011
<input checked="" type="checkbox"/>	Triple vessel coronary artery...	2535923015

The Problem of Acute Chest Pain is recorded in the patient record

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

Orders Medication List Document in Scheme

View

Diagnoses & Problems

Diagnosis (Problem) being Addressed this Visit

+ Add Convert Display: All

	Clinical Dx	Code
<input checked="" type="checkbox"/>	Acute chest pain	165906017

Problems

+ Add Convert Display: All

	Name of Problem	Code
<input checked="" type="checkbox"/>	Hypertension	64176011
<input checked="" type="checkbox"/>	Triple vessel coronary artery...	2535923015

Search: Starts with Advanced Options Type: Inpatient

Up Home Favourites Folders Folder: At location: BWRT

Suggested

- Acute Chest Pain - (BMJ AS)
- EBN Pain Management Acute Adult

A list of Action Sets is displayed relevant to Acute Chest Pain

Orders for Signature
Details
0 Missing Required Details Dx Table Orders for Nurse Review

Hamilton, Robert X

Hamilton, Robert

Age: 57 years
DOB: 26/04/1953

Gender: Male
MRN: BWMC 006-725

Location: BW ED
Fin Number: 00013202

Allergies: di...
Emergency [08/07]

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

Status Meds His

Orders Medication List Document in Scheme

View

Diagnoses & Problems

Diagnosis (Problem) being Addressed this Visit

+ Add Convert Display: All

	Clinical Dx	Code
<input checked="" type="checkbox"/>	1 Acute chest pain	165906017

Problems

+ Add Convert Display: All

	Name of Problem	Code
<input checked="" type="checkbox"/>	Hypertension	64176011
<input checked="" type="checkbox"/>	Triple vessel coronary artery...	2535923015

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Up Home Favourites Folders Folder:

At location: BWRT

Suggested

- Acute Chest Pain - (BMJ AS)
- EBN Pain Management Acute Adult

Orders for Signature

Details

Related Results

0 Missing Required Details

Dx Table

Orders for Nurse Review

Menu - All

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

Orders Medication List Document in Scheme

View

- Orders for Signature
- Plans
 - Document in Scheme
 - Medical
 - Acute Chest Pain - (BMJ AS)
 - Initial assessment of chest pain (*) (Planned Pending)
 - STEMI - Initial management: emergency department (Planned Pending)
 - STEMI - Thrombolysis: emergency department or coronary care U
 - Cath Lab- Percutaneous Coronary Interven (Planned Pending)
 - STEMI - subs care foll PCI - CCU (Planned Pending)
 - STEMI - Discharge (Planned Pending)
- Suggested Plans (0)
- Orders
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 - Discharge Planning
 - Patient Status
 - Basic Observations
 - Activity
 - Diet
 - Patient Care
 - IV Solutions
 - Medications
 - Laboratory
 - Diagnostic Tests
 - Special
 - Referrals
 - Ancillary Services
 - Ordersets
 - Surgical Procedure

Diagnoses & Problems
Related Results

Search: [] Starts with [] Advanced Options [] Type: [] Inpatient

Up Home Favourites Folders Folder: At location: BWRT

Plans

Initiate Add to Phase Check Alerts Start: Now Duration: None

Component	Status	Details
Patient Care		
<input checked="" type="checkbox"/> Cardiac Monitoring		t,n, Once only, for 2, hour
Invasive Interventions		
<input checked="" type="checkbox"/> Peripheral IV Insertion		Once only
Nursing Requests		
<input checked="" type="checkbox"/> Glucose Point of Care - Nursing		Once only
<input checked="" type="checkbox"/> Fluid Balance		t,n, Every hour for 2 day(s)
<input checked="" type="checkbox"/> Urine Pregnancy Test Point of Care		if possibility of pregnancy, prior to potential diagnostic radiology
IV Solutions		
<input checked="" type="checkbox"/> Balance need for urgent IV fluid therapy in hypotension against risk of potential myocardial dysfunction		
Medications		
<input checked="" type="checkbox"/> diamorphine		2.5 mg, IV, Injection, Every four hours, chest pain
<input checked="" type="checkbox"/> morphine (CD)		10 mg, IM, Soln, Every four hours, initial dose; increase frequency

Details
Dx Table Orders for Nurse Review

The Action Set is ordered, showing all the possible phases

Hamilton, Robert X

Hamilton, Robert

Age: 57 years
DOB: 26/04/1953

Gender: Male
MRN: BWMC 006-725

Location: BW ED
Fin Number: 00013202

Allergies: dihydro...
Emergency [08/07/2012]

Menu - All

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

Orders Medication List Document in Scheme

Status Meds His

Nursing requests

Medication and i.v. fluid requests

Including dose instructions

Orders for Signature

- Initial assessment of chest pain (*) (Planned Pending)
- STEMI - Initial management: emergency department (Planned Pending)
- STEMI - Thrombolysis: emergency department or coronary care unit (Planned Pending)
- Cath Lab - Percutaneous Coronary Intervention (Planned Pending)

Patient Status

Basic Observations

Activity

Diet

Patient Care

Ancillary Services

Ordersets

Surgical Procedure

Diagnoses & Problems

Related Results

Search: [] Starts with [] Advanced Options [] Type: [] Inpatient

Up Home Favourites Folders Folder: At location: BWRT

Plans

Initiate Add to Phase Check Alerts Start: Now Duration: None

Component	Status	Details
Patient Care		
<input checked="" type="checkbox"/> Cardiac Monitoring		t,n, Once only, for 2, hour
Invasive Interventions		
<input checked="" type="checkbox"/> Peripheral IV Insertion		Once only
Nursing Requests		
<input checked="" type="checkbox"/> Glucose Point of Care - Nursing		Once only
<input checked="" type="checkbox"/> Fluid Balance		t,n, Every hour for 2 day(s)
<input type="checkbox"/> Urine Pregnancy Test Point of Care		if possibility of pregnancy, prior to potential diagnostic radiology
IV Solutions		
<input type="checkbox"/> Balance need for urgent IV fluid therapy in hypotension against risk of potential myocardial dysfunction		
<input type="checkbox"/> Dextrose 5% in Water		1,000 mL, IV
<input checked="" type="checkbox"/> Sodium Chloride 0.9%		100 mL/hr, 500 mL, IV
<input type="checkbox"/> Sodium Chloride 0.9% and Potassium Chloride 0.15% 1L		
<input type="checkbox"/> Sodium Chloride 0.9% and Potassium Chloride 0.3% 1L		
Medications		
Analgesics: Opioids		
<input checked="" type="checkbox"/> PROBABLE ACUTE CORONARY SYNDROME:		
<input checked="" type="checkbox"/> Reduce dosage in the elderly and use with caution in those with underlying cardiorespiratory conditions		
<input checked="" type="checkbox"/> CAUTION: Avoid NSAID use in suspected pericarditis following myocardial infarction		
<input type="checkbox"/> diamorphine		2.5 mg, IV, Injection, Every four hours, chest pain
<input type="checkbox"/> morphine (CD)		10 mg, IM, Soln, Every four hours, initial dose; increase frequency

Details

Dx Table Orders for Nurse Review

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

Orders Medication List Document in Scheme

Status Meds His

Search: Starts with Advanced Options Type: Inpatient

Up Home Favourites Folders Folder: At location: BWRT

Plans Initiate Add to Phase Check Alerts Start: Now Duration: None

Component	Status	Details
<input checked="" type="checkbox"/> FBC		
<input checked="" type="checkbox"/> PTT (APTT ratio)		
<input checked="" type="checkbox"/> Prothrombin Time		
PATIENTS ON WARFARIN:		
<input checked="" type="checkbox"/> Prothrombin Time (INR/PT)		
Chemistry		
<input checked="" type="checkbox"/> Urea & Electrolytes		
<input checked="" type="checkbox"/> Hepatic Function Panel (LFT)		
<input checked="" type="checkbox"/> Cholesterol Total		
HYPOXAEMIA:		
<input checked="" type="checkbox"/> Blood Gas Arterial (ABG)		
Diagnostic Tests		
Cardiac		
<input checked="" type="checkbox"/> Repeat ECG if worsening pain or change in symptoms		
<input checked="" type="checkbox"/> ECG		Urgent, 12-lead within 10 minutes of arrival
Radiology		
<input checked="" type="checkbox"/> XR Chest		Urgent, Once only, Reason: Chest Pain, Transport Mode: Portable
Referrals		
<input checked="" type="checkbox"/> Referral to Anaesthetics		
<input checked="" type="checkbox"/> Referral to Critical Care		
<input checked="" type="checkbox"/> Referral to Cardiology		

Pathology tests

Radiology and other tests

Specialist Referrals

Hamilton, Robert X

Hamilton, Robert

Age: 57 years
DOB: 26/04/1953

Gender: Male
MRN: BWMC 006-725

Location: BW ED
Fin Number: 00013202

Allergies: dihy
Emergency [08/07]

Requests/Care Plans

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Status Meds His

Orders Medication List Document in Scheme

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Search: Starts with: Advanced Options: Type: Inpatient

Folder: At location: BWRT

Plans

Initiate Add to Phase Check Alerts Start: Now Duration: None

Component	Status	Details
<input checked="" type="checkbox"/> FBC		
<input type="checkbox"/> PTT (APTT ratio)		
<input type="checkbox"/> Prothrombin Time		
PATIENTS ON WARFARIN:		
<input type="checkbox"/> Prothrombin Time (INR/PT)		
Chemistry		
<input checked="" type="checkbox"/> Urea & Electrolytes		
<input checked="" type="checkbox"/> Hepatic Function Panel (LFT)		
<input type="checkbox"/> Cholesterol Total		
HYPOXAEMIA:		
<input type="checkbox"/> Blood Gas Arterial (ABG)		
Diagnostic Tests		
Cardiac		
Repeat ECG if worsening pain or change in symptoms		
<input checked="" type="checkbox"/> ECG		Urgent, 12-lead within 10 minutes of arrival
Radiology		
<input checked="" type="checkbox"/> XR Chest		Urgent Once only, Reason: Chest Pain, Transport Mode Portable
Referrals		
<input type="checkbox"/> Referral to Anaesthetics		
<input type="checkbox"/> Referral to Critical Care		
<input type="checkbox"/> Referral to Cardiology		

Details

Dx Table Orders for Nurse Review

Hamilton, Robert X

Hamilton, Robert

Age: 57 years
DOB: 26/04/1953

Gender: Male
MRN: BWMC 006-725

Location: BW ED
Fin Number: 00013202

Allergies: di...
Emergency [08/07/2010]

Requests/Care Plans

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 - STEMI - subs care foll PCI - CCU (Planned)
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Initiate Add to Phase Check Alerts Start: Now Duration: None

Acute Chest Pain - (BMJ AS), STEMI - Initial management: emergency department (Planned)
 Last updated on: 08/07/2010 11:46 by: Speed , Edwina

Admit/Discharge/Transfer

Initial assessment of chest pain (*) (Initiated)

STEMI - Initial management: emergency department (Planned)

<input type="checkbox"/>	TARGET: NSF for Coronary heart disease: All eligible patients with acute MI to receive thrombolysis within 30 minutes of arrival
<input type="checkbox"/>	TARGET: NHS ID: CV36 - Percentage of ST-elevation myocardial infarction (STEMI) patients who received thrombolytic treatment within 60 minutes of arrival
<input checked="" type="checkbox"/>	Notify Cardiac Cath Lab
<input type="checkbox"/>	Patient Status
<input type="checkbox"/>	See evidence summary for scope, references and relevant performance measures
<input type="checkbox"/>	Medications
<input type="checkbox"/>	Anticoagulant
<input type="checkbox"/>	REPERFUSION NOT PLANNED:
<input type="checkbox"/>	dalteparin Every twelve hours
<input type="checkbox"/>	THROMBOLYTIC
<input type="checkbox"/>	heparin loading dose; maximum of 10,000 U; maximum of 1,000 U/h maximum) a
<input type="checkbox"/>	Heparin 25,000
<input type="checkbox"/>	dalteparin 120 unit/kg, Subcutaneous, Soln, Every twelve hours
<input type="checkbox"/>	Age under 75 years, thrombolysis planned:
<input checked="" type="checkbox"/>	enoxaparin 30 mg, IV, Injection, Once only, bolus
<input type="checkbox"/>	Age over 75 years, thrombolysis planned:
<input type="checkbox"/>	enoxaparin 0.75 mg/kg, Subcutaneous, Injection, Twice a day, no loading
<input type="checkbox"/>	Creatinine clearance less than 30 mL/min; thrombolysis planned:
<input type="checkbox"/>	enoxaparin 1 mg/kg, Subcutaneous, Injection, Once a day
<input type="checkbox"/>	PRIMARY PCI PLANNED:
<input type="checkbox"/>	bivalirudin 0.1 mg/kg, IV, Injection, Once only, bolus, on admission
<input type="checkbox"/>	enoxaparin 1 mg/kg, Subcutaneous, Injection, Every twelve hours

New phase selected as patient progresses

Hamilton, Robert X

Hamilton, Robert

Age: 57 years
DOB: 26/04/1953

Gender: Male
MRN: BWMC 006-725

Location: BW ED
Fin Number: 00013202

Allergies: di...
Emergency [08/07/2010]

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

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 - Diet
 - Patient Care
 - IV Solutions
 - Medications
 - Laboratory

Initiate Add to Phase Check Alerts Start: Now Duration: None

Component	Status	Details
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Acute Chest Pain - (BMJ AS), STEMI - Initial management: emergency department (Planned)
Last updated on: 08/07/2010 11:46 by: Speed, Edwina

Component	Status	Details
Admit/Discharge/Transfer		
TARGET: NSF for Coronary heart disease: All eligible patients with acute MI to receive thrombolysis within 30 minutes of arrival		
TARGET: NHS ID: CV36 - Percentage of ST-elevation myocardial infarction (STEMI) patients who received thrombolytic treatment within 30 minutes of arrival		
percentage of STEMI patients who received primary angioplasty within 120 minutes of call (call to balloon time)		
<input checked="" type="checkbox"/> Notify Cardiac Cath Lab		
Patient Status		
See evidence summary for scope, references and relevant performance measures		
Medications		
Anticoagulants		
REPERFUSION NOT PLANNED:		
<input type="checkbox"/> dalteparin		120 unit/kg, Subcutaneous, Soln, Every twelve hours
THROMBOLYSIS PLANNED:		
<input type="checkbox"/> heparin		60 unit/kg, IV, Injection, Once only, loading dose; maximum of 5000 units
<input type="checkbox"/> Heparin 25,000 units/D5W 500mL		500 mL, IV, -1, Routine, T:N, 48 hour, [1,000 U/h maximum at 10 min]
<input type="checkbox"/> dalteparin		120 unit/kg, Subcutaneous, Soln, Every twelve hours
Age under 75 years, thrombolysis planned:		
<input checked="" type="checkbox"/> enoxaparin		30 mg, IV, Injection, Once only, bolus
Age over 75 years, thrombolysis planned:		
<input type="checkbox"/> enoxaparin		0.75 mg/kg, Subcutaneous, Injection, Twice a day, no loading dose
Creatinine clearance less than 30 mL/min; thrombolysis planned:		
<input type="checkbox"/> enoxaparin		1 mg/kg, Subcutaneous, Injection, Once a day
PRIMARY PCI PLANNED:		
<input type="checkbox"/> bivalirudin		0.1 mg/kg, IV, Injection, Once only, bolus, on admission
<input type="checkbox"/> enoxaparin		1 mg/kg, Subcutaneous, Injection, Every twelve hours

New set of evidence based orders

Requests/Care Plans

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 - STEMI - Thrombolysis: emergency department or coronar
 - Cath Lab- Percutaneous Coronary Interven (Planned)
 - STEMI - subs care foll PCI - CCU (Planned)
 - STEMI - Discharge (Planned)
- Suggested Plans (0)
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Diagnoses & Problems

Related Results

BNF ENOXAPARIN SODIUM: B...

http://bnf.org/bnf/bnf/current/2775.htm?q=enoxaparin&t=search

BNF 59 British National Formulary

enoxaparin Search

Home Contents Index Print

Home > British National Formulary 59 > 2 Cardiovascular system > 2.8 Anticoagulants and protamine > 2.8.1 Parenteral anticoagulants > Low molecular weight heparins

Search Results | Hide Highlighting | Next Result ▶

ENOXAPARIN SODIUM

Additional information interactions ("**Enoxaparin**").

Indications see notes above and under preparations

Cautions see under [Heparin](#) and notes above; low body-weight (increased risk of bleeding)

Contra-indications see under [Heparin](#)

Hepatic impairment manufacturer advises caution—no information available

Renal impairment risk of bleeding increased; reduce dose if eGFR less than 30 mL/minute/1.73 m²—consult product literature for details; monitoring of anti-factor Xa may be required; use of unfractionated heparin may be preferable

Hamilton, Robert X

Hamilton, Robert

Age: 57 years
DOB: 26/04/1953

Gender: Male
MRN: BWMC 006-725

Location: BW ED
Fin Number: 00013202

Allergies: di...
Emergency [08/07/2010]

Menu - All

Requests/Care Plans

+ Add Document Medication by Hx Reconciliation Check Interactions

Status Meds His

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Initiate Add to Phase Check Alerts Start: Now Duration: None

Component	Status	Details
Acute Chest Pain - (BMJ AS), STEMI - Initial management: emergency department (Planned)		
Last updated on: 08/07/2010 11:46 by: Speed , Edwina		
Admit/Discharge/Transfer		
TARGET: NSF for Coronary heart disease: All eligible patients with acute MI to receive thrombolysis within 30 minutes of arrival		
TARGET: NHS ID: CV36 - Percentage of ST-elevation myocardial infarction (STEMI) patients who received thrombolytic treatment within 60 percentage of STEMI patients who received primary angioplasty within 120 minutes of call (call to balloon time)		
<input checked="" type="checkbox"/> Notify Cardiac Cath Lab		
Patient Status		
See evidence summary for scope, references and relevant performance measures		
Medications		
Anticoagulants		
REPERFUSION NOT PLANNED:		
<input type="checkbox"/> dalteparin		120 unit/kg, Subcutaneous, Soln, Every twelve hours
THROMBOLYSIS PLANNED:		
<input type="checkbox"/> heparin		60 unit/kg, IV, Injection, Once only, loading dose; maximum of 500 mL, IV, -1, Routine, T:N, 48 hour, [1,000 U/h maximum] a 70 s; continue for 48 hours
<input type="checkbox"/> Heparin 25,000 units/D5W 500mL		
<input type="checkbox"/> dalteparin		120 unit/kg, Subcutaneous, Soln, Every twelve hours
Age under 75 years, thrombolysis planned:		
<input checked="" type="checkbox"/> enoxaparin		30 mg, IV, Injection, Once only, bolus
Age over 75 years, thrombolysis planned:		
<input type="checkbox"/> enoxaparin		0.75 mg/kg, Subcutaneous, Injection, Twice a day, no loading
Creatinine clearance less than 30 mL/min; thrombolysis planned:		
<input type="checkbox"/> enoxaparin		1 mg/kg, Subcutaneous, Injection, Once a day
PRIMARY PCI PLANNED:		
<input type="checkbox"/> bivalirudin		0.1 mg/kg, IV, Injection, Once only, bolus, on admission
<input type="checkbox"/> enoxaparin		1 mg/kg, Subcutaneous, Injection, Every twelve hours

Details
Dx Table Orders for Nurse Review

BMJ Evidence Centre Evidence summary for Assessment of chest pain

Diagnostic tests

ECG for likely acute coronary syndrome

Test	Result	Comments
ECG	ST-elevation MI (STEMI): ST-segment elevation >1 mm in ≥2 anatomically contiguous leads or new left bundle-branch block; non-ST-elevation MI (NSTEMI) or unstable angina: non-specific; ST-segment depression or T-wave inversion	ECG should be obtained in all patients with chest pain within 10 minutes of presentation. Serial ECGs are extremely important, as many cases of ACS present with normal initial ECGs.

Information from:
[Best Practice: Assessment of chest pain](#)

ECG for likely stable angina

Test	Result	Comments
ECG	no acute changes; may have evidence of previous infarction, such as Q waves	

Information from:
[Best Practice: Assessment of chest pain](#)



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Assessment of chest pain

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Summary

Chest pain is a common chief complaint, accounting for 5% to 8% of all emergency department visits in the US per year, [1] and is the presenting complaint in 1% to 2% of office-based visits. [2] In general practice in the UK, the incidence of newly diagnosed chest pain is 15.5 per 1000 person-years. [3]

Chest pain may be caused by either benign or life-threatening aetiologies and is usually divided into cardiac and non-cardiac causes. Acute coronary syndrome (ACS) encompasses unstable angina and MI. ACS affects only a few of the patients presenting with chest pain, but excluding ACS is vital because of the mortality associated with untreated MI. This monograph concentrates on the assessment of chest pain in the emergency setting.

Differential diagnosis

Sort by: common/uncommon or category

Common

- Acute coronary syndrome
- Stable angina
- Pulmonary embolism
- Pneumonia
- Viral pleuritis
- GORD
- Costochondritis
- Anxiety or panic disorder

Uncommon

- Pericarditis
- Cardiac tamponade
- Aortic dissection
- Aortic stenosis
- Mitral valve prolapse
- Pneumothorax
- Pulmonary hypertension
- Peptic ulcer disease (PUD)

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Urgent considerations

See [Differential Diagnosis](#) for more details

Acute chest pain warrants rapid clinical assessment, as underlying disease can be life-threatening. Continuous monitoring of pulse, BP, and oxygen saturation is standard care. If the patient is in pain or breathless, or oxygen saturation is <90%, high-flow oxygen should be given. Morphine (IV) may also be necessary to relieve severe pain.

Initial investigations include a 12-lead ECG, CXR, cardiac biomarkers, FBC, and renal profile. The patient may need to be transferred to an intensive care setting. Once the patient is stable, further tests such as a V/Q scan, echocardiography, CT, or angiography should be requested to confirm clinical suspicion.

Acute coronary syndrome

Acute coronary syndrome (ACS) refers to acute myocardial ischaemia caused by atherosclerotic coronary disease and includes ST-elevation MI (STEMI), non-ST-elevation MI (NSTEMI), and unstable angina (UA). These terms are used as a framework for guiding management.

Patients with STEMI need to be urgently triaged, as they may have life-threatening arrhythmias, cardiogenic shock, or pulmonary oedema. STEMI presents with a severe central chest pressure radiating to the jaw or upper extremities. There can be associated nausea and vomiting. Anticoagulation and acute reperfusion therapy with angioplasty (if available within 2

Red flags

- Acute coronary syndrome
- Pulmonary embolism
- Pneumonia
- Cardiac tamponade
- Aortic dissection
- Aortic stenosis
- Mitral valve prolapse
- Pneumothorax
- Acute cholecystitis
- Pancreatitis

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Differential diagnosis

Sort by: [common/uncommon](#) or [category](#)

Common [show all](#)

- ▶ Acute coronary syndrome
- ▶ Stable angina
- ▶ Pulmonary embolism
- ▶ Pneumonia
- ▶ Viral pleuritis
- ▶ GORD
- ▶ Costochondritis
- ▶ Anxiety or panic disorder

Uncommon [show all](#)

- ▶ Pericarditis
- ▶ Cardiac tamponade
- ▶ Aortic dissection

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Overview: Summary, Aetiology

Emergencies: Urgent considerations

Diagnosis: Step-by-step, Differential diagnosis, Guidelines

Resources: References, Images, Patient leaflets, Credits

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Differential diagnosis

Sort by: **common/uncommon** or category

Common [show all](#)

- ▶ Acute coronary syndrome
- ▶ Stable angina
- ▼ Pulmonary embolism
 - 📌 see our comprehensive coverage of Pulmonary embolism

History	Exam	1st test	Other tests
sharp and pleuritic in nature; shortness of breath; haemoptysis may occur if pulmonary infarction develops; massive PE results in syncope; risk factors: history of immobilisation, orthopaedic procedures, oral contraceptive use, previous PE, hypercoagulable states, or recent travel over long distances; [26] unilateral swollen lower leg that is red and painful suggests DVT; use of the modified Wells criteria can help to screen for	tachycardia, loud P2, right-sided S4 gallop, jugular venous distention, fever, right ventricular lift; massive PE may cause hypotension [26]	<ul style="list-style-type: none"> • ECG: sinus tachycardia; presence of S1, Q3, and T3 More • D-dimer: non-specific if positive; PE excluded if result negative in patients with low probability of having a PE • CXR: decreased perfusion in a segment of pulmonary vasculature (Westermark sign); presence of pleural effusion • CT pulmonary angiography: identification of thrombus in the 	<ul style="list-style-type: none"> • echocardiography: acute right ventricular dilation or hypokinesia • V/Q scan : V/Q mismatch • pulmonary angiography: identification of thrombus in the pulmonary circulation More

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Pulmonary embolism

Highlights Summary Overview	Basics Definition Epidemiology Aetiology Pathophysiology	Prevention Primary Secondary	Diagnosis History & examination Tests Differential Step-by-step Criteria Guidelines Case history	Treatment Details Step-by-step Emerging Guidelines Evidence	Follow Up Recommendations Complications Prognosis	Resources References Images Online resources Patient leaflets Credits
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History & exam

Key factors

- presence of risk factors
- chest pain
- dyspnoea
- syncope
- tachypnoea
- hypotension (systolic BP <90 mmHg)

Other diagnostic factors

- feeling of apprehension
- cough
- haemoptysis
- tachycardia
- fever
- elevated jugular venous pressure
- sternal heave

Diagnostic tests

1st tests to order

- ECG
- CXR
- ABG
- modified Wells score
- Geneva score
- D-dimer
- multi-detector computed tomography (MDCT) of chest
- ventilation-perfusion scan (V/Q scan)

Tests to consider

- transthoracic echocardiography (TTE)
- INR and activated partial thromboplastin time
- brain natriuretic peptide (BNP)

Treatment details

Presumptive

high suspicion of PE

- BP <90 mm Hg
 - oxygen ± mechanical ventilation
 - judicious IV fluids
 - anticoagulation
 - vasopressor therapy
- BP >90 mm Hg
 - oxygen
 - anticoagulation

Acute

confirmed PE: BP <90 mm Hg

- no excessive risk of bleeding

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Differential diagnosis

Sort by: **common/uncommon** or category

Common show all

- ▶ Acute coronary syndrome
- ▶ Stable angina
- ▼ Pulmonary embolism
 - see our comprehensive coverage of Pulmonary embolism

History	Exam	1st test	Other tests
sharp and pleuritic in nature; shortness of breath; haemoptysis may occur if pulmonary infarction develops; massive PE results in syncope; risk factors: history of immobilisation, orthopaedic procedures, oral contraceptive use, previous PE, hypercoagulable states, or recent travel over long distances; [26] unilateral swollen lower leg that is red and painful suggests DVT; use of the modified Wells criteria can help to screen for	tachycardia, loud P2, right-sided S4 gallop, jugular venous distention, fever, right ventricular lift; massive PE may cause hypotension [26]	<ul style="list-style-type: none"> ECG: sinus tachycardia; presence of S1, Q3, and T3 More D-dimer: non-specific if positive; PE excluded if result negative in patients with low probability of having a PE CXR: decreased perfusion in a segment of pulmonary vasculature (Westermark sign); presence of pleural effusion CT pulmonary angiography: identification of thrombus in the 	<ul style="list-style-type: none"> echocardiography: acute right ventricular dilation or hypokinesis V/Q scan : V/Q mismatch pulmonary angiography: identification of thrombus in the pulmonary circulation More

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Differential diagnosis

Sort by: **common/uncommon** or category

Common show all

▼ Acute coronary syndrome

see our comprehensive coverage of Overview of acute coronary syndrome

History	Exam	1st test	Other tests
central chest pressure, squeezing, or heaviness; radiation to jaw or upper extremities; associated nausea, vomiting, dyspnoea, dizziness, weakness; occurs at rest or accelerating tempo (crescendo); risk factors: smoking, age (men >45, women >55 years), positive FHx of premature CAD, hypertension, hyperlipidaemia, diabetes, stroke, or peripheral arterial disease [6] [7]	examination may be normal; jugular venous distention, S4 gallop, holosystolic murmur (mitral regurgitation), bibasilar rales; hypotensive, tachycardic, bradycardic, or hypoxic depending on severity of ischaemia [6] [7]	<ul style="list-style-type: none"> ECG: ST-elevation MI (STEMI): ST-segment elevation >1 mm in ≥2 anatomically contiguous leads or new left bundle-branch block; non-ST-elevation MI (NSTEMI) or unstable angina: non-specific; ST-segment depression or T-wave inversion More CXR: normal or signs of heart failure, such as increased alveolar markings More cardiac enzymes: elevated in STEMI and NSTEMI; not elevated in unstable angina More 	<ul style="list-style-type: none"> BNP: >99th percentile of normal More coronary angiography: STEMI: critical occlusion of a coronary artery; NSTEMI and unstable angina: evidence of coronary artery narrowing More

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Step-by-step diagnostic approach

Chest pain can be triaged into traumatic and atraumatic aetiologies. The evaluation of atraumatic chest pain requires an algorithmic approach that first excludes acute myocardial ischaemia before working through the various aetiologies of chest pain.

History

The character of chest pain should be determined, as this can help differentiate between cardiac, respiratory, musculoskeletal, and other causes. The type, severity, location, and duration of pain; the presence of any radiation; and exacerbating or relieving factors may be helpful in pointing towards a diagnosis. Clinical presentation alone cannot reliably determine acute coronary syndrome (ACS). [10] [11] Past medical history and specific cardiac risk factors such as known cardiac disease, raised cholesterol, hypertension, smoking, and family history support a cardiac cause. [12] Cocaine use also makes cardiac ischaemia more likely. [13] A detailed drug history should also be taken (e.g., use of NSAIDs may result in gastric aetiology).

Certain characteristics of chest pain can give clues to the origin.

- Constricting pain may be due to cardiac ischaemia or oesophageal spasm.
- Pain that lasts >20 minutes and is dull, central, and crushing is likely to be caused by an MI.
- Pain that radiates to the jaw or upper extremities suggests a cardiac cause.

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The screenshot shows a web browser window with the address bar displaying `http://bestpractice.bmj.com/best-practice/monograph/301/`. The page content includes a sidebar with 'Clinical Evidence' and 'Patient' tabs, and a main area with a 'Best Practice' logo and an 'Assessment of chest pain' article. The article has sections for 'Overview' (Summary, Aetiology), 'Step-by-step diagnosis', and 'History'. The 'Step-by-step diagnosis' section states: 'Chest pain can be triaged. Atraumatic chest pain requires a detailed history should be taken (e.g., see on the page for further guidance)'. The 'History' section states: 'The character of chest pain (cardiac, respiratory, musculoskeletal, or gastrointestinal) and the duration of pain; the presence of other symptoms are helpful in pointing towards a specific cause. For example, acute coronary syndrome (ACS) such as known cardiac disease, a family history of heart disease, or support a cardiac cause. A detailed drug history should be taken (e.g., see on the page for further guidance)'. Below this is a list of characteristics of chest pain:

- Constricting pain may be due to cardiac ischaemia or oesophageal spasm.
- Pain that lasts >20 minutes and is dull, central, and crushing is likely to be caused by an MI.
- Pain that radiates to the jaw or upper extremities suggests a cardiac cause.

 An 'Add to portfolio' dialog box is overlaid on the page. It has the following fields:

- Title ***: Assessment of chest pain
- Notes**: I need to learn more about this subject
- URL**: `http://bestpractice.bmj.com/best-practice/monograph/301/diagnosis/step-by-step.html`
- Tags**: (empty)
- TAG SETS**: select a tag
- MY TAGS**: (empty)

 The dialog box also includes an 'Add' button and a 'Cancel' button. A note below the 'MY TAGS' field says: 'Separate each tag with a space: cardiovascular stroke heart. To join 2 words together in one tag, use double quotes: "Gestational Diabetes".'

The screenshot shows a web browser window with two tabs: 'BMJ Evidence summary for Assess...' and 'BMJ Chest pain (Assessment of) ...'. The main page is titled 'Best Practice' and features an 'Assessment of chest pain' article. A 'BMJ Portfolio - Windows Internet Explorer' dialog box is open, titled 'Add to portfolio'. The dialog contains the following fields:

- Title ***: Assessment of chest pain
- Notes**: I need to learn more about this subject
- URL**: http://bestpractice.bmj.com/best-practice/monograph/301/diagnosis/step-by-step.html
- Tags**: Learning Need

The 'TAG SETS' section shows a dropdown menu with 'select a tag' and a plus sign. The 'MY TAGS' section shows 'Learning Need' with a plus sign and a link to 'lose from your personal tags'. Below the tags is an 'Add' button and a 'Cancel' button. The background article includes a 'Step-by-step' section and a 'History' section.

Step-by-step
Chest pain can be triaged...
traumatic chest pain requ...
ischaemia before working

History
The character of chest pain...
cardiac, respiratory, musc...
duration of pain; the prese...
helpful in pointing towards...
acute coronary syndrome (...
such as known cardiac dis...
support a cardiac cause. [...
detailed drug history shou...

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The screenshot shows a web browser window with the address bar displaying `http://bestpractice.bmj.com/best-practice/monograph/301/`. The page content includes a search bar, navigation tabs for 'Clinical Evidence' and 'Patient', and a main article titled 'Assessment of chest pain'. The article has sections for 'Overview', 'Summary', and 'Aetiology'. The 'Step-by-step' section discusses triaging chest pain, and the 'History' section describes the characteristics of chest pain. A 'BMJ Portfolio - Windows Internet Explorer' dialog box is overlaid on the page, titled 'Add to portfolio'. The dialog contains the following fields:

- Title ***: Assessment of chest pain
- Notes**: I need to learn more about this subject
- URL**: `http://bestpractice.bmj.com/best-practice/monograph/301/diagnosis/step-by-step.html`
- Tags**: A section with a 'TAG SETS' dropdown (currently 'select a tag') and a 'MY TAGS' input field containing 'Learning Need'. A tooltip for the 'MY TAGS' field reads: 'Separate each tag with a space: cardiovascular stroke heart. To join 2 words together in one tag, use double quotes: "Gestational Diabetes".'

 At the bottom of the dialog are 'Add' and 'Cancel' buttons.

The screenshot shows a Windows Internet Explorer browser window displaying a 'Best Practice' article titled 'Assessment of chest pain'. The article content includes a 'Step-by-step' section and a 'History' section. A 'BMJ Portfolio - Windows Internet Explorer' dialog box is overlaid on top, titled 'Add to portfolio'. The dialog box contains the following information:

- Title ***: Assessment of chest pain
- Notes**: I need to learn more about this subject
- URL**: http://bestpractice.bmj.com/best-practice/monograph/301/diagnosis/step-by-step.html
- Tags**: Learning Need x
- TAG SETS**: select a tag
- MY TAGS**: (empty field with a plus icon)

Below the 'MY TAGS' field, there is a link that says 'Choose from your personal tags'. To the right of the 'MY TAGS' field, there is a note: 'Separate each tag with a space: cardiovascular stroke heart. To join 2 words together in one tag, use double quotes: "Gestational Diabetes".' At the bottom of the dialog box, there are 'Add' and 'Cancel' buttons. A mouse cursor is pointing at the 'Add' button.

The background article text includes:

Step-by-step
Chest pain can be triaged...
History
The character of chest pain...
Certain characteristics of chest pain can give clues to the origin.

- Constricting pain may be due to cardiac ischaemia or oesophageal spasm.
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The screenshot shows a Windows Internet Explorer browser window displaying the 'Add to portfolio' dialog box. The dialog box is titled 'Add to portfolio' and contains the following fields and elements:

- Title ***: Assessment of chest pain
- Notes**: I need to learn more about this subject
- Message from webpage**: A small dialog box with a yellow warning icon and the text 'Your item is successfully added to BMJ Portfolio.' with an 'OK' button.
- MY TAGS**: A text input field with a plus sign icon and the text 'Choose from your personal tags'.
- Buttons**: 'Add' and 'Cancel' buttons.

The background page is titled 'Assessment of chest pain' and includes sections for 'Overview', 'Step-by-step', and 'History'. The 'History' section contains a list of bullet points:

- Constricting pain may be due to cardiac ischaemia or oesophageal spasm.
- Pain that lasts >20 minutes and is dull, central, and crushing is likely to be caused by an MI.
- Pain that radiates to the jaw or upper extremities suggests a cardiac cause.

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Step-by-step diagnostic approach

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Title	Date added	Note	Start date	End date	Learning need
Assessment of chest pain	23-Nov-2011	Need to learning more about t...	-	-	
Volume depletion in children	09-Nov-2011		-	-	
Starting patients on anticoagu...	02-Nov-2011		09-Nov-2011	-	
Assessment of abdominal pain...	27-Oct-2011		-	-	
Urethritis	18-Oct-2011		-	-	
Musculoskeletal lower back pain	16-Sep-2011	General review of the pathoph...	-	-	
ST-elevation myocardial infar...	09-Sep-2011	Add some notes	-	-	
Acute liver failure	05-Aug-2011		-	-	
Viral gastroenteritis in children	12-Jul-2011	Saw a patient with viral GE an...	-	-	
Shock	11-Jul-2011		-	-	
Severe sepsis and septic shock...	23-Jun-2011		23-Jun-2011	23-Jun-2011	
Coeliac disease	30-May-2011		-	-	Need to learn about the lastes...
Chronic atrial fibrillation - Pati...	02-May-2011		-	-	Bp need
Atrial fibrillation: diagnosis an...	02-May-2011		02-May-2011	-	Need to understand the prooes...
Anticoagulation uptake remai...	02-May-2011	BMJ 2011;342:1153 doi:10.1...	14-Mar-2011	-	
Atrial Fibrillation CHADS2...	02-May-2011	My results for the Consortium ...	10-Feb-2011	09-Mar-2011	
BMJ Learning: Atrial Fibrillatio...	02-May-2011	Learning module on the fund...	15-Apr-2011	-	
Needs assessment: Diabetes	02-May-2011	To identify my learning needs...	27-Apr-2011	-	
Action Set: Atrial Fibrillation	02-May-2011	Learnt standard orders for AF ...	03-Apr-2011	-	



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Alzheimer's disease: diagnosis and management

Chronic fatigue syndrome-ME: an update for primary care

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The screenshot shows a web browser window with the URL <http://learning.bmj.com/learning/search.html?searchTerms:>. The browser tabs include "BMJ Evidence su...", "BMJ Chest pain (...)", "BMJ BMJ Portfolio", and "BMJ Search R...". The page header features a search bar with "Search all BMJ Products" and navigation links for "BMJ", "BMJ Journals", "BMJ Careers", "BMJ Learning", "BMJ Evidence Centre", and "BMJ GROUP". A user is signed in as "Andrew Jones" with options for "My Account", "Site Settings", and "Sign out".

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- Chest pain: a guide to investigation and management for GPs
- Chest pain of recent origin - assessment and diagnosis: in association with NICE
- Chest radiographs: a guide to interpretation
- Non-invasive cardiac imaging in the patient with chest pain: coronary CT angiography
- Managing recurrent chest infections in a child
- The ECG in patients with chest pain: diagnosis and management
- Chest x ray: an essential guide to interpretation
- Chest x rays: a guide to interpretation - part 2
- Chest x rays: a guide to interpretation - part 1
- Functional recurrent abdominal pain in children: assessment and management
- Acute thoracic aortic syndromes: in association with Heart

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EDUCATION IN
heart

Acute chest pain: diagnosis and management: in association with Heart Start module Add to portfolio

Learning outcomes

When you have completed this module you should understand:

- How to assess risk in patients with an acute coronary syndrome
- The natural history of acute coronary syndrome
- The potential pitfalls in interpreting data in affected patients
- How to choose who needs early intervention
- The best combinations of drug treatments and interventions.

Estimated Time to Complete: 1 hour
Release date: 27 Apr 2011
Expiration date: 27 Apr 2013

In collaboration with
Heart Online Journal.

DESCRIPTION
Acute chest pain: diagnosis and management

TARGET AUDIENCE
Hospital doctors, GPs, Prehospital care practitioners.

Author
Christopher SR Baker

Biography
Christopher SR Baker, Charing Cross and Hammersmith Hospitals, London

RFH Pilot

- Royal Free Hospital pilot of BMJ Action Sets targeting the management of upper GI bleeding
- Examined two quality indicators in the initial management
 - Rockall Scores and use of i.v. proton pump inhibitors
- Rockall scoring is a simple risk assessment tool which takes account of age, signs of shock and co-morbidity ¹
- Patients with a score of 0 or 1 have <1% mortality ²

1. *Risk assessment after acute upper gastrointestinal haemorrhage. Rockall TA, Logan RF, Devlin HB, Northfield TC. Gut. 1996 Mar;38(3):316-21.*

2. *Risk assessment in upper gastrointestinal haemorrhage: implications for resource utilisation. Phang TS, Vornik V, Stubbs R. N Z Med J. 2000 Aug 11;113(1115):331-3.*

RFH Pilot - data

- 0% of acute clinicians calculated a Rockall score on admission
- 0% of gastroenterology clinicians calculated a Rockall score on admission
- 50% of inpatient endoscopy patients had a Rockall score of 0 (length of stay 3-5 days)
- 65% of patients received i.v. pantoprazole pre-endoscopy

1. *Unpublished data from the Royal Free Hospital, presented at the Cerner Health Conference by Dr. O'Bierne, September 2010*

BMJ^{Group}



- RFH implemented the BMJ upper GI bleed Action Set in Cerner Millennium system
- Adapted it to their organisation
- Recent data presented at the BSG:
 - Rockall score recorded – 33%
 - Discharge from A&E if Rockall score 0 – 100%
 - Inappropriate PPI use – 67% reduction

1. *THERE WILL BE BLOOD... A COMPLETE AUDIT CYCLE. M. Pericleous, C. Murray, M. Hamilton, O. Negus, J. O'Beirne. BSG 2011 - Abstract Submission, Health Service Research and IT BSG11-ABS-2046*



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