Diabetes and Hypertension Project ECHO* Clinic

*ECHO: Extension of Community Healthcare Outcomes

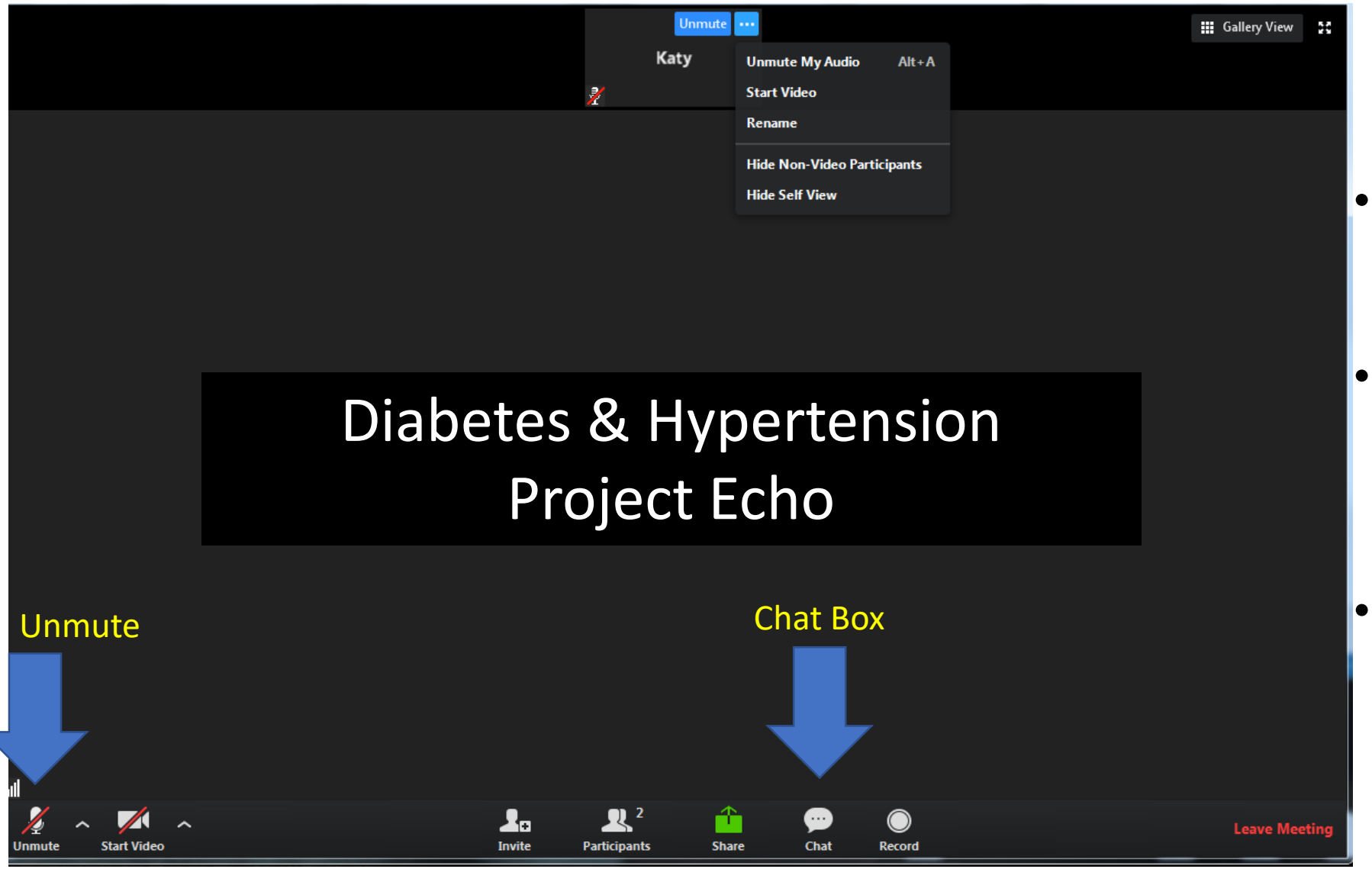
Oct. 14, 2021

Before we begin:

- Rename your Zoom screen with your name and organization
- Claim CE: text 19183-18817 to 804-625-4041
  - Go to **vcuhealth.org/echodmhtn** for instructions on creating your account

The Diabetes and Hypertension ECHO is made possible by funding through CDC Cooperative Agreement NU58DP006620-InnoVAte.

Zoom Reminders



- You are all on mute. Please unmute to talk.
- If joining by telephone audio only, press *6 to mute and unmute.
- Use the chat function to speak with our team or ask questions.

Helpful Reminders

- Please feel free to eat your lunch or step away briefly if needed
- We are recording and can share sessions upon request
  - Each session's slides are available on www.vcuhealth.org/echodmhtn
- Please **do not share any protected health information** in your discussion or the chat box
- Project ECHO operates on the "All Teach, All Learn" model
  - Feel free to ask questions in the chat or unmute to ask questions at designated times
  - We're all here to learn from each other and value each person's input and expertise!

VCU Health Diabetes & Hypertension ECHO Clinics

VCU Hub Team	
Principal Investigator	Dave Dixon, PharmD
Administrative Medical Director ECHO Hub	Vimal Mishra, MD, MMCi
Clinical Experts	Niraj Kothari, MD Trang Le, MD
Project Coordinator/IT Support	Madeleine Wagner

- One-hour ECHO clinics on 2nd and 4th Thursdays
- Every ECHO clinic includes a didactic presentation followed by case discussions
- Website: www.vcuhealth.org/echodmhtn
  - Directions for claiming CE can be found here
  - You have up to six days after our session to claim CE by texting **19183-18817** to **804-625-4041**

Disclosures

Trang Le, M.D., has no financial conflicts of interest to disclose.
Niraj Kothari, M.D., has no financial conflicts of interest to disclose.
Clint Patrick, D.O., M.S., has no financial conflicts of interest to disclose.
There is no commercial or in-kind support for this activity.

Primary and Secondary Hyperaldosteronism

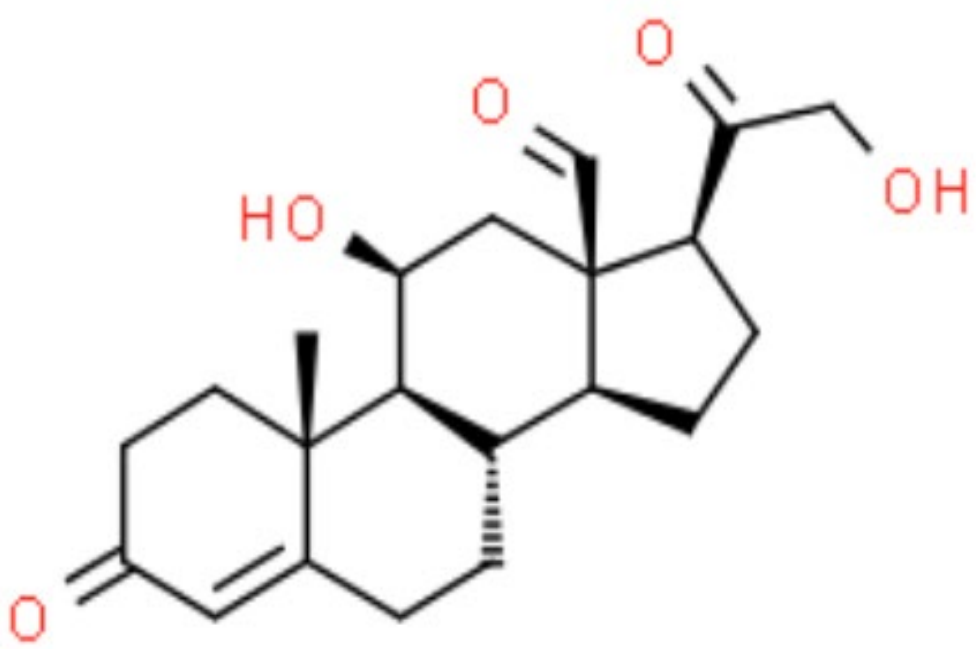
Clint Patrick, PGY-5
Department of Nephrology
VCU Health System

Objectives:

- Overview of primary & secondary hyperaldosteronism
- Clinical features and consequences of primary hyperaldo
- Evaluation/Work up of hyperaldosteronism
- Treatment Approach
- Clinical cases!

What is aldosterone?

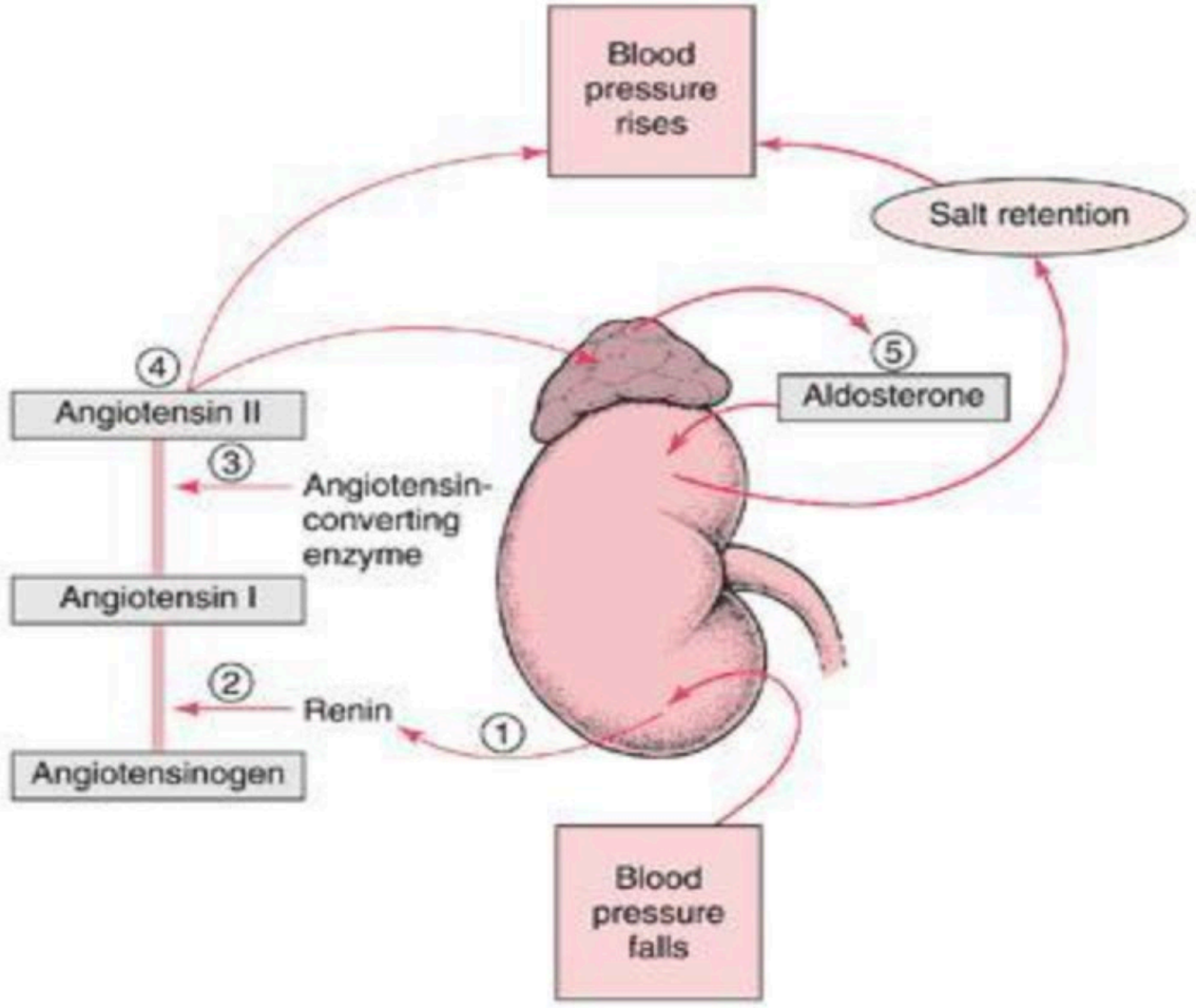
- The main mineralocorticoid hormone
  - Produced by the zona glomerulosa in the adrenal cortex
- Synthesized from cholesterol
- Binds to the aldosterone receptor in the renal collecting duct



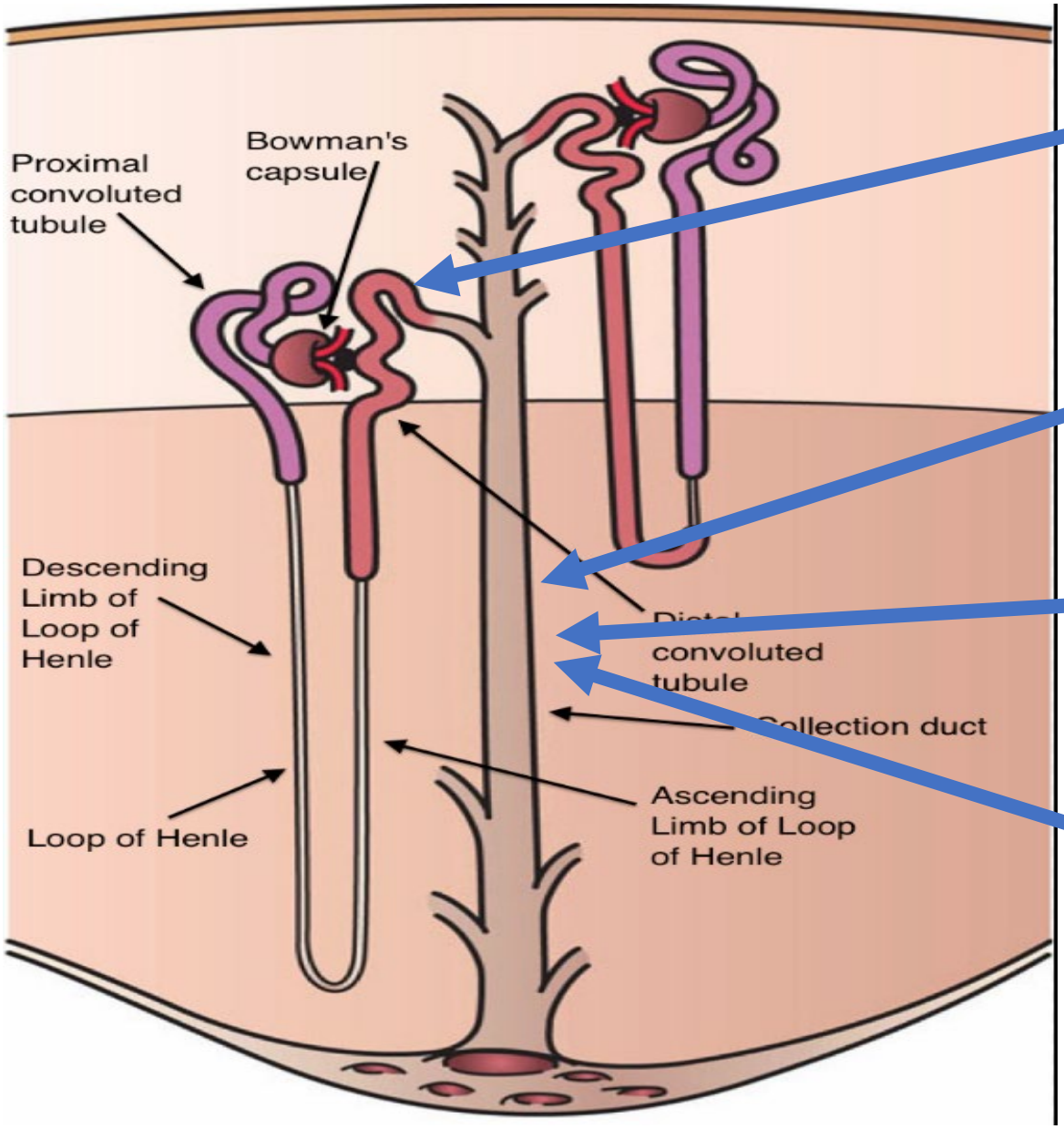
Chemspider.com/ChemicalStructures

What causes aldosterone to be released?

- Renin-angiotensin-aldosterone system (RAAS)
- Low serum potassium levels
  - The strong stimulus for aldosterone release
- ACTH (minor role)
- Stretch receptors in the atria of the heart



RVC (2008). Schematic of the RAAS



Upregulates NCC in the distal convoluted tubule

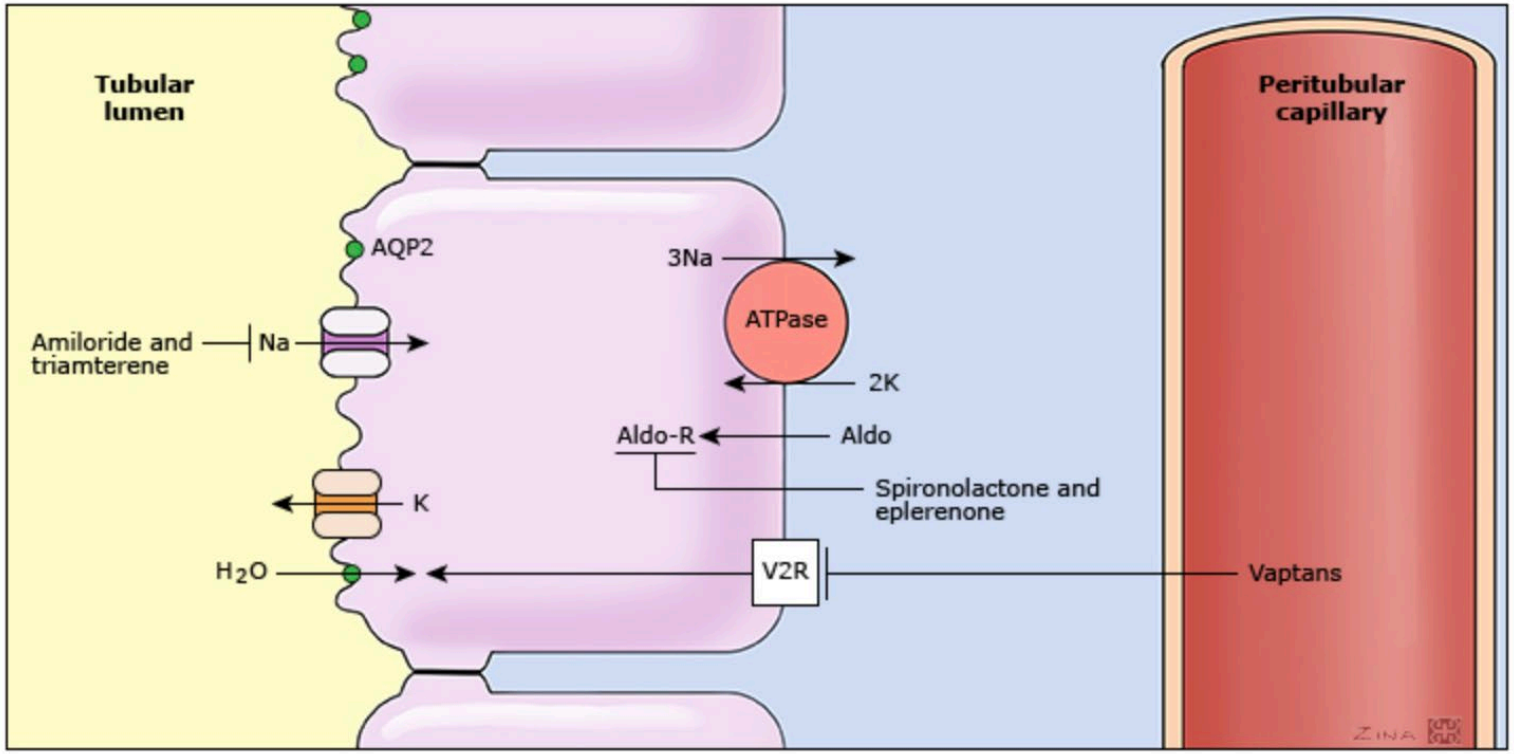
Upregulates ENAC

Stimulates secretion of potassium into the tubular lumen

Stimulates secretion of H+ into the tubular lumen

Clinical features of hyperaldosteronism

- Hypertension
  - Increased retention of sodium
- Hypokalemia
  - Increase urinary K+ wasting
- Metabolic alkalosis
  - Increased urinary H+ wasting



UpToDate.com/overview of the renin-angiotensin system

Primary Hyperaldosteronism

- Unilateral adrenal adenoma
- Bilateral adrenal hyperplasia
- Ectopic aldosterone-producing tumor

Secondary Hyperaldosteronism

- Renal artery stenosis
- Liddle syndrome
- Renin-secreting tumor
- Glucocorticoid remedial aldosteronism
- Apparent mineralocorticoid excess:
  - Acute or chronic licorice ingestion
  - Ectopic ACTH syndromes

Primary Hyperaldosteronism Long-term Consequences:

- Resistant hypertension
- Hypokalemia
  - May contribute to progressive CKD
  - Muscle weakness (K < 2.5mmol/L)
- Higher risk of cardiovascular morbidity and mortality
  - Greater LV mass
  - Decreased LV function
  - Increased risk of:
    - Heart failure, non-fatal myocardial infarction & atrial fibrillation
- Increased risk of stroke
- Renal effects:
  - Increased albuminuria
  - Increased glomerular filtration rate (GFR)

Evaluation of suspected hyperaldosteronism:

- Suspect primary hyperaldo in cases of resistant HTN, hypokalemia, and metabolic alkalosis
- **Work Up:**
  - Obtain plasma renin (PRC) and aldosterone (PAC) level
    - Obtain sample in the morning
    - Patients should be seated
  - PRC should be low, and PAC should be high
  - No further testing needed if demonstrate the following:
    - Low PRC and high PAC
    - Spontaneous hypokalemia
    - PAC > 20ng/dL
    - Undetectable PRC
  - Recommend renal artery duplex to rule out renal artery stenosis

Confirmatory Testing:

- Most cases will need **confirmatory testing:** need to ensure potassium is normal
  - 24-hour urine aldosterone, sodium, and creatinine on high sodium diet X3 days
  - Fludrocortisone suppression testing
  - Saline suppression test

Evaluating established Primary Hyperaldo

- Adrenal CT with and without contrast
  - Initial study to determine subtype (adenoma vs hyperplasia)
  - Will also evaluate for adrenal carcinoma
  - Limitations:
    - May miss small adenomas that are contributing to aldosterone secretion
    - Bilateral adrenal hyperplasia may appear normal on CT imaging
    - Bilateral adrenal lesions are not diagnostic of hyperplasia

- Adrenal vein sampling:
  - Technically challenging, need an experience Radiologist
  - Limit medications that may affect interpretation:
    - MRA, ACEi, ARB, diuretics

Primary Hyperaldosteronism
Goals of Treatment:

- Normalization of blood pressure
- Normalization of potassium levels
- Reverse the CV effects of hyperaldosteronism
- Prevent renal adverse effects

Management of Primary Hyperaldosteronism

- **Bilateral adrenal hyperplasia:**
  - Treatment is medical
  - Surgical risks outweigh benefits
  - First line treatment is MRA (spironolactone or eplerenone)

- **Unilateral adrenal adenoma:**
  - Medical vs Surgical Management

WGE.com/blogs/surgical-nurse-job-description-career-guide

Medical Management:

- Indicated in:
  - Bilateral adrenal hyperplasia
  - Unilateral adrenal adenoma (not surgical candidate)
- Spironolactone (MRA) is first line
  - If intolerable side effects, then switch to eplerenone
- If unable to tolerate MRA, then trial potassium sparing diuretic:
  - Amiloride or triamterene
- Goals of therapy:
  - Potassium in the high-normal range (K > 4.5mmol/L)
  - Normalization of BP
  - Reverse/prevent long-term effects of hyperaldo on cardiac and kidney function

1800petmeds.com/spironolactone

Medical Management:

- Outcomes:
  - Non-surgical candidates for unilateral adrenal adenoma:
    - Regardless of blood pressure control, if PRA remains suppressed (< 1ug/L):
      - Higher rate of CV events than patient with essential HTN
      - Higher incidence of mortality (HR 1.34, 95% CI 1.06-1.71)
      - Higher incidence of diabetes (HR 1.26, 95% CI 1.01-1.57)
      - Higher incidence of atrial fibrillation (HR 1.93, 95% CI 1.54-2.42)
  - Patient on high-dose MRA with unsuppressed PRA (> 1ug/L) have no excess CV risk

Surgical Management:

- Benefits:
  - Hypertension:
    - In some patients, HTN is cured
    - HTN persists in 40-65% of cases
      - This may be due to underlying HTN or nephrosclerosis
  - Improvement in quality of life
  - Biochemical outcomes:
    - Decrease in plasma aldosterone concentration
    - Increase in serum potassium
  - Potential health care cost benefit

www.britannica.com/science/plastic-surgery
Sywak, M. & Pasieka, J.L. (2002)

Cost benefit of adrenalectomy:

- **Long-term follow-up and cost benefit of adrenalectomy in patients with primary hyperaldosteronism**
  - 24 adrenalectomies were performed for primary hyperaldosteronism
    - Mean follow-up was 42 months
    - Showed significant decrease in both the mean systolic and diastolic blood pressure
    - 20 patients were either off all anti-hypertensives (eight) or had a reduction in medication (12)
    - Mean estimated cost savings over individuals lifetime after adrenalectomy vs medication alone:
      - Canadian $31,132

Sywak, M. & Pasieka, J.L. (2002)

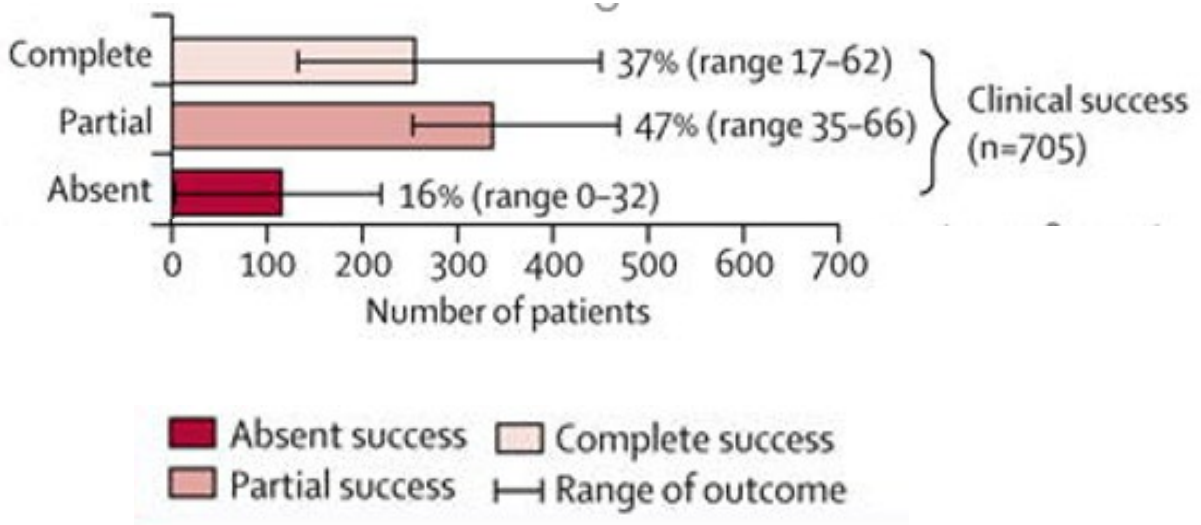
Primary Aldosteronism Surgical Outcome (PASO) study:

- International project (9 countries) evaluating outcomes after unilateral adrenalectomy:
- Objective:
  - To develop consensus criteria for outcomes
  - To follow-up outcomes after adrenalectomy
- Retrospective study
- Analyzed follow-up data after total adrenalectomy

Williams, TA, et al. (2017)

Primary Aldosteronism Surgical Outcome (PASO) study:

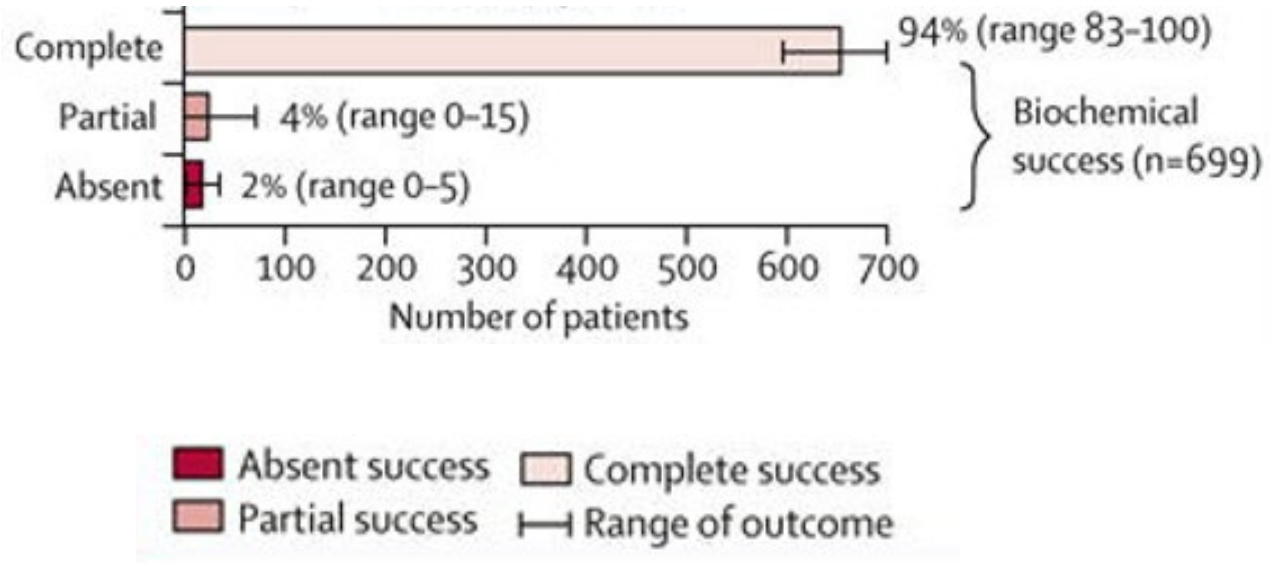
- Clinical response:
  - Complete:
    - Normalization of BP without anti-HTN meds
  - Partial:
    - Same BP as pre-surgery but with fewer anti-HTN meds
    - Lower BP on the same number of anti-HTN meds
  - Absent:
    - Unchanged or increase BP



Williams, TA, et al. (2017)

Primary Aldosteronism Surgical Outcome (PASO) study:

- Biochemical response:
  - Complete:
    - Correction of hypokalemia
    - Correction of aldosterone-to-renin ratio
  - Partial:
    - Correction of hypokalemia
    - Raised aldosterone-to-renin ratio
      - ≥50% decrease in baseline plasma aldosterone concentration
  - Absent:
    - Persistent hypokalemia
    - Persistent raised aldosterone-to-renin ratio



Williams, TA, et al. (2017)

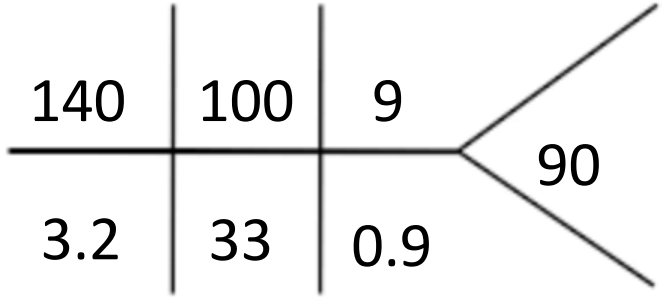
Case Study #1

- **61 yo male veteran presented to Nephrology clinic for evaluation of hypokalemia and HTN**
- **PMHx**
  - **HTN, HLD, chronic hypokalemia**
- **Medications: Amlodipine 10mg daily, Ramipril 10mg daily, potassium 10mEq BID, tamsulosin 0.4mg daily, atorvastatin 40mg daily**
- **Social Hx:**
  - **Previous smoker, 10 pack year history**
  - **No alcohol or drug use**
- **No drug allergies and no pertinent family history**
- **Physical exam: afebrile 138/72, HR 78, RR 16**
  - **Heart: RRR**
  - **Lungs: CTA**
  - **Abdomen: no abdominal bruit**

Any clarifying questions?

Case Study #1 (continued)

- Labs:



- What additional evaluation is needed?

- Any proposed solutions?

Case Study #1 (continued)

- Aldosterone: 34
- Renin: 0.55
- 24h urine aldosterone: 13.1
- Evidence of urinary potassium wasting in setting of hypokalemia
- Renal artery duplex:
  - No renal artery stenosis
- Saline suppression test: aldosterone not suppressed by 2L 0.9% NaCl over 4 hours
- CT A/P with and without contrast: no adrenal abnormalities

- Adrenal vein sampling pending

Case Study #2

- 56 yo man pmh of CKDIV, orthostatic hypotension and supine hypertension with history of CVA. Last CVA occurred when he presented with systolics in the 200s and had significant residual deficits warranting a prolonged stay at an inpatient rehab center s/p discharge. During his admission he had severe supine HTN that was complicated by orthostatic hypotension that limited his ability to undergo physical therapy

Case Study #2 (continued)

- Allergies: Lisinopril (lip swelling), hydralazine
- Meds: Carvidilol 25mg BID, Clonidine 0.2mg Tab BID, Nifedipine 90mg BID, Minoxidil (held), Chlorthalidone 50mg qd, Bumex 2mg qd
- Physical exam: RRR, +1 pitting edema, garbled speech

Case Study #2 (continued)

- Non-medical interventions : avoid supine position during the day, abdominal binders and compression stockings (when not supine), sleep w/ HOB raised

- Medical Interventions: use short acting vasodilators at night (Nifedipine, nitroglycerine, hydralazine); Captopril,

References:

- Sywak, M. & Pasieka, J.L. (2002). Long-term follow-up and cost benefit of adrenalectomy in patients with primary hyperaldosteronism. Br J Surg. 89(12):1587-93.
- Williams, T.A., et al. (2017). Outcomes after adrenalectomy for unilateral primary aldosteronism: an international consensus on outcome measures and analysis of remission rates in an international cohort. *Lancet Diabetes Endocrinol.* 5(9): 689-699.

Case Studies

- Anyone can submit cases: www.vcuhealth.org/echodmhtn
- Receive feedback from participants and content experts
- Earn **$150** for submitting and presenting

Provide Feedback

www.vcuhealth.org/echodmhtn

- Feedback
  - Overall feedback related to session content and flow?
  - Ideas for guest speakers?

Access Your Evaluation

vcuhealth.org/services/telehealth/for-providers/education/diabetes-and-hypertension-project-echo

For Providers

- Education
  - **Diabetes and Hypertension Project ECHO**
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  - Virginia Opioid Addiction ECHO
  - Virginia Sickle Cell Disease ECHO

Diabetes and Hypertension Project ECHO

Welcome to the Diabetes and Hypertension Extension for Community Health Outcomes or ECHO, a virtual network of multidisciplinary diabetes and hypertension experts. An ECHO model connects professionals with each other in real-time collaborative virtual sessions on Zoom. Participants present de-identified cases to one another, share resources, connect to each other, and grow in their expertise. This ECHO will address practice level issues and solutions related to managing complex patients with difficult to control diabetes and hypertension. Register now for an ECHO Session!

Network, Participate and Present

- Engage in a collaborative community with your peers.
- Listen, learn and discuss informational and case presentations in real-time.
- Take the opportunity to submit your de-identified case study for feedback from a team of specialists for diabetes and hypertension.
- Provide valuable feedback.
- Claim CE credit by texting in attendance.

Benefits

VCU Diabetes & Hypertension Project ECHO Clinics

2nd and 4th Thursdays — ***NEW: 12 p.m. to 1 p.m.***

Mark Your Calendars — Upcoming Sessions

Oct. 28: CGM Interpretation

Nov. 11: Hypertension in older adults

Please register at www.vcuhealth.org/echodmhtn

Thank you for coming!

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