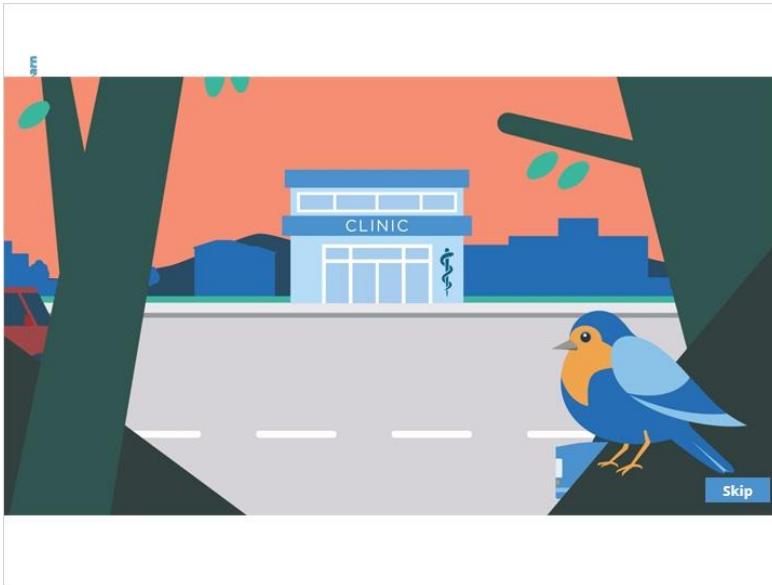


Case 48 Al Dosterone

1. Introduction

1.1 Intro Video



1.2 Module Navigation and Instructions

Module Navigation and Instructions

Throughout this course there are several interactive features. You may review each marker on the screen to understand how to navigate this course.

Slide instruction

More Information

A screenshot of a module navigation and instructions screen. On the left, there is a sidebar with a 'Module Navigation' section containing links to 'Course Welcome', 'Module Navigation...', 'Conflict of Interest...', 'Learning Objectives', 'Note to Learners', 'Patient case: Part 1', 'Priming Questions...', and 'Comparison of COVID-...'. On the right, there is a main content area showing a slide titled 'COVID-19 Diagnosis' with an illustration of a doctor and a patient. There are navigation arrows and a 'Proceed' button at the bottom of the slide. The top of the screen shows the 'eCFPLearn' logo and a 'Skip' button.

1.3 Learning Objectives

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Learning Objectives

At the end of this module participants should be able to:

1. Identify key factors/findings in family medicine to help establish common clinical diagnoses.
2. Evaluate best evidence/guidance and practice tools to determine preferred treatment options for patients.
3. Synthesize patient preference, evidence and experience to formulate comprehensive plans for patient cases.

Approximately 15 minutes to complete each patient case.

Proceed

2. AI Dosterone

2.1 Meet AI Dosterone

CFPCLearn

AI Dosterone, 54

AI is a computer engineer. He has hypertension, with no other past medical history. Last time you saw him, you asked him to do some bloodwork.

Medications AI Bloodwork

What do you think?



Medications (Slide Layer)

CFPC Learn

AI Dosterone, 54

AI's medications:

- Ramipril 5mg daily
- Hydrochlorothiazide 25mg daily
- Amlodipine 10mg daily

Medications AI Bloodwork

What do you think?



AI (Slide Layer)

CFPC Learn

AI Dosterone, 54

AI: My blood pressure is still high. I don't know why. It's usually ~160/95.

Medications AI Bloodwork

What do you think?



Bloodwork (Slide Layer)

CFPC Learn

AI Dosterone, 54

Al's bloodwork:

- Na: 134 mmol/L, K: 4.2mmol/L
- eGFR 55 ml/min, ACR 1.5
- Urinalysis: no protein, no blood
- HbA1c: 5.5%, LDL: 1.9 mmol/L
- Renin: 6.6 ng/L (2.6-27.6)
- Aldosterone: 220pmol/L (61-978)

Medications AI Bloodwork

What do you think?



2.2 Review

CFPC Learn

AI Dosterone, 54

You: Ok, let's start at the beginning. Tell me how you take your blood pressure.

AI: You told me to sit for a few minutes, not crossing my feet. Then I take two blood pressures. I write down the second one. I do it once in a while when I feel relaxed.

You: That's pretty good! Let's see if anything else could increase your blood pressure.

Moving Forward



2.3 Question

(Multiple Response, 10 points, 1 attempt permitted)

CFPCLearn

Which of the following factors could increase systolic blood pressure by at least 2-3 mmHg?



Select all that apply.

Alcohol (one drink per day)

Sleep apnea

Ibuprofen 400mg BID

Venlafaxine XR 150mg daily

Acetaminophen 1g TID

Submit

2.4 Review

CFPCLearn

Review



Answer: The correct answer is sleep apnea, ibuprofen and acetaminophen.

Ibuprofen

Sleep apnea

Acetaminophen

SNRI and SSRI

Alcohol

Click on the buttons to view additional information

Moving Forward

Ibuprofen (Slide Layer)

CFPC Learn

Review



Answer: The correct answer is sleep apnea, ibuprofen and acetaminophen.

Ibuprofen

Sleep apnea

Acetaminophen

SNRI and SSRI

Alcohol

Ibuprofen: In a systematic review of randomized trials, the mean change in systolic blood pressure from baseline with ibuprofen was ~ 3.5 mmHg. Naproxen may have a smaller effect on blood pressure.

Moving Forward

Sleep apnea (Slide Layer)

CFPC Learn

Review



Answer: The correct answer is sleep apnea, ibuprofen and acetaminophen.

Ibuprofen

Sleep apnea

Acetaminophen

SNRI and SSRI

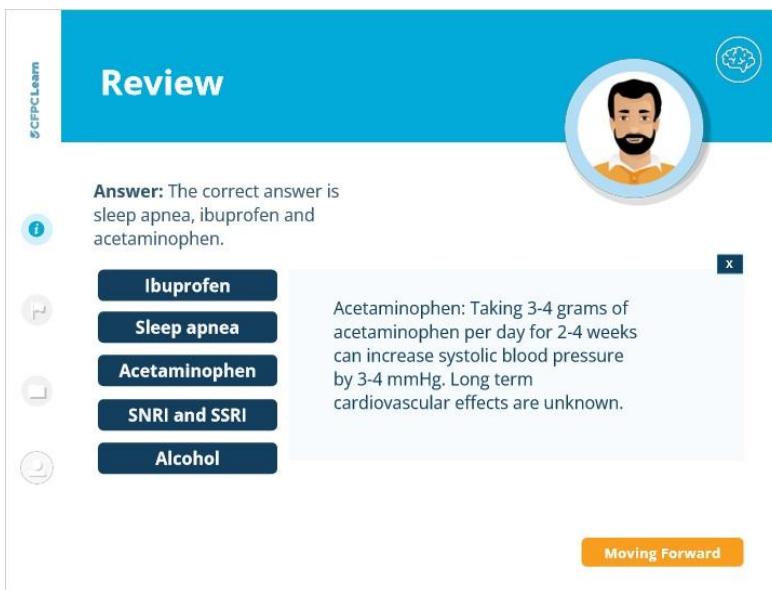
Alcohol

Sleep apnea

- CPAP decreases blood pressure (mean 2.5mmHg systolic, 2mmHg diastolic)
- However, there is a lack of evidence that CPAP decreases cardiovascular disease or mortality in patients with moderate-severe sleep apnea.
- Current CPAP machines are hard to tolerate (mean: used 1.4-5.8 hours/night)

Moving Forward

Acetaminophen (Slide Layer)



CFPC Learn

Review

Answer: The correct answer is sleep apnea, ibuprofen and acetaminophen.

Ibuprofen

Sleep apnea

Acetaminophen x

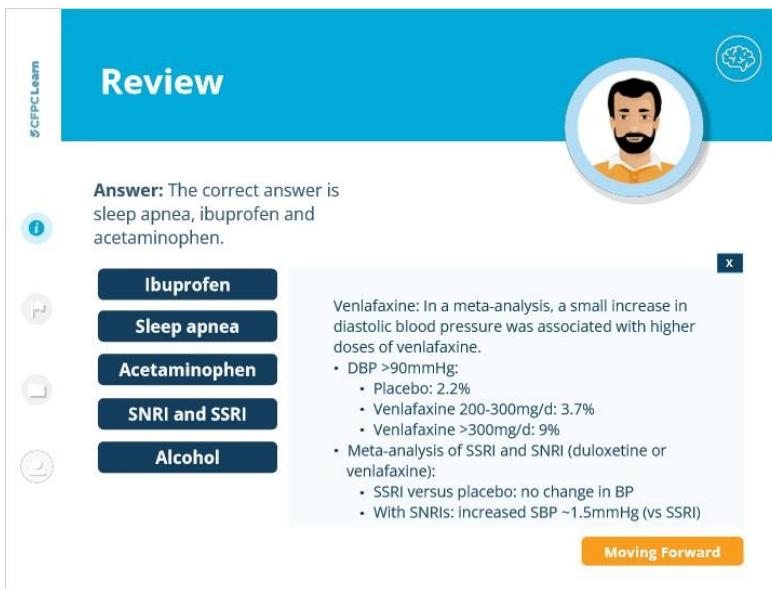
SNRI and SSRI

Alcohol

Acetaminophen: Taking 3-4 grams of acetaminophen per day for 2-4 weeks can increase systolic blood pressure by 3-4 mmHg. Long term cardiovascular effects are unknown.

Moving Forward

SNRI and SSRI (Slide Layer)



CFPC Learn

Review

Answer: The correct answer is sleep apnea, ibuprofen and acetaminophen.

Ibuprofen

Sleep apnea

Acetaminophen

SNRI and SSRI

Alcohol

Venlafaxine: In a meta-analysis, a small increase in diastolic blood pressure was associated with higher doses of venlafaxine.

- DBP >90mmHg:
 - Placebo: 2.2%
 - Venlafaxine 200-300mg/d: 3.7%
 - Venlafaxine >300mg/d: 9%
- Meta-analysis of SSRI and SNRI (duloxetine or venlafaxine):
 - SSRI versus placebo: no change in BP
 - With SNRIs: Increased SBP ~1.5mmHg (vs SSRI)

Moving Forward

Alcohol (Slide Layer)

CFPC Learn

Review



Answer: The correct answer is sleep apnea, ibuprofen and acetaminophen.

Ibuprofen

Sleep apnea

Acetaminophen

SNRI and SSRI

Alcohol

A systematic review of alcohol demonstrated that among patients who consume:

- Two drinks or less per day: Reduction in alcohol is not associated with a reduction in BP
- >2 drinks per day: Reduction is associated with improvement in BP. Example: if patients drink >6 drinks per day and reduce their consumption by 50%, systolic BP can be reduced up to ~5.5 mmHg reduction.

Moving Forward

2.5 Review

CFPC Learn

AI Dosterone, 54



You: It looks like your blood pressure remains elevated despite being on three blood pressure medications. Let's make sure we are not missing anything.

Moving Forward

2.6 Question

(Multiple Response, 10 points, 1 attempt permitted)

Which of the following conditions is the most common in resistant hypertension?

- Primary hyperaldosteronism
- Pheochromocytoma
- Medication non-adherence

Submit

2.7 Review

The slide features a blue header with the word 'Review' in white. On the right is a circular icon with a male character and a brain icon. Below the header, the text 'Answer: The correct answer is medication non-adherence.' is displayed. To the left are three buttons: 'Adherence I', 'Adherence II', and 'Single Pill Combos'. To the right is a call-to-action button: 'Click on the buttons to view additional information'. The bottom right corner contains a 'Moving Forward' button.

Answer: The correct answer is medication non-adherence.

Adherence I

Adherence II

Single Pill Combos

Click on the buttons to view additional information

Moving Forward

Adherence (Slide Layer)

The slide has a blue header with the word 'Review' and a circular profile picture of a man with a beard. The main content area contains the following text:

Answer: The correct answer is medication non-adherence.

Adherence I

Adherence II

Single Pill Combos

Non-adherence is common. In patients with resistant hypertension, rates of adherence range from 20% (measured with pill counts, questionnaires) to 46% (urine drug assays). Pharmacy refill data or questionnaires are not always accurate and patients tend to overestimate adherence. Physicians often intensify BP medications even when suspecting non-adherence.

Moving Forward

Adherence II (Slide Layer)

The slide has a blue header with the word 'Review' and a circular profile picture of a man with a beard. The main content area contains the following text:

Answer: The correct answer is medication non-adherence.

Adherence I

Adherence II

Single Pill Combos

Improving adherence to medications is challenging. In a Cochrane review, despite resource intensive interventions, improvements in adherence were small. These resources included allied health professionals, with intense education, counseling and sometimes daily treatment support.

Moving Forward

Single-pill comb (Slide Layer)

The slide layer has a blue header with the word 'Review' and a circular profile picture of a man with a beard. The main content area contains the following text: 'Answer: The correct answer is medication non-adherence.' Below this, there are three buttons: 'Adherence I', 'Adherence II', and 'Single Pill Combos'. To the right of these buttons is a text box containing: 'For patients with hypertension, single-pill combinations may help with adherence: the combination pill decreased systolic blood pressure by 4mmHg compared to equivalent medications give in individual pill format.' At the bottom right of the slide layer is a 'Moving Forward' button.

2.8 Primary Hyperaldosteronism and Pheochromocytoma

The slide layer has a blue header with the title 'Primary Hyperaldosteronism and Pheochromocytoma' and a circular profile picture of a man with a beard. The main content area contains the following text: 'Click on the buttons to view additional information'. Below this, there are four buttons: 'Primary hyperaldosteronism', 'Diagnosis I', 'Diagnosis II', and 'Pheochromocytoma'. At the bottom right of the slide layer is a 'Moving Forward' button.

Primary hyperaldos (Slide Layer)

Primary Hyperaldosteronism and Pheochromocytoma

Primary hyperaldosteronism:

- Occurs in 10-20% of patients with resistant hypertension
- Diagnosis rarely investigated. Evidence is limited by cohort studies but suggests that only 1.6% of patients with systolic BP >140 mmHg and on three BP medications are tested.
- Testing associated with 4X higher likelihood of initiating aldosterone antagonist and better BP control.

Moving Forward

Testing I (Slide Layer)

Primary Hyperaldosteronism and Pheochromocytoma

Primary hyperaldosteronism:

- To test: order **serum aldosterone** and **serum renin**.
- In order to test, there is no need to be an endocrinologist or to stop BP medications (except spironolactone, eplerenone or amiloride).
- Autonomous aldosterone secretion leads to renin suppression: suspect if **suppressed renin with elevated aldosterone >750pmol/L**. The lower the renin and the higher the aldosterone: the more likely the diagnosis.

Moving Forward

Testing II (Slide Layer)

Primary Hyperaldosteronism and Pheochromocytoma

CFPC Learn

Primary hyperaldosteronism

Diagnosis I

Diagnosis II

Pheochromocytoma

Moving Forward

Pheo (Slide Layer)

Primary Hyperaldosteronism and Pheochromocytoma

CFPC Learn

Primary hyperaldosteronism

Diagnosis I

Diagnosis II

Pheochromocytoma

Pheochromocytomas occur in 0.2%-0.6% of patients with hypertension. Testing should only be considered if blood pressure remains difficult to control despite optimal management. Labs can be difficult to interpret: only test in the right clinical context:

- Paroxysmal or sustained hypertension
- Headache (90% of patients)
- Non-exertional sweating (60-70% of patients)
- Other: palpitations, tremor, panic-attack like symptoms

Moving Forward

2.9 Review

CFPCLearn

AI Dosterone, 54

You: How about the medications? Do you mind taking them? Any side effects that make you skip doses?

AI: I'm a micro manager! I have an alarm in the morning to remind me to take my meds. I keep an extra medication bottle at work in case I forget (somehow)! And my husband is just as bad, or good, depending how you look at it. Please don't add another pill.

Moving Forward



2.10 Question

(Multiple Response, 10 points, 1 attempt permitted)

CFPCLearn

Adding a new blood pressure medication will likely improve AI's blood pressure *more* than increasing the dose of current medications.



True or false?

True

False

Submit

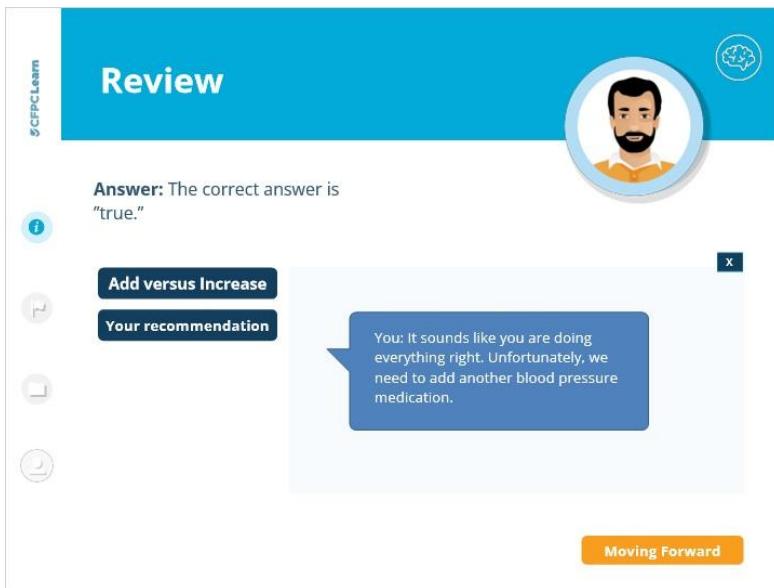
2.11 Review

This slide is a review for the question 'add vs increase'. It features a blue header with the word 'Review' and a circular profile picture of a man with a beard. A brain icon is in the top right corner. On the left, there are three circular icons: a question mark, a clipboard, and a clock. The main text area says 'Answer: The correct answer is "true."'. Below this are two buttons: 'Add versus Increase' and 'Your recommendation'. To the right, a text box says 'Click on the buttons to view additional information'. At the bottom right is an orange 'Moving Forward' button.

add vs increase (Slide Layer)

This is a slide layer for the 'add vs increase' question. It has a blue header with 'Review' and a profile picture of a man with a beard. A brain icon is in the top right. On the left are three icons: a question mark, a clipboard, and a clock. The main text area says 'Answer: The correct answer is "true."'. Below this are two buttons: 'Add versus Increase' and 'Your recommendation'. To the right, there is a text box with the following content: 'The average effect of adding one drug to another is *additive*.'. Below that, another text box says: 'Doubling the dose of a given medication only provides ~20% of the blood pressure lowering effect of the initial dose.' At the bottom right is an orange 'Moving Forward' button.

you (Slide Layer)



Answer: The correct answer is "true."

Add versus Increase

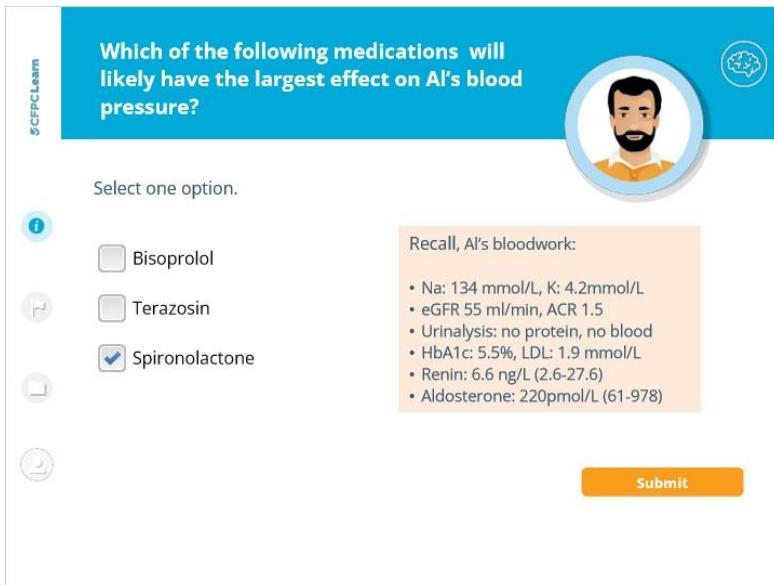
Your recommendation

You: It sounds like you are doing everything right. Unfortunately, we need to add another blood pressure medication.

Moving Forward

2.12 Question

(Multiple Response, 10 points, 1 attempt permitted)



Which of the following medications will likely have the largest effect on Al's blood pressure?

Select one option.

Bisoprolol

Terazosin

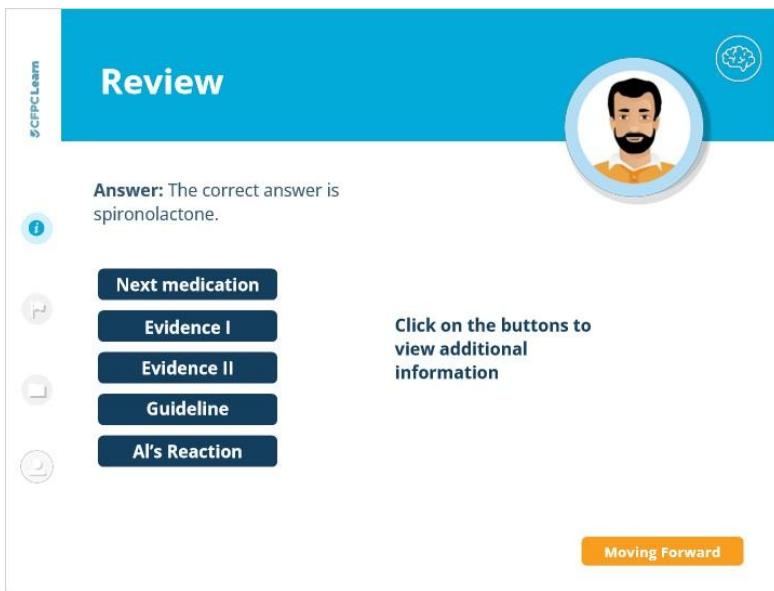
Spironolactone

Recall, Al's bloodwork:

- Na: 134 mmol/L, K: 4.2 mmol/L
- eGFR 55 ml/min, ACR 1.5
- Urinalysis: no protein, no blood
- HbA1c: 5.5%, LDL: 1.9 mmol/L
- Renin: 6.6 ng/L (2.6-27.6)
- Aldosterone: 220 pmol/L (61-978)

Submit

2.13 Review



Answer: The correct answer is spironolactone.

Next medication

Evidence I

Evidence II

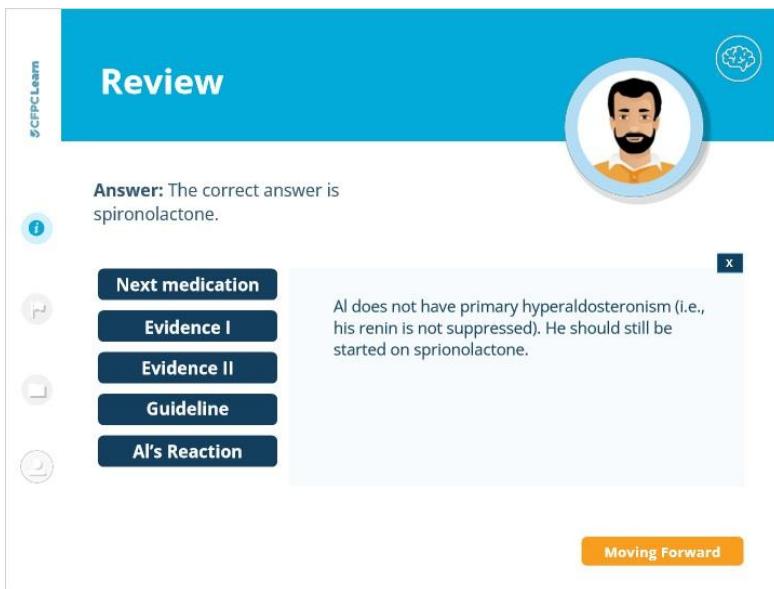
Guideline

AI's Reaction

Click on the buttons to view additional information

Moving Forward

Next medication (Slide Layer)



Answer: The correct answer is spironolactone.

Next medication

Evidence I

Evidence II

Guideline

AI's Reaction

Al does not have primary hyperaldosteronism (i.e., his renin is not suppressed). He should still be started on spironolactone.

Moving Forward

Evidence (Slide Layer)

The slide has a blue header with the word 'Review' and a circular profile picture of a man with a beard. The main content area contains the following text:

Answer: The correct answer is spironolactone.

Next medication

Evidence I

Evidence II

Guideline

AI's Reaction

• In a systematic review of randomized trials, patients with elevated blood pressure despite taking three medications were put on either spironolactone or placebo. Spironolactone:

- Decreased systolic BP by ~20mmHg versus placebo
- Decrease systolic BP by ~6mmHg versus active medications (e.g., beta-blockers, terazosin)
- No randomized trials reported patient-centered outcomes (e.g., mortality, CV events), no studies with hydralazine.

Moving Forward

evidence II (Slide Layer)

The slide has a blue header with the word 'Review' and a circular profile picture of a man with a beard. The main content area contains the following text:

Answer: The correct answer is spironolactone.

Next medication

Evidence I

Evidence II

Guideline

AI's Reaction

In a randomized trial of 175 patients with resistant hypertension (i.e., on ≥ 3 medications), spironolactone decreased blood pressure by ~16mmHg systolic (versus placebo) irrespective of aldosterone level or aldosterone-to-renin ratio.

Moving Forward

Guideline (Slide Layer)

Review

Answer: The correct answer is spironolactone.

The Canadian Hypertension Guideline recommends:

- Referring patients to hypertension clinic if persistent hypertension and >3 agents (an ACEI or ARB, CCB and diuretic).
- Several systematic reviews support spironolactone as fourth agent.
- Other primary care guidelines (e.g., NICE) recommend starting spironolactone as fourth agent (versus referring to hypertension clinic).
- Use spironolactone with caution if $K > 4.5 \text{ mmol/L}$ (usually in context of CKD)

Moving Forward

AI (Slide Layer)

Review

Answer: The correct answer is spironolactone.

AI: You want to add another pill?
You must be kidding me!

Moving Forward

2.14 Simplifying Meds

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Simplifying Meds



Al's regimen can be simplified. He is taking three classes of antihypertensives and three pills: ramipril 5mg, hydrochlorothiazide 25mg, and amlodipine 10mg.

One option that would get Al on 4 classes but only 2 pills is:

- Replacing hydrochlorothiazide with a combination pill: spironolactone / hydrochlorothiazide 25mg/25mg (~\$50)
- Replacing ramipril and amlodipine with a combination pill: telmisartan / amlodipine 40mg/10mg (~\$200)

Notes:

- There is no combination pill for ramipril and amlodipine. As separate pills, cost ~\$80.
- Amlodipine is available with perindopril but is more expensive (~\$350).

(Prices are per year, from ODB formulary)

Moving Forward

2.15 Create a Plan

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Let's Make a Plan



Using what you have learned write a plan for the Jay. It can include any/all of the following: lifestyle intervention(s), prescription intervention(s), lab(s)/test(s) required, follow up appointment time frame, and referral required.

Fill in your plan for the patient here

See how your plan compares

2.16 Plan Answers

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Al Dosterone, 54



This is the proposed plan for Al. How does your plan compare?

Details

Medication changes

Blood work and Follow Up

Select details on the left to see suggested recommendations

What's in a name?

Detail (Slide Layer)

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Al Dosterone, 54



This is the proposed plan for Al. How does your plan compare?

Details

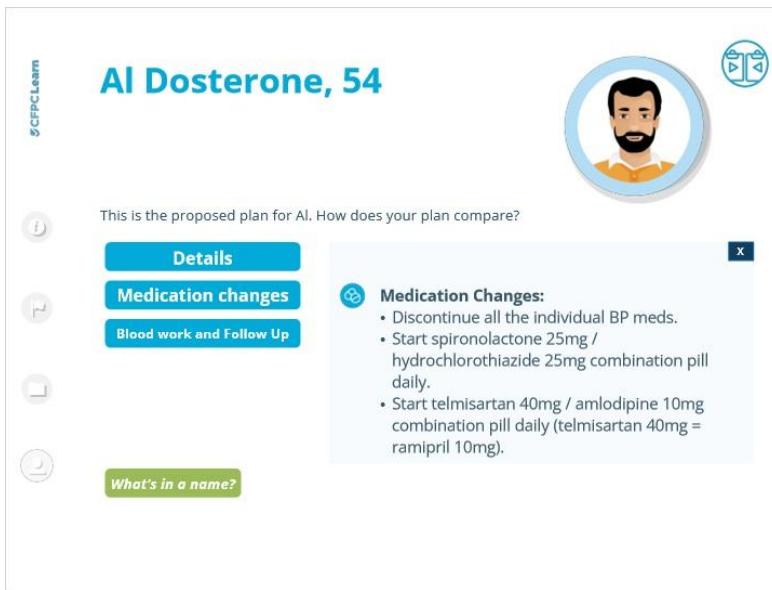
Medication changes

Blood work and Follow Up

• Al's potassium is 4.2 mmol/L.
• He has good medication coverage thanks to work.

What's in a name?

Med changes (Slide Layer)



CFPC Learn

Al Dosterone, 54



This is the proposed plan for Al. How does your plan compare?

Details

Medication changes

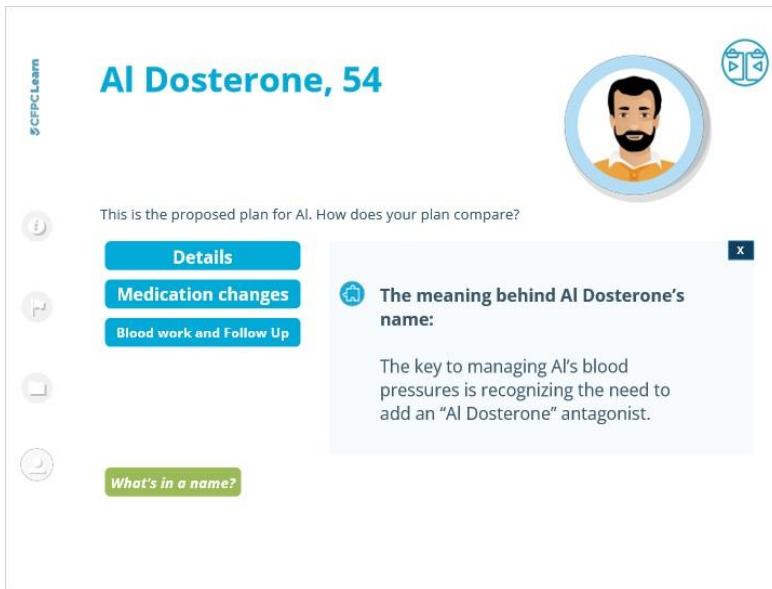
Blood work and Follow Up

What's in a name?

Medication Changes:

- Discontinue all the individual BP meds.
- Start spironolactone 25mg / hydrochlorothiazide 25mg combination pill daily.
- Start telmisartan 40mg / amlodipine 10mg combination pill daily (telmisartan 40mg = ramipril 10mg).

Name (Slide Layer)



CFPC Learn

Al Dosterone, 54



This is the proposed plan for Al. How does your plan compare?

Details

Medication changes

Blood work and Follow Up

What's in a name?

The meaning behind Al Dosterone's name:

The key to managing Al's blood pressures is recognizing the need to add an "Al Dosterone" antagonist.

Bloodwork and follow up (Slide Layer)

AI Dosterone, 54

This is the proposed plan for AI. How does your plan compare?

Details

Medication changes

Blood work and Follow Up

Bloodwork and follow up

You give AI a lab requisition for Cr, Na, K to be done in two weeks and will follow up with him in four weeks.

What's in a name?

2.17 References

References

Thanks for visiting the clinic!

References: Available [here](#).

This activity is eligible for up to 0.25 Mainpro+ credits.