JOHNS HOPKINS ALL CHILDREN'S HOSPITAL

Arginine Vasopressin Disorder (Diabetes Insipidus) Clinical Pathway

JOHNS HOPKINS
All Children's Hospital

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Updated: 07/25/2025
Owners: Endocrinology

Johns Hopkins All Children's Hospital

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Rationale:

This clinical pathway was developed by a consensus group of Johns Hopkins All Children's Hospital (JHACH) physicians, advanced practice providers, nurses, and pharmacists to standardize the management of children hospitalized for arginine vasopressin (AVP) disorder (formerly known as diabetes insipidus (DI)). It addresses the following clinical questions or problems:

1. How to differentiate between the two primary categories of AVP disorder
2. Evaluating a patient with suspected AVP disorder, including laboratory analysis
3. How to treat AVP disorder, depending on the specific etiology
4. When to consult Endocrinology

Background:

AVP disorder results in either decreased release of antidiuretic hormone (ADH) or reduced response to ADH, causing electrolyte imbalances [Hui]. There are two types: AVP deficiency (AVP-D; formerly central DI) and AVP resistance (AVP-R; formerly nephrogenic DI). The hallmarks of AVP disorder include polyuria (urine output (UOP) > 3 mL/kg/hour), dilute urine (osmolality < 300 mOsm/L), and hypernatremia (sodium (Na) > 145 mEq/L). Untreated AVP disorder can lead to hypovolemia, dehydration, and electrolyte imbalances.

AVP-D:
AVP-D is secondary to inadequate or impaired secretion of ADH from the posterior pituitary gland in response to osmotic stimulation and a decrease in blood pressure [Hui]. A majority of cases of AVP-D are idiopathic. Other causes of AVP-D include familial and congenital disease, cancer, adipsic DI, hypoxic encephalopathy, and infiltrative disorders [Hui].

Traumatic injury to the hypothalamus and posterior pituitary or neurosurgery may induce AVP-D [Ghirardello; Nemergut; Hadjizacharia]. Despite the relatively high frequency of AVP-D in patients undergoing neurosurgery, most cases of polyuria in this setting are **NOT** due to AVP-D [Seckl]. More common causes after neurosurgery are the excretion of excess fluid administered during the procedure and an osmotic diuresis induced by mannitol or glucocorticoids. This can be differentiated from AVP-D by measuring urine osmolality, fluid restriction, and administration of an ADH analog.

AVP-R:
AVP-R refers to a decrease in the urinary concentrating ability of the kidney that results from resistance to the action of ADH. The most common cause of AVP-R in children is hereditary nephrogenic DI. Acquired causes (e.g., lithium toxicity, hypercalcemia, hypokalemia) are often

partially reversible with cessation of the offending medication or correction of hypercalcemia. Additional causes of AVP-R are hereditary or genetic mutations.

Diagnosis:

The hallmarks of AVP disorder include polyuria (UOP > 3 mL/kg/hour), dilute urine (osmolality < 300 mOsm/L), and hypernatremia (Na > 145 mEq/L). The primary symptoms common to both AVP-D and AVP-R include polydipsia, polyuria, and nocturia. In children, symptoms can be nonspecific, and they may present with severe dehydration, constipation, vomiting, fevers, irritability, failure to thrive, and growth retardation.

Lab tests:

- Sodium
- Urine osmolality
- Plasma osmolality

Clinical Management:

It is essential to replace fluid losses in all patients with AVP disorder, as some may have impaired thirst and will not respond adequately to water intake. This can be attained by providing free water enterally or giving intravenous (IV) fluids. In the acute setting, initiating dextrose 5% normal saline (D5NS) at two-thirds of the patient's maintenance fluid rate should be considered. Potassium (K) can be added to fluids based on patient requirements. For patients with severe hypernatremia (Na > 155 mEq/L), consider urine replacement with D5W, **NOT** to exceed 6 mL/kg/hour of enteral (PO)/IV intake.

AVP-D:
In addition to fluid replacement, vasopressin, an ADH analog, can be administered as a continuous IV infusion and titrated to maintain the patient's UOP. After the patient has stable Na concentrations (140 – 155 mEq/L) and UOP (1 – 3 mL/kg/hour), transitioning to desmopressin (DDAVP) can be considered. DDAVP is an ADH analog that can be administered enterally, intranasally (IN), subcutaneously (SQ), or IV. Consider an Endocrinology consult for DDAVP management. It is crucial to monitor for hyponatremia, as water retention can lead to Na concentration changes.

Pharmacologic considerations:

Medication	Starting Dose	Maximum Dose	Comments
DDAVP (enteral)	See below for further guidance	**---**	**Consult Endocrinology for IV or SQ dosing**
vasopressin (IV)	0.5 milliunits/kg/HOUR	10 milliunits/kg/HOUR	Titrate by 0.5 milliunits/kg/HOUR no more frequently than every 30 minutes to a maximum of 10 milliunits/kg/HR to maintain UOP goal

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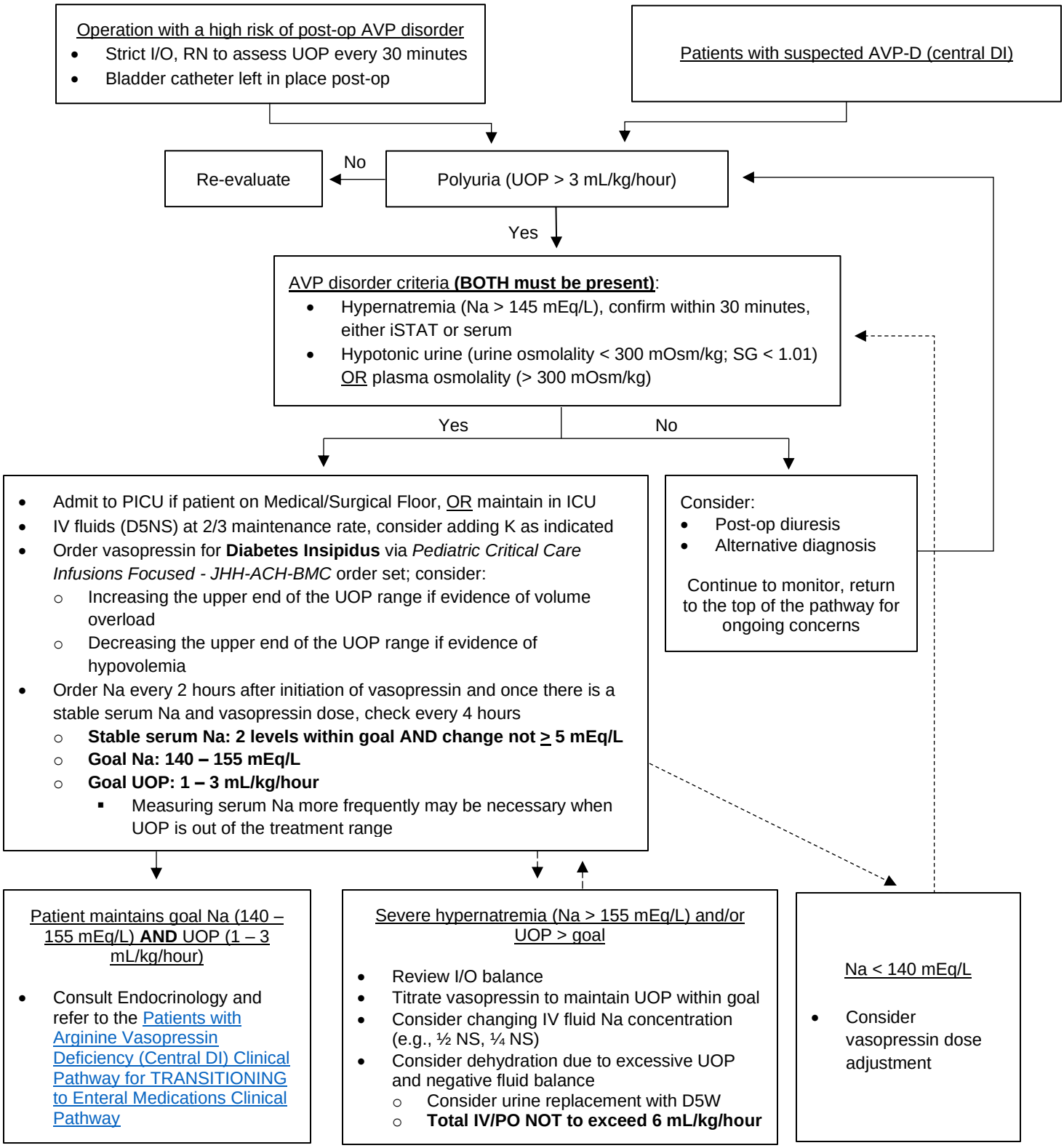
Patients with SUSPECTED Arginine Vasopressin Deficiency (Central DI) Clinical Pathway



Abbreviations: ICU, Intensive Care Unit; I/O, ins/outs; PICU, Pediatric Intensive Care Unit; RN, registered nurse; SG, specific gravity

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Patients with Arginine Vasopressin Deficiency (Central DI) Clinical Pathway for TRANSITIONING to Enteral Medications Clinical Pathway

Criteria for transition off vasopressin to enteral DDAVP

The patient's neuro status is adequate for the patient to maintain appropriate fluid intake

OR

The patient can tolerate enteral therapy and fluid intake

AND

The patient's UOP and Na are stable, defined as:

- **Stable serum Na: 2 levels within goal AND change not ≥ 5 mEq/L**
- **Goal Na: 140 – 155 mEq/L**
- **Goal UOP: 1 – 3 mL/kg/hour**

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Step 1: Preplanning – Order DDAVP and consult Endocrinology

- < 1 year: Per Endocrinology
- 1 – 11 years: 0.025 mg (25 mcg) enteral Q12h
- ≥ 12 years: 0.05 mg (50 mcg) enteral Q12h

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Step 2: Transition

- Place an order to allow free, unrestricted access to water
  - Ensure the diet order is placed
  - Anticipate inadequate thirst mechanism (must know daily fluid requirements) and monitor every 6 – 8 hours for inadequate intake
- Administer enteral DDAVP and stop vasopressin **1 hour AFTER DDAVP** administration
- Of note:
  - Enteral DDAVP takes ~1 hour to see ADH effects
  - Effects may be diminished if taken with meals
  - Goal is to achieve Q12h dosing (0800/2000)
- Order the next dose of DDAVP to the bedside no later than 1 hour before the anticipated administration time
- Order monitoring parameters:
  - Strict I/O's
    - RN to check/weigh diapers/UOP Q2h
  - Serum Na every 6 hours (during 1st 24 – 48 hours) while the DDAVP dose is being titrated
    - ****Timing of Na should be 2 hours BEFORE the next DDAVP for treatment determination** (see below)
    - Calculate UOP during the 6-hour interval between two blood tests
  - Treatment determination:
    - If UOP is < 2 mL/kg/hour OR serum Na is < 135 mEq/L, consider holding DDAVP (notify Endocrinology)
    - If UOP is > 4 mL/kg/hour OR serum Na is > 155 mEq/L, consider increasing free water, monitor UOP and Na level at 6 hours; if Na and UOP do not improve, contact Endocrinology to discuss an additional dose of DDAVP

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Step 3: Titrate DDAVP to achieve Q12h dosing at 0800/2000

Consider transfer to the Medical/Surgical Floor

Abbreviations: NPO, nothing by mouth

Endocrinology ONLY: *DDAVP IV can be given SQ in patients who are not tolerating enteral or made NPO

The dose is 0.02 - 0.08 mcg SQ once or twice daily [Srivatsa]

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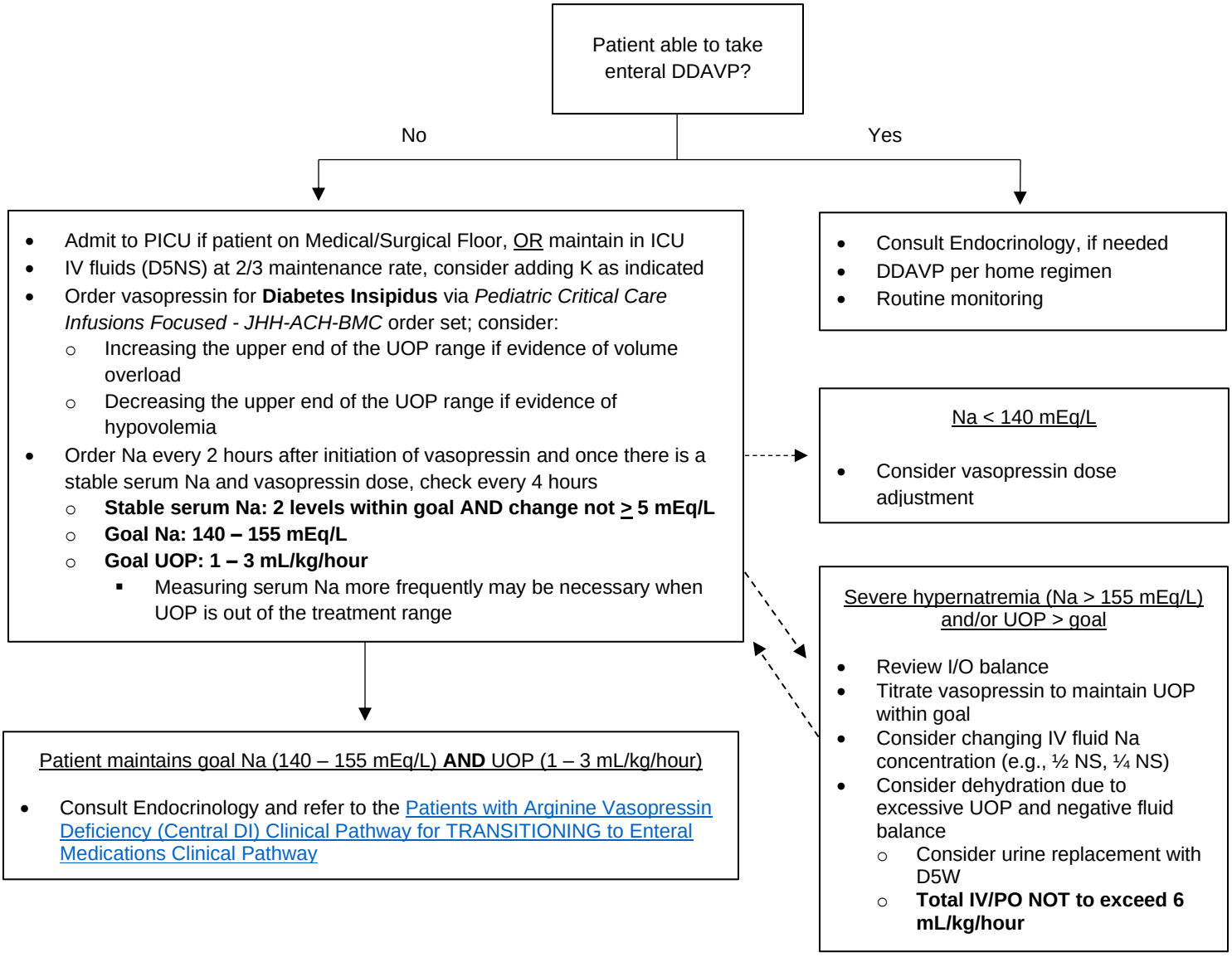
Patients with KNOWN Arginine Vasopressin Deficiency (Central DI) Clinical Pathway



AVP-R:
Correct the underlying cause and, if possible, discontinue the offending agent. A low-solute diet may decrease UOP. Other treatment options include thiazide diuretics and DDAVP. Consider a Nephrology consultation.

References:

1. Ghirardello S, Hopper N, Albanese A, Maghnie M. Diabetes insipidus in craniopharyngioma: postoperative management of water and electrolyte disorders. J Pediatr Endocrinol Metab. 2006 Apr;19 Suppl 1:413-21.
2. Grace M, Balachandran V, Preethy. Menon S. Idiopathic central diabetes insipidus. Indian J Med Sci. 2011 Oct;65(10):452-5.
3. Hadjizacharia P, Beale EO, Inaba K, Chan LS, Demetriades D. Acute diabetes insipidus in severe head injury: a prospective study. J Am Coll Surg. 2008 Oct;207(4):477-84.
4. Hui C, Khan M, Khan Suheb MZ, et al. Arginine Vasopressin Disorder (Diabetes Insipidus) [Updated 2024 Jan 11]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470458/
5. Nemergut EC, Zuo Z, Jane JA, Laws ER. Predictors of diabetes insipidus after transsphenoidal surgery: a review of 881 patients. J Neurosurg. 2005 Sep;103(3):448-54.
6. Seckl J, Dunger D. Postoperative diabetes insipidus. BMJ. 1989 Jan 07;298(6665):2-3.
7. Srivatsa A, Majzoub J. Disorder of Posterior Pituitary. *Sperling Pediatric Endocrinology (5th Edition).*2021.*379.*

Outcome Measures:

- Length of stay

Clinical Pathway Team

Arginine Vasopressin Disorder (Diabetes Insipidus) Clinical Pathway

Johns Hopkins All Children's Hospital

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Disclaimer:

Clinical Pathways are intended to assist physicians, physician assistants, nurse practitioners, and other healthcare providers in clinical decision-making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. The ultimate judgment regarding the care of a particular patient must be made by the physician in light of the individual circumstances presented by the patient.

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