Hypoglycaemia in inpatients with diabetes on nasogastric feeding

**Abstract**

Hypoglycaemia in patients with diabetes on nasogastric feeding is both potentially damaging and under-researched. We retrospectively reviewed 50 such inpatients to determine factors influencing hypoglycaemia. Our results showed 10.9% patient-days with ≥1 hypoglycaemic episode and 3.5% total blood glucose values <3.5mmol/L. There was an association between sulphonylurea treatment and increased and extended hypoglycaemia. Reducing diabetes treatment post-hypoglycaemia was associated with reduced subsequent hypoglycaemia but not increased hyperglycaemia.

This study supports optimal blood glucose monitoring, insulin treatment and judicious medication reduction post-hypoglycaemia. Copyright © 2014 John Wiley & Sons. Practical Diabetes 2014; 31(1): 29–31

**Key words**

hypoglycaemia; nasogastric feeding; diabetes; retrospective

**Introduction**

Hypoglycaemia is a common complication of treatment with insulin and sulphonylurea agents. Swift identification and management of mild hypoglycaemic episodes prevent progression to severe hypoglycaemia which has been associated with increased morbidity and mortality.1,4 As has increased duration of hypoglycaemia.5,6 The majority of inpatients with diabetes on nasogastric feeding have altered conscious state and are unable to respond to symptoms of hypoglycaemia, making them reliant on often busy staff, to identify and treat their hypoglycaemia. In this context, even with regular blood glucose monitoring (BGM) there may be considerable progression of a hypoglycaemic episode prior to its identification.5,6 There is extensive literature on diabetes specific formula feeds, mainly with regard to post-feed hyperglycaemia7 but less quantifying hypoglycaemia.8–10

We carried out a retrospective case note review to determine the frequency and timing of hypoglycaemia in hospitalised patients with diabetes on established nasogastric feeding in a tertiary hospital.

**Methods**

Subjects were 50 inpatients with diabetes (27 male, 23 female) fed entirely by nasogastric feeding for ≥3 days as per hospital protocol (Table 1). Patients on insulin infusions or in ICU were excluded. Subjects were consecutively flagged by the treating dietitian. Data were collected from medical notes, BGM records, and medication charts. Goals of treatment were blood glucose level (BGL) ≥4 and <10mmol/L. Initial treatment of hypoglycaemia was liquid carbohydrate as per hospital protocol. No identifying information was collected. The study was approved by the Human Ethics Research Committee (Curtin University, Western Australia) and as a tertiary hospital clinical audit.

**Measures**

Hypoglycaemia was defined as BGL <3.5mmol/L, as a level having clinical relevance.11,12 Severe hypoglycaemia is formally defined as ‘an event requiring assistance of another person to actively administer carbohydrate’;13 but as this was applicable to all events in this study, we arbitrarily defined severe hypoglycaemia as BGL <2.0mmol/L. and extended hypoglycaemia as duration ≥2 hours or repeat episode within 2 hours. There is no standardised reporting method for frequency of hypoglycaemia so we have reported it both as percentage of patient-days with ≥1 hypoglycaemic episode (PPD) and percentage of total blood glucose values <3.5mmol/L (PTG), to allow for variable feed duration and consistent with two other studies.8,9

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Descriptive statistics were used for subject demographics, χ² test to compare categorical variables and proportions, Shapiro-Wilk test to determine normality, Spearman rank-order correlation to determine strength of association between non-normally distributed continuous variables, and log-rank test to compare time to event data. Analysis was performed using IBM SPSS Statistics, v21, IBM, NY, USA, and GraphPad Prism 6, GraphPad Software Inc, USA.

Results
Subject characteristics are shown in Table 2. Frequency of hypoglycaemia was: PPD 10.9%, PTG 3.5%, and this was not statistically associated with gender, age, or feed carbohydrate content (p>0.05). Increased total hypoglycaemia was associated with increased duration of nasogastric feeding (p=0.016).

Hypoglycaemia was prevalent before the next medication dose and rare between medication administration and feed bolus: 34.8% and 4.3% of hypoglycaemic patients respectively.

It was not possible to assess the impact of withheld feeds from available documentation. Frequencies of hypoglycaemia, severe hypoglycaemia and extended hypoglycaemia are shown in Table 3. Sulphonylurea treatment (SU) was associated with increased incidence of hypoglycaemia (p=0.001) and extended hypoglycaemia (p=0.038).

All hypoglycaemic patients had increased BGM post-hypoglycaemia (6.1±1.6/day) and based on this

78% had medication decreased in response to hypoglycaemia. Survival analysis showed a significantly longer time to a subsequent hypoglycaemic episode between patients whose treatment was reduced in response to hypoglycaemia and those whose treatment remained unchanged (p=0.008) (see Figure 1). There was no association with subsequent hyperglycaemia (p=0.33).

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**Table 1. Bolus nasogastric feeding – timing**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender: M/F</td>
<td>27/23</td>
</tr>
<tr>
<td>Age: years</td>
<td>67.8±13.9</td>
</tr>
<tr>
<td>NG duration: days[range]</td>
<td>13.0±9.2[3–41]</td>
</tr>
<tr>
<td>NG content (CHO): ≤40%/&gt;40%</td>
<td>19/31</td>
</tr>
<tr>
<td>NG administration (bolus/continuous)</td>
<td>49/1</td>
</tr>
<tr>
<td>Treatment: SCII/SU</td>
<td>42/8</td>
</tr>
</tbody>
</table>

- SCII: Basal bolus 28
- SCII: Twice daily 7
- SCII: Long acting 1
- SCII: Correctional 6

- NG: nasogastric feed; CHO: carbohydrate; SCII: subcutaneous insulin injection; SU: sulphonylurea.

**Table 2. Patient characteristics (n=50)**

**Table 3. Frequency of hypoglycaemia**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percent</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPD</td>
<td>10.9</td>
<td></td>
</tr>
<tr>
<td>PTG</td>
<td>3.5</td>
<td>0.001</td>
</tr>
<tr>
<td>SCII</td>
<td>3.1</td>
<td>0.179</td>
</tr>
<tr>
<td>SU</td>
<td>5.8</td>
<td>0.038</td>
</tr>
<tr>
<td>PTG &lt;2h</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>SCII</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>SU</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td>PTG &gt;2h</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>SCII</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>SU</td>
<td>0.65</td>
<td></td>
</tr>
</tbody>
</table>

PPD: percent of patient days with 1+ hypoglycaemic event; PTG: percent of total blood glucose level <3.5 mmol/L; SCII: subcutaneous insulin injection; SU: sulphonylurea; PTG <2, percent of total blood glucose level <2.0 mmol/L (severe hypoglycaemia); PTG >2h, percent of total blood glucose level >2h (extended hypoglycaemia).

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**Figure 1.** Kaplan-Meier survival curves for patients with treatment changed post-hypoglycaemia (blue line) and unchanged (red line); + denotes censored data

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BGM: blood glucose monitoring; SA: short acting; LA: long acting.
Discussion

Hypoglycaemic episodes were not uncommon in these patients. Comparison with other nasogastric studies is difficult due to lack of quantification of hypoglycaemic events. Rates of hypoglycaemia in this study (PPD 10.9%; PTG 3.5%) were higher than the two comparable studies (PPD – not reported6 and 1.1–1.3%;7 PTG – 1.4–5.48 and 1.1–1.3%), especially as both defined hypoglycaemia as <3.9mmol/L; the higher cut-off point would be expected to identify more hypoglycaemic episodes.9

Frequency of BGM also varied from 6.1±1.6/day (this study) compared to 4/day,5 and 4/day+ (maximum 6/day).2 However, it has been shown that increased BGM can increase documented inpatient hypoglycaemia and severe hypoglycaemia.17

Severe and extended hypoglycaemia are not quantified in the literature on nasogastric feeding but the high frequency of BGM in our study may have increased documentation of these.17 Hypoglycaemia and extended hypoglycaemia were statistically associated with SU, consistent with other reports documenting increased frequency of hypoglycaemia in SU treated individuals, especially those >65 years of age.19,20

As this was a retrospective observational study, duration of nasogastric feeding varied. We therefore used Kaplan-Meier survival curves for time to event analysis of the effect of reduction in medication post-hypoglycaemia on a subsequent hypoglycaemic episode. This meant that censored data which arose from cessation of nasogastric feeding before a subsequent hypoglycaemic event was observed, were taken into account. As a consequence, we have shown a significantly increased time to a subsequent hypoglycaemic event in those whose medication was reduced. There was no association with subsequent hyperglycaemia.

Limitations of study

Neither type nor duration of diabetes or interruption of feeds are quantified as they were not consistently recorded in patient notes.

Conclusions

This study highlights the prevalence of hypoglycaemia in patients on nasogastric feeding. It supports optimal blood glucose monitoring and treatment with insulin rather than sulphonylureas, and highlights the need for appropriate medication reduction based on blood glucose monitoring results.

Declaration of interests

There are no conflicts of interest declared. Funding: none.

References


Drug notes

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Dexigoin
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Dronedarone
Duloxetine
Erythromycin
Labetalol
Lidocaine
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