Perioperative Management of Diabetes

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Diabetes in Nepal

• 19.0% above the age of 40 have diabetes in urban area Shrestha Diabet Med 23 (2006) 1130

• 25.9% above the age of 60 have diabetes Chhetri Nepal Med Coll J 11 (2009) 34

• More than half of these were newly diagnosed on screening
Surgery in DM very common

- 20% of surgical patients have diabetes (Clement, Diabetes Care 2004)
- 50% of DM need surgery in their life time (Root, Postgrad Med 1966)
- Number of diabetic subjects increasing
Perioperative problems

- Stress response to surgery with catabolic hormone secretion
- Interruption of food intake, pre- and perhaps post-surgery (also Post Operative Nausea & Vomoting)
- Altered consciousness, masking the symptoms of hypoglycaemia
- Circulatory disturbance that may alter the uptake of s.c. insulin
- The altered physiological state resulting from end organ pathology
DM is associated with

- Increased risk of perioperative infection
- Perioperative MI
- Postoperative Acute kidney injury
- Postoperative cardiovascular morbidity and mortality
- Prolonged hospital stay
Problems in glycaemic control

- Operative procedure
- Anesthesia
- Disrupted meal schedules
- Altered nutritional intake
- Postoperative factors such as sepsis and emesis
Cardiac Risk

- Coronary heart disease is common in individuals with diabetes
- Patients with diabetes have an increased risk of silent ischemia
- Higher risk of peri-operative MI
- Need to focus on cardiopulmonary risk assessment and modification before planned surgery.
Other Risks for Anaesthesia and Postoperative Care.

- Hypertension
- Obesity
- Chronic kidney disease
- Cerebrovascular disease
- Autonomic neuropathy

Need to assess these before planned surgery
History and Examination

- Determination of the type of diabetes as type 1 have risk of DKA.
- Long-term complications of diabetes
- Assessment of glycemic (HbA1C)
- Assessment of hypoglycemia
- Detailed history of diabetes and other therapy
Many patients have other end organ damage

- Chronic Renal Failure
- Congestive Cardiac Failure
- Cardiac Autonomic Neuropathy
- Ischaemic heart disease

Consider cardiac investigations & coronary reperfusion before elective surgery
Background

- No evidence based perioperative management
- Good glycaemic control reduces mortality in critically ill patients by 50% (NEJM, 2001)
- Different hospitals have own management protocol
- No RCT on different protocols
Perioperative goal

• Minimize morbidity
• Avoiding hyperglycaemia and its associated lipolysis, ketogenesis, protein catabolism and electrolyte disturbances
• Avoiding hypoglycaemia
How?

• Provide adequate insulin to counteract the catabolic processes in response to surgery
• Glucose needs to be provided to meet the increased metabolic needs, caused by surgical stress, as well as basal metabolic requirements
• A simple regimen that is immune to error
Factors that need to be considered

- Glucose
- Insulin
- Potassium
- Fluids
Need Standard Protocol

• Agreed by surgeons, Anaesthetists & Physicians

• Simple, Short & Comprehensive

• Readily available

• Accessible in electronic format
Once Surgery Planned

- Screen for diabetes
- Remember to check HbA1c along with routine bloods
- Ask patient to contact their diabetes care provider to improve their control
- Use of prophylactic beta blocker is controversial

Diabetes control can be improved within 3 months with intensive treatment
Principle of management

• Choose a treatment regime from the table.
• Check U&E before IV infusion in the morning
• Start IV insulin infusion as needed
• Adjust infusion rate & potassium content if abnormal
• Monitor blood glucose regularly
• Maintain blood glucose between 4 to 9 mmol/l
• Contact on call medical team if any problem
<table>
<thead>
<tr>
<th>Types of surgery</th>
<th>Diet only</th>
<th>Tablets</th>
<th>Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not eating &lt; 12 hours</td>
<td>Regime 1</td>
<td>Regime 2</td>
<td>Regime 3/X</td>
</tr>
<tr>
<td>Not eating 12 – 48 hours</td>
<td>Regime 1</td>
<td>Regime 3/X</td>
<td>Regime 3/X</td>
</tr>
<tr>
<td>Emergency and/or poor control</td>
<td>Regime 3/X</td>
<td>Regime 3/X</td>
<td>Regime 3/X</td>
</tr>
</tbody>
</table>
Regime 1
(Observation only)

• Use only in diet controlled diabetic subjects
• Monitor blood glucose 4 hourly
• If blood glucose consistently $>11$ mmol/l on two or more occasions consider regime X or regime 3
Regime 2
(Omission of Oral Hypoglycaemic agents)

- Use only in tablet controlled diabetic subjects
- Stop drugs 6 – 12 hours pre-operatively
- Take 4 hourly blood glucose measurements
- Recommence tablets after patient has tolerated a full meal
- Consider regime X or regime 3 if any problem
Regime X (GIK Infusion) 1

- Discontinue usual insulin / tablets on the day of surgery
- Ideally commence infusion 4 hours preoperatively via a dedicated canula
- 500ml 10% glucose + 10mmol KCl + 10 units insulin. Run at 10 drops/min (= 0.6 U/Hr)
  (20 drops = 1 ml)
- Check blood glucose hourly
- Adjust the infusion as needed
# Regime X (GIK Infusion) 2

<table>
<thead>
<tr>
<th>Blood glucose mmol/l</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 (&lt; 72mg/ml)</td>
<td>Change bag to normal saline</td>
</tr>
<tr>
<td>4 - 9 (72 – 162mg/ml)</td>
<td>Continue same</td>
</tr>
<tr>
<td>&gt; 9 (&gt; 162mg/ml)</td>
<td>Increase rate to 20 drops per min and measure again in one hour. Increase progressively to reach up to 50 drops per minute by increment of 10 drops</td>
</tr>
<tr>
<td>&gt; 9 after 50 drops/min</td>
<td>Change bag with 20 units of insulin and start at 30 drops per minute and increase as before</td>
</tr>
<tr>
<td>BG &lt;4 after increase</td>
<td>Reduce to previous dose</td>
</tr>
</tbody>
</table>

Consider regime 3 if available or develop any problem
Regime X (GIK infusion) 3

- Strength of insulin needs to be doubled after 50 drops per minute to avoid fluid overload (3.5 L per day maximum) and start at 30 drops per minute.
- Infusion to be continued till patient tolerates full meal.
- Discontinue infusion and recommence usual treatment before next meal.
Regime X (GIK infusion) 4

- If patient already on insulin and takes > 100 units of insulin start with 20 Units of insulin in 500ml of 10% Glucose &10mmol KCl.
- Continue process as before
Regime 3 (Insulin sliding scale)

1. Discontinue usual insulin / tablets on the day of surgery.
2. Ideally start infusion 4 hours preoperatively via a dedicated canula. Use other line for N. Saline.
3. Use 10% glucose with 20mmol KCl. Run at 50ml/hour.
4. 50 units human soluble or fast acting analogue insulin in 50ml saline (1unit/ml) to run via syringe driver.
5. Check blood glucose hourly.
6. Start the infusion at sliding scale A (Scale B if daily insulin requirement > 100 units).
## Regime 3 (Insulin sliding scale) 2

<table>
<thead>
<tr>
<th>Blood glucose concentration (mmol/l)</th>
<th>Sliding scale regime</th>
<th>Insulin infusion rates (units/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>0 - 3.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4 – 6.9</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7 – 8.9</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>9 – 10.9</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>11 – 12.9</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>&gt;12.9</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>
Anaesthetic considerations

• Preferably first case in the morning to minimize the starvation period
• The stress imposed by the anaesthetic is usually minor compared to the stress of the surgery.
• The challenge is to give the most stable anaesthesia possible and limit the hyper & Hypoglycaemia
NG feeding after surgery

• Monitor blood glucose before, after 4 hours and after the feed
• If patient on oral medications, can give crushed tablets before feeding
• If patient on insulin, give s/c isophane insulin before overnight feed
Transplant Surgery

KIDNEY

WHOLE PANCREAS

ISLET CELL
Diabetes Complications Following Transplant

- Insulin Resistance
- Steroid complications
- Intercurrent Infection
- Malignancy

- Insulin independence may be achieved in about 75% of Pancreas transplant
- Insulin or OHA requirement may increase in renal transplant subjects on steroid
Post operative decubitus ulcer

• Common in Heel
• Neuropathy and PVD contribute to this
• 100% preventable
• Need to provide adequate off loading in post-operative period.
Summary

- The most important factors are good control of the patient’s perioperative blood glucose concentrations to prevent the acute complications of hyperglycaemia
- The strict avoidance of any hypoglycaemia
- The complications of diabetes should be sought out and the affected organs protected, especially the heart, brain and kidneys
- An aggressive approach to glycaemic control will result in better wound healing, lower mortality and shorter hospital stays
Any Questions ???