

Renal and Respiratory Answers

RENAL

SAQ 23

12 Marks

A 77yr old man presents 7 days after being discharged following a total colectomy for a newly diagnosed obstructing bowel cancer. He describes non-specific symptoms of malaise, lethargy and nausea.

His blood results are;

Na	127	(135-145 mmol/L)
K	6.1	(3.5 – 5.2 mmol/L)
Ur	37.1	(2.9 – 8.2 mmol/L)
Cr	700	(64 – 108 mmol/L)
eGFR	6	(>60 mL/min)
HCO ₃	12	(22-32 mmol/L)
Cl	95	(95-110 mmol/L)

1. State THREE abnormalities, including any equations used, on these blood results (3 marks)

1. High Anion Gap Metabolic Acidosis ($127 - 95 - 12 = 20$)

2. Renal failure - intrinsic or post renal (Ur:Cr ratio = 53 or <100)

3. Either mild or moderate hyponatraemia OR moderate to severe hyperkalaemia

No marks for metabolic acidosis with mention of AG or for renal failure without mention of ratio

2. List FOUR potential causes for this gentleman's presentation and blood results (4 marks)

Pre-renal

- Hypovolaemia
 - Poor oral intake
 - Post operative bleeding
 - 3rd space losses
 - Malabsorption
 - High output stoma
- Sepsis
 - Intra-abdominal or post operative collection
 - One other cause of infection (e.g. UTI, pneumonia etc)

Renal

- *Nephrotoxic drugs*

Post-renal

- Damage to ureters intra-operatively
- *Urinary retention*

3. List FIVE investigations you might perform. Include a clinical indication for each investigation. (5 marks)

*list not comprehensive, other investigations could be correct if deemed appropriate and reasonable justification

Investigation	Justification
VBG	Define degree of acidosis Measure lactate as a surrogate marker of tissue hypoperfusion
ECG	Investigate for hyperkalaemia
Bladder Scan	To investigate for urinary retention
Urine MCS	Assess for UTI as cause for sepsis
Urine Na/Osmolality/Cr	Help distinguish pre-renal vs renal/obstructive causes
FBC	Hb - anaemia due to volume loss or indication of CKD WCC - marker for infection
Blood cultures	Assess for infectious organism and targeted antibiotic therapy
CXR	Assess for fluid overload
Renal Ultrasound	Assess for hydronephrosis
CT Abdomen (non-contrast)	Investigate for collection or intra-operative complications

SAQ 1 (18 marks)

A 67 year old male patient was brought into the ED by his family after he collapsed at home. His past medical history includes dialysis dependent chronic renal failure (secondary to diabetic nephropathy), hypertension, ischaemic heart disease and congestive cardiac failure.

His initial vital signs in ED are as follows:

GCS 15

BP 80/50

P 80

RR 30

SpO₂ 90% on air

(a) List 4 specific point of care / bedside tests which are indicated in this patient and state your justifications (8 marks)

Blood glucose level - hypoglycaemia

Serum K⁺ - hyperkalaemia

ECG – dysrhythmias secondary to hyperkalaemia

Bedside U/S – pericardial tamponade, pulmonary oedema

CXR – pulmonary oedema

Blood gas – acid-base status → expect metabolic and respiratory acidosis

Lactate – hypoperfusion, sepsis

Hb – critical anaemia

(b) An ECG is performed. List 3 diagnostic abnormalities in his ECG and state your unifying diagnosis (4 marks)

Peaked T waves

Abnormally wide QRS

Superior axis

Sinoventricular rhythm / sine-wave morphology

Diagnosis : critical hyperkalaemia

(c) In view of the ECG findings, state 3 priorities of treatment to address this specific abnormality and the critical interventions you would institute to achieve these goals (6 marks)

Stabilise myocardium : calcium chloride or calcium gluconate

Move K⁺ from extracellular to intracellular space : salbutamol, insulin / dextrose, bicarbonate

Remove K⁺ : haemodialysis

Pass marks a 7/8 b 3/4 c 4/6 total 14/18

Q19 17/24

1.

Refractory hyperkalaemia

Uraemic Encephalopathy

Volume Overload

Refractory Acidosis

Uraemic pericarditis

2.

Taking a Cultural History

Incorporating culturally diverse health beliefs and priorities into ED care and management plans

Access to support people based on cultural needs

Ability to speak to a cultural/religious representative of their choosing

Access to professional interpreter services

Establishing effective relationships with local primary health carers who service culturally diverse populations

Feedback mechanisms for consumer engagement for those from culturally diverse backgrounds

Department fosters a work ethic of reflection and non-judgemental review of approach to cultural safety and competency

3.

Hyperkalaemia

Loss of P waves

Very broad QRS

Tall T waves

Bizarre morphology with atypical LBBB

4.

Salbutamol – acts on β -receptors to stimulate K^+ reuptake – minutes

Insulin – facilitates increased uptake of K into cells – 15 - 60 minutes

$NaHCO_3$ – Alkalosis shifts K directly into cells through action on H^+-K^+ channels - minutes

Calcium – Stabilises cardiac membrane – protects against hyperkalaemic effect -seconds - minutes

SAQ 20 (11 marks)

You are working in a rural ED. A 6-year-old boy has been sent in by the GP. He has been generally unwell with a recent febrile illness and discoloured urine.

Parents deny any previous episodes of discoloured urine. The child has no relevant previous medical history.

The observations are as follows:

HR	100	bpm
T	37.2	°C
BP	135/85	mmHg
Sats	98%	room air

On examination the child looks tired but otherwise well.

His chest is clear, heart sounds normal and ENT examination is unremarkable. The abdomen is soft and non-tender with no masses felt. There is no joint swelling and no rash.

He has some healing skin sores on his leg and he is a little puffy around the eyes.

a) A urine sample shows dark reddish-brown blood in the urine, which on microscopy appears to be from the upper urinary tract. List three (3) disease entities/conditions which will produce this type of haematuria. (3 marks)

- Post strep glomerulonephritis
- IgA glomerulonephritis
- Membranoproliferative glomerulonephritis
- Vasculitis e.g. HUS
- Tumour- Wilms etc
- Alport Syndrome
- Interstitial nephritis- drugs, infections, autoimmune disease

List four (4) specific features from your **history** in this child which would help you narrow down your diagnosis? (4 marks)

- Family history
- When was fever?
- Nature of illness – sore throat
- Recent medications including antibiotics
- Rash – suggestive of Henoch Schonlein
- Diarrhoea and abdominal pain
- Previous episodes

b) What is the most likely diagnosis in this child given the description above? (1 mark)

Post streptococcal glomerulonephritis

c) List three (3) further investigations you would request to help confirm the diagnosis and explain how they might help. (3 marks)

- Urine microscopy and culture – may identify infective cause
- ASOT – as evidence of recent streptococcal infection
- Complement – suggests autoimmune cause, low in post strep, normal in IgA
- Skin/ throat culture – evidence of streptococcal infection
- Renal biopsy – will determine type of GN present
- FBC for platelet count – reduced in HUS/TTP, increased in HS

RESP

SAQ 11:

Questions:

1- List 8 sequential steps in the management of this patient?

(8 marks) 6/8

- IV fluid bolus (N Saline 1-2L. Aim SBP 100)
- Central venous access and commence vasopressor if patient remains hypotensive (Noradrenaline infusion – Aim MAP 60-65)
- Organise bed side echo – look for elevated RV pressure and/or deviation of interventricular septum suggestion increased RV pressure
- Find further information of cerebral aneurysm – were there more than one aneurysm/ what interventions done
- Discuss with cardiothoracic surgery regarding suitability for surgical embolectomy (preferred treatment option)
- Discuss other treatment options with patient and family – thrombolysis with tenecteplase (if RV pressure is high) / anticoagulation with heparin (if RV pressure normal)
- If patient arrests – thrombolysis

2-Briefly describe 3 ethical and medico-legal issues in this situation

(3 marks) 2/3

- Consent – challenging situation as previous h/o clipped aneurysm. May have difficulty in obtaining previous clinical information. Patient should be given information (risks and benefits) on each treatment modality for informed consent
- Possible thrombolysis of a patient with previous aneurysm without full clinical information
- Adequate documentation of discussions with patient and other specialties

Passmark 8/11 (Adjust to /10)

(7.3/10)

Question 24

Other than pulmonary hemorrhage and renal failure, list two other manifestations of Wegener's granulomatosis (Granulomatosis with Polyangiitis - GPA) (2 marks)

- Respiratory
 - Subglottic stenosis
 - Collapsing nasal bridge
 - Upper airway granulomas
 - Pulmonary fibrosis
- Pulmonary hypertension
- Myalgia, arthralgia/arthritis
- Conjunctivitis, episcleritis, uveitis
- Cranial and peripheral neuritis
- Myo/pericarditis

Contrast the rationale for intubation and treatment of pulmonary hemorrhage in GPA and solitary lung tumour. (4 marks)

	GPA	Tumour
Rationale for intubation (1 mark each)	- Purely for respiratory support	- Protect contralateral lung from soiling - Also facilitates bronchoscopic intervention and biopsy, which may not be tolerated if significant distress - Provide respiratory support if significant blood aspiration
Treatment of hemorrhage (1 mark each)	- Immunotherapy - Steroids - Plasma exchange - Immunosuppressants	- Interventional - Bronchoscopic injection - Vascular embolisation - Wedge resection/lobectomy

List one blood test you may order to confirm a diagnosis of GPA. (1 mark)

- ANCA (anti-neutrophil cytoplasmic antibodies; typically PR3 or C-ANCA; 90% sensitivity for GPA)

List two infectious diseases which may cause hemoptysis and renal failure. (2 marks)

- Malaria
- Leptospirosis
- Bacterial sepsis ie tricuspid valve endocarditis/lung abscess/S. aureus bacteremia
- Influenza H1N1
- Dengue fever
- Hantavirus
- Pulmonary + renal Tuberculosis

List two other non-infective causes for a patient presenting with both hemoptysis and hematuria. (2 marks)

- Goodpasture's syndrome/Anti-GBM disease
- Churg-Strauss syndrome (EGPA)
- SLE
- IgA nephropathy
- Microscopic polyangiitis
- Henoch-Schonlein Purpura
- Disseminated malignancy
- Thrombotic microangiopathies
 - HUS/TTP
 - Antiphospholipid syndrome
 - Malignancy
- Others
 - Drug-associated ANCA-positive vasculitis
 - Behcet's disease

MARKING SHEET Q 7

1. Consciousness – agitated, drowsy

Marked increased work breathing

Silent chest

Inability to talk

Tachypnoea

Tachycardia

Hypotension

Hypoxia

Pass 5/6

2. Oxygen via mask to keep sats >92%

Salbutamol nebs 2.5 - 5mg continuous

Ipratropium 250mcg times 3 nebs in first hour

Steroid IV – methypred 1mg/kg or hydrocortisone 4mg/kg

Salbutamol IV – 5-10mcg/kg bolus then infusion

Also accept MgSO₄ – 50mg/kg bolus then infusion

Also accept aminophylline – 10mg/kg loading dose

1 mark for complete treatment with correct dose

Pass 3/5

3. Ketamine 1-2mg/kg

Sux 1-2mg/kg

Also accept other variations that seem sensible

Pass 2/2

Total pass 10/13 corrects to **7.5/10**

SAQ 21: (6 Minutes)**Candidate Name:****Total Marks 12**

Pass Mark:8

A 28 year old female patient presents to your regional ED with a fever and cough. She is 6 months post-op from a double lung transplant for cystic fibrosis.

Her vital signs are:

Temp 38.0
HR 105
BP 120/75
RR 24
O2 sats 91% on RA

Her CXR is shown below.

Questions:

1. Describe the key findings on her CXR. (2 marks)

Bilateral areas of consolidation in RML, RLL & LLL
Multiple clips bilaterally consistent with double lung transplant
CTR within normal limits
(No Pneumothorax or pleural effusions)
(No free gas under diaphragm)

2. List 5 differential diagnosis for her presentation. (5 marks)

Infection – Bacterial, viral or fungal (1 mark for each = 3 marks)
Acute Rejection (1 mark)
(1 mark for any of the following, up to max 2 marks)
CCF
PE
ARDS secondary to sepsis/immunosuppression
Bronchiolitis obliterans

3. Outline 5 key steps in your management of this patient in the ED. (5 marks)

O2 therapy via NRBM to maintain PO2 > 60 (1 mark)
May need respiratory support with NIV or intubation if failing to maintain oxygenation on NRBM alone. (1 mark)

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The Prince Charles Hospital
Emergency Department

The Royal Brisbane & Women Hospital
Emergency Department

Redcliffe and Caboolture
Emergency Departments

Broad spectrum antibiotics (1 mark) with antifungal & antiviral cover (1 mark)
Eg Piptaz + Fluconazole + Aciclovir (or similar is acceptable)

(1 mark for any of the following up to 2 marks)
Steroids (under guidance of transplant team)
Early referral to transplant specialist team for ongoing management
Caution with IV fluid resuscitation
Check levels of immunosuppressant drugs

SAQ 17 (12 marks)

Passmark = 8/12

1. List 4 other treatment options for this patient. (4 marks)

4 treatment options

- a) IV magnesium 2gm IV over 20 mins
- b) Salbutamol IVI 250mcg bolus followed by an infusion 5 -10 mcg/kg/hour
- c) BIPAP (IPAP 7 -15 cmH₂O; EPAP 3 – 5 cm H₂O)
- d) Adrenaline 0.3mg IM or IV infusion
Aminophylline also acceptable if in discussion with ICU

The patient continues to deteriorate and has become more obtunded with poor respiratory effort. You decide to proceed with intubation.

2. List 4 steps you will take to optimise the patient before proceeding with RSI. (4 marks)

Optimise for RSI

- a) Keep upright until last moment
- b) Preoxygenate (BiPaP or 15L NRBM)
- c) High flow oxygen by nasal cannula (15L/min)
- d) Continuous salbutamol nebulisation 10 – 15 mg/hr
- e) Normal Saline 1L IV bolus

The patient's BP drops to 80/ 40 immediately post intubation.

3. List 4 immediate measures you will take to manage this. (4 marks)

Post intubation hypotension

- a) Disconnect from ventilator & allow prolonged exhalation
- b) IV fluid bolus 10 – 20 ml/kg
- c) Rule out tension pneumothorax (clinical/ USS) or needle /finger thoracostomies
- d) Vasopressors eg metaraminol 0.5-1mg bolus / adrenaline 10mcg IV bolus

SAQ 27

SAQ X Child with breathing difficulty (13 marks)

A one year old boy has been unwell with cough for a week. Today he was eating spaghetti when he seemed to gag and have difficulty breathing over a period of 1 minute. His mum reports he is now clingy with a 'strange cough'.

The following observations are recorded:

HR 120

Blood pressure 90/50

Oxygen saturation 90% in air

Respiratory rate 24

Temp 37.5

Weight 10kg

On examination he is alert and responsive and comfortable in his mother's arms.

On examination he has multiple petechiae around his eyes, and an intermittent unusual cough.

Cardiovascular examination is normal. He has mild indrawing of intercostal muscles and mild tracheal tug, but no stridor.

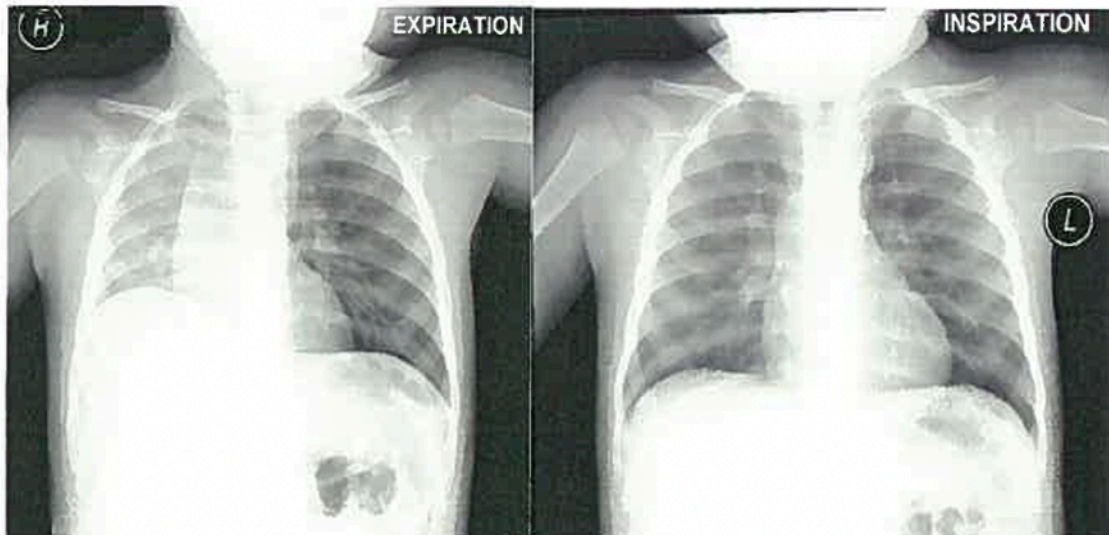
a) Provide an explanation for the examination findings. (3 marks)

Petechiae due to high venous pressure suggestive of significant choking episode

Cough due to tracheobronchial irritation

Indrawing and tracheal tug in absence of stridor suggestive of intrathoracic airway obstruction.

His Xrays are shown below



a) Describe the findings on CXR (3 marks)

Mediastinal shift to the right on expiratory film

Increased lucency left lung on expiration

Hyperexpansion left lung on expiration

Normal inspiratory film

b) Indicate your preferred diagnosis (2marks)

Inhaled foreign body in left main bronchus (needs correct side for both marks)

After a short coughing spell the infant becomes cyanosed and unresponsive.

No chest movement is obtained despite with good self inflating bag/ and mask ventilation. The child remains cyanosed and no oxygen saturations can be obtained. Chest thrusts have been given without effect.

c) Describe your management of the infant's airway. (5 marks)

Attempt Bag/ and Mask ventilation with anaesthetic circuit (can generate higher pressures relative to self inflating bag)

Perform direct laryngoscopy with Magills forceps on hand to remove foreign body

Intubate if unable to remove FB (adjust TV to prevent barotrauma as ventilation of only part of the lung may occur)– plan A

Insert LMA – plan B

Needle cricothyroidotomy if AB fails

Insert above cricoid, below thyroid

oxygenate with occlusion of Y connector on 1 off 4 seconds

To OT for EUA by ENT if able to adequately oxygenate

Additional notes

Needle Technique ETM®:

Setup for full RSI with paralytics

If possible extend neck to allow better palpation of anatomy by placing a pillow well under the patient's shoulders, allowing head/neck to extend – not possible if c-spine injury suspected

If right handed, stand on patient's left

Draw 2-3ml of saline into 5ml syringe

Remove proximal end of flash chamber of 14G cannula and attach syringe to proximal end of cannula flash chamber

Palpate the larynx with the left hand and find cricothyroid membrane with left index finger

Approach skin with cannula at 30-45 degree angle, aiming toward patient's feet with syringe over patient's chin

Aspirate on syringe as you advance cannula into trachea – successful entry into trachea signaled by aspirating air (seen as bubbles in the saline in syringe barrel)

Advance the cannula off the needle into trachea

Remove the needle from the syringe, and attach syringe to the orange hub of the cannula in the neck and perform a 2nd aspiration to confirm that air can still be aspirated and the cannula is still in trachea

Attach oxygen delivery device to cannula

If using a Rapid-O2 or LeRoy device deliver and initial 4-5 second jet of oxygen

Wait 20 seconds to check for a response in oxygen saturation. If there is no response deliver a further 2 second

Base further delivery on oxygen on the oxygen saturation level: if the saturations drop by 5% or more, deliver further 2 second jets of oxygen.

Cannula Insertion

Jet ventilation

SAQ 7:
Questions:

1. List 3 relevant positive and 2 relevant negative findings on this CXR. (5 Marks) 4/5

Positive:

(Large) Pleural effusion

Pneumothorax

Tracheal deviation / mediastinum displaced to the left / radiological signs of tension

?? 2 marks for hydropneumothorax

NEGATIVES

No surgical emphysema

No oxygen tubing seen

No visible mass / evidence of infection

No bony lesions

2. In point form, describe the immediate management priorities in this case (3 Marks) - 2/3

Identify any established limitations of care and manage appropriately

Improve oxygenation – Additional oxygen via NRBM

Decompression of pneumothorax + Formal ICC insertion

3. List the parameters needed to help distinguish between a transudate and an exudate pleural effusion in general? - 3/4

(4 Marks)

Light's Criteria – therefore tests needed are pleural fluid and serum LDH, pleural fluid and serum cholesterol, pleural fluid and serum albumin

Passmark = 9/12 (adjust to /10)

(7.5/10)

MARKING SHEET Q 3

1.

Decreased level consciousness

Not initiating own breaths

Vomiting

Large haemoptysis

Facial abnormalities

Pt intolerance

Not appropriate level of care

** 3 of above to pass

***nb change to 2 marks

Each response ½ mark, pass 1.5/2

2.

Acute on chronic respiratory acidosis – raised CO₂, acidaemia indicates acute, but pH not low enough for CO₂ to be solely acute – therefore chronic process with chronic metabolic compensation

Metabolic compensation – raised HCO₃ and BE, chronic process

2/4 to pass

3.

Increase iPAP - to increase TV and hence ventilation – to remove CO₂

Increase FiO₂ or increase PEEP – to improve O₂ (accept either but not both)

2/2 to pass

5.5/8 to pass corrects to 6.5/10

Q6 **8/12**

1

Hb – guide packed cell replacement, define severity of blood loss

ABG – quantify degree of hypoxia / respiratory compromise / need for invasive ventilation

Coag – exclude coagulopathy contributing

CXR – looking for masses / malignancy, identifying which lung is bleeding to guide management eg isolated lung ventilation

CTA chest – looking for blush to guide management eg IR embolization, diagnosis of cause

Renal function – in suspected vasculitis eg Wegeners

2

Conservative – no ongoing bleeding

Interventional radiology embolization – active bleeding blush on CT, IR available

Thoracotomy – surgeon available, ongoing bleeding, not amenable to IR

Endoscopic – minor haemoptysis – settled

SAQ 5 Answers

1.

Left hilar mass – rounded opacity left hilum

- Some patchy consolidation around this area

Confluent consolidation right upper lobe bordered by horizontal fissure

- Air bronchograms

Patchy consolidation right lower zone as well – right middle lobe as part of right cardiac border obscured

2.

Multi-lobar pneumonia

Left hilar mass likely malignancy

3.

O₂ – titrate to keep sats >92%

IV fluids – 500 – 1000mL stat aiming for pulse <100, BP >100

IV antibiotics for severe CAP

Either – ceftriaxone 1g and azithromycin 500mg

Or – amp/ben-pen, gentamicin 5 - 7mg/kg, azithromycin 500mg

QUESTION 9 - Contact Person Jo Koryzna (12 marks)

i) 3 marks

	Causes of pneumomediastinum
MOST LIKELY	Oesophageal Perforation (Must be first)
Other cause 1	Valsalva / drug use
Other cause 2	Asthma / other lung disease (interstitial)
Other cause 3	Chest Trauma
	'Idiopathic'
	Carcinoma (Oesophageal), or other significant esophageal pathology

ii) 4 marks

- Aggressive management of septic shock with targeted antibiotics to cover sepsis from likely oesophageal/ git source. Need to include antibiotics and doses. Needs a betalactam + aminoglycoside combo. Examples include ampicillin 2g + gentamycin 7mg/kg OR Tazocin 4.5g + gent / or other combo like cef
- Fluid resuscitation to treat septic shock and restore haemodynamics ie 10-20ml/kg bolus / crystalloid targeted to some kind of end points like falling lactate or UO 0.5mg/kg/hr at a minimum
- Appropriate referral to surgical specialty such as Cardiothoracic for management of possible mediastinitis. (ie Source Control which will need Cardiothoracic team)
- Symptom control : antiemetics and analgesia. Doses please. Fentanyl drug of choice in view of septic shock and hypotension

iii) 5 marks

EDUCATION

- Use as educational opportunity for the individual and the group ie through quality / m & m meetings. **MUST INCLUDE POINT ABOUT SENIOR REVIEW IN SHORT STAY FOR ONE MARK**

REPORTING – To organisation – to patient

Use a mandatory reporting system for missed Xrays eg IIMS etc, TEL-RAD 'immediate reporting'

- **QUALITY** : address any systems issues - in terms of radiology reporting and the failure to communicate to ED critical results in a timely fashion

ED PROCESSES

Ensure x-ray reports are followed up & actioned routinely by ED. Roster for staff to review X-rays

- **EMR/TECHNOLOGY**

Explore capability in electronic medical record for notification of abnormal results with stakeholders from pathology and radiology

- **JMO SUPERVISION**

Ensure adequate senior supervision on the ED floor and implement real time review of imaging in the ED by a senior re CXRs