

# Guidelines for the Management of Adult Patients with DKA in the ED

DIAGNOSIS		INITIAL EVALUATION									
<p><b>Diabetic Ketoacidosis (DKA)</b> BGL &gt;11mmol/L or known diabetes pH &lt;7.3 HCO<sub>3</sub> &lt;15mmol/L Serum/urine ketones elevated Euglycaemic DKA can occur in:</p> <ul style="list-style-type: none"> <li>- pregnancy</li> <li>- pre-hospital insulin</li> <li>- reduced oral intake</li> <li>- patients on SGLT2 inhibitors</li> </ul>	<p><b>Hyperosmolar Hyperglycaemic State (HHS)</b> BGL Often high &gt;28mmol/L pH &gt;7.3 HCO<sub>3</sub> &gt;15 Ketones can be present but low (&lt; 3mmol/L) Osmolality &gt;320mosmol/L Undiagnosed or known type II DM Hypernatraemia in 50% cases ALOC spectrum confusion to coma</p>	<p><b>Resuscitation within the ABCDE system assumed, ask for help</b> Airway patent or controlled, breathing maintained and IV access with two lines, monitored Commence IV Fluids Lab - VBG (seek result if not bedside), finger prick BSL, POC serum ketones - FBC / UEC / Osmolality / Lipase / Mg / PO4 / BHCG** / BC / Coags Urine - U/A / MCS / Ketone / BHCG ECG, Chest X-Ray Admit ICU/Endocrine, involve early</p>									
<p><b>CRITERIA FOR ICU/HDU MANAGEMENT OF DKA / HHS</b></p> <ol style="list-style-type: none"> <li>1. Haemodynamic Instability</li> <li>2. Inability to protect airway</li> <li>3. Obtundation</li> <li>4. Presence of abdominal distension or succussion splash (acute gastric dilatation)</li> <li>5. Insulin infusion (varies in different institutions)</li> </ol>		<p><b>TRENDS</b> <b>Vital signs</b> - Temp, PR, BP, SatO2 ongoing <b>Glucose</b> - (VBG, ABG, ketones finger prick) – q1H <b>Lab EUC/BSL</b> - q2H (X3), then q4H until normalisation of levels <b>Ketones</b> - q4H until clearance( blood levels give more immediate result) <b>Unstable patients</b> - Arterial BP, CVP when available</p>									
FLUIDS	INSULIN	POTASSIUM	OTHER THERAPIES								
<ol style="list-style-type: none"> <li>1. Fluid overload in elderly / cardiac / renal patients – Consider CVP, caution in young and adolescent patients when not shocked</li> <li>2. Difficult IV access consider external jugular vein, intraosseous or central access initially</li> <li>3. Fluid deficits = 5-10L are common in DKA and HHS adults</li> <li>4. Monitor haemodynamics, hydration, and urine output</li> <li>5. Balanced fluids such as Plasmalyte carry less risk of hyperchloraemic acidosis</li> <li>6. Some institutions and guidelines use Normal Saline</li> </ol> <p><b>Volume of Fluids and rate, resuscitation phase</b> Resuscitate shocked patients with 10ml/Kg boluses to systolic&gt;90 Then 1L in 1<sup>st</sup> Hour (adult), 10mL/kg (children) THEN 500mLs/hr for hrs 2 and 3 250mLs/hr for hrs 4-6 and review fluid state</p> <p><b>When circulation is stable</b> Note: - Ongoing fluids, we suggest use Plasmalyte - If NS used in resuscitation then use 0.45% Saline reduces risk of hyperchloraemic acidosis and non- AG acidosis - Aim to correct remaining fluid deficit gradually over next 24-48h Match with urine output (U/O) + 100-200mL/h</p> <p><b>ADD 5%-10% Dextrose when BGL &lt;15 mmol/L</b> Can run concurrent Dextrose solutions and adjust other infusions so same total fluids/hour or add dextrose to existing fluids -Titrated to maintain BGL around 10-15 during insulin infusion - Increased sugar requirements in late pregnancy (2 times)</p> <p><b>Continue dextrose / Insulin until Ketones* / AG clearance and patient tolerating fluids PO</b> <i>*serum ketones earlier and more reliable detection than urine</i></p>	<ol style="list-style-type: none"> <li>1. Give fluids, resuscitate</li> <li>2. <b>Delay in pts with severe K+ (&lt;3.0), until K+ replacement</b></li> <li>3. No Bolus insulin</li> <li>4. Check pump hourly</li> <li>5. HHS pts may be very sensitive to exogenous insulin</li> <li>6. Patients with SC insulin pump <ul style="list-style-type: none"> <li>• safer to disconnect pump, start iv insulin</li> <li>• for mild DKA, interrogate pump/flow issue, may discuss with endocrinologist</li> </ul> </li> <li>7. Monitor – hourly BGL, POC ketones, fluid status</li> <li>8. Give usual basal long acting insulin doses SC at the usual time concurrent with infusion</li> <li>9. Consider use of Regular SC Rapid acting insulin regimens for mild to moderate DKA, DW your endocrine team</li> </ol> <p><b>INFUSION:</b> <b>50 units ACTRAPID in 50mLs 0.9% Saline via Syringe</b></p> <p>NB: Flush 10mL of solution through tubing before connecting to patient</p> <ol style="list-style-type: none"> <li>A. Start Insulin infusion at 0.1units/kg/h, measure blood ketones and glucose (POC) hourly</li> <li>B. Target change, fall ketones 0.5mmols/hr, rise HCO<sub>3</sub> 5mmols/hr</li> <li>C. Titrated only if no ( increase by 1U/hr) or excessive response initially</li> <li>D. In ED setting usually do not reduce rate</li> <li>E. Taper/transition to SC insulin with advice from endocrine admitting team.</li> </ol> <p>In HHS patients, endpoint of treatment is based on normalisation of osmolality and normal mental LOC</p>	<p>Note:</p> <ol style="list-style-type: none"> <li>1. Insulin infusion will drop K+ levels = risk</li> <li>2. Exclude Hyperkalaemia</li> <li>3. Ensure Urine output &gt;30mL/hr</li> <li>4. Generally KCL is given (consider other preparation to avoid excess Chloride)</li> </ol> <p><b>POTASSIUM</b></p> <p><b>REPLACEMENT</b></p> <table border="1"> <tr> <td>K<sup>+</sup> &gt;5</td> <td>Nil</td> </tr> <tr> <td>K<sup>+</sup> 4 – 5</td> <td>20mmol/L in replacement fluid</td> </tr> <tr> <td>K<sup>+</sup> 3 – 4</td> <td>30-40mmol/L in replacement fluid or via separate infusion pump</td> </tr> <tr> <td>K<sup>+</sup> ≤3</td> <td>40-60mmol/L in replacement fluid or via separate infusion pump, central access required if given at rate &gt;10mmol/H</td> </tr> </table>	K <sup>+</sup> >5	Nil	K <sup>+</sup> 4 – 5	20mmol/L in replacement fluid	K <sup>+</sup> 3 – 4	30-40mmol/L in replacement fluid or via separate infusion pump	K <sup>+</sup> ≤3	40-60mmol/L in replacement fluid or via separate infusion pump, central access required if given at rate >10mmol/H	<p>Consider:</p> <p><b>HCO<sub>3</sub> replacement, generally NO.</b> Consider if pH &lt; 6.9 (in setting of high K+ or arrhythmias or HCO<sub>3</sub> ≤ 5), consult widely May be beneficial if resuscitated with NS and hyperchloraemic acidosis</p> <p><b>Heparin for HHS cases</b> Note that large vessel arterial thrombosis and embolisation are common events Low dose heparin provided no clinical evidence of thrombosis</p> <p><b>Hypo/HyperNa</b> Stabilize circulation with Plasmalyte Then consult senior ED, endocrine, ICU (corrected Na+ = [(Glucose – 10) ÷ 3] + measured Na+) (Lab “flame techniques)</p> <p><b>Phosphate / Magnesium replacement</b> PO4&lt;0.32 - K2PO4 20mmol over 6 hours Mg&lt;0.6 – MgSO4 2g over 4h</p> <p><b>Empirical/directed Antibiotics with sepsis</b> See Sepsis guidelines (link)</p>
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PRECIPITATING EVENTS		MAIN CAUSES OF DEATH									
<p><b>DKA</b> Infection (Temp and WCC not helpful) New onset diabetes / Poor compliance Acute abdomen (pancreatitis) / Alcohol / Drugs Silent MI / CVA (older patients) / Trauma Steroids</p>	<p><b>HHS</b> New onset diabetes AMI Acute abdomen Any serious / significant physiological / metabolic event</p>	<p><b>DKA</b> Hyper / hypokalaemia / Hypoglycaemic Aspiration (gastroperesis) ARDS Comorbid conditions, AMI, Sepsis Cerebral oedema (rare in adults, 0.3-1% in children)</p>	<p><b>HHS (5-20% Mortality)</b> Aspiration Pre-existing pathology Cerebral oedema</p>								