Hey Clinical Problem Solvers! This is Jasmine Saeedian, 4th year medical student at Western Michigan University Homer Stryker MD School of Medicine! I'm so excited to talk to you about our new schema describing an approach to polyuria. You're in (urine) for a treat! Let's get started!

First, let's walk through what polyuria actually is. Polyuria describes increased volume of urine output and is defined as defined as a urine output exceeding 3 L/day in adults and 2 L/m2 in children. It can be caused by a solute (aka osmotic) diuresis—which is Osmotic diuresis is the increase of urination rate caused by the presence of certain substances—or a water diuresis. We differentiate between the two of these in a few ways. We can look at the urine osmolarity and free water clearance, which function as inverses of each other. So for example, in solute diuresis, urine osmolarity will go up and free water clearance will go down. This means with high urine osmolarity, there is less water per unit volume of urine, and there is less free water clearance, meaning there is less plasma being cleared of water.

Speaking of solute diuresis… let's talk about a few things that cause this branch of polyuria. The most common cause for this is glucose-induced diuresis in patients with uncontrolled diabetes mellitus. The mechanism for this is that excess glucose ends up in the urine, where it pulls more water and results in more urine. Increased sodium intake can lead to a solute diuresis, and this is usually caused by administration of large volumes of IV saline. Mannitol can similarly cause solute diuresis, and this happens in the context of mannitol administration in patients with increased intracranial pressure. As a reminder, mannitol is an osmotic diuretic that leads to create solute diuresis and polyuria.

Water diuresis is the other branch of polyuria, and it describes an increase in water output and specifically the excretion of a relatively dilute urine. There are two main mechanisms for how we think about this –primary polydipsia and diabetes insipidus—and we can differentiate based on the patient's response to the water deprivation test. You might be wondering, "Jasmine, what's that?" and I'll tell you! It's actually exactly what the name implies – we deprive the patient of water for a few hours and see how their body responds. If at that later time, the patient appropriately responds and their urine concentrates, we say this to be "primary polydipsia".

Primary polydipsia, also known as psychogenic polydipsia, is caused by an increase in water intake, sometimes due to psychiatric illness or other different etiologies which cause lesions to the thirst center of the hypothalamus.

If after the water deprivation test the urine is still dilute, then we have to explore etiologies of diabetes insipidus. For a more thorough explanation of diabetes insipidus, check out the CPS schema on DI! But for now, here's a quick run down!

When diabetes insipidus is suspected, the next step is to administer ADH, to see how the body responds. If the body makes concentrated urine as a response to ADH administration, this indicates central diabetes insipidus. This means that for some reason, either from idiopathic or

autoimmune causes, or from trauma, the body has stopped releasing ADH from the pituitary gland; but it can respond to ADH if it is available. This differs from nephrogenic diabetes insipidus, which will not respond to ADH administration. This is because even though there is normal ADH secretion in the body, there is renal resistance or a defect in renal concentrating ability.

We can also use copeptin as a biomarker to distinguish between central and nephrogenic diabetes insipidus. It's released in equimolar amount to ADH, so it makes sense that baseline copeptin would be high in nephrogenic DI, but would be low in central DI.

So to summarize: polyuria is when there is an increased in urine volume. It can be caused by solutes which pull water out, like in the case of uncontrolled diabetes mellitus, or it can be caused by too much water being excreted, which can be caused by either too much water intake, a problem with the brain's release of vasopressin, or a problem with the kidneys' response to vasopressin.

Thanks for listening! I hope you enjoyed this schema and learned something exciting!