


Aldosterone And Sodium Escape




Aldosterone increases sodium reabsorption and potassium secretion. However, during chronic aldosterone excess, such as in primary aldosteronism, sodium balance is achieved. Achieving this balance is known as *sodium escape*. There has been considerable interest in the mechanisms which account for sodium escape.

In this exercise, we will simulate primary aldosteronism and then observe the factors which control sodium excretion.

The Aldosterone And Sodium Escape Protocol

Begin by clicking Restart to reset the model's variables to their initial values. Record the control (Day 0) data in the table below. Click  Aldosterone. Slide the basic aldosterone formation rate down to 0. Slide the aldosterone pump rate up to 2000 and click the aldosterone pump switch to on. Advance the solution and record data in table below.

On Day 10, increase the Na⁺ and Cl⁻ intake (at ) from normal to 500 mEq/Day. Advance the solution for 1 more week and record the Day 17 data.



Arterial Pressure (mmHg)

Right Atrial Pressure (mmHg)

Left Atrial Pressure (mmHg)





Plasma [All] (pG/mL)

Plasma [Aldosterone] (pMol/L)

Plasma [ANP] (pMol/L)

Plasma [Na+] (mEq/L)

Plasma [K+] (mEq/L)



Glomerular Filtration Rate (mL/Min)

Proximal Na+ Inflow (mEq/Min)

Proximal Na+ Reabsorption
(mEq/Min)

Distal Na+ Inflow (mEq/Min)

Distal Na+ Reabsorption (mEq/Min)

Collecting Duct Na+ Inflow
(mEq/Min)

Collecting Duct Na+ Reabsorption
(mEq/Min)

Na+ Excretion (mEq/Min)



Plasma Volume (mL)

ECFV (L)

Ascites (mL)

| | | | | | |
|-------------|---|---|---|----|----|
| Time (Days) | 0 | 1 | 3 | 10 | 17 |
|-------------|---|---|---|----|----|



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|---------------------------------|--|--|--|--|--|
| Arterial Pressure | | | | | |
| Right Atrial Pressure | | | | | |
| Left Atrial Pressure | | | | | |
| Plasma [All] | | | | | |
| Plasma [Aldosterone] | | | | | |
| Plasma [ANP] | | | | | |
| Plasma [Na ⁺] | | | | | |
| Plasma [K ⁺] | | | | | |
| GFR | | | | | |
| Proximal Na ⁺ Inflow | | | | | |
| Proximal Na ⁺ Reab. | | | | | |
| Distal Na ⁺ Inflow | | | | | |
| Distal Na ⁺ Reab. | | | | | |
| CD Na ⁺ Inflow | | | | | |
| CD Na ⁺ Reabsorption | | | | | |
| Urine Na ⁺ Excretion | | | | | |





| | | | | | |
|---------------|--|--|--|--|--|
| Plasma Volume | | | | | |
| ECFV | | | | | |
| Ascites | | | | | |

Describe the time-dependent effects of aldosterone on urinary sodium and potassium excretion. Are sodium and potassium balance achieved during aldosterone excess? Does aldosterone have a sustained effect on sodium reabsorption and potassium secretion in the distal nephron? Does edema occur during primary aldosteronism? Is aldosterone hypertension salt-sensitive? How does increased salt intake affect plasma potassium concentration in primary aldosteronism?

When Sodium Escape Does Not Occur

In states of secondary aldosteronism, such as congestive heart failure, sodium escape may not occur. In this exercise, we will investigate the role of renal perfusion pressure in sodium escape. We will repeat the protocol given above with renal perfusion pressure clamped at a normal value.

Begin again by clicking Restart to reset the model's variables to their initial values. Record the control (Day 0) data in the table below. Click  Circulation. At the perfusion pump, slide perfusion pressure up to 96 and click the perfusion pump switch to on. Click  Aldosterone. Slide the basic aldosterone formation rate down to 0. Slide the aldosterone pump rate up to 2000 and click the aldosterone pump switch to on. Advance the solution and record data in table below. Stop at Day 10 (see below).





Arterial Pressure (mmHg)

Right Atrial Pressure (mmHg)

Left Atrial Pressure (mmHg)



Plasma [All] (pG/mL)

Plasma [Aldosterone] (pMol/L)

Plasma [ANP] (pMol/L)

Plasma [Na⁺] (mEq/L)

Plasma [K⁺] (mEq/L)



Glomerular Filtration Rate (mL/Min)

Proximal Na⁺ Inflow (mEq/Min)

Proximal Na⁺ Reabsorption
(mEq/Min)

Distal Na⁺ Inflow (mEq/Min)

Distal Na⁺ Reabsorption (mEq/Min)

Collecting Duct Na⁺ Inflow
(mEq/Min)

Collecting Duct Na⁺ Reabsorption
(mEq/Min)

Na⁺ Excretion (mEq/Min)





Plasma Volume (mL)

ECFV (L)


Ascites (mL)

| Time (Days) | 0 | 1 | 3 | 10 | 17 |
|---------------------------------|---|---|---|----|----|
| Arterial Pressure | | | | | |
| Right Atrial Pressure | | | | | |
| Left Atrial Pressure | | | | | |
| Plasma [All] | | | | | |
| Plasma [Aldosterone] | | | | | |
| Plasma [ANP] | | | | | |
| Plasma [Na ⁺] | | | | | |
| Plasma [K ⁺] | | | | | |
| GFR | | | | | |
| Proximal Na ⁺ Inflow | | | | | |



| | | | | | |
|---------------------|--|--|--|--|--|
| Proximal Na+ Reab. | | | | | |
| Distal Na+ Inflow | | | | | |
| Distal Na+ Reab. | | | | | |
| CD Na+ Inflow | | | | | |
| CD Na+ Reabsorption | | | | | |
| Urine Na+ Excretion | | | | | |
| Plasma Volume | | | | | |
| ECFV | | | | | |
| Ascites | | | | | |

Does sodium escape occur? Why? Is edema present?

As before, on Day 10 increase the Na+ and Cl- intake (at ) from normal to 500 mEq/Day. Advance the solution 1 more week and record the Day 17 data.

