Respiratory Medicine Protocols for Cork University Hospital

Oct. 2006

Contents Pages

Introduction

Welcome to Dr's Henry, Dr Plant's and Dr Bredin's team. We hope the time that you spend with us will be both enjoyable and informative. Enclosed are some guidelines about the management of conditions that you are likely to see whilst on our firm.

It should be stressed that these are not all encompassing and are only meant to provide guidance about investigation and management of these patients.

IF YOU ARE EVER IN DOUBT ABOUT WHAT TO DO YOU SHOULD NOT HESITATE TO ASK FOR ADVICE - these guidelines are not a substitute for discussing an individual case.

We would be grateful if the following "rules" could be observed:

1. The Consultants should be informed if any patient under their care is admitted to the Intensive Care Unit.
2. In cases where an active management strategy is not felt to be appropriate this should first be discussed with Consultants unless it has been expressly stated previously or where further treatment is clearly inappropriate (eg advanced malignant disease).
3. When a patient dies in hospital the General Practitioner should be informed by telephone by, at the latest, the next morning.
4. In outpatients Senior House Officers seeing new patients should always discuss the case with the Consultant (or Specialist Registrar) and say in the letter to the General Practitioner that the case has been discussed with a more senior member of the team.
5. Please plot out lung function results on the charts provided in out-patients
6. Discharge summaries should be dictated within 48 hours of the patient leaving hospital.
7. Adverse clinical incidents should be reported to a senior member of your team and a clinical incident form filled in given to Dr Henry.

IF IN DOUBT ALWAYS ASK A MORE SENIOR MEMBER OF THE TEAM.

If you find any mistakes please inform us.

The following conditions should always be discussed with the SpR or consultant and may require non-invasive ventilatory support on ward 3A.

1. Acidotic COPD requiring initiation of NIV
2. Acute severe / life-threatening asthma *(BTS criteria any 1 of PEFR<50%, resp rate >25, unable to speak sentences, life-threatening asthma)*
3. Severe Community Pneumonia *(CURB65 score: Any 3 or more of : diastolic BP<60, urea>7, resp rate >30, new confusion, age >65 yrs)*
4. Other acute respiratory patient requiring ventilatory support or close monitoring at the discretion of the respiratory registrar or consultant (in other words only after discussion). Patients should be seen by respiratory doctor before accepting transfer to Room 9 Ward 3A ie 'observation ward'.
5. Referrals from ICU should go through the SpR or consultant.
6. CPAP / Bi-level ventilation should not be started on ward 3A without discussion with a respiratory consultant during the day.

If in doubt about admission consult the SpR or consultant.

Blood gases

These are frequently required in patients with acute respiratory disease. If in doubt they should be performed. **Always state whether on room air or oxygen and if the latter the flow rate or percentage. If on NIV record this and document pressure settings.**

Out of hours there may be a respiratory registrar on medical call who can give advice. Dr Henry's home number is available from switchboard in cases of emergency when not on call.

IF YOU ARE <u>EVER</u> IN DOUBT ABOUT WHAT TO DO OR CONCERNED ABOUT A PARTICULAR PATIENT PLEASE CONTACT THE RESPIRATORY REGISTRAR OR CONSULTANT.

Commmunity Acquired Pneumonia

ASSESSMENT

Patients who have a CURB-65 score of 3 or more are at high risk of death and should be managed as having severe pneumonia according to the BTS recommendations and require urgent hospital admission. Patients who have a CURB-65 score of 2 are at increased risk of death. They should be considered for short stay inpatient treatment or hospital supervised outpatient treatment. This decision is a matter of clinical judgement.

Patients who have a CURB-65 score of 0 or 1 are at low risk of death.

They can be treated as having non-severe pneumonia and may be suitable for home treatment.

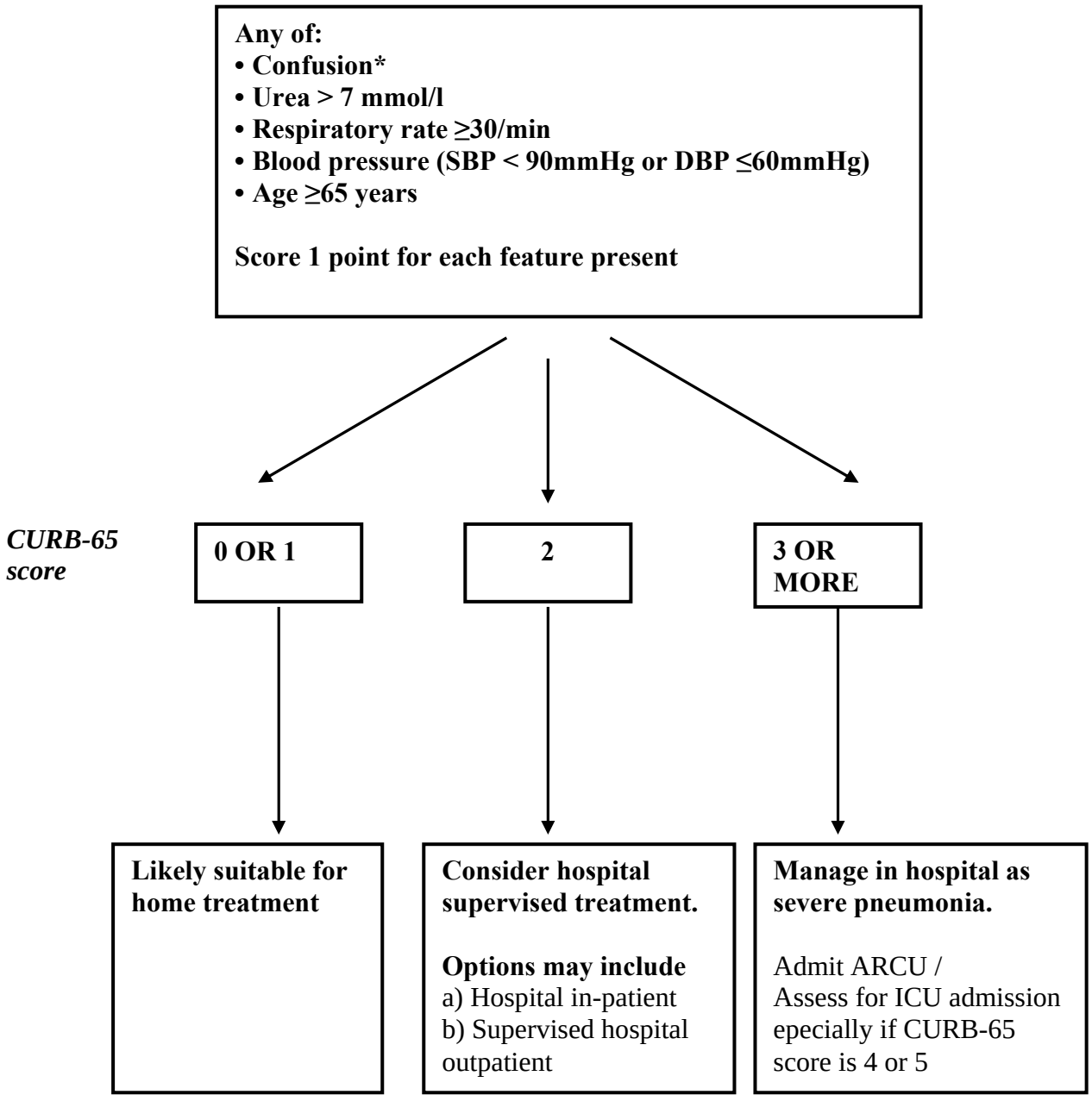
Switch from parenteral drug to the equivalent oral preparation should be made as soon as clinically appropriate, in the absence of microbiologically confirmed infection. In the case of the parenteral cephalosporins, the oral switch to co-amoxiclav 625 mg tds or moxifloxacin 400 mg *mane* is recommended rather than to oral cephalosporins; **for those with penicillin allergy consider oral erythromycin or moxifloxacin after discussion with your consultant.**

DISCHARGE

Patients should be reviewed within 24 hours of planned discharge home and those suitable for discharge should not have more than one of the following characteristics present (unless they represent the usual baseline status for that patient).

These clinical "instabilities" include temperature > 37.8^{o} C, heart rate >100/min, respiratory rate >24/min, systolic blood pressure <90mmHg, oxygen saturation <90%, inability to maintain oral intake and abnormal mental status. A follow up appointment should be arranged for 6-8 weeks with a CXR to ensure resolution of the consolidation and no underlying malignant process particularly in smokers.

Severity assessment used to determine the management of CAP in patients admitted to hospital (CURB-65 score)



****Defined as a Mental Test Score of 8 or less, or new disorientation**

Preferred and alternative initial empirical treatment regimens and parenteral to oral switch regimens for community acquired pneumonia

[1] Home- treated, not severe amoxicillin 500 mg - 1.0 g tds po	**Penicillin Allergic** erythromycin 500 mg qds po *or* clarithromycin 500 mg bd po
[2i] Hospital- treated, not severe [Admitted for non- clinical reasons or previously untreated in the community] As under Home-treated, not severe	
[2ii] Hospital- treated, not severe ***Either oral*** amoxicillin 500 mg – 1.0 g tds po *plus* erythromycin 500 mg qds po ***or if IV needed*** ampicillin 500 mg qds iv *or* benzylpenicillin 1.2g qds iv *plus* clarithromycin 500 mg bd iv	Erythromycin 500 mg qds po or moxifloxacin 400 mg po *mane* if significant co-morbidity cefuroxime 1.5 g tds iv *or* clarithromycin 500 mg bd iv
[3] Hospital- treated, severe co-amoxiclav 1.2 g tds iv *or* cefuroxime 1.5 g tds iv *plus* clarithromycin 500 mg bd iv *(with or without* rifampicin 600 mg od or bd iv) or moxifloxacin 400 mg iv or po *mane*	cefuroxime 1.5 g tds iv *plus* clarithromycin 500 mg bd iv *(with or without* rifampicin 600 mg od or bd iv) moxifloxacin 400 mg iv or po *mane*

Management of Suspected Pulmonary Embolus.

CLINICAL CONDITION

- Pulmonary Embolism (PE) is a common clinical condition with significant mortality and morbidity. The exact incidence cannot be accurately determined because of many undiagnosed non-fatal cases. However, it is estimated to be the cause of death in 5- 15 % of patients who die in hospital.

- At post mortem 70 % of major PE's had been missed by the clinician. The fact that such a large percentage are missed is due primarily to the huge variety of possible presentations. Emboli are usually multiple and the degree of obstruction and time scale over which the obstruction develops lead to this diversity of signs and symptoms. In view of this, PE may be classified into three main types.
- **acute minor PE,**
- **acute massive PE,**
- **subacute massive PE.**

Acute minor pulmonary embolism is the most common type caused by emboli obstructing less than 50% of the pulmonary circulation and classically presenting with dyspnoea with or without pleuritic chest pain and haemoptysis. The mortality in this group is around 1%.

Acute massive pulmonary embolism is caused by sudden obstruction of over 50% of the pulmonary circulation and presents with haemodynamic instability as well as other more "typical" PE clinical features (e.g. dyspnoea, pleuritic chest pain, haemoptysis and syncope).

Subacute massive PE is caused by repeated emboli of small or moderate size occurring over several weeks. This is the least common of the three types of PE. As the onset is over several weeks, there is time for the right ventricle to adapt and this

condition may therefore present more insidiously with heart failure and decreasing exercise tolerance.

Patients with a **HIGH clinical probablity of PE** and cardiovascular instability will need **URGENT** investigation as per the algorithm and admission to the physicians. These patients should have urgent respiratory SpR or consultant review.

INVESTIGATIONS

ECG – most commonly shows only sinus tachycardia but recognised patterns also include right axis deviation, right bundle branch block, T inversion in V_{1-3}, P pulmonale and the well-known but relatively infrequent $S_IQ_{III}T_{III}$. The main role of the ECG is to help to exclude acute myocardial infarction or pericarditis

ABG – classical findings are hypoxaemia and hypocapnia. Sensitivity and specificity for PE on ABGs is low (approx 50%)

CXR – may well be normal. However, it may show peripheral opacities (wedge infarcts or Hampton's humps), prominent pulmonary hilar vessels or hyperlucency (due to oligaemia) of lung parenchyma (Westermark sign). However the chest X-ray is most useful in helping to rule out, or rule in, other possible diagnoses.

D-dimer – a measure of fibrin degradation products in the blood and therefore used to detect the process of clot breakdown. **Due to significant numbers of false positives, this test is only really helpful in with low clinical probability of PE who can then be safely discharged if their D-dimer levels are low** and another explanation of the clinical findings can be justified.

Ventilation-Perfusion (V/Q) scanning –

- when combined with a clinical likelihood score, lung scintigraphy can be useful in determining treatment. For example, in a patient with a low clinical likelihood and a normal or low probability scan, treatment can be safely withheld. It should not be used in patients with any underlying lung disease, patients with LVF and is

also less reliable in elderly patients. In these groups either compression Doppler ultrasound if clinical DVT or CTPA is the investigation of choice.

Spiral CT Chest / CTPA

- the accuracy and reliability of CT in diagnosing PE has been as well demonstrated as it has been for V/Q scans. The advantages including the speed of the procedure (the scan is completed in one breath-hold) and less problems in patients with underlying lung disease (a well-recognised cause of false positives in V/Q's), as well as imaging of abdomen, pelvis and lower limb veins make spiral chest CT a popular investigation for PE. Notably however, the exposure in terms of radiation is slightly greater. This is the investigation of choice for any patient with underlying lung disease, LV dysfunction and anyone <65yrs.

In the case of pregnancy discuss with consultant in radiology and one of the respiratory consultants and one of the consultants in feto-maternal medicine before deciding which investigation to choose.

Echocardiogram –

- The potential benefit of echocardiogram in identifying patients with massive PE is largely that the procedure may be performed at the bedside and so the patient need not leave the resuscitation room. Evidence suggests that a hypotensive patient with a high clinical suspicion of PE and right ventricular strain on echo should be thrombolysed. Echo may also identify alternative diagnoses such as cardiac tamponade, aortic dissection or ventricular septal rupture.

Assessment of patient with suspected PE

Signs and symptoms

The following is a list of signs and symptoms which may present in a patient with suspected PE

- ❑ Dyspnoea (or worsening chronic dyspnoea)
- ❑ Single ☐ >1 episode ☐ Persistent
- ❑ Pleuritic chest pain ❑ Cough
- ❑ Haemoptysis
- ❑ Leg swelling or leg pain ❑ Palpitations
- ❑ Other
- ❑ Arterial oxygen saturation< 92% on air
- ❑ Pleural Rub
- ❑ Tachycardia (>100/min)
- ❑ Low grade fever

Predisposing risk factors

Tick either YES or NO against ALL risk factors

Risk factor		Comments
History of immobilisation (complete bed rest for 3 or 4 days in previous 4 weeks)	Yes ☐ No ☐	
Recent surgery (within past 12 weeks, note type of surgery)	Yes ☐ No ☐	
Cancer (within past 6 months or in palliative stages)	Yes ☐ No ☐	
Lower limb problems (trauma or immobility problems e.g. paralysis)	Yes ☐ No ☐	
Pregnancy / puerperium	Yes ☐ No ☐	
Cardiorespiratory disorders (acute MI, chronic symptomatic illness, irreversible airways disease)	Yes ☐ No ☐	
Thrombophilia (e.g Protein S, Factor V Leiden)	Yes ☐ No ☐	
Strong family history of DVT or PE	Yes ☐ No ☐	
Previous proven or current PE or DVT	Yes ☐ No ☐	
Relative risk factors. Please specify the relative risk factors if present		
Relative risk factors present *(3 rd generation oral contraceptive pill, drugs travel)*	Yes ☐ No ☐	

Investigations

Tick either YES or NO against ALL results

Investigation		Comments
Respiratory rate > 20 / min	Yes ☐ No ☐	
ECG changes (tachycardia, non specific ST segment changes [new], right sided changes not diagnostic of another condition, other)	Yes ☐ No ☐	
CXR (abnormal but not diagnostic of another condition)	Yes ☐ No ☐	
ABG's : PaO_2 less than 10.7kPa on air	Yes ☐ No ☐	

Can you now make a firm diagnosis of condition other than PE which you intend to treat?
YES ☐ NO ☐

If *YES,* do not continue with this pathway. If *NO,* proceed to assess clinical probability of PE

INE THE CLINICAL PROBABILITY

Probability	**Criteria**	
Low	Absence of any predisposing risk factor and alternative diagnosis is as likely as PE	
High	Presence of one or more predisposing risk factor, appropriate signs and symptoms and the absence of an alternative diagnosis to account for these	
Intermediate	Not easily falling into either high or low	

For simplicity the Modified Wells Score is also verified to quantify PE risk.

Criterion	Points value
Clinical signs of DVT	3
Alternative diagnosis less probable than PE	3
Heart rate>100 bpm	1.5
Immobilization or surgery <4 weeks ago	1.5
Previous DVT or PE	1.5
Haemoptysis	1
Cancer	1

Total score:

- Low probability of PE<2
- Moderate probability of PE 2–6
- High probability of PE >6

FLOWCHART FOR THE MANAGEMENT OF PATIENTS WITH SUSPECTED PULMONARY EMBOLUS

- ❑ LOW PROBABILITY
- ❑ MEDIUM PROBABILITY
- ❑ HIGH PROBABILITY

D-DIMER RESULT (<275ng/ml)

D-DIMER NOT INDICATED

- ❑ Negative | ❑ Positive
- ❑ **DISCHARGE**
- ❑ Tinzaparin

RESUSCITATE

Reassess patient. If no alternative diagnosis then administer Tinzaparin & proceed [1]

ASSESS CLINICAL STATUS IF ANY OF THE FOLLOWING CRITERIA
- ❑ **PULSE RATE >100/MIN**
- ❑ **BP SYSTOLIC <100mmHg**
- ❑ **SpO2 < 92% on air**

IF ALL CRITERIA NORMAL, administer Tinzaparin and proceed

If **YES** to any of above criteria **Admit Medically**

Improved?

Office hours: Arrange scan as indicated. If same day, keep patient for scan and result. If unavailable, follow out of hours procedure.

Out of hours: Admit general medical CTPA the following day. Consider CDU admission may be worth discussing with A&E staff

ULTRASOUND LEGS if there are clinical signs to suggest possible DVT

- ❑ Positive Scan
- ❑ Negative, or Scan not necessary

TREAT AS PE:
- **Anticoagulate & Admit to medical team**

NEEDS FURTHER IMAGING V/Q SCAN OR SPIRAL CT SCAN

NORMAL SCAN
Consider alternative diagnosis.
PE excluded

LOW OR INTERMEDIATE SCAN
D/W senior, may need further imaging or consider alternative diagnosis

HIGH PROBABILITY SCAN
TREAT AS PE: Anticoagulate & Admit to medical team

TREATMENT

Consider the following options :

Oxygen – 10-15L/min via non-rebreathing mask – give especially if signs of massive PE.

Fluid resuscitation – Massive PE leads to acutely increased pulmonary vascular resistance with RVF and a reduced preload for the LV. Cautious fluid resuscitation with the consideration of inotropic support may be indicated.

Low molecular weight heparin.
Evidence and BTS guidelines support the use of low molecular weight heparin in patients with suspected or confirmed PE. At the present time the CUH uses Tinzaparin at a dose of 175u/kg. This should be continued for a minimum of 5 days, regardless of how quickly the therapeutic INR is reached with warfarin. Warfarin should not be commenced until DVT or PE is confirmed. Adjustments to dose may be necessary in renal failure.

Thrombolysis –

- Limited evidence of reduced mortality in massive PE, but current guidelines recommend it in this patient group if no contra-indications exist.
- There is no clear evidence of exactly which thrombolytic should be administered or exactly how; but a 2-hour tPA infusion (100mg) appears to be well supported . Discuss the case with the on-call Respiratory Registrar. Joint evidence based multi-specialty guidelines are presently being developed for this group of high risk patients in whom mortality can be very high. Until these are available, patients should be managed on an individual case basis with SENIOR A&E and Respiratory input. These cases are usually best managed in CCU. Discuss with cardiology early. They may also be able to expedite a rapid diagnosis in thoses with high clinical suspicion with ECHO without having to resort to CTPA if the patient is too unstable to bring to x-ray.

- In non-massive PE there is no statistically significant evidence of improved survival rates with thrombolysis .

Suggested algorithm for patients with a likely acute MASSIVE pulmonary embolism.

NOTE: This is only a guide – manage patients on an individual basis.

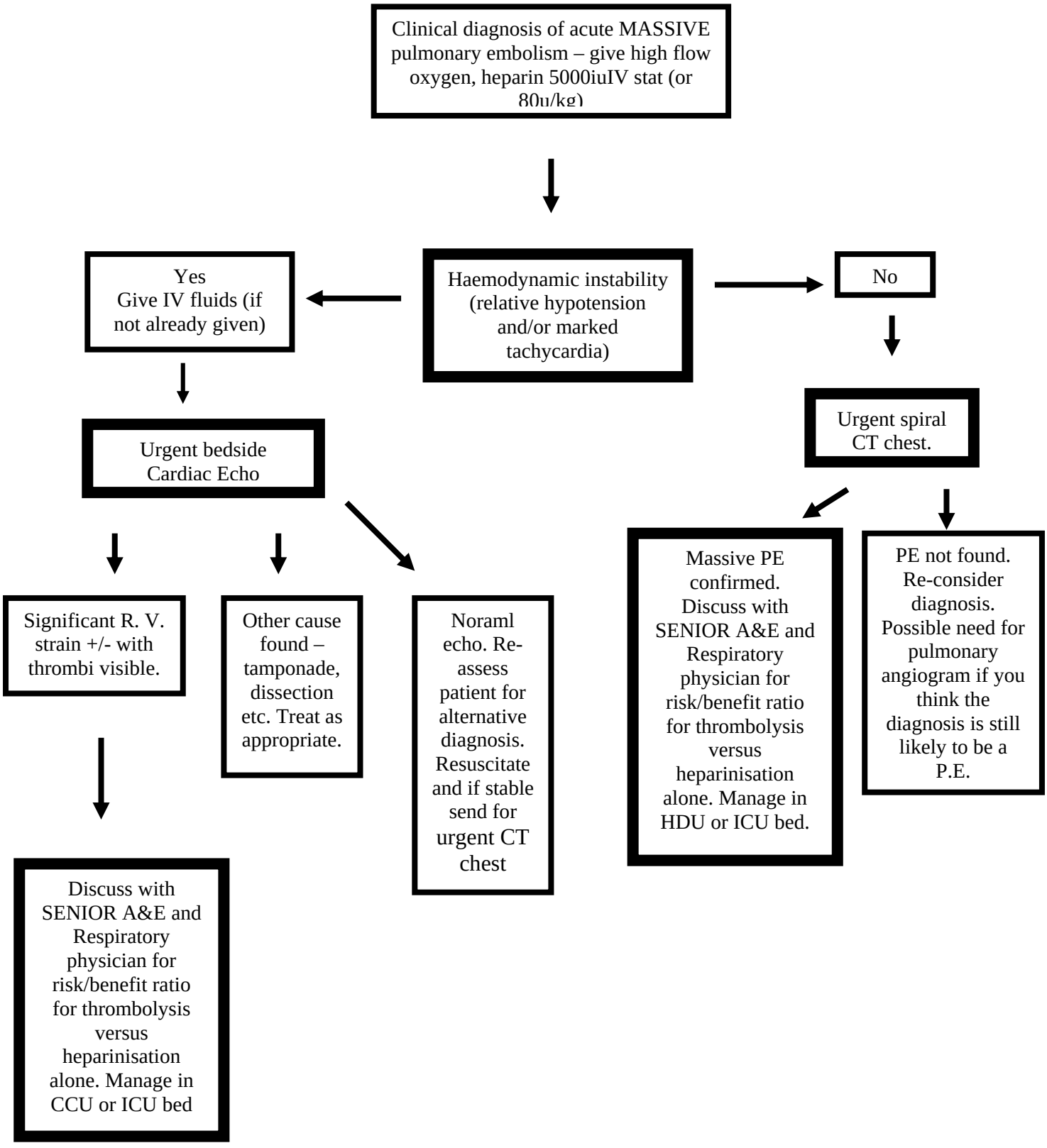


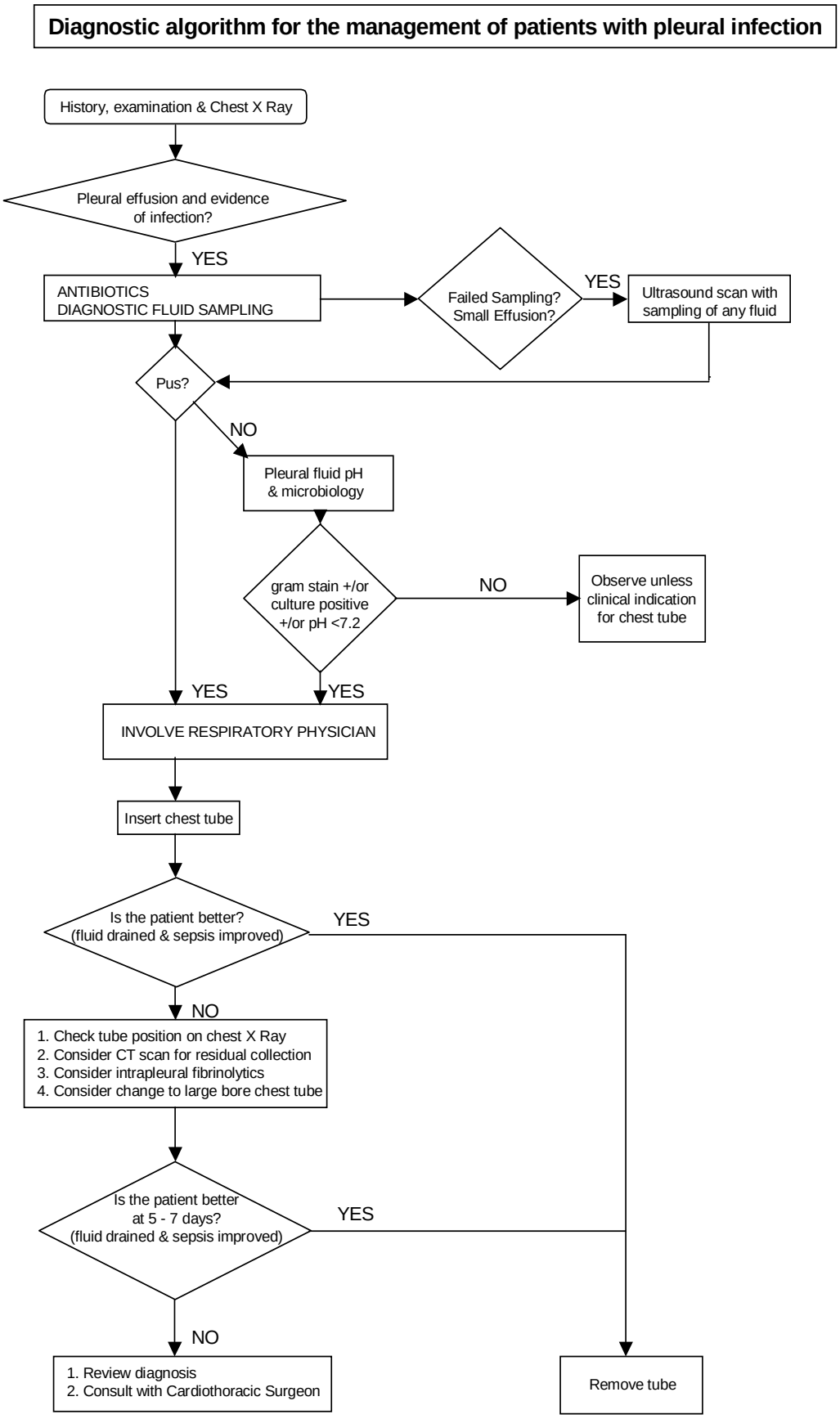
Table 1: Contraindications for fibrinolytic therapy in patients with massive PE

Thrombolyse 100mg tPA IV over 2hrs followed by heparinisation.

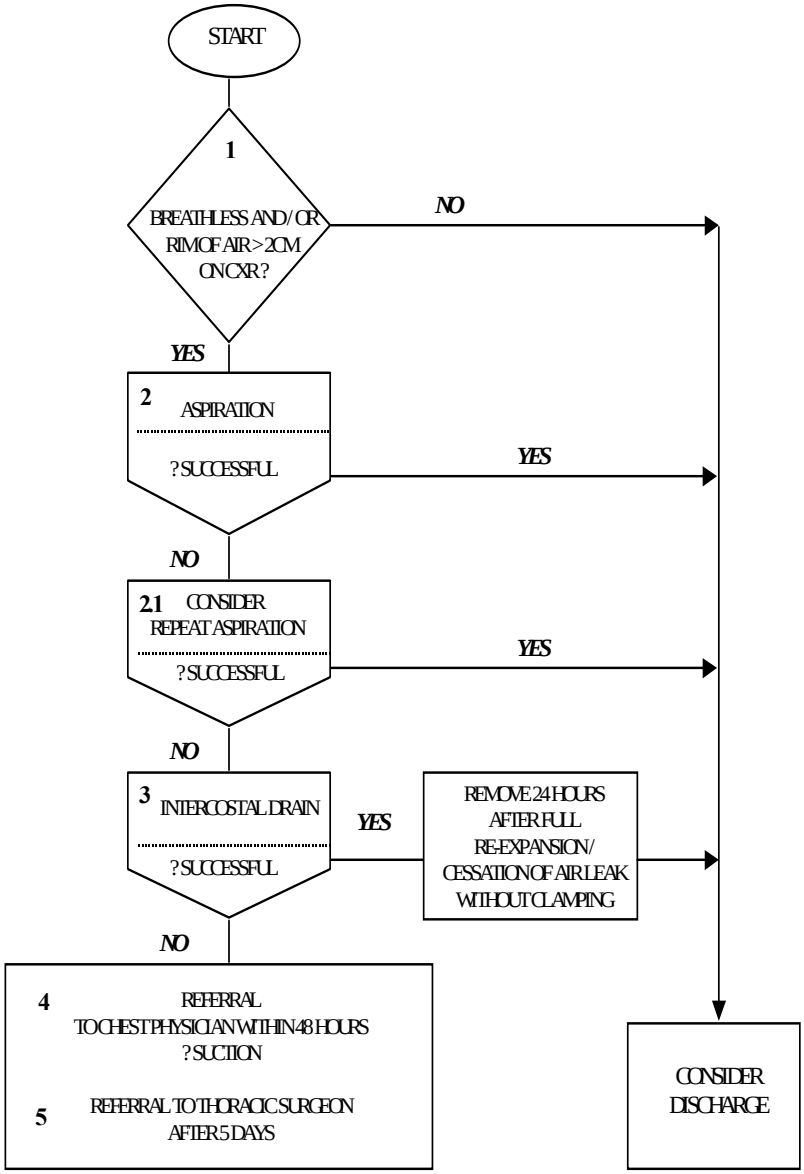
Absolute contraindications:
Active internal bleeding
Recent spontaneous intracranial bleeding

Relative contraindications:
Major surgery, delivery, organ biopsy, gastrointestinal bleeding or puncture of noncompressible vessels in the last 10 days
Ischaemic stroke within 2 months
Serious trauma within 15 days
Neurosurgery or Ophthalmologic surgery within 1 month
Uncontrolled severe hypertension (Systolic BP > 180 mmHg; Diastolic BP > 110 mmHg)
Recent cardiorespiratory resuscitation
Platelet count < 100 000/mm3
Prothrombin time less than 50%
Pregnancy
Bacterial endocarditis
Diabetic haemorrhagic retinopathy

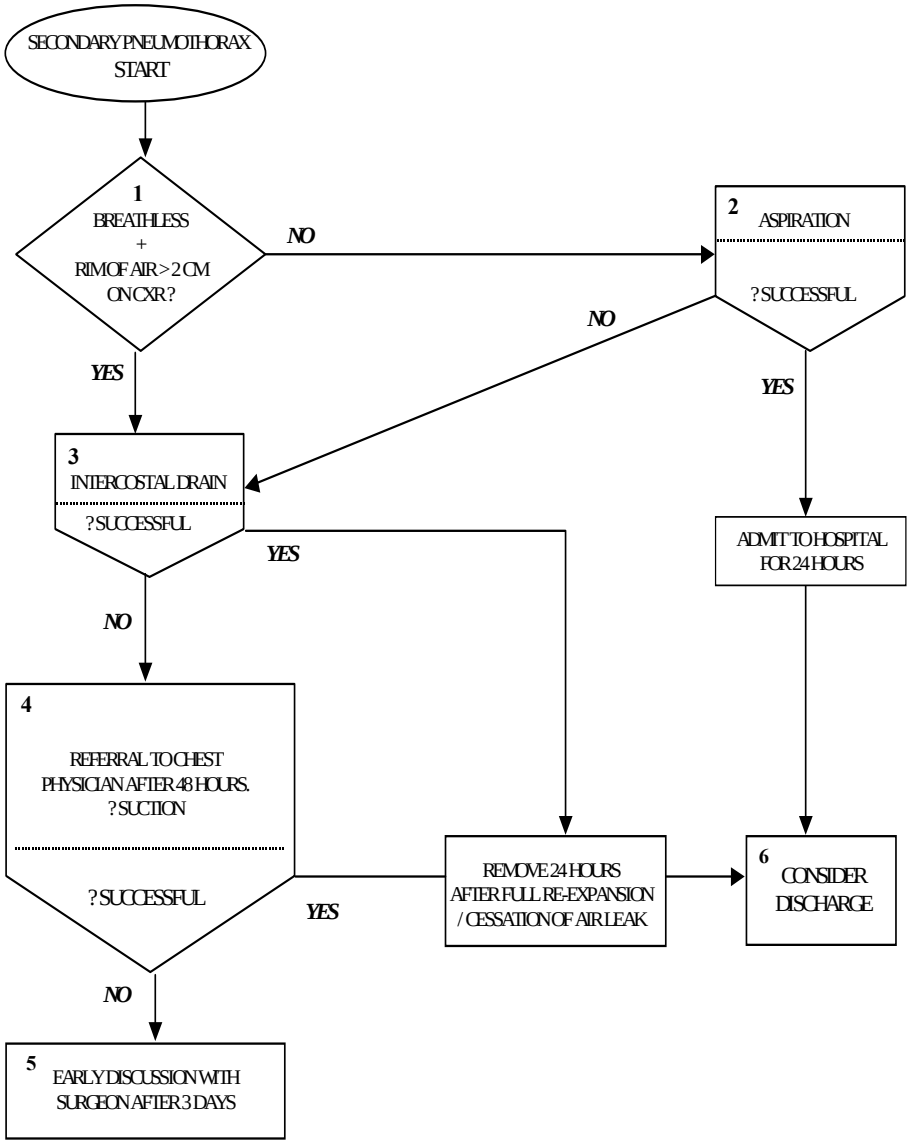
PLEURAL DISEASE



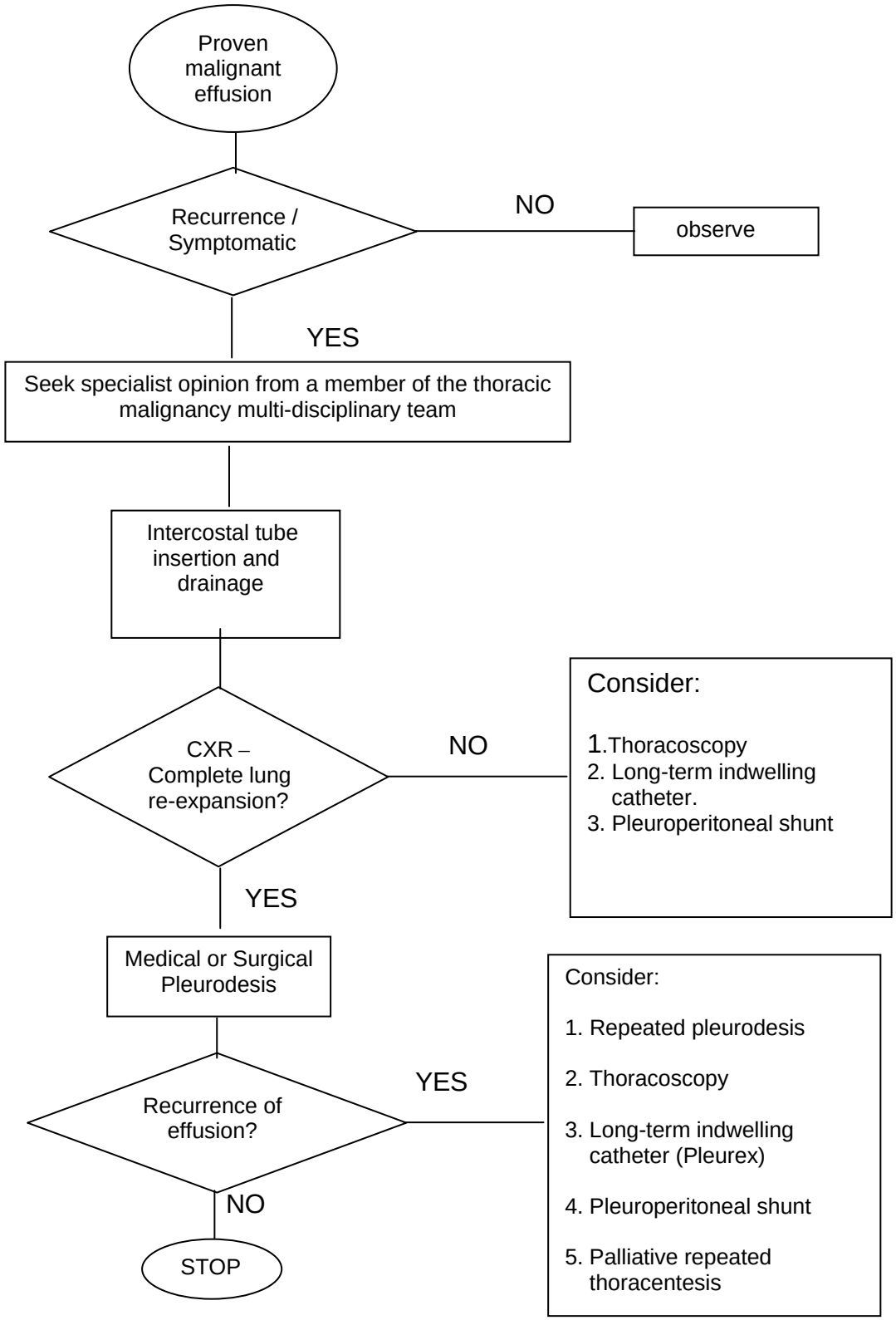
Management of patients with primary spontaneous pneumothorax ie patients with no underlying lung disease.



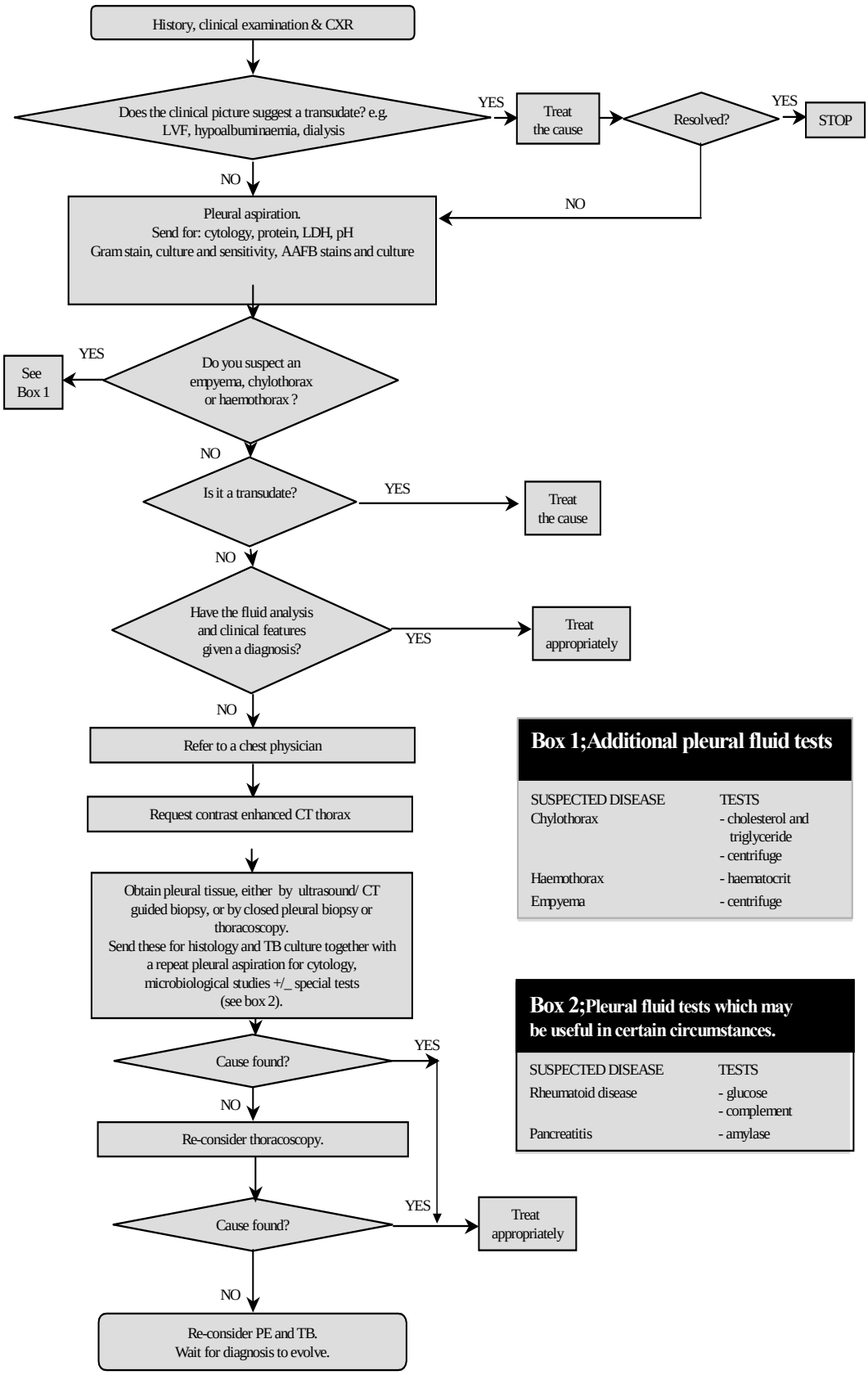
Management of patients with secondary spontaneous pneumothorax ie patients with underlying lung disease (usually COPD)



Management of a Malignant Pleural Effusion



Diagnostic algorithm for the investigation of a pleural effusion



Box 1;Additional pleural fluid tests

SUSPECTED DISEASE	TESTS
Chylothorax	- cholesterol and triglyceride - centrifuge
Haemothorax	- haematocrit
Empyema	- centrifuge

Box 2;Pleural fluid tests which may be useful in certain circumstances.

SUSPECTED DISEASE	TESTS
Rheumatoid disease	- glucose - complement
Pancreatitis	- amylase

COPD

Introduction

Most cases of COPD are due to the effects of cigarette smoking though some patients with long standing chronic asthma develop it.

Management of Acute Exacerbations of Non-acidotic COPD – Summary:

- Any with a $PaCO_2$ >6kPa should have controlled oxygen via a Venturi mask or nasal cannulae to maintain an oxygen saturation 85-92% i.e equivalent of 7.3-10kPa. Oxygen should be reduced if SpO_2 >92%.
- Nebulised salbutamol 2.5mg 4 hourly.
- Atrovent need not be added routinely.
- Prednisolone EC 30 mg od for 1-2 weeks in total –no need to tail dose over this time period.
- Antibiotic if 2 of the following 3 criteria occur

1. Increased breathlessness
2. Increased sputum volume
3. Increased sputum purulence

- 1st line antibiotic –amoxycillin or doxycycline. 2nd line – ciprofloxacin
- If use **CIPROFLOXACIN or ERYTHROMYCIN BEWARE OF INTERACTION WITH AMINOPHYLLINE** and use half the routine aminophylline dose. Theophylline levels should be checked after 4 hours and daily thereafter while the patient is on IV aminophylline and the dose adjusted daily to stay within the therapeutic range. The same applies if erythromycin is used.

Consider DVT prophylaxis.

Reason for Exacerbation

Most exacerbations are caused by infections but some may be caused by an exposure to irritants. Always note the trigger. If the exacerbating agent is smoke (eg house fire) or an exposure to occupational irritants document details of the exposure (nature of exposure, duration of exposure etc).

History

Review the evidence for the diagnosis. There are a lot of patients with "known" COPD, based upon the previous admission clerking, in whom a definite diagnosis has never been established.

Document normal exercise tolerance in 6 to 12 months prior to admission.

Investigations

Routinely check the following on admission:

- Hb
- WCC
- PV
- Electrolytes
- Urea
- Liver function tests
- Arterial blood gases provided the resting oxygen sat^{n} <92% on air (always state whether on air or oxygen and if the latter how much)
- Sputum culture if sputum purulent
- Chest X-Ray
- ECG

Frequency of Investigations

- Hb, WCC - only repeat if haemoglobin abnormal or white cell count raised on admission.
- Electrolytes/urea - repeat only if abnormal or clinical deteriortion.
- Arterial blood gases - repeat as necessary
- Sputum culture - no need to repeat
- Chest X-ray – pneumothorax or hospital acquired infection suspected.

Bronchodilators - Give nebulised Salbutamol - 2.5 mgs 4 hourly. If the patient already has home nebulised salbutamol 2.5 mg then double hospital dose to 5 mg 4 hourly.

Do not give nebulised Ipratropium routinely (expensive and largely unnecessary) unless they have home nebulised atrovent. Do not give nebulised atrovent to those taking Tiotropium (Spireva).

There is no need to provide / perscribe a 'new' inhaler (eg Seretide or Symbicort) for the first 48 hours during admission if the patient has left there inhaler at home. Rather efforts should be made to get the patients inhaler from home. The patient will be perfectly adequetly treated with regular nebulised bronchodilators and oral steroids.

Antibiotics - Prescribe oral Amoxycillin (500 mgs qds) or Doxycycline (100 mg bd) if allergic to Penicillin. Only give IV antibiotics if there is clinical or radiological evidence of consolidation or if the patient has a severe exacerbation and has received antibiotics as an outpatient and still has frankly purulent sputum. In these circumstances give IV Cefuroxime or oral ciprofloxacin.

Oral Steroids - Prednisolone EC 30 mgs daily has been shown to bring about more rapid improvement in patients with an acute exacerbation of COPD. There is nothing to be gained by prolonging the course beyond two weeks.

Oxygen - Give controlled oxygen starting with 24% by mask with the aim of getting the PaO2 above 8 kPa. Increase to 28% if necessary but watch the PCO2. Some patients cannot tolerate a mask - it is reasonable to use nasal cannulae but always be alert to worsening hypercapnia.

Diuretics - If significant peripheral oedema present give oral Frumil or Frusemide (40 mgs), if renal impairment or high potassium, for a few days. If given weigh patient daily. May not be needed long term.

Stopping nebulisers - Unless patient is already on a nebuliser at home stop nebuliser at least 24 hours before discharge.

Medication on Discharge - Most patients will be on an MDI bronchodilator used prn. If they have had two or more exacerbations in the previous 12 months they should start an inhaled steroid - budesomide 400mg bd or flixatide 500 bd, if they are also taking an inhaled LABA (long acting beata agonist inhaler) prescribe as Symbicort 200/6 2 clicks BD (Seretide accuhaler 500 1 BD is an acceptable but more expensive alternative). Patients who have had two exacerbations in last 12 months despite this should receive Carbocysteine 750 mg BD. An oral theophyllin (uniphyllin /

phyllocontin) and subsequently Tiotropium 18 mcgms OD should be considered in patients who are symptomatic despite prn bronchodilators instead of or in addition to LABAs.

Advice on Smoking - Reinforce need to stop smoking (or at least reduce) if still smoking.

Check Inhaler Technique

Longterm Oxygen Therapy.

This is one of only two treatments (the other being stopping smoking) which have been shown to improve survival in patients with COPD. It needs to be used for at least 15 hours per day for significant benefit to accrue to the patient. This needs to be pointed out from the outset. It is important however to stress that this means that there are 9 hours in the day when they do not need oxygen and are therefore still free to get out and about etc. Oxygen assessments should take place in clinically stable patients. In other words oxygen should seldom be started at the time of discharge (see below). Ideally patients should be at least 6 weeks away from any sort of exacerbation. FEV_1 should be less than 1.5 litres and PO2 less than 7.3 kPa documented on two separate occasions, though this is seldom practical. Generally speaking long-term oxygen should not be prescribed for patients who continue to smoke. Firstly the benefit is thought to be less in this group and secondly if patients smoke at the same time as receiving oxygen there is a risk of severe facial burns etc.

Once the decision has been made to prescribe long-term oxygen an appropriate flow rate needs to be selected. Patients should come as a day case and have blood gases taken at base line and then have oxygen at a flow rate sufficient to increase the oxygen saturation 85-92% (oxygen concentrators are normally set to 2 or 4 litres per minute but can be adjusted to 0.5 or 1 L/min using low flow meters). After 2 hours blood gases should be repeated. It is worth remembering that ventilation is reduced during sleep and if there is any concern about worsening hypercapnia or that oxygenation may be inadequate during sleep the patient should have a overnight oximetry or an early morning ABG.

Contact Respiratory Nurse Specialist (Bleep 877) who will provide eduction regarding the oxygen concentrator and make arrangements for connection to be fitted if time

permits. Otherwise, the team will need to contact Abbeycourt House (Ext 23800) with letter to arrange this.

In some situations it is legitimate to provide oxygen for patients at the time of discharge:

a) those with severe hypoxia who are oxygen dependant on the ward ie when the oxygen is removed they become desaturated and symptomatic.

b) patients who are frequently admitted and are unlikely ever to have to a period of clinical stability.

Immunisation

It is recommended that patients with chronic lung disease be immunised against flu every year and against pneumococcus once and repeat in five years. Patients who have had a bad experience previously may not wish to be immunised again but ***Relenza*** may be recommended.

Pulmonary rehabilitation

Selected patients should be considered for pulmonary rehabilitation . At the time of writing these guidelines no programme exists in CUH. Exercise leaflets will be provided to the patients by the COPD nurse specialist who should also be made aware of all COPD in patients and ward discharges.

Lung volume reduction surgery

Lung volume reduction surgery is an option in a very small proportion of patients with COPD. At the very least they must be confirmed non-smokers for at least six months - if considered possible discuss with Consultant.

Acute on chronic Ventilatory Failure due to COPD.

Management of Acute Exacerbations of acidotic COPD – Summary:

In acute COPD a pH <7.35 is associated with a 20% mortality without NIV. NIV reduces this by 50%.

- All COPD patients should have a blood gas on arrival.
- Any with a $PaCO_2$ >6kPa should have controlled oxygen via a Venturi mask to maintain an oxygen saturation 85-92% i.e equivalent of 7.3-10kPa. Oxygen should be reduced if SpO_2 >92%.
- pH<7.35 –give standard emergency care (nebulisers, steroids) and consider move to Ward 3A for NIV
- Repeat gas on arrival to ward and count respiratory rate.
- If still acidotic start NIV and use ventilation prescription sheet (available on 3A and includes typical settings). The nurses and physiotherapists initiate ventilation during normal working hours and the anaesthetic registrar on call initiates out of hours. It is planned that this will become the responsibility of the nursing staff and on-call medical registrar on call but this has not happened yet.
- Repeat gas at 1 and 4 hours with respiratory rate.
- Good signs are improving pH and falling respiratory rate. Change in $PaCO_2$ is less important in the first 4 hours. Oxygenation should be managed as above.
- If at 1 hour the patient is more acidotic or remains acidotic at 4 hours –**contact respiratory registrar or ICU on call registrar.**
- Make sure maximal medical therapy is written up i.e nebulised salbutamol 2.5 mg and ipratropium 0.5 mg four hourly, steroids. Consider antibiotics (SEE BELOW), iv aminophylline (prescribe on the designated chart), prophylactic clexane 40 mg and sucralfate for the very acidotic (pH<7.25).
- Any patient commenced on IV aminophylline should have a level checked 6 hours later and thereafter every day. The dose of aminophylline should be halved in patients being treated with erythromycin or ciprofloxacin.

1) **A decision about withholding ventilatory support or admission to ICU should only be made after discussion with a Consultant unless it has already been clearly stated in the notes that this is not appropriate.**

2) Respiratory acidosis indicates acute decompensation and is predictive of a poor prognosis. Survival has been shown to be significantly improved by non-invasive ventilation in a number of prospective randomised controlled trials.

3) 20% of patients acidotic on admission to the A&E Department will completely correct their pH into the normal range with standard medical therapy, particularly controlled oxygen therapy. Unless the patient is moribund it is reasonable to see the effect of the above treatment over a one to two hour period.

4) The YONIV study showed that patients who remained acidotic (pH < 7.35) and tachypnoeic (23 bpm) after this initial therapy had a reduced failure rate (surrogate for endotracheal intubation) and improved survival with non-invasive ventilation. The outcome in patients with pH < 7.30 at this time without ventilatory support (the conventional therapy arm of the trial) was very much worse.

- Non invasive ventilation should be started in patients with pH < 7.35 and RR > 23 after initial therapy.
- The best indicators of successful non invasive ventilation are an improvement in pH and respiratory rate after 1 and 4 hours.

5) In patients receiving non-invasive ventilation you should try to improve gas exchange by altering ventilator settings rather than simply increasing the FiO2 (this leads to a false sense of security by improving oxygenation and the continuous oximetry read out at the expense of inadequate ventilation and worsening hypercapnia).

6) Arterial blood gas tensions should be rechecked after one to two hours

of NPPV

of any change in ventilator settings

of any change in oxygen therapy.

7) Patients receiving NPPV should be encouraged to use the ventilator as much as possible for the first twenty four hours. Thereafter the decision of whether to continue NPPV will be based around the clinical situation, but as a rough rule of thumb most patients should expect to need NPPV for 2 to 3 days. A proportion will refuse to use it much sooner than this because they are clearly completely recovered. Others, although better, would benefit from more NPPV, but simply refuse to continue. Patients who remain acidotic should be persuaded to persist, but if they chose not to continue they should understand that this is potentially risky. Common sense should always prevail in decisions about when to withdraw NPPV.

8) Patients with acute on chronic ventilatory failure are usually well acclimatised to chronic hypoxia and you should not be over aggressive in trying to achieve "normal" oxygen tensions. An oxygen tension of greater than >6 KPa is desirable, however 6 KPa is acceptable in a chronically hypoxic patient (this is **not** true for patients with acute illness eg pneumonia or asthma, who are not acclimatised and in whom severe hypoxia is indicative of a very severe attack - failure to maintain PaO_2 > 8 KPa in these individuals warrants ICU admission).

9) In patients who have a tracheostomy, agitation or distress on the part of the patient is usually indicative of tube blockage. Remember that it is possible to pass a suction catheter easily through a tube that is 90% occluded so do not be misled by this. If there is any doubt the tube should be changed, particularly if it has been in for any length of time.

10) Aggressively treat what is reversible - eg infection, bronchospasm, fluid overload etc.

Acute on chronic respiratory failure due to conditions other than COPD

The above principles broadly apply though there is less clinical trial data upon which to base practice.

Patients with chest wall deformity and/or neuromuscular disease may look surprisingly well despite quite appalling arterial blood gas tensions.

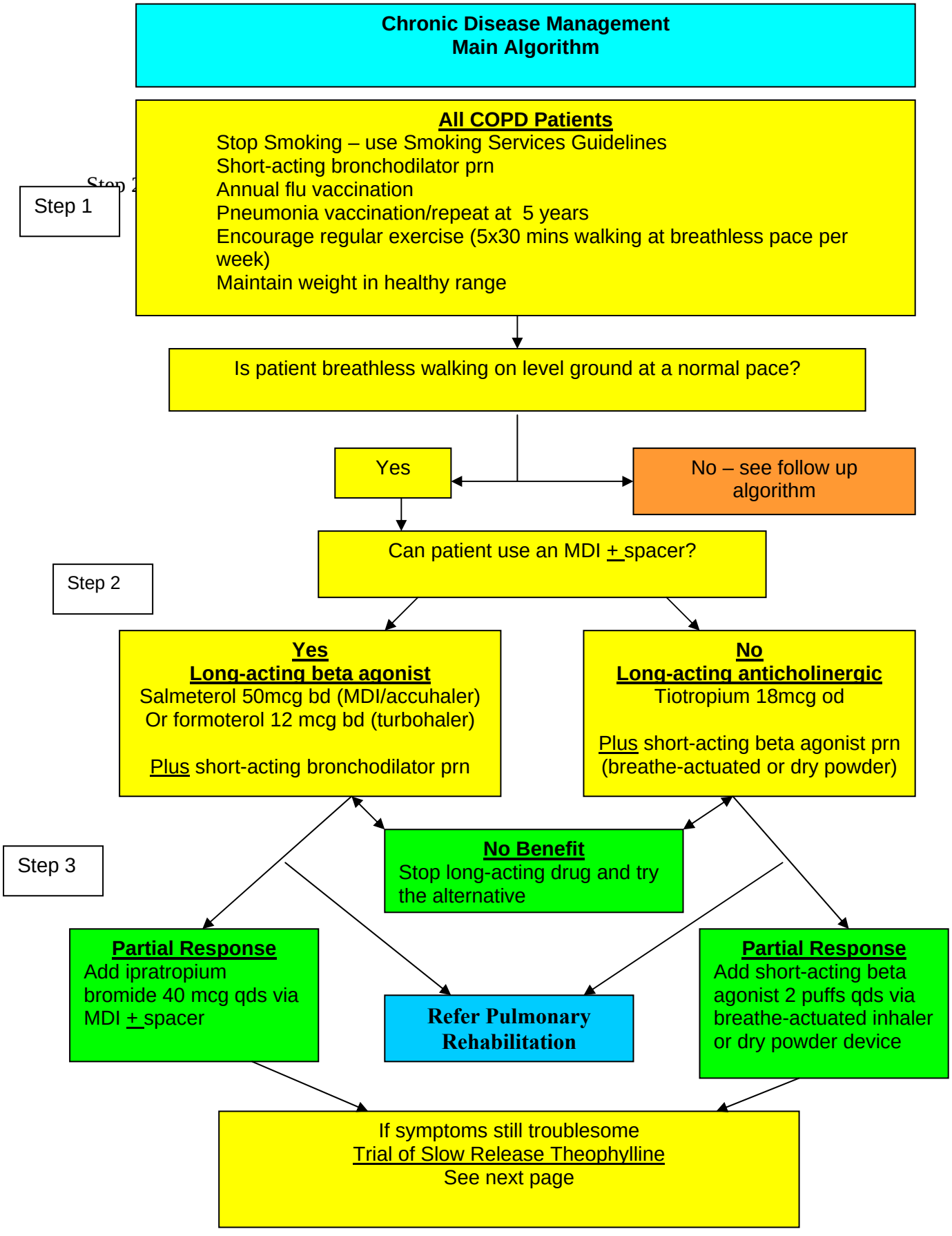
Breathlessness / respiratory distress may not be the dominant symptom

There is often a background of tiredness, sleepiness, difficulty sleeping at night, morning headaches sometimes going back over many weeks.

You should have a low threshold for checking the arterial blood gases in patients with neuromuscular disease or chest wall deformity who have presented to hospital.

If patients are hypercapnic and acidotic this is an indication for starting NPPV – there is no need to do a sleep study first.

COPD – CHRONIC DISEASE MANAGEMENT ALGORITHM



Step 4

Trial of Slow Release Theophylline

Check BNF for drug interactions (Common respiratory drugs include macrolides/quinolones)
Prescribe by brand eg uniphyllin, phyllocontin, nuelin
In first week prescribe half standard dose eg uniphyllin 200mg od, stepping to full dose in week 2 eg 200mg bd
Check blood level at end of 2nd week in the afternoon. Target range 55-110 micromoles/l
Discontinue after 1 month in therapeutic range if no symptomatic improvement
Levels should be repeated if patients smoking status changes, develops cardiac or liver disease or is prescribed a drug which interacts

Step 5

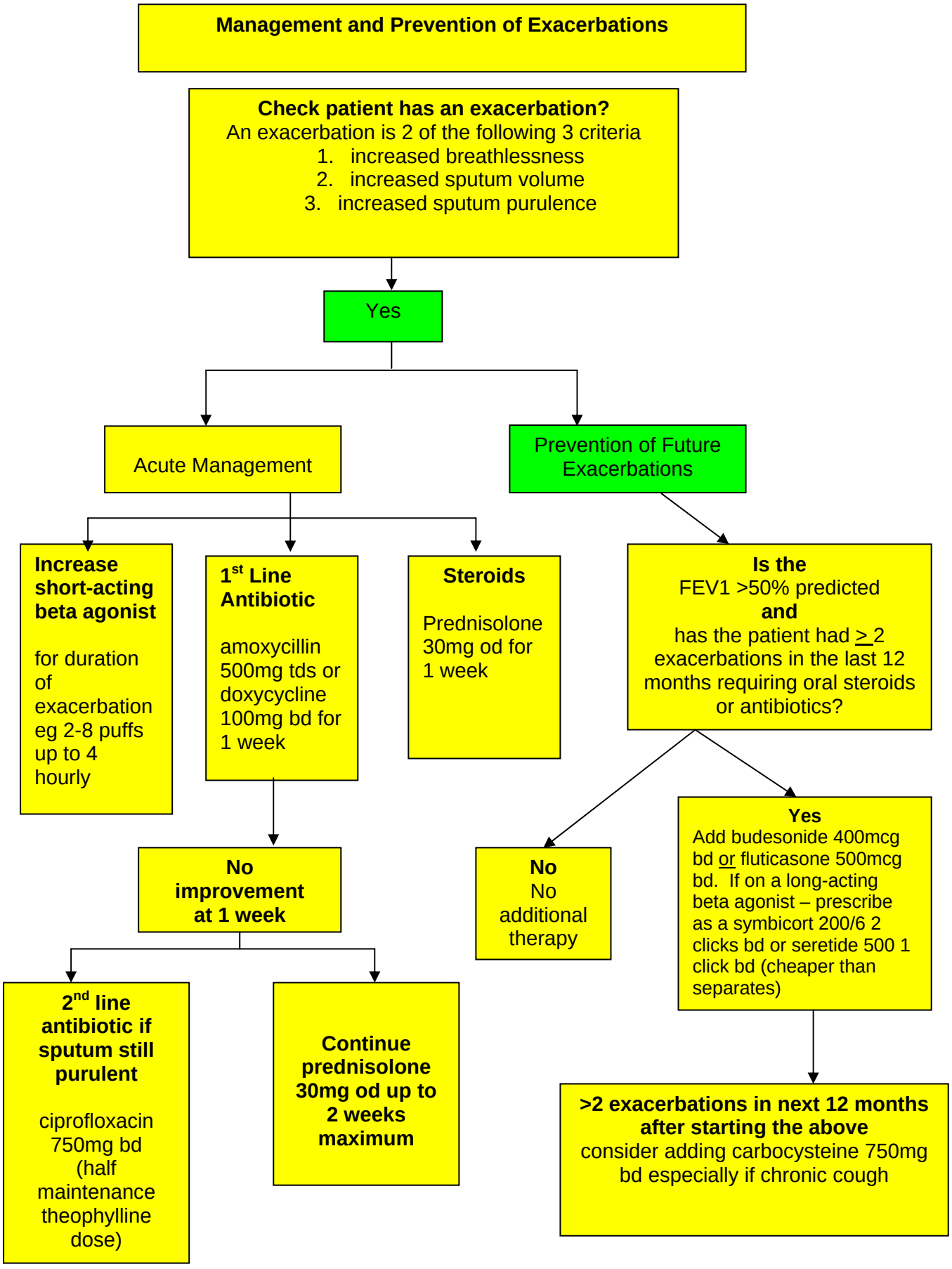
Combination Long-acting Bronchodilators

i.e. long-acting beta agonist + tiotropium + theophylline

Step 6

Nebulised Therapy

Management of an Acute Exacerbation of COPD



Users guide for the Bilevel Ventilation Machine

There are numerous different machines providing bilevel ventilation for type II respiratory failure eg Harmony, Synchrony, Breas, BiPAP, BiPAP vision, NIPPY II and others. The following criteria may differ slightly with each model but the theory for each remains the same.

1) INSPIRATORY TIME. This is the length of time that the ventilator will push air into the patient, often this is written as Ti and is measured in seconds. Normally this is set at about 1.0 seconds but this varies depending on the patients respiratory rate, underlying condition and comfort.

2) PRESSURE CONTROL. Inspiratory pressure or sometimes referred to as Inspiratory Positive Airway Pressure (IPAP). This is the positive pressure produced by the ventilator during inspiration. This can be easily adjusted to INCREASE the pressure. The inspiratory pressure is shown on the airway pressure meter as the peak reading and is measured in centimetres of water (cm H_2O) pressure. Generally start at IPAP of 10 cm H_20 and titrate upwards to 16-18 cms H_20 according to patient comfort.

3) MAXIMUM EXPIRATORY TIME. This is the maximum length of time that the ventilator will allow the patient to breathe out, often this is written as Te and is measured in seconds the same as Ti. The patient can breathe out for less time when they trigger another breath, but they will not be able to breathe for longer than Te as usually the ventilator will assume that the patient has stopped breathing and give a controlled breath. Normally Te is set between 2 and 3 seconds but this varies depending on the patients respiratory rate, underlying condition and comfort.

When Ti and Te are added together they give the breath time, this is the time taken by the patient to breathe in and out. If the breath time is divided into 60 it gives the respiratory rate in breaths per minute. For Example

Ti = 1 second

Te = 2 seconds

Total breath time = 3 seconds 60/3 = 20 breaths per minute.

4)PEEP. Positive End Expiratory Pressure (PEEP), this is some times known as Expiratory Positive Airway Pressure (EPAP). This is the positive pressure produced by the ventilator during expiration. The PEEP is shown on the airway pressure meter as the base reading and is measured in cm H_2O pressure. The PEEP cannot be set at less than 3cm H_2O as there has to be some flow in the circuit at all times to allow the patient to trigger the ventilator. Generally set EPAP at 4 cm H_20 to start and titrate up slightly if necessary and difficulty in lowering PCO_2. EPAP above 8 cms H_20 should not routinely be set.

5) AIRWAY PRESSURE METER. (on NIPPY II ventilator). This shows the pressure within the ventilator circuit at any given time by lighting a green bar which moves up and down the scale. The scale is in 1cm H_2O of pressure increments. During expiration this will show the level of PEEP in the circuit and this is the level of PEEP that is recorded. During inspiration the lit bar will move up the display until it reaches a peak and this is known as peak inspiratory pressure and is the inspiratory pressure that is recorded.

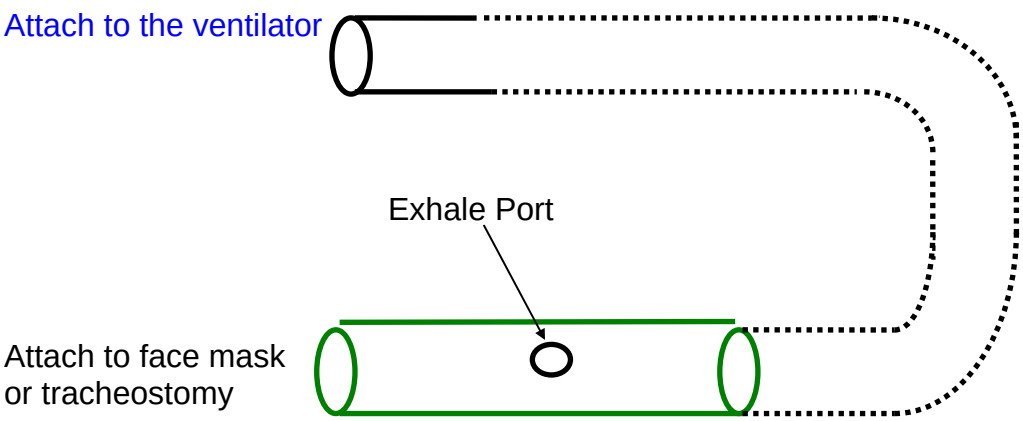
6) AIRWAY FLOW METER. This shows the flow of air within the ventilator circuit at any given time by lighting a green bar which moves up and down the scale (on NIPPY II ventilator). The scale is in 5 litres of air per minute (L/min) increments. There is always some flow within the circuit as the circuit has a constant leak fitted into it. Flow is measured as this is the safest way of ensuring the patient is breathing. In an apnoeic patient there can be a change in pressure without any change in flow because they do not breathe in. During expiration this will show the base level of flow needed to maintain the PEEP in the circuit normally the base level of flow is around 20 - 30 L/min if the level of flow is higher than this during expiration there may be a leak in the circuit or the mask is not a good fit. During inspiration the lit bar will go up the scale until it reaches a peak and this is known as peak inspiratory flow and is usually around 70 - 140 L/min if the level of flow is higher than this during inspiration the patient may be taking in a big breath or there may be a leak in

the circuit or the mask is not a good fit. Both the high and low flow alarms are shown as static green bars on the meter.

7) HIGH FLOW ALARM. This is the maximum amount of flow that should be reached during a breath. If it is set too low it will be set off during each inspiration or if there is a slight leak, if set too high it may never alarm if there is a problem. Normally this is set at between 10 L/min and 30 L/min more than peak inspiratory flow around the 150 L/min mark. It is used for detecting large leaks in the circuit and for patient disconnection.

8) LOW FLOW ALARM. This is the minimum amount of flow that must be reached during inspiration. THIS ALARM MUST BE SET SO THAT THE LEVEL OF FLOW CROSSES IT DURING INSPIRATION. If it is set too high then the level of flow will not reach it and the ventilator assumes a breath has not been taken and it will alarm constantly, if set too low it i.e. below the base level of flow then the level of flow will not cross it and the ventilator assumes a breath has not been taken and it will alarm constantly. It is used to detect that adequate ventilation has taken place and is the alarm that causes the most problems as it often needs to be adjusted to meet the patients changes in respiratory demand for example between deep daytime breathing and shallow night-time breathing. Normally the low flow alarm is set between 10 L/min and 30 L/min above base inspiratory flow. It is shown as a static green bar towards the bottom of the airway flow meter. Due to the number of false low flow alarms due to leakage when using masks the newer versions of the Nippy 2 have a key to allow the low flow alarm to be turned off. The alarm should never be turned off when using via a tracheostomy as this is the alarm that will sound if the tracheostomy becomes blocked.

THE VENTILATOR CIRCUIT



The circuit comprises of a 22mm wide reusable tube for the patient output about 1.8m in length shown here in black. With a connector at the patient end containing an opening or Exhale Port (Whisper swivel).

THE EXHALE PORT MUST BE KEPT OPEN AND FREE FROM ANY OBSTRUCTION AT ALL TIMES

The tube is attached to outlet on the side of the ventilator as shown:

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SETTING UP THE VENTILATOR FOR I.P.P.V. USE

Not every function is on every ventilator. The settings below are standard on most ventilators.

1 Connect the ventilator circuit as described before.
2 Connect the mains lead.
3 Open the lid.
4 Set the low flow alarm to 10.
5 Set the high flow alarm to 150.
6 Set the inspiratory time to 1 (set at 0.7 or less if tachypnoeic).
7 Set the expiratory time to 3.
8 Set the trigger to 4.
9 Turn on the ventilator

10 Press the alarm mute if present

11 Cover the end of the circuit with your hand and set the pressure control until the peak pressure seen on the airway pressure meter is 10 - 15.

12 Set the PEEP to 4.

13 Attach to the patient using a suitable mask or connection.

14 Ask the patient if the breathing in time is too long or too short, adjust the inspiratory time accordingly.

15 Ask the patient if the breath is big enough adjust the pressure control as appropriate.

16 Watch the patient and the controls, if the green trigger light (NIPPV II) is coming on for each breath reduce the expiratory time until about half the breaths are triggered.

17 Check observations and SaO_2.

18 Close the lid.

REMEMBER that the inspiratory pressure may need to be increased rapidly if under ventilating. PEEP may need to be increased to help overcome intrinsic PEEP in patients with COPD (usually set at 5 - 7 cm H_2O) or to maintain an upper airway in patients with Obstructive and Mixed Sleep Apnoea.

Set the low flow alarm to between 10 and 30 L/min below peak airway flow or turn off if using a mask that leaks and the high flow alarm to between 10 and 30 L/min above peak airway flow.

TROUBLE SHOOTING

Problem	Solution
Constant tone alarm sounds but no alarm lit on display.	CHECK PATIENT! Power failure / disconnection. Check mains lead attached and turned on.

	Ventilator failure? Replace ventilator.
Constant tone alarm sounds and valve fault alarm lit.	CHECK PATIENT! Replace ventilator.
Constant tone alarm sounds and high flow alarm lit	CHECK PATIENT! Patient disconnected? Leak in circuit, check connections, mask fit. Alarm level set too low?
Constant tone alarm sounds and low flow alarm lit.	CHECK PATIENT! Patient coughing or vomiting? Circuit blocked or kinked? Outlet port missing? Mask leaking significantly? Alarm level set too high? Consider turning off if mask problem.
Constant tone alarm sounds and alarm set up incorrect alarm lit.	Adjust alarms appropriately.
Patient can’t get a breath when needed.	Check trigger is set to between 4 - 20 L/min. Check circuit and mask for leaks. Patients inspiratory effort too weak? if so reduce expiratory time to increase respiratory rate or decrease trigger if set above 4 L/min.

Patient cannot breathe out easily.	Check outlet port not missing. Reduce PEEP if set above 3 cm H_2O and patient not COPD. Increase PEEP if set at 3 cm H_2O and patient has COPD (usually set at 5 - 7 cm H_2O) to overcome intrinsic PEEP. Check humidifying filter (if used) is not sodden.
Breath too long or too short.	Alter inspiratory time as needed.
Breath too big.	Reduce inspiratory time and/or reduce inspiratory pressure. Ensure SaO_2 is not compromised.
Breath too small.	Increase inspiratory time and/or increase inspiratory pressure. Ensure SaO_2 is not compromised.

THEORY OF OPERATION

BIPAP ventilators are bi-level pressure cycled ventilators, that means that they give a breath to a given inspiratory pressure, which is set on the ventilator. During expiration a usually smaller (unless used as CPAP) pressure “PEEP” is maintained in the circuit. The pressure of each breath remains constant while the volume of the breath (Tidal Volume) varies from breath to breath and is determined by how deeply the patient inhales, airways resistance, chest wall and lung compliance as well as the amount of leak in the circuit.

Advantages:- Reduce risk of barotrauma, patient more likely to feel comfortable and the ventilator is more able to compensate for leaks. PEEP may prevent atelectasis and overcome intrinsic PEEP.
Disadvantages:- Tidal volume cannot be guaranteed as it varies from breath to breath. Patients with very weak respiratory muscles and compliant lungs may feel “blown up” by the PEEP.

There are 3 types of breath that the patient can have on most bilevel ventilators:

1) Assisted (Triggered) Breath, this is where the patient initiates the breath by creating enough drop in flow to trigger the ventilator, the value of the trigger can be set between 4 L/min and 80 L/min the higher the value the harder it is to trigger a breath. Leaks in the circuit and weak respiratory effort may mean that the trigger value is not reached and an assisted breath is not given. An assisted breath is given at the set pressure for the set inspiratory time (Ti).

2) Controlled Breath, this is where the ventilator gives the patient a breath when the patient has not triggered the ventilator themselves by the end of the maximum expiratory time (Te). A controlled breath is given at the set pressure for the set inspiratory time (Ti).

3) CPAP, this is where the ventilator gives the same pressure irrespective of whether the patient is breathing in or out. The flow will of course alter during inspiration and exhalation.

The ventilator functions by controlling the airflow with an internal valve. Air is constantly pushed into the circuit to maintain the pressure required and as air is pushed constantly into the circuit it must be allowed to constantly come out of the circuit hence the need for an outlet port rather than a valve. During inspiration the ventilator pushes air at the set inspiratory pressure through the patient tubing and the excess air is vented through the outlet port. During expiration the pressure in the patient tubing decreases to the set PEEP and

as the patient breathes out the excess air is vented through the outlet port. To minimise the dead space ensure that the outlet port is as near the patient as possible.

OXYGEN

Oxygen can be added into the circuit as near the patient as possible to prevent the risk of explosion. Normally a maximum of 13 litres a minute can be used, above this and the concentration of oxygen does not rise significantly.

NON INVASIVE VENTILATION MUST NOT BE USED IN THE PRESENCE OF INFLAMMABLE ANAESTHETIC GASES.

HUMIDIFICATION

As there is a constant flow of air through the circuit there is the potential to dry out the nasal and oral mucosa when ventilating a patient via a mask. The first line of treatment should be good fluid intake and regular mouth care. The use of artificial saliva (Glandosane) may be useful for some patients.

If supplementary humidification is necessary then the easiest and safest way is by using a heat and moisture exchanging (HME) filter, this traps the moisture breathed out by the patient and recycles it. There are several disadvantages to HMEs:

a) to be effective they have to be placed between the patient and the exhale port thus increasing dead space.

b) they can affect the performance of the ventilator especially when wet and sodden.

c) they provide the ideal environment for bacteria to grow and have to be changed at least daily.

d) they can be bulky and awkward.

e) they do not add in any extra water just recycle what is breathed out.

f) moderately expensive.

Supplementary humidification can also be given by using a water bath humidifier. These add in extra water and vary in cost and complexity from cold water pass over to heated active humidification such as the Fisher & Paykel MR730. There disadvantages are as follows:

a) the efficiency varies greatly depending on type used.

b) they provide the ideal environment for bacteria to grow and have to be changed at least daily or weekly for F & P.

c) Initially more expensive but may be cheaper in the long run compared with HME.

d) they can be bulky, may require a drip stand and mains electricity.

e) can be complex to use.

f) risk of water entering the NIPPV they must be used with extreme caution.

When the Nippy is turned off, the patient tubing must be disconnected between the Nippy and the humidifier to prevent water entering the Nippy. A hydrophobic filter should be used to protect the ventilator from water ingress.

Humidification is mandatory for patients receiving tracheal ventilation as their natural humidification of the nose and mouth is bypassed. First line treatment must not be forgotten but HMEs or hot water active humidification should always be used.

Lung Cancer

Patients with known or suspected lung cancer should be under the care and investigation of either the respiratory medicine or thoracic surgical team. If a patient with a CXR with a lung mass is admitted under any other team on medical or other 'take' then early and direct referral to respiratory medicine is strongly recommended.

All patients should be discussed at the Multidisciplinary Team Meeting. They should be presented when the histology is known and the above initial staging investigations have been performed i.e. approx. 2-4 weeks after 1st clinic visit. The pro-forma has been developed. It should be completed prior to the meeting. This will summarise the histology, staging and process.

There must be a demand on us to provide prompt access for lung cancer patients e.g. 2-week wait initiative, thorough assessment including high histology rates and staging and multidisciplinary management of all patients. Data should to be collected on all lung cancer patients seen in CUH. A lung cancer working group has been formulated to address these issues.

These guidelines are a brief summary of what we wish to achieve in the investigation and management of lung cancer patients.

OUTPATIENT INVESTIGATION AND MANAGEMENT:

Investigation and Staging

- Patients should to be seen within 2 weeks of the GP deciding to refer,
- Bronchoscopy or CT guided biopsy should be arranged within 2 weeks of outpatient attendance and they should be seen in clinic 2 week after bronchoscopy / CT biopsy.

- In most circumstances a histological or cytological confirmation of the diagnosis should be made. Where not considered appropriate this should be discussed with a senior member of the team.
- Patients should be considered operable until proven otherwise.

To maximise the speed and completeness of assessment I would recommend the following when lung cancer is suspected;

1st Visit:

- For all patients; FBC, U+E, LFTs, Ca, LDH, INR and CXR and assess performance status (see below).

WHO Performance status

0	Normal activity, no restriction
1	Strenuous activity restricted, ambulatory, can do light work
2	Up and about for >50% of waking hours, capable of self care but unable to work
3	Confined to bed or chair for >50% of waking hours, limited self care
4	Confined to bed or chair, no self care, completely disabled

Clinically localised disease:

- Bronchoscopy – book via the respiratory registrar either for outpatients (DPU or ward 1A/2C) or in-patients. There are two bronchoscopy lists per week. Tuesday is reserved predominantly for outpatients and Thursday for in-patients.
- If high clinical probability of lung cancer book ‘Staging CT chest with liver and adrenals cuts’ Mark card –urgent or fast track.
- Spirometry and oxygen saturation in clinic. If FEV1 <40% predicted book laboratory spirometry with reversibilities and transfer factor. Mark urgent.

- Send copy letters to Pauline O'Dea, lung cancer support nurse with patient phone number.
- Book follow up appointment for 2 weeks and discuss at MDT – held Tuesday morning 8.30 am in x-ray department.
- If tumour seen at bronchoscopy, but CT not already arranged, organise it from bronchoscopy.
- If CT guided biopsy is felt to be a more appropriate first investigation, perhaps after discussion with senior member of respiratory medicine team or consultant radiologist then this needs to be co-ordinated between Prof Maher's service in radiology and the DPU if the patient is an outpatient. A free 'slot' in the DPU for a Monday, Tuesday or Wednesday must be arranged with the DPU staff within two weeks of the decision that CT guided biopsy (or bronchoscopy) is indicated. If there is no slot available to respiratory medicine / thoracic surgery then contact the admissions and if necessary Ann Keating to authorise the use of a slot 'block booked' by another services. Once the slot is arranged, then the x-ray card outlining the request for CT guided biopsy and date arranged in DPU and patients telephone no. is given to the CT radiology sister to book onto the appropriate radiology list for Prof Maher. Emphasise that the CT guided biopsy should have been discussed at the x-ray / lung cancer MDT Tuesday am before this process taken forward.
- The patient's details should be given to Dr Louise Burke before the end of the same week in the expectation that the case including full clinical and radiological details and histology may be discussed at the lung cancer MDT meeting, Tuesday morning, within the next two weeks.
- Details of the MDT discussion should be recorded on the lung cancer MDT sheet. This sheet may then be used to refer to the appropriate team. A copy of the completed MDT form should also be given to Dr Henry's secretary, Pauline O'Dea (lung cancer nurse specialist) and a copy should be left in the patients notes.

Clinically advanced disease:

There is still a need for a tissue diagnosis as this will effect management i.e. small cell carcinoma vs. non-small cell carcinoma. Most patients will require a bronchoscopy. Additional sources of tissue are:

Lymphadenopathy: arrange FNA of nodes. Easily done at time of bronchscopy.

Pleural effusion: aspirate for cytology, protein, LDH, glucose, pH and microbiology. Samples can be sent from clinic. Gererally a fast track CT is indicated particularly if malignancy is suspected. If 1st sample negative, consider repeat aspirate for cytology and perform pleural biopsy or CT guided pleural biopsy (arrange 2 week admission to ward 1A or DPU). Generally this choice will be made after discussion at the cancer MDT. Thoracoscopic (VATS) biopsy and pleurodesis is the altenative.

The following should be arranged as staging investigations from the 1st visit if symptoms are present.

CNS symptoms: arrange CT head

Bone pain: arrange plain X-Rays of site and bone scan. If back pain examine for signs of cord compression, if present admit immediately and investigate with MRI as an emergency.

Need for Staging Chest CT in clinically advanced disease.

If a patient is found to have metastases and the diagnosis is NSCLC, a staging chest CT is not routinely required.

If a patient is found to have metastases and small cell carcinoma a staging chest CT is required prior to chemotherapy.

- All patients with clinically advanced disease should be discussed in the same way as localised disease at the Tuesday am MDT. The lung cancer MDT form should be filled out and referral in this way to be made to surgery (unlikely), oncology or

palliative care. Copy form to Dr Henry and Pauline O'Dea lung cancer nurse specialist.

- The patient must be reviewed within two weeks of the canacer MDT by the appropriate team as agreed by the members of the MDT team.

Staging of NSCLC (Guidance on back of forms)

Staging of Small cell lung cancer

Limited: Disease confined to the soft tissues of one hemithorax and ipsilateral and contralateral scalene, lower cervical and mediastinal nodes.

Extensive: Any disease more extensive than limited.

Modified Manchester Score. This score correlates with survival and effects the choice of chemotherapy.

Extensive disease	1
LDH > normal	1
Na < normal	1
Alk Phos >1.5 upper limit of normal	1
Performance status >2	1

Total 0-1 Good prognostic group
2-3 Intermediate prognostic group
4-5 Poor prognostic group

Malignant pleural effusion *(see Managing Malignant Pleural Effusion algorithm – p20)*

The treatment of this condition is symptomatic only - there is no cure. If the patient does not have symptoms there is no need to treat - do not treat the CXR. At the time of diagnosis it is reasonable to take off 500 mls then see whether this relieves patient

breathlessness rather than proceeding direct to pleurodesis (a chest drain is uncomfortable). If this relieves breathlessness then a small seldinger chest drain and pleurodesis is appropriate. If not the patient may have a trapped lung and drainage of the effusion may not be appropriate

If appropriate, a small calibre 'seldinger' chest drain should be inserted and the pleural effusion drained to dryness (confirm radiologically).

Diamorphine 2.5-5 mg IV and Lignocaine 1% x 25 mls into the chest drain and drain closed for 5 mins given for pre-pleurodesis analgesia. Following this Sterile talc (4 gms) disolved in 50 mls N/Saline should be instilled and the chest drain clamped for four hours. The clamp should be released and suction commenced and maintained for at least 12 hours at which time the drain can be removed after CXR to ensure no recurrence of effusion. NSAIDs should not be used for pain relief since they reduce the inflammatory response that you are trying to provoke – Oromorph or Pethidine are preferrable.
The main reasons for failure are not draining the effusion completely or removing the chest drain too quickly.

Thoracic biopsy under imaging guidance: protocol for patient care

Indications:
Lung or mediastinal mass or pleural thickening after discussion of radiology with Prof Maher or at the Lung cancer MDT Tueday am (8.30 am in radiology)
Patients should be under the care of physicians experienced in looking after patients after such procedures, aware of and able to manage potential complications.

Pre biopsy requirements:

(1) Patient recently clinically assessed regarding fitness and appropriateness of biopsy by medical team and seen again on day of biopsy by medical staff to check that there has been no change in clinical condition.
(2) Recent FBC, clotting screen – result must be within the normal range.
(3) Recent lung function.
(4) Consent with particular mention of post biopsy haemoptysis and pneumothorax. There is a small risk of death, estimated at less than 0.01%, usually secondary to massive bleed or air embolism.
(5) Nil by mouth for 2 hours pre biopsy.
(6) If patient to be discharged on day of biopsy, check friend or relative able to drive the patient home and stay with patient overnight. This must be clearly indicated on the request form in order to arrange early biopsy time.

Post biopsy requirements:
Lie supine in bed for 2 hours post biopsy, of which the first hour should preferably be lying on side of biopsy.
The patient should be advised to move as little as possible and to avoid coughing.
CXR 15 minutes post biopsy (unless patient staying over-night).

Observations:
On return to ward and then at half hourly intervals for 2 hours:

(1) Pulse, BP, oxygen saturation
(2) Check wound site for bleed or air leak
(3) Ask patient about chest pain and breathlessness

May eat when returns to ward.

If patient well and all post biopsy observations satisfactory, may get up 2 hours post biopsy as long as nurse present when first gets out of bed.
Discuss with doctor if any problem with above.

CXR 4 hours post biopsy.
(If patient to stay overnight, CXR on the next morning prior to discharge.)
If symptoms warrant, CXR earlier.

Patient can be discharged on day of biopsy if:

(1) CXR shows no pneumothorax or only a tiny apical pneumothorax, unchanged in comparison with the immediate post biopsy CXR.

(2) No significant SOB or haemoptysis.
(3) Patient well and has capable adult to drive home and stay overnight
(4) Patient must
    (i) have letter to give to GP/A&E explaining he/she has had a lung biopsy stating the side,
    (ii) know to call for help if suffers chest pain, worsening SOB, significant haemoptysis,
    (iii) know who to call for help

If CXR shows pneumothorax do not discharge unless stable in size on repeat CXR.
If large or symptomatic, consider aspiration or drainage.

Acute Severe Asthma

Full BTS Guidelines are available on the British Thoracic Society website through the guidelines link and no username or password are required.

Indications for Arterial blood gas - SpO_2 <92% or any severe or life threatening feature.

Features of Severe Asthma

PEFR <50% of predicted or best.

Can't complete sentences

Resp Rate >25/min

Pulse >110/min

Features of Life-Threatening Asthma

PEFR <33%

Silent chest /feeble effort/ cyanosis

Bradycardia or hypotension

Exhaustion /confusion /coma

Normal $PaCO_2$, hypoxia <8kPa or acidosis.

Table of Normal PEFR Values

	Height (top row =cm. Second row =inches)						
MALE	**1.55**	**1.6**	**1.65**	**1.7**	**1.75**	**1.8**	**1.85**
Age	**61**	**63**	**65**	**67**	**69**	**71**	**73**
25	515	534	552	570	589	607	625
30	502	520	539	557	576	594	612
35	489	508	526	544	563	582	600
40	476	495	513	531	550	568	586
45	463	482	501	519	537	556	574
50	450	469	487	505	524	543	561
55	438	456	475	493	511	530	548
60	424	443	462	480	498	517	535

Height (top row =cm. Second row =inches)

FEMALE	1.45	1.5	1.55	1.6	1.65	1.7	1.75
Age	**57**	**59**	**61**	**63**	**65**	**67**	**69**
25	365	383	400	416	433	449	466
30	357	374	390	407	423	440	456
35	348	365	381	398	414	431	447
40	339	356	372	389	405	422	438
45	330	347	363	380	397	413	429
50	321	338	354	371	388	404	420
55	312	329	345	362	379	395	411
60	303	320	336	353	370	386	402

Treatment of Severe / Life threatening Asthma
Immediate Treatment

- High flow oxygen 60% plus
- Salbutamol 5mg neb
- Hydrocortisone 200mg iv stat
- Prednisolone 30mg (plus) po

If life-threatening or not responsive to initial treatment –add atrovent 500mcg and consider continuous nebulisation. Consider a single dose of IV magnesium sulphate 1.2 to 2 grams over twenty minutes.

CXR to exclude pneumothorax / pneumonia

Subsequent management

Improving –4 hourly nebs and prednisolone 30mg od

Not improving – see above.

Monitor with: PEFR at 15 mins, 30 mins and thereafter minimum of bd.

Where to manage

Severe: These patients should be admitted under a consultant in respiratory medicine onto ward 3A – observation bay (Room 9)

Life-threatening: Respiratory registrar or ICU registrar must review all life-threatening cases.

BTS Guidelines for Assessment and Management of Acute Severe Asthma.

Near fatal asthma	Raised $PaCO_2$ and/or requiring mechanical ventilation with raised inflation pressures
Life threatening asthma	Any one of the following in a patient with severe asthma: • PEF <33% best or predicted • SpO_2 <92% • PaO_2 <8 kPa • normal $PaCO_2$ (4.6-6.0 kPa) • silent chest • cyanosis • feeble respiratory effort • bradycardia • dysrhythmia • hypotension • exhaustion • confusion • coma
Acute severe asthma	Any one of: • PEF 33-50% best or predicted • respiratory rate ≥25/min • heart rate ≥110/min • inability to complete sentences in one breath
Moderate asthma exacerbation	• Increasing symptoms • PEF >50-75% best or predicted • No features of acute severe asthma
Brittle asthma	• Type 1: wide PEF variability (>40% diurnal variation for >50% of the time over a period >150 days) despite intense therapy • Type 2: sudden severe attacks on a background of apparently well-controlled asthma

IMMEDIATE TREATMENT

- Oxygen 40-60% (CO_2 retention is not usually aggravated by oxygen therapy in asthma)
- Salbutamol 5mg or terbutaline 10mg via an oxygen-driven nebuliser
- Ipraptropium bromide 0.5mg via an oxygen-driven nebuliser
- Prednisolone tablets 40-50mg or IV hydrocortisone 100mg or both if very ill
- No sedatives of any kind
- Chest radiograph only if pneumothorax or consolidation are suspected or patient requires IPPV

IF LIFE THREATENING FEATURES ARE PRESENT:

- Discuss with senior clinician and ICU team
- Add IV magnesium sulphate 1.2-2g infusion over 20 minutes *(unless already given)*
- Give nebulised $ß_2$ agonist more frequently e.g. salbutamol 5mg up to every 15-30 minutes or 10mg continuously hourly

MANAGEMENT OF ACUTE ASTHMA IN ADULTS

CRITERIA FOR ADMISSION

B Admit patients with any feature of
- a life threatening or near fatal attack
- severe attack persisting after initial treatment

C Patients whose peak flow is greater than 75% best or predicted one hour after initial treatment may be discharged from A&E, unless there are other reasons why admission may be appropriate

TREATMENT OF ACUTE ASTHMA

OXYGEN

C ▪ Give high flow oxygen to all patients with acute severe asthma

A ▪ Nebulised β_2 agonist bronchodilators should be driven by oxygen (hospital, ambulance and primary care)

C ▪ The non-availablity of supplemental oxygen should not prevent nebulised therapy being given if indicated

STEROID THERAPY

A Give systemic steroids in adequate doses in all cases

☑ Continue prednisolone 40-50 mg daily for at least five days or until recovery

OTHER THERAPIES

A Consider a single dose of IV magnesium sulphate (1.2-2 g IV infusion over 20 mins) for patients with:
- acute severe asthma without a good *initial response to inhaled bronchodilator* therapy
- life threatening or near fatal asthma

☑ IV Magnesium sulphate should only be used following consultation with senior medical staff

B Routine prescription of antibiotics is not recommended

β_2 AGONIST BRONCHODILATORS

A Administer high dose inhaled β_2 agonists as first line agents and administer as early as possible. Outside hospital high dose β_2 agonist bronchodilators may be delivered via large volume spacer or nebuliser

☑ In acute asthma with life threatening features the nebulised route (oxygen-driven) is *recommended*

A In severe asthma (PEF or $FEV_1 < 50\%$ best or predicted) and asthma that is poorly responsive to an initial bolus dose of β_2 agonist, consider continuous nebulisation

IPRATROPIUM BROMIDE

A Nebulised ipratropium bromide (0.5 mg 4-6 hourly) should be added to β_2 agonist treatment for patients with acute severe or life-threatening asthma or those with a poor initial response to β_2 agonist therapy

REFERRAL TO INTENSIVE CARE

Refer any patient:
- requiring ventilatory support
- with acute severe or life threatening asthma, failing to respond to therapy, evidenced by:
  - deteriorating PEF
  - persisting or worsening hypoxia
  - hypercapnia
  - ABG analysis showing ↓ pH or ↑ H^+
  - exhaustion, feeble respiration
  - drowsiness, confusion
  - coma or respiratory arrest

TUBERCULOSIS

1. Most patients can and should be managed as outpatients. If a patient presents to A&E with features suggestive of TB, consider investigation as outpatient, including 3 morning sputum specimens for AAFB, rather than admission. Urgent appointment can be booked respiratory clinic at CUH within the next two weeks after discussion with respiratory consultant or SpR.

2. If hospital admission is necessary, patient MUST be admitted to a side room if known / suspected pulmonary TB. If no side room available on the respiratory ward, the patient must be kept in a side room in A&E or an acute medical admission area until a single side room becomes available on the respiratory ward or on the TB unit in St Finbarr's hospital after consultation between CUH respiratory consultant and Dr Terry O'Connor, clinical lead for TB in Cork and consultant respiratory physician, Mercy Hospital.

3. Known / suspected MDR TB (resistance to Rifampicin plus isoniazid) MUST referred to TB unit SFH through Dr O'Connor.

4. When a patient is commenced on treatment a NOTIFICATION FORM must be completed. These forms are available from any of the respiratory consultants secretaries.

5. Check sputum for AAFB on all patients – even if you have confirmed the dignosis by another means – as the result affects contact screening procedures.

6. Try to get culture if at all possible – to confirm diagnosis and check sensitivities. For pleural effusions, best test is pleural biopsy, with specimens in saline to microbiology for AAFB, as well as in formalin to histology.

7. Treatment of TB cases should be in accordance with British Thoracic Society Guidelines *see BTS website*. If in doubt consult with Dr Bredin or Dr Henry.

8. All patients with TB aged 16-64 should be offered HIV test

9. When commencing treatment remember to explain about the risk of side effects from the drugs.

10. All anti-tuberculous drugs should be prescribed from the Clinic, we should **not** delegate this to General Practitioners. Normally prescribe 4 weeks at a time (including on first prescription even if next visit is in 2 weeks)

11. Check liver function tests prior to commencing on treatment and then at every visit, for the first two months of treatment. (After that, only if previously abnormal LFT or if symptoms)

12. Apart from exceptional circumstances, drugs should be prescribed as combination tablets, i.e. Rifater during the initial phase and Rifinah during the continuation phase. Unfortunately there are no combination tablets currently

available that include Ethambutol but remember that the majority of patients should be on Ethambutol during the initial phase

13. Normally treatment is reduced to two drugs after the first two months of treatment. However, please ensure that you have checked the sensitivity result before changing the drugs.

Standards of Medical Records

All entries in medical notes:

1. **Should be contemporary with the clinical event being documented**.

2. **Should be legible and unambiguous.**

3. **Should only be completed by the person making the clinical observation or recommendation.**

4. **Should be signed (legibly) by that person indicating his/her position in the trust.**

5. **Should have the date and time of the entry recorded.**

I appreciate this is all common sense but I think it is worth reinforcing generally and including in the induction of all junior doctors.