**CLINICAL PATHWAY:**
Diabetes Insipidus (DI) Post-operative Neurosurgical Management
PICU Post-operative Monitoring for DI

**Pre-Operative Risk Factors for DI:**
- Hx of nocturia, enuresis

**Inclusion Criteria:**
- Patients ≥ 1 year old undergoing surgery involving the sellar or parasellar regions of the brain

**Exclusion Criteria:**
- Age < 1 year, acute kidney injury or chronic kidney disease

- Record fluid management intra-operatively
- Admit to PICU post-operatively and follow care below for 48 hrs
- If DI criteria** present immediately post-operatively, proceed to page 2 (DI management)
- Neurosurgery to stress dose hydrocortisone post-operatively; wean per endocrine until cysotropin stim test performed

**CLINICAL PATHWAY: Diabetes Insipidus (DI) Post-operative Neurosurgical Management PICU Post-operative Monitoring for DI**

**GOAL: INTAKE = OUTPUT**
*METICULOUS TRACKING OF INTAKE AND OUTPUT IS ESSENTIAL*

**Access:**
- Maintain A-line for the lab draws x36 hours. If necessary, second IV line can be placed

**Baseline Intake:**
- D5 ½ NS with 20 mEq KC1/L at maintenance rate
- If able to PO:
  - Encourage all PO intake from single volumetric container in order to maintain accurate intake record
  - Ensure drinking water available to patient at all times
- If unable to PO:
  - Continue IVFs at maintenance with careful monitoring of output

**Output:**
- Daily weights
- Continue foley catheter x24-48 hrs until one of the following criteria is met:
  - Patient can urinate into urinal/phant or
  - Foleys was in place for 48 hrs
- Strict recording of urine output q1hr for 12 hrs, then may space to q2hr x 36 hrs
  - Enter into Epic hourly (in addition to paper record keeping)

**Sodium >145 mEq/L OR an increase in 8 mEq/L in 1 hr OR**
Urine output > 4 ml/kg/hr for 2 consecutive hours OR >6 ml/kg/hr for 1 hr

**NO**
- Continue post-op monitoring above in the PICU for 48 hrs

**YES**
- Obtain STAT serum sodium, serum osm, urine osm
- If UOP > 6 ml/kg/hr OR iSTAT Na > 150 mEq/L:
  - Consider starting vasopressin infusion while waiting for serum labs (see DI Management for order specific)
  - If possible, allow patient to drink freely OR increase IVF rate to 1.5 maintenance

**Continue monitoring for 72 hrs post-op:**
- I&O monitoring q2hr until UOP < 6 ml/kg/hr
- iSTAT Na 2q2hr until Na < 145 mEq/L
- Continue replacement PO intake OR IVF @ 1.5 maintenance rate
- If started on vasopressin infusion while awaiting labs and patient does NOT have DI, titrate drop-down and discontinue per Endocrine
- Continue to assess for DI criteria, even if transferred to IVS floors

**DI criteria met?**

**NO**

**YES**
- Proceed to page 2 (DI Management)

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Diabetes Insipidus diagnosed if all of the following are met:
- Serum sodium >145 mEq/L or an increase in 8 mEq/L in 1 hr
- Serum osmolality >300 mosm/kg H2O
- Urine osmolality <300 mosm/kg H2O
- Urine output > 4 ml/kg/hr for 2 consecutive hours or >6 ml/kg/hr for 1 hr

**MEDICATION**
- Order STAT Vasopressin IV infusion at 0.5 ml/kg/hr (max vasopressin dose of 5 ml/kg/hr)
  - Call pharmacy in order to ensure timely (<30 min) delivery of the medication
- Titrations of Vasopressin
  - Titrations for UOP:
    - Increase vasopressin by 0.5 ml/kg/hr every 30-60 min until UOP < 3 ml/kg/hr (max vasopressin dose of 5 ml/kg/hr)
  - If UOP < 1 ml/kg/hr x 2 hrs:
    - Decrease vasopressin by 0.2 ml/kg/hr each hour, to no lower than 0.2 ml/kg/hr
  - If UOP increases while decreasing vasopressin:
    - Increase infusion back up to the last rate

*(if UOP remains >4 ml/kg/hr after 4 hr on vasopressin: notify endocrine

**INTAKE/OUTPUT**
- **GOAL: INTAKE = OUTPUT**
- Meticulous tracking of intake and output is essential
- **Access:**
  - Maintain A-line and Foley catheter as long as patient is on vasopressin
- **Baseline intake:** record 24hr
  - If able to PO:
    - Discontinue/wean IVFs with goal of matching intake to output
    - Encourage all PO intake from single volumetric container in order to maintain accurate intake record
    - Ensure drinking water available to patient at all times
  - If unable to PO:
    - Change IVFs to DS 5% NS w/20 mEq KCl/l at maintenance rate
    - Once tolerating PO, allow PO intake to thirst and discontinue/wean IVFs with goal of matching intake to output
    - If unable to maintain PO (ie, input is <50% of output in the last 4 hours), use DS 5% NS to replace 1:1 in ml UOP minus PO intake, every 4 hours or sooner if needed (ie., younger children have larger outputs)
- **Output:** measure q1hr
  - Strict recording of urine output (UOP) q1hr
  - **If Na > 155 mEq/L:**
    - Place 2nd line for access
    - Calculate free water deficit and replace with D5W over 12 hours ONE TIME within 24 hours, to a goal serum Na of >150 mEq/L
  - Rate of serum sodium decrease should be approximately 0.5 mEq/L/hr

**LABS**
- Serum sodium q2hr in the first 24 hrs after diagnosis; then can space out to q4hr
  - If Na > 155 mEq/L at any time, must obtain 2nd line access and replace free water deficit**
- Urine Osm q12hr

**MEDIICATION**
- If sodium ≥140 mEq/L, start Desmopressin (DDAVP):
  - 34 yrs old:
    - Initial: 0.05 mg PO once to twice daily
    - Titrate to optimal daily dose range: 0.1 – 0.8 mg/d in 2 divided doses
  - <4 yrs old:
    - DDAVP subQ
    - SubQ initial dosage: 0.05 mg/kg
    - Dosing range of 0.1 – 1 mg/kg daily subQ
- If sodium <135 mEq/L:
  - HOLD DDAVP and call endocrine

**LABS**
- Serum sodium q4hr

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**CLINICAL PATHWAY:**
Diabetes Insipidus (DI)
Med/Surg Management of DI

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**Monitoring:**
- Meticulous tracking of intake and output q4hr is essential
- Vitals q4hr
- Labs q12hr and are dependent upon thirst (see below)

If more frequent monitoring of vital signs and I&Os are required, consider transfer back to PICU.

**Medications**
- Continue DDAVP dose established in PICU prior to transfer to Med/Surg
- If treatment goals are not met, additional DDAVP titration to the optimal range may be required:
  - 24 yrs old:
    - Initial: 0.05 mg twice daily PO
    - Titrate to optimal daily dose range: 0.1 – 0.8 mg/day in 2 divided doses
  - <4 yrs old:
    - DDAVP subQ
    - SubQ initial: 0.05 mg BID
    - Optimal daily dose range: 0.1 – 1 mg/day daily BID

**INTAKE/OUTPUT**
**METICULOUS TRACKING OF INTAKE AND OUTPUT IS ESSENTIAL**

**Intake**
- Fluid intake goals = fluid maintenance goals for weight/BSA

**If able to drink PO:**
- Set fluid goal per shift (or 1st and 2nd half of the day between DDAVP doses)
- Goal: match intake to output
  - Encourage all PO intake from a single volumetric container in order to maintain accurate intake record
  - Ensure drinking water available to patient at all times

**If poor, or unreliable, PO intake:**
- IVF replacement
  - DS ½ NS with 20 mEq KC1/L at maintenance rate
  - Once tolerating PO, allow PO intake to thirst and discontinue/use IVF to match goal intake = output
  - If unable to keep up with PO: use DS ½ NS 1:1 replacement
  - Consider NG/PEG for long term management

**Output**
- Intake = Output (1-2 ml/kg/hr)

**LABS**
- iSTAT or serum sodium q12hr
  - Draw before DDAVP doses if twice daily (or before AM DDAVP dose if on once a day dosing)
  - Urine osm q12hr

**Are both of the following treatment goals met?**
- Input = Output
- Na+ 135-150 mEq/L

**If input does not equal output:**
- Follow recommendations above to meet treatment goals for 24 hours:
  - DDAVP titration, and
  - Adjust fluid goals based on thirst

**If Na+ goals not met:**
- If Na+ <135 mEq/L:
  - Hold DDAVP and assess input and output
- If Na+ >150 mEq/L:
  - Titrate DDAVP and/or increase fluid volume
- If Na+ >155 mEq/L AND UOP >4 ml/kg/hr:
  - Consider transfer back to ICU for ICU level of care

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**Consider discharge home.**

**Discharge criteria:**
- Stable treatment goals for at least 24 hours on established DDAVP doses
- Family education/expectations and outpatient follow up plan completed and in place

**Discharge Instructions:**
- Discharge instructions and education by endocrine

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