Patient:BM

DOB: 14/05/1954

Sex:F

Allergies:Penicillin

Weight:64kg

Alcohol:Nil

Smoking status:Non-smoker

MHx: Osteoarthiritis (1995)

DHx: Morphine sulphate modified release tablets -10mg BD

Morphine Sulfate 10mg/5ml solution -2.5ml QDS PRN

Ibuprofen 400mg TDS

Paracetamol 1g QDS

Zacin 0.025% cream QDS

Plan: Elective admission for knee replacement due to severe osteoarthiritis of the knee impairing mobilisation and causing severe pain. Operation to take place this afternoon

Plan for immediate post-op pain relief- morphine sulfate PCA (dose =1mg up to every 5 minutes)

Oral step down analgesia pain plan from day 3:

Paracetamol 1g QDS

Naproxen 500g BD

Morphine modified release 15mg BD

Gabapentin 300mg TDS

Patient for VTE prophylaxis- dalteparin 5000 units OD

Day 2-

Operation successful, patient has been very drowsy and nauseous.

Overnight complained that area red. Warm to touch and inflamed

Area marked to monitor spread. Cannula removed and swab taken. New cannula in other hand for PCA. Antibiotics- clarithromyocin 500mg BD for 7 days

Day 3:

Patient confirmed MRSA positive. Switch antibiotic to vancomycin 1g BD, daily review.

Blood test results:

Cr Urea (1.7- 7.1 )- 9.2 on day 2, 12.0 on day 3 and 25.5 on day 4

EGFR- on day 2 27, on day 3 24, on day 4 19

Potassium (3.6-5) 5.1 on day 3 and 5.6 on day 4

CRP <10, on day 1 its 87, on day 2 its 168, on day 3 its 183 on day 4- its 195

**Question 1:**

**With reference to the medical notes, review and comment on BM renal function since admission. Discuss potential contributory factors ot the current situation and how these could be managed**

**Analysis of Renal Function Parameters**

* **Creatinine and Urea:**
  + **Creatinine**: The serum creatinine levels have progressively increased from 9.2 mg/dL on day 2 to 25.5 mg/dL on day 4. Creatinine is a waste product filtered by the kidneys, and its accumulation in the blood is a direct indicator of impaired renal function.
  + **Urea**: Urea levels have similarly risen from 9.2 mmol/L on day 2 to 25.5 mmol/L on day 4. Elevated urea, in conjunction with rising creatinine, points towards reduced kidney clearance, reinforcing the diagnosis of AKI.
* **eGFR:**
  + The **eGFR** has decreased from 27 mL/min/1.73 m² on day 2 to 19 mL/min/1.73 m² on day 4. eGFR is a key indicator of renal function, with values below 60 mL/min/1.73 m² indicating chronic kidney disease (CKD) and lower values suggesting more severe kidney impairment. The sharp decline here indicates a significant loss of renal function.
* **Potassium:**
  + **Potassium** levels have increased from 5.1 mmol/L on day 3 to 5.6 mmol/L on day 4. Hyperkalemia (elevated potassium) is a dangerous complication of AKI, as the kidneys are responsible for excreting potassium. Persistent hyperkalemia can lead to cardiac arrhythmias and other serious conditions.
* **CRP (C-reactive protein):**
  + **CRP** levels have risen sharply from 87 mg/L on day 1 to 195 mg/L on day 4, indicating a strong inflammatory or infectious process. The CRP rise could be related to the MRSA infection, which is also likely contributing to the renal deterioration.

**2. Potential Contributory Factors to Renal Deterioration**

Several factors could be contributing to BM's declining renal function:

* **Nephrotoxic Medications:**
  + **NSAIDs (Ibuprofen and Naproxen):** NSAIDs inhibit prostaglandin synthesis, leading to afferent arteriole vasoconstriction and reduced renal perfusion, particularly in patients with compromised kidney function or those undergoing surgery. BM was on ibuprofen 400 mg TDS preoperatively, which might have contributed to renal hypoperfusion and subsequent AKI. Postoperatively, naproxen was introduced, which could exacerbate renal function decline.
  + **Vancomycin:** This antibiotic, introduced on day 3 for MRSA, is known to be nephrotoxic, especially at higher doses or when administered to patients with pre-existing renal impairment. Vancomycin can cause acute tubular necrosis, contributing to the observed rise in creatinine and decrease in eGFR.
  + **Morphine:** Although not directly nephrotoxic, morphine can contribute to renal impairment indirectly by causing hypotension (through histamine release and vasodilation) and leading to reduced renal perfusion.
* **Infection (MRSA):**
  + The confirmed MRSA infection, indicated by increasing CRP levels, suggests a systemic inflammatory response, which can exacerbate renal injury. Sepsis and severe infection are well-known precipitants of AKI due to the systemic release of cytokines, leading to renal vasoconstriction, endothelial dysfunction, and direct tubular injury.
* **Postoperative State:**
  + Post-surgical patients, particularly those undergoing major orthopedic surgery like knee replacement, are at risk for AKI due to factors like hypotension during surgery, fluid shifts, and the use of nephrotoxic agents. BM’s operation and subsequent complications, such as infection, likely compounded her risk.
* **Reduced Renal Perfusion:**
  + In the context of acute illness, BM’s kidneys may have experienced reduced perfusion due to factors such as dehydration, blood loss during surgery, or sepsis-induced hypotension. This is particularly concerning in the elderly population with pre-existing comorbidities.

**3. Management of the Current Situation**

Given the evidence of worsening AKI and potential contributing factors, several steps should be taken to manage BM’s condition:

* **Discontinuation of Nephrotoxic Agents:**
  + **NSAIDs** (e.g., naproxen) should be discontinued immediately due to their role in reducing renal perfusion.
  + Consider reducing the dose of **vancomycin** or switching to an alternative antibiotic with a lower nephrotoxic risk, provided it covers MRSA. Regular monitoring of vancomycin trough levels is essential to minimize toxicity.
  + Review the use of **morphine**, especially if it is contributing to hypotension, and consider alternative pain management strategies that are safer for patients with impaired renal function.
* **Fluid Management:**
  + Assess BM’s fluid status carefully. If she is hypovolemic, cautious fluid resuscitation may be necessary to restore renal perfusion. However, in the presence of oliguria or signs of fluid overload, fluid administration should be balanced to avoid exacerbating renal impairment or causing pulmonary edema.
* **Monitoring and Supportive Care:**
  + Close monitoring of **renal function** (daily urea, creatinine, eGFR, electrolytes) is crucial.
  + **Electrolyte management**, particularly of hyperkalemia, is essential. If potassium levels continue to rise, interventions such as calcium gluconate, insulin with glucose, or potassium-binding agents may be necessary.
  + **CRP and white cell count** should be monitored regularly to gauge the effectiveness of antibiotic therapy and the progression of the infection.
* **Consider Nephrology Referral:**
  + If BM’s renal function continues to deteriorate despite the above measures, consider involving a nephrologist for further assessment and potential initiation of renal replacement therapy (e.g., dialysis) if indicated.

**4. Summary of Recommendations**

* **Immediate discontinuation of NSAIDs** (e.g., naproxen).
* **Review and possibly reduce the dose of vancomycin** with careful monitoring of renal function and vancomycin levels.
* **Assess and manage fluid balance** to optimize renal perfusion while avoiding fluid overload.
* **Close monitoring of renal function and electrolytes,** particularly potassium, with active management of hyperkalemia if necessary.
* **Consider alternative pain management** strategies to reduce the potential nephrotoxic burden.
* **Referral to nephrology** if renal function does not stabilize or if dialysis is required.

**With regards to post operative step down analgesia, critique the appropriateness of the drug therapies for BM. For any issues identified, describe how these could be managed**

#### ****Paracetamol 1 g QDS****

* **Appropriateness:** Paracetamol is a first-line analgesic with a good safety profile, especially useful in multimodal pain management to reduce opioid requirements. It is safe at the prescribed dose (4 g/day) for a patient of this weight (64 kg).
* **Considerations:** Given BM's declining renal function (eGFR 19 on day 4), paracetamol’s dosing frequency and total daily dose should be closely monitored, but generally, paracetamol is considered safe in renal impairment at standard doses.

#### ****2. Naproxen 500 mg BD****

* **Appropriateness:** Naproxen is a nonsteroidal anti-inflammatory drug (NSAID) effective for post-operative pain management due to its anti-inflammatory properties, which are beneficial following knee replacement surgery.
* **Concerns:**
  + **Renal Function:** Naproxen is contraindicated or should be used with extreme caution in patients with significant renal impairment (eGFR <30 mL/min). BM's eGFR has significantly declined (19 on day 4), indicating worsening renal function, likely acute kidney injury (AKI). NSAIDs like naproxen can exacerbate renal impairment by reducing renal blood flow, particularly in patients at risk for AKI.
  + **Recommendation:** **Discontinue Naproxen** immediately. Alternative analgesics less harmful to renal function should be considered, such as acetaminophen alone or, if necessary, low-dose opioids with careful monitoring.

#### ****3. Morphine MR 15 mg BD****

* **Appropriateness:** Morphine MR is appropriate for managing moderate to severe post-operative pain, particularly in patients already on chronic opioid therapy. The dose increase from 10 mg BD to 15 mg BD reflects a reasonable step-up for post-operative pain.
* **Concerns:**
  + **Renal Function:** Morphine metabolites (e.g., morphine-6-glucuronide) are renally excreted and can accumulate in patients with renal impairment, leading to increased risk of toxicity (e.g., sedation, respiratory depression).
  + **Recommendation:** Given BM's deteriorating renal function, **reduce the dose of Morphine MR** or consider switching to an opioid less reliant on renal clearance, such as fentanyl or oxycodone. Morphine should be used with close monitoring for signs of opioid toxicity.

#### ****4. Gabapentin 300 mg TDS****

* **Appropriateness:** Gabapentin is used for neuropathic pain and may have a role in multimodal post-operative pain management, potentially reducing opioid requirements. However, gabapentin is primarily renally excreted.
* **Concerns:**
  + **Renal Function:** In patients with reduced renal function (eGFR 19 mL/min), gabapentin dosing should be adjusted to prevent accumulation and toxicity (e.g., sedation, dizziness, respiratory depression).
  + **Recommendation:** **Adjust Gabapentin dosage** according to renal function. For an eGFR <30 mL/min, the typical recommendation is to reduce the dose to 100-300 mg daily or every other day. Alternatively, consider discontinuing gabapentin if neuropathic pain is not a significant concern.

#### ****5. Vancomycin 1 g BD****

* **Appropriateness:** Vancomycin is appropriate for treating MRSA infections. However, vancomycin is nephrotoxic, especially in patients with pre-existing renal impairment.
* **Concerns:**
  + **Renal Function:** BM's worsening renal function could be exacerbated by vancomycin, leading to further renal damage.
  + **Recommendation:** **Monitor vancomycin levels closely** and adjust the dose according to renal function. Consider switching to an alternative, less nephrotoxic antibiotic if clinically appropriate, depending on the sensitivity profile.

### **Overall Recommendations to Address Identified Issues:**

1. **Discontinue Naproxen**: Immediately stop naproxen due to significant renal impairment. Use alternative analgesia such as acetaminophen or a short-acting opioid with careful monitoring.
2. **Reduce Morphine Dose**: Lower the morphine MR dose or consider switching to an opioid with less renal excretion, like fentanyl or oxycodone, to reduce the risk of opioid toxicity in the context of declining renal function.
3. **Adjust Gabapentin Dose**: Decrease the gabapentin dose significantly based on eGFR, or discontinue if neuropathic pain is not predominant, to avoid accumulation and potential toxicity.
4. **Monitor Vancomycin Closely**: Perform therapeutic drug monitoring (TDM) of vancomycin, adjust dosing based on renal function, and explore alternatives if vancomycin is contributing to renal deterioration.
5. **Overall Monitoring and Support**: Given the worsening renal function, closely monitor renal parameters (e.g., Cr, eGFR, K+ levels) and fluid status. Involve a renal specialist for managing AKI and consider alternative pain management strategies with reduced renal impact.

### **Conclusion:**

BM’s post-operative analgesic regimen needs significant adjustments due to worsening renal function. Immediate discontinuation of nephrotoxic drugs (naproxen) and careful adjustment of other medications (morphine, gabapentin, vancomycin) are essential to manage pain effectively while preventing further renal impairment. Regular monitoring and a multidisciplinary approach involving renal and pain management specialists are crucial for optimizing BM's post-operative care.

Bottom of Form

Case study for uncontrolled AF:

### **Critique of Current Drug Therapy for Patient BM**

#### ****Patient Overview:****

* **Name:** BM
* **DOB:** 1/1/1954 (Age: 70)
* **Sex:** Female
* **Allergies:** None Known Drug Allergies (NKDA)
* **Social History (SH):** Retired, active (walks 2-3 times per day), consumes 1-2 units of alcohol per week, non-smoker.
* **Past Medical History (PMH):** Epilepsy
* **Current Medications:**
  + **Carbamazepine MR 400 mg BD** (Modified Release, twice daily)
  + **Sodium Valproate MR 500 mg BD** (Modified Release, twice daily)
* **On Examination (OE):**
  + **Blood Pressure (BP):** 150/100 mmHg
  + **Pulse:** 120 beats per minute (BPM), regular
* **Diagnosis:** Uncontrolled Atrial Fibrillation (AF)
* **Presenting Complaint (PC):** Uncontrolled AF

### **Current Drug Chart:**

1. **Digoxin:**
   * 500 mcg, followed by another 500 mcg after 6 hours.
   * Maintenance: 125 mcg once daily (OD).
2. **Apixaban:** 5 mg BD (twice daily).

### **Evidence-Based Critique of Current Therapy:**

#### ****1. Atrial Fibrillation Management:****

* **Atrial Fibrillation (AF):** The primary goals in managing AF are to control the heart rate (rate control), prevent thromboembolic events (stroke prevention), and potentially restore normal sinus rhythm (rhythm control). Given BM's presentation with an elevated pulse and BP, her AF appears uncontrolled.

**a. Digoxin:**

* **Loading Dose:** The administration of digoxin at 500 mcg twice within 6 hours indicates a loading dose, which is a standard approach to quickly achieve therapeutic plasma levels, especially in acute settings of AF.
* **Maintenance Dose:** The subsequent prescription of 125 mcg OD (once daily) as maintenance therapy is within the usual range for elderly patients with normal renal function.
* **Evidence-Based Considerations:**
  + Digoxin is primarily used for rate control in AF, especially in sedentary individuals, as it primarily works by increasing vagal tone and reducing the heart rate. However, in an active patient like BM, who walks regularly, digoxin may not be the most effective sole agent for rate control, as its efficacy decreases during physical activity.
  + **Guideline Considerations:** The NICE guidelines suggest beta-blockers or non-dihydropyridine calcium channel blockers (e.g., diltiazem or verapamil) as first-line agents for rate control in AF, particularly in active patients. Digoxin is typically recommended as an add-on therapy rather than monotherapy unless the patient is primarily sedentary.

**Recommendation:**

* Consider the addition of or switch to a beta-blocker (e.g., bisoprolol) or a calcium channel blocker (e.g., diltiazem) for better rate control, especially given BM’s active lifestyle. Beta-blockers can provide more consistent rate control during both rest and exercise. Monitor her response to therapy and adjust doses as needed.

**b. Apixaban:**

* **Indication:** Apixaban, a direct oral anticoagulant (DOAC), is prescribed for stroke prevention in AF, as BM is at increased risk due to age and possibly hypertension.
* **Dosage:** The 5 mg BD dosage is appropriate unless BM has specific risk factors (e.g., advanced age >80, low body weight <60 kg, or serum creatinine ≥133 µmol/L), which would necessitate a dose reduction to 2.5 mg BD according to the guidelines.

**Recommendation:**

* **Assessment for Dose Adjustment:** Ensure BM does not meet any criteria that would require a reduced dose of apixaban. This includes reviewing her renal function and other relevant parameters.
* **Regular Monitoring:** Regular renal function monitoring is crucial to ensure continued appropriateness of apixaban dosing.
* **Hypertension Management:** BM's BP readings (150/100 mmHg) suggest uncontrolled hypertension. This condition needs to be addressed as it increases the risk of stroke, particularly in the context of AF.
* **Consideration with Epilepsy:** BM's existing anti-epileptic drugs (AEDs) – carbamazepine and sodium valproate – have interactions with cardiovascular drugs, particularly those metabolized by the liver.

**a. Carbamazepine Interaction:**

* Carbamazepine is an enzyme inducer (CYP3A4 inducer) and can reduce the plasma levels of many cardiovascular drugs, including calcium channel blockers, which might limit their effectiveness. This interaction should be considered when choosing antihypertensive therapy.

**b. Hypertension Treatment Options:**

* **First-line Treatment:** Given her AF and hypertension, a beta-blocker like bisoprolol could serve dual purposes – controlling both heart rate and blood pressure.
* **Combination Therapy:** If additional antihypertensive therapy is needed, consider using an ACE inhibitor (e.g., ramipril) or an angiotensin receptor blocker (e.g., losartan), which would not interact significantly with carbamazepine.

**Recommendation:**

* **Initiate or Adjust Antihypertensive Therapy:** Consider starting or adjusting antihypertensive therapy with a beta-blocker (e.g., bisoprolol) that would also assist in rate control. If further BP reduction is needed, consider adding an ACE inhibitor or ARB.
* **Monitor for Interactions:** Be vigilant about potential drug interactions with BM’s antiepileptic medications, particularly when choosing additional antihypertensive agents.

#### ****3. Anti-Epileptic Drug Considerations:****

* **Carbamazepine and Sodium Valproate:** BM is on both carbamazepine and sodium valproate for epilepsy. The dual use of these AEDs should be regularly reviewed for efficacy and side effects, particularly considering the possible interaction between carbamazepine and other medications.

**a. Carbamazepine and Cardiovascular Drug Interactions:**

* Carbamazepine, as an enzyme inducer, can lower the effectiveness of certain cardiovascular drugs, as previously mentioned. The prescribing physician must ensure that the dosing of cardiovascular drugs accounts for this interaction.

**b. Sodium Valproate:**

* Sodium valproate can increase the levels of other medications by inhibiting their metabolism. However, its impact on cardiovascular drugs is generally less pronounced compared to carbamazepine.

**Recommendation:**

* **Regular Monitoring:** Review BM’s seizure control and consider whether the combination therapy is still necessary or if monotherapy could be an option. This is important to minimize polypharmacy and potential drug interactions.

### **Summary of Interventions:**

1. **Rate and Rhythm Control:**
   * **Consider switching digoxin** to or adding a beta-blocker (e.g., bisoprolol) or a calcium channel blocker (e.g., diltiazem) for better rate control in an active patient like BM.
   * **Continue apixaban** but assess if dose adjustment is necessary based on renal function and other risk factors.
2. **Hypertension Management:**
   * Initiate or adjust antihypertensive therapy, potentially with a beta-blocker that also aids in rate control.
   * Consider adding an ACE inhibitor or ARB if further blood pressure control is needed.
3. **Epilepsy Management:**
   * **Review AED therapy** to ensure optimal seizure control while minimizing potential drug interactions.
   * Monitor for interactions between carbamazepine and any new cardiovascular drugs introduced, adjusting doses as necessary.

**With reference to evidence-based guidelines, critique current drug therapy. Describe and explain any interventions you would like to make regarding her treatment**

### **Summary of Interventions:**

1. **Rate and Rhythm Control:**
   * **Consider switching digoxin** to or adding a beta-blocker (e.g., bisoprolol) or a calcium channel blocker (e.g., diltiazem) for better rate control in an active patient like BM.
   * **Continue apixaban** but assess if dose adjustment is necessary based on renal function and other risk factors.
2. **Hypertension Management:**
   * Initiate or adjust antihypertensive therapy, potentially with a beta-blocker that also aids in rate control.
   * Consider adding an ACE inhibitor or ARB if further blood pressure control is needed.
3. **Epilepsy Management:**
   * **Review AED therapy** to ensure optimal seizure control while minimizing potential drug interactions.
   * Monitor for interactions between carbamazepine and any new cardiovascular drugs introduced, adjusting doses as necessary.