|  |  |
| --- | --- |
| **Case Title** | Pediatric DKA |
| **Scenario Name** | Undiagnosed DM |

|  |  |
| --- | --- |
| **Learning Objectives -** [**Use action words**](http://ubccpd.ca/sites/ubccpd.ca/files/Accreditation_Learning%20Objectives_%20Verbs.pdf) | |
| **Knowledge:**   1. Recognize acidosis, hyperglycemia, prerenal azotemia, and co-existent hyperglycemic hyperosmolar state 2. Recognize frequency of subclinical cerebral edema in DKA | |
| **Skills:**   1. Demonstrate effective management of DKA, hyperglycemic hyperosmolar state and suspected cerebral edema 2. Demonstrate intubation of a pediatric patient | |
| **Attitude/Behaviours:**   1. Demonstrate Team skills 2. Demonstrate Situational awareness 3. Demonstrate Graded Assertiveness | |
| **Scenario Environment** | |
| **Location** | ED |
| **Monitors** | Cardiac, BP, pulse oximeter |
| **Props/Equipment** | Video – Kussmaul Respirations, #10 F foley with urometer, Ondansetron, IV infusion supplies, insulin infusion supplies, Calcium Gluconate, Mannitol, NaCl 3%, RSI meds  DKA protocol, flow sheets |
| **Make-up/Moulage** | None |
| **Potential Distractors** | None |

|  |
| --- |
| **Case Introduction:** |
| 8 year old boy is brought in by grandparents to ED with a 2 week hx of fever and lethargy |

| **Patient Parameters** | **Effective Management** | **Notes** |
| --- | --- | --- |
| **Phase 1: Initial Presentation**  **Condition:** Looks unwell. Decreased LOC, flushed cheeks, dry mucous membranes. c/o abd pain. Intermittent crying  ***\*\*recommend playing video of Kussmaul Breathing***  **Initial Assessment**   * **Heart Rhythm:** ST * **HR:** 160 * **BP:** 84/50 * **Glucose:** *Critical high (provide when asked)* * **RR:** 40 * **SP02:** 97% RA * **T:** 37.4 * **CNS:** GCS 13 (E-3, V-4, M-6). Drowsy. PERL * **Chest:** Kussmaul resps, lung fields clear * **CVS:** normal HS, cap refill <2 secs, peripheral pulses weak, pale * **GI:** mild diffuse tenderness, no mass * **Other:** mouth/lips very dry and crying a few tears. Flushed cheeks. * **Weight:** 20 kg | 1. **Take a focused history and assessment** (see Notes column) 2. **Medical Management**  * Ask for bedside BGM *(Critical High)* * Identifies likely DKA & initiate DKA protocol (*provide link to IH/BCCH PEDIATRIC DKA Protocol #829660 (fillable pdf), and corresponding IH PEDIATRIC DKA Pre-printed Physician Orderset #829659)* * Obtain weight (20 kg) * Monitors, vital signs, GCS * Obtains IV access * Keep NPO, Strict I/O * Establish extent of dehydration and calculate IV fluid needs (Give group a copy of *IH/BCCH PEDIATRIC DKA Protocol #829660 and corresponding IH PEDIATRIC DKA Pre-printed Physician Orderset #829659* to follow).   + Bolus: NS bolus of 10 mL x 20 kg = 200 mL over 30 mins   + Determine if an additional bolus is necessary (consider persistent tachycardia,   prolonged cap refill (greater than 2 sec), cool extremities)   * + Replacement: *see IH/BCCH PEDIATRIC DKA Protocol #829660* * STAT venous blood gas; whole blood sodium, potassium, chloride, bicarbonate, anion gap, total calcium, glucose, urea, creatinine, phosphorus, CBC, HbA1c * Urine dip – ketones, glucose, infection * Uses appropriate replacement pending labs * Consider possibility of underlying infection. Monitor abd pain. Consider starting abx * Monitor for cerebral edema   **Consequences of ineffective management**   * IV fluids should be used judiciously. If >10 mL/kg over 30-60 mins with max 30 mL/kg, then progress to Phase **2A: Cerebral Edema** * Insulin boluses are contraindicated. Insulin in the first 1-2h of DKA repair is thought to increase mortality. | 1. **Focused history**  * 2-week history of fever and lethargy * Very unwell in last 24 hours – excessively drowsy, very poor energy, difficulty breathing, abdominal pain, no vomiting   **PMHx**   * Healthy   **Meds**   * None grandparents are aware of   **Allergies**   * None grandparents are aware of   **Airway**   * Patent   **Breathing**   * Kussmaul breathing   **Circulation**   * Sinus Tachycardia * Hypotension   **To calculate systolic hypotension in pts age 1-10:** 70 mmHg + (2 x years in age) (=86 for this pt) |
| **Phase 2A: Cerebral Edema** *(Go to Phase 2B if IV fluid bolus given correctly)*  **Condition:** Falling LOC. Eyes closed. Widening pulse pressure, bradycardia, irregular respirations.  **Physical Examination**   * **Heart Rhythm:** S * **HR:** 70 * **BP:** 150/40 * **RR:** 30 (irregular) * **SP02:** 95% RA * **T:** 38.3 * **Glucose:** 53.1 *(when results provided)* * **CNS:** GCS 8 (E-2, V-3, M-3). Grumpy and tired, mumbling, eyes closed * **Chest:** no changes * **CVS:** normal HS, capillary refill 2 seconds, peripheral pulses bounding | 1. **Patient Reassessment** (see Notes column) 2. **Medical Management**  * Recognizes change in LOC, intubates with RSI * Recognizes cerebral edema and Cushing’s triad (widening pulse pressure, bradycardia, irreg resps) and orders the following:   + Maintain HOB at 30°   + Decrease IV to 5-10 mL/h   + Mannitol (0.5-1 g/kg) IV over 20 minutes OR NaCl 3% (5-10 mL/kg) IV over 30 minutes * *Lab results are in – provide results* * Confirmation of DKA * Recognizes co-existing prerenal azotemia * Changes IV to NS if not currently using   ***Progress to Phase 4 once intubated AND Mannitol/NaCl 3% given*** | 1. **Patient Reassessment**   **Airway**   * Not protected, needs to be intubated   **Breathing**   * Irregular   **Circulation:**   * Hypertensive |
| **Phase 2B: Condition Unchanged**  **Condition:** Unchanged. Parents arrive/contacted – provide further history  **Physical Examination**   * **Heart Rhythm:** ST * **HR:** 160 * **BP:** 94/50 * **RR:** 38 * **SP02:** 98% RA * **T:** 37.5 * **Glucose:** 53.1 *(when results provided)* * **CNS:** GCS 13 (K-3, V-4, M-6). Sleepy. * **Chest:** no changes * **CVS:** normal HS, capillary refill 2 seconds, peripheral pulses still weak | 1. **Patient Reassessment** (see Notes column) 2. **Medical Management**  * *Lab results are in – provide results* * Confirmation of DKA * Recognizes co-existing prerenal azotemia * Changes IV to NS if not currently using | 1. **Patient Reassessment**   **Further History From Parents**   * Excessive drinking, bedwetting and increasing tiredness * “Growing but not gaining weight” * Drinking “lots of pop” * Voiding frequently but volume is decreasing * Progressively lethargic * Family Hx: mom has hypothyroidism   **Airway**   * Reassess no change   **Breathing**   * Reassess no change Kussmaul Breathing   **Circulation:**   * Reassess HR/BP, cap-refill * Cycles HR/BP q5-10mins |
| **Phase 3: Less Responsive**  **Condition:** Less responsive. Sleepy. Slightly dropping GCS.  **Physical Examination**   * **Heart Rhythm:** ST * **HR:** 120 * **BP:** 110/60 * **RR:** 24 * **SP02:** 95% RA * **T:** 37.5 * **CNS:** GCS 8 (E-2, V-3, M-3). Grumpy and tired, mumbling, eyes closed * **Chest:** resps a bit less laboured | 1. **Patient Reassessment** (see Notes column) 2. **Medical Management**  * Intubates with RSI * Continues DKA protocol * Rechecks fluid rate and calculations * Considers impending cerebral edema | 1. **Patient Reassessment**  * Identifies change in CNS, reassess   **Airway**  **▪** Not protected  **Breathing**  ▪ A little less labored resps  **Circulation**  **▪** Reassess HR/BP, cap refill  ▪ Hydration |
| **Phase 4: Intubated and Stabilized**  **Condition:** Intubated and ventilated.  **Physical Examination**   * **Heart Rhythm:** ST * **HR:** 100 * **BP:** 106/68 * **RR:** ventilated * **SP02:** 98% vent * **CNS:** Intubated and sedated. * **Chest:** lungs clear | 1. **Patient Reassessment** (see Notes column) 2. **Medical Management**  * Admission to ICU or transfer to tertiary center * Bedside glucose q30-60 mins * Orders repeat BW q2-4 hrs * Indicates after 1-2 hours from presentation will:   + Begin “2 bag-method” protocol (*per IH/BCCH PEDIATRIC DKA Protocol #829660 sum of Bag A rate + Bag B rate determined from DKA protocol, line 8, to keep glucose btw 8 to 12 mmol / L)*   + **Bag A: sodium chloride 0.9% + 40 mEq / L potassium chloride**   + **Bag B: dextrose 10% / sodium chloride 0.9% + 40 mEq / L potassium chloride**   + **Insulin Infusion/Bag C: 50 units insulin regular (i.e. Humulin® R or Novolin® Toronto) in 500 mL sodium chloride 0.9%** (*per IH/BCCH PEDIATRIC DKA Protocol #829660line 7, where 1 mL / kg / hour = 0.1 units / kg / hour)* | 1. **Patient Reassessment**   **Airway**  **▪** Intubated  **Breathing**  ▪ Ventilated  **Circulation**  **▪** Hemodynamically stable |

|  |  |
| --- | --- |
| **Expected Patient Management** | **Debriefing Points** |
| 1. **Student** 2. **R1** 3. **Senior IM resident** |  |

**References:**

[**IH Pediatric DKA Toolkit**](http://insidenet.interiorhealth.ca/Clinical/Diabetes/Pages/DKA.aspx) **(revised 2020)**



**LABS – click** [here](https://extranet.interiorhealth.ca/IHUBCFaculty/Diagnostics/Forms/AllItems.aspx?RootFolder=%25252FIHUBCFaculty%25252FDiagnostics%25252FLabs&View=%25257bFD97E2FE-FD01-433F-B9CB-D75A4195924E%25257d) **OR fill out below**

LABORATORY \*LIVE\* Lab Summary Report

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **DATE/TIME here** | | **Flag** (H or L) | **Reference** |
| **CBC** | | | | |
| WBC | | **31.0** | **H** | 3.5 – 10.8 10^9/L |
| Neutrophils | | **26.97** | **H** | 1.50-7.40 10^9/L |
| Lymphocytes | | 2.17 |  | 1.00-3.60 10^9/L |
| Monocytes | | **1.24** | **H** | 0.10-0.70 10^9/L |
| RBC | | **5.1** | **H** | 4.3 – 5.7 10^12/L |
| Hgb | | **172** | **H** | 130 – 170 g/L |
| HCT | | **0.51** | **H** | 0.37 – 0.47 L/L |
| MCV | | **100.4** | **H** | 84.0 – 98.0 fL |
| MCH | | 34.1 |  | 28.3 – 33.5 pg |
| MCHC | | 339 |  | 329 – 352 g/L |
| RDW | | 13% |  | 12.0/15.0 % |
| Platelets | | 242 |  | 150 – 400 10^9/L |
| **Chemistry** | | | | |
| Na | | **126** | **L** | 137 – 145 mmol/L |
| K | | **6.0** | **H** | 3.5 – 5.0 mmol/L |
| Cl | | **88** | **L** | 98 – 107 mmol/L |
| HCO3 | | **<5** | **L** | 22-26 mmol/L |
| Urea | | 6 |  | 2.5 – 6.1 mmol/L |
| Creat | | **131** | **H** | 62 – 106 umol/L |
| Alkaline Phosphatase | | **276** | **H** | 62-209 U/L |
| AST | | **31** | **H** | 10-30 U/L |
| Lacatate Dehydrogenase | | 683 |  | 340-750 U/L |
| GGT | | **29** | **H** | 10-23 U/L |
| ALT | | 28 |  | 6-30 U/L |
| Lipase | | 40 |  | 10-220 U/L |
| Glucose - Random | | **53.1** | **H** | 3.0 – 11.0 mmol/L |
| Lactate | | **6.0** | **H** | 0.9 – 1.8 mmol/L |

|  |  |  |  |
| --- | --- | --- | --- |
| **ABGs** | | | |
| **Arterial** | | | |
| pH | **7.03** | **L** | 7.35- 7.45 |
| pCO2 | **9** | **L** | 35 – 45 mmHg |
| PO2 | **164** | **H** | 80-100 mmHg |
| BE | **-26.1** |  | -2.0 to +2.0 mmol/L |
| HCO3 | **2** | **L** | 22 – 26 mmol/L |
| O2 Sat |  |  | 95 – 100% |