Infective exacerbation of Asthma in Pregnancy requiring Extracorporeal membrane oxygenation

Dr Alex Novak ST1 O&G
Miss Salma Ibrahim SpR O&G

NHS
Milton Keynes University Hospital
NHS Foundation Trust

Contents

- Case Presentation
- Summary of ECMO
- Asthma Treatment

Case History

- 27 years old
- P2+3
  - 2 previous LSCS at 40 and 36 weeks
- LMP 21/1/2016
- EDD 26/11/2016

- Previous admission to ITU with postnatal septicaemia

Case History (2)

PMH:

•Obesity - BMI 31

•Asthma, IBS, Depression and

•Presentation to ED at 23/40 with Exacerbation of asthma – discharged home after med rv

DH:

Salbutamol, Formoterol, Beclomethasone

Mirtazapine

SH:

•Smoker 15/day

Obstetric Care

- Booked at 12/40 – Consultant Led Care
- Review 15/40 by CMW
- Anomaly scan was normal at 20/40
- MW review at 22/40 and referred to IAPT
- Seen in ANC at 24/40
  - Plan
    - refer to anaesthetics for previous ITU admission
    - LSCS at 39/40

Obstetric Care

- Presented to ED on 18/9/16 with lethargy, cough and chest tightness following asthma attack, D&V and reduced FM
  - Using salbutamol up to 18 times a day
  - CTG by midwife met criteria
- ED Consultant review – discharged
  - Bilateral wheeze and creps
  - Sent home with reassurance and **Co-amoxiclav**
    - No PFR or CXR

Re-presented on 19/9/16 to ED

30/40

PC:

- Persistent cough and wheeze despite salbutamol, SOB and chest pain
- Yellow sputum

O/E:

- Bilateral inspiratory chest wheezing
- RR 44, HR 112 ,O2 87% on RA, T 36, BP 95/52

Investigations

- BLOODS:
  - Hb 121
  - WBC 9.6
  - PLT 213
  - CRP 12.7
  - Lactate 1.2
  - U&E N
- ECG: sinus tachycardia

- ABG:

  pH 7.42

  pO2 8.47
  pCO2 3.39
  HCO3 16.2

  BE -6.8
  Sats 93%
  Lac 1.3

(treated comp met acid ? Cause)

ED Plan

- Salbutamol nebs
- $MgSO_4$ IV infusion

Medical/Obs care

Impression

- Infected exacerbation of asthma

- Management
  - Nebuliser
  - PO Amoxicillin
  - PFR
  - Level 1 Pathway
  - IVI

Medical/Obs care

Patient deterioration same evening

- Increased chest pain and shoulder pain
- Repeated Lactate was 2.4
- Prednisolone added to her management

- Early hours of following morning (20/9/19)
  - Reported left leg pain, seen by medical SpR still tachycardia and RR 30, struggling to complete sentences

Medical/Obs care

Review by Consultant Respiratory Med

- Asthma + Community Acq Pneumonia

Plan

- Prednisolone increased to 40mg/therapeutic dalteparin
- For CXR and LL Doppler

CTG normal

Later same day

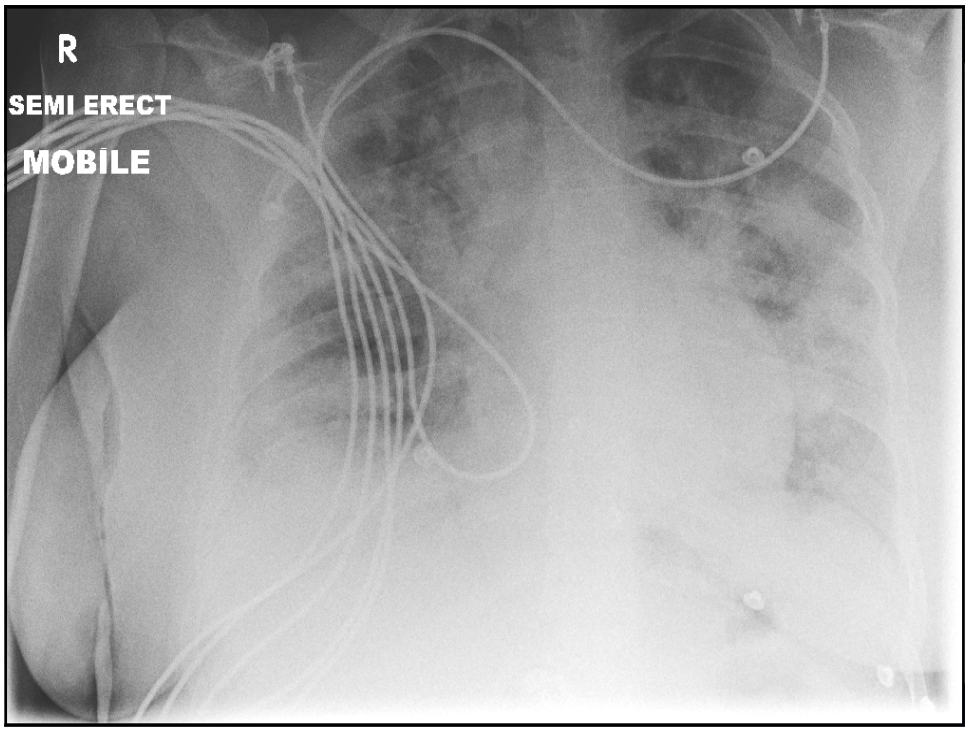
- Patient deteriorated further with increase in O2 requirements
- Decision to transfer to ITU and Arterial line

ITU care

21/9/16

- Patient remains unwell, unable to complete sentences
- RR 40,Sats 89% on air
- WBC 16, CRP 200
- CXR diffuse consolidation.

- Added management
  - Mg sulphate and Aminophylline
  - Ipratropium
  - Intravenous Hydrocortisone
  - Micro advice; Tazocin and Clindamycin
  - BD CTG so far reassuring



ITU Care

22/9/16

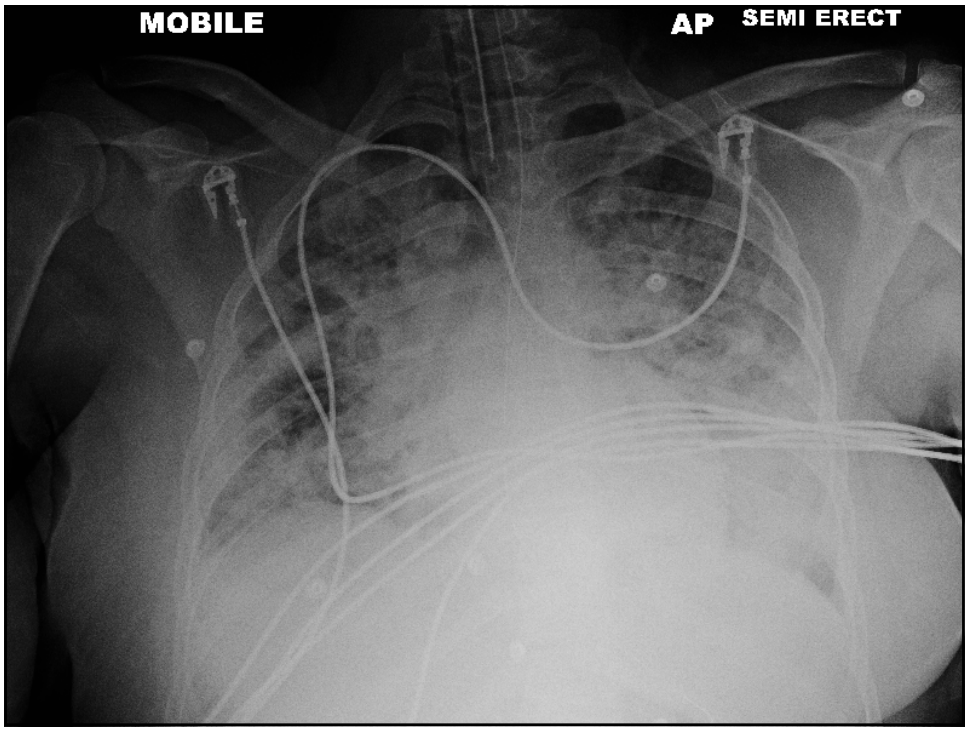
- Ongoing deteriorations
  - Continued cough
  - Desats to 80%
- ABG
  - Type 1 respiratory failure
- CTG still normal
- Decision for intubation
- Transferred to theatre for intubation +/- delivery as may help in ventilation
- Very difficult intubation severe bronchospasm

ITU Care

- CTG pathological and decision for Emergency LSCS.
- **Emergency Cat 1 LSCS** uncomplicated PPH1.2L
- Baby wt 1530g (30+4) admitted to SCBU 24 hours of respiratory support

pH	7.220	[	7.350	-	7.450	] ↓
PCO_2	5.38 kPa	[	4.67	-	6.00	]
PO_2	2.84 kPa	[	10.67	-	13.33	] ⇊
$cHCO_3^-$	16.1 mmol/L					
BE	-10.99 mmol/L					

- Post Delivery
  - Very difficult to ventilate
  - Severe Bronchospasm
  - Critical care team discussing transfer to Royal Brompton Hospital to consider ECMO
  - ECMO team arrived and patient transferred



RBH

- V-V ECMO from 22/9/16-29/9/16
  - Positive for enterovirus and rhinovirus
  - Wound dehiscence resuture + PICO dressing
- CT
  - Extensive peribronchial consolidation, ground glass appearance, No PE's
- Repatriated to MKUH on 02/10/16 and extubated successfully following respiratory wean on 03/10/17
- Initially very confused. D/C ITU on 6/10/16.

Follow up

- At discharge 5 weeks later was mobilising around the ward but wheelchair for long distances.
  - Required rehab for critical care neuropathy
- Struggling psychologically as all three children taken by SS. Anxiety & Depression.
- Further in pt. admission for asthma - Mobility since declined – mainly using wheelchair. Not been to OP Pt sessions.

What is ECMO?

- Life support
  - When conventional life support isn't sufficient and there is respiratory/cardiac failure ECMO can be used
  - ECMO replaces the function of the heart and lungs by using a pump to circulate blood through an artificial lung back into the bloodstream

How was it developed?[1,2,3,]

- 1944 noted blood became oxygenated through artificial kidney
- 1953 artificial oxygenation in first open heart surgery
- Further developed from cardiopulmonary bypass
- 1965 bubble oxygenators developed, but were not good for prolonged used due to blood hemolysis and so membrane oxygenators were developed.
- First successful report of long term ECMO in an adult was published in 1972

Indications [8,9]

- When conventional therapies have failed to support the function of the heart and lungs adequately
- Support – must have reversible cause
- Respiratory
  - Causes of severe acute respiratory failure
    - Hypoxemic respiratory failure with a ratio of arterial oxygen tension to fraction of inspired oxygen (PaO_2/FiO_2) of <100 mmHg
    - Hypercapnic respiratory failure with an arterial pH less than 7.20
  - ARDS
  - Pneumonia
  - Chest trauma
  - Asthma ELSO 20/24 survived to DC, SVH 2/2
  - Bridge to Transplant
- Cardiac
  - Cardiogenic shock
  - Post cardiotomy/heart transplant
  - Chronic cardiomyopathy as bridge
  - Periprocedural
  - ECPR

Evidence

- Initial RCT in early 1970s revealed no improved outcomes (Morris et al.) [4]
- Review in the journal of Intensive Care of 9 prospective comparative trials in neonates children and adults showed a statistically significant improvement with conventional care [5]

Evidence

- Inclusion criteria CESAR trial
  - RCT; 180 patients
  - Murray Score >3, Ventilation <7days, Age >18 <65
  - Reversibility
- Survival
  - CESAR 63% vs 43% conventional (survival without disability at 6 months) p=0·03 [7]
  - Another study 75 matched pairs of patients with severe 2009 influenza A(H1N1) related ARDS revealed lower hospital mortality (23.7 versus 52.5 percent) [8]
  - ANZ ECMO (H1N1) survival 77% vs 47.5% [9]

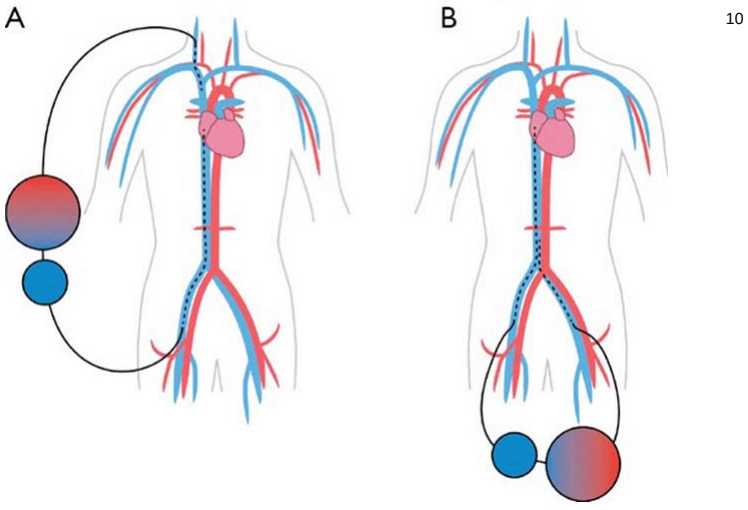
Contraindications

- ARDS for over 7 days
- AGE over 65
- End stage disease
- Unlikely reversibility
- Multi-organ failure (31% in CESAR trial had 3 or more organ failure)

The procedure

- Two types
  - Venovenous ECMO (respiratory support)
  - Venoarterial ECMO (cardiac/mixed support)
- Constant anticoagulation with heparin

Veno-venous ECMO: two cannulation approach



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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4522501/#r27

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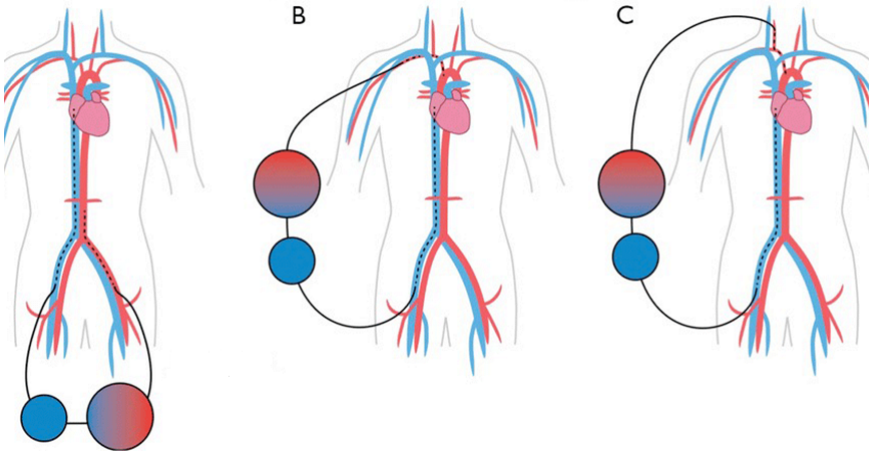
Peripheral veno-arterial ECMO cannulation approach



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Complications of ECMO

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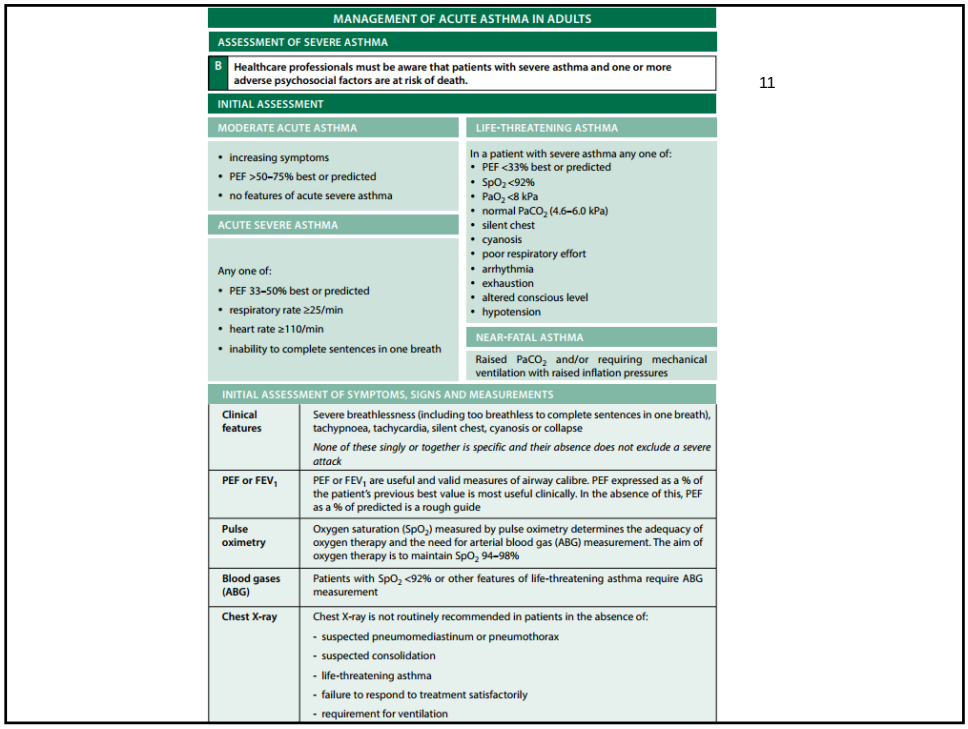
- Higher in ECMO for cardiogenic support
- Haemorrhage 10-30% (bleeding at sites of invasive procedure, cannulation, pulmonary, intracerebral)
- Systemic thromboembolism and mechanical complications
- Heparin induced thrombocytopenia
- Neurological complications
- Medical – HTN, arrhythmia, AKI, GI haemorrhage, Direct hyperbilirubinaemia
- Sepsis
- Electrolyte imbalances



MANAGEMENT OF ACUTE ASTHMA IN ADULTS

ASSESSMENT OF SEVERE ASTHMA

B Healthcare professionals must be aware that patients with severe asthma and one or more adverse psychosocial factors are at risk of death.

INITIAL ASSESSMENT

MODERATE ACUTE ASTHMA

- increasing symptoms
- PEF >50–75% best or predicted
- no features of acute severe asthma

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

LIFE-THREATENING ASTHMA

In a patient with severe asthma any one of:

- PEF <33% best or predicted
- SpO_2 <92%
- PaO_2 <8 kPa
- normal $PaCO_2$ (4.6–6.0 kPa)
- silent chest
- cyanosis
- poor respiratory effort
- arrhythmia
- exhaustion
- altered conscious level
- hypotension

NEAR-FATAL ASTHMA

Raised $PaCO_2$ and/or requiring mechanical ventilation with raised inflation pressures

INITIAL ASSESSMENT OF SYMPTOMS, SIGNS AND MEASUREMENTS

Clinical features	Severe breathlessness (including too breathless to complete sentences in one breath), tachypnoea, tachycardia, silent chest, cyanosis or collapse *None of these singly or together is specific and their absence does not exclude a severe attack*
PEF or FEV_1	PEF or FEV_1 are useful and valid measures of airway calibre. PEF expressed as a % of the patient's previous best value is most useful clinically. In the absence of this, PEF as a % of predicted is a rough guide
Pulse oximetry	Oxygen saturation (SpO_2) measured by pulse oximetry determines the adequacy of oxygen therapy and the need for arterial blood gas (ABG) measurement. The aim of oxygen therapy is to maintain SpO_2 94–98%
Blood gases (ABG)	Patients with SpO_2 <92% or other features of life-threatening asthma require ABG measurement
Chest X-ray	Chest X-ray is not routinely recommended in patients in the absence of: - suspected pneumomediastinum or pneumothorax - suspected consolidation - life-threatening asthma - failure to respond to treatment satisfactorily - requirement for ventilation

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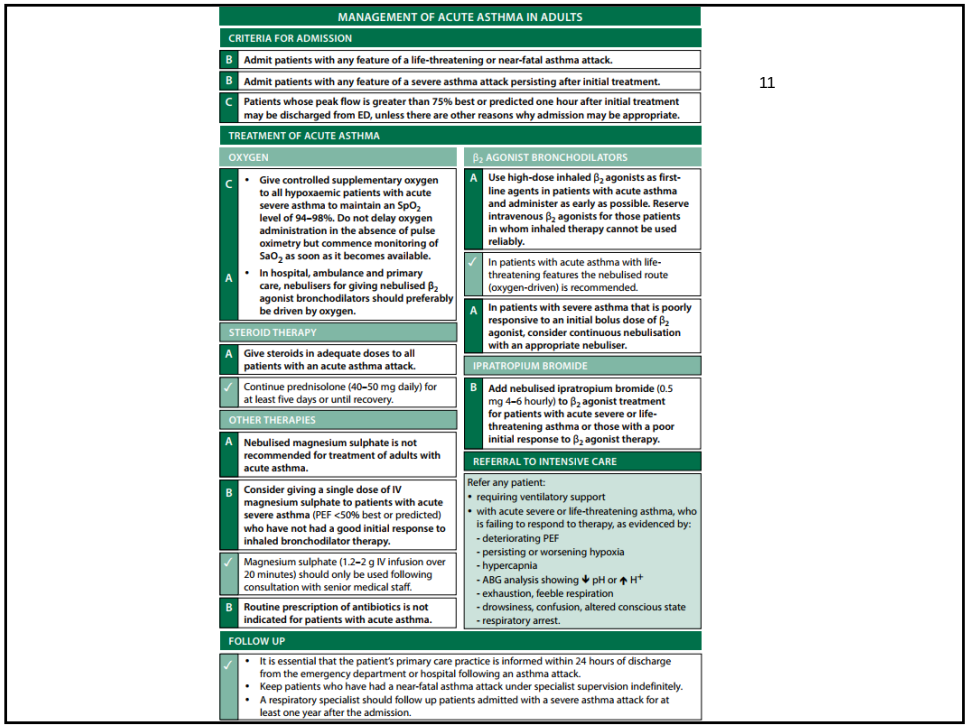

MANAGEMENT OF ACUTE ASTHMA IN ADULTS

CRITERIA FOR ADMISSION

B Admit patients with any feature of a life-threatening or near-fatal asthma attack.

B Admit patients with any feature of a severe asthma 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 ED, unless there are other reasons why admission may be appropriate.

TREATMENT OF ACUTE ASTHMA

OXYGEN

C • **Give controlled supplementary oxygen to all hypoxaemic patients with acute severe asthma to maintain an SpO_2 level of 94–98%. Do not delay oxygen administration in the absence of pulse oximetry but commence monitoring of SaO_2 as soon as it becomes available.**

A • **In hospital, ambulance and primary care, nebulisers for giving nebulised β_2 agonist bronchodilators should preferably be driven by oxygen.**

STEROID THERAPY

A Give steroids in adequate doses to all patients with an acute asthma attack.

✓ Continue prednisolone (40–50 mg daily) for at least five days or until recovery.

OTHER THERAPIES

A Nebulised magnesium sulphate is not recommended for treatment of adults with acute asthma.

B Consider giving a single dose of IV magnesium sulphate to patients with acute severe asthma (PEF <50% best or predicted) who have not had a good initial response to inhaled bronchodilator therapy.

✓ Magnesium sulphate (1.2–2 g IV infusion over 20 minutes) should only be used following consultation with senior medical staff.

B Routine prescription of antibiotics is not indicated for patients with acute asthma.

β_2 AGONIST BRONCHODILATORS

A Use high-dose inhaled β_2 agonists as first-line agents in patients with acute asthma and administer as early as possible. Reserve intravenous β_2 agonists for those patients in whom inhaled therapy cannot be used reliably.

✓ In patients with acute asthma with life-threatening features the nebulised route (oxygen-driven) is recommended.

A In patients with severe asthma that is poorly responsive to an initial bolus dose of β_2 agonist, consider continuous nebulisation with an appropriate nebuliser.

IPRATROPIUM BROMIDE

B Add nebulised ipratropium bromide (0.5 mg 4–6 hourly) 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, who is failing to respond to therapy, as evidenced by:
  - deteriorating PEF
  - persisting or worsening hypoxia
  - hypercapnia
  - ABG analysis showing ↓ pH or ↑ H^+
  - exhaustion, feeble respiration
  - drowsiness, confusion, altered conscious state
  - respiratory arrest.

FOLLOW UP

✓
- It is essential that the patient's primary care practice is informed within 24 hours of discharge from the emergency department or hospital following an asthma attack.
- Keep patients who have had a near-fatal asthma attack under specialist supervision indefinitely.
- A respiratory specialist should follow up patients admitted with a severe asthma attack for at least one year after the admission.

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Discussion points

- ECMO is a useful with evidence when conventional support may either fail or be failing.
- Early diagnosis and treatment of severe asthma is imperative.
- Importance of both medical, obstetric, Intensive care and wider MDT input.

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