Does type of diabetes, and treatment prescribed prior to admission influence quality of treatment of inpatient hypoglycaemia?

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CONFLICT OF INTEREST

☐ I have the following potential conflicts of interest to report:

☐ Research Contracts
X Consulting
☐ Employment in the Industry
X Stockholder of a healthcare company
☐ Owner of a healthcare company
☐ Other(s)

Novo Nordisk, Glycosys Ltd
rationale

inpatient hypoglycaemia common (43.6% T1DM admissions, 21.3% T2DM admissions)

response to hypoglycaemia known to be suboptimal

? what factors might influence response to hypoglycaemia on the ward
setting

Approaches developed from a large inpatient glucose dataset:

>7 y unbroken data
>6.5m data points (4.4M identifiable) from >200000 IDs

187691 CBGs <4mmol/l
130000 episodes of hypoglycaemia

>58k individuals with known diabetes (5k T1)
setting

CBG dataset is linked to:

SCI diabetes
prescribing (encashed prescription) datasets

prescription of SU or Insulin within a 4 month period prior to admission used to associate the drug with the admission
metric used to investigate response to hypoglycaemia
Algorithm for the Treatment of Hypoglycaemia in Adults with Diabetes in Hospital

Hypoglycaemia is a serious condition and should be treated as an emergency regardless of level of consciousness. Hypoglycaemia is defined as blood glucose of less than 4mmol/L (if not less than 4mmol/L but symptomatic give a small carbohydrate snack for symptom relief).

For further information see the full guideline “The Hospital Management of Hypoglycaemia in Adults with Diabetes Mellitus” at www.diabetes.org.uk

**Mild**

- Patient conscious, orientated and able to swallow

  - Give 15-20 g of quick acting carbohydrate, such as 5-7 Dextrosol® tablets or 4-5 Glucotabs® or 90-120mLs original Lucozade®, or 150-200mLs pure fruit juice**

  - Test blood glucose after 10-15 minutes; if still less than 4 mmol/L, repeat treatment (up to 3 cycles). If still hypoglycaemic, or deteriorating at any stage, call doctor and consider IV glucose (as for severe) or 1mg Glucagon IM (once only)*.

**Moderate**

- Patient conscious and able to swallow, but confused, disorientated or aggressive

  - If capable and cooperative, treat as for mild hypoglycaemia

    - If not capable and cooperative but can swallow give 1.5-2 tubes of GlucoGel® (squeezed into mouth between teeth and gums) or, if ineffective, use 1mg Glucagon IM (once only)*.

    - Test blood glucose after 10-15 minutes and if still less than 4 mmol/L repeat above (up to 3 cycles). If still hypoglycaemic after 30-45 minutes, or deteriorating at any stage, call doctor and consider IV glucose (as for severe).

**Severe**

- Patient unconscious/fitting, very aggressive or nil by mouth (NBM)

  - Check ABC, stop IV insulin, contact doctor urgently

    - Give IV glucose over 10-15 minutes as 75 -100mL 20% glucose or 150-200mL 10% glucose or 30-40mL 50% glucose (avoid unless 10% or 20% glucose unavailable – venous irritant and extravasation risk)

    - or 1mg Glucagon IM (once only) *

    - Recheck glucose after 10 minutes and if still less than 4mmol/L, repeat IV glucose.

Blood glucose should now be above 4mmol/L.

- Give 20g of long acting carbohydrate e.g. two biscuits / slice of bread / 200-300mL milk/ next meal containing carbohydrate (give 40g if IM Glucagon has been used).

- Patients with enteral feeding tube Give 20g quick-acting carbohydrate via enteral tube eg. 50-70mL Ensure Plus®/Juce or 100mLs original Lucozade®, then flush. Check glucose after 10-15 minutes. Repeat up to three times or use IV glucose if needed. Follow up with feed bolus or by recommending the feed to prevent further hypoglycaemia. If tube is dislodged or patient is unconscious IV glucose may be needed. See section E of full guideline and www.staffnet.ggc.scot.nhs.uk.

- If glucose now above 4mmol/L, follow up treatment as described on the left. If NBM, once glucose >4.0mmol/L give 10% glucose infusion at 100mL/hr** until no longer NBM or reviewed by doctor.

Do not omit subsequent doses of insulin. Continue regular capillary blood glucose monitoring for 24 to 48 hours. Long acting insulins and oral hypoglycaemic agents may be associated with prolonged and recurrent hypoglycaemia (> 36h, especially in renal impairment) needing IV glucose infusion and regular (at least hourly) blood glucose monitoring. Review insulin / oral hypoglycaemic doses. Give hypoglycaemia education and refer to diabetes team repeated hypoglycaemia. Do not use in hypoglycaemia induced by oral hypoglycaemic agents (e.g. sulfonylureas).

**In patients with renal/cardiac disease, use intravenous fluids with caution. Avoid fruit juice in renal failure.
time to repeat (TTR) CBG post hypoglycaemic-range CBG
what is the overall level of performance within the system?
Histogram of TTR (mins) after index CBG of <4mmol/l

131962 index CBGs <4mmol/l
Histogram of TTR (mins) after index CBG of <4mmol/l

n=131962

repeat within 15 mins 0.07
repeat within 60 mins 0.41
large health board performance 09-15

- n episodes hypoglycaemia
- proportion managed appropriately
what factors influence performance?
most individual staff see very few hypoglycaemic episodes
initial hypoglycaemic CBG value

Capillary blood glucose monitoring, inpatient hypoglycaemia and quality of care
effect of diagnosis and class of drug treatment
association with drug class

<table>
<thead>
<tr>
<th></th>
<th>type 1 diabetes</th>
<th>type 2 diabetes SU group</th>
<th>type 2 diabetes Insulin group</th>
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<tr>
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<td>5162</td>
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<tr>
<td>age</td>
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<td>72.8(64.1-79.6)</td>
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<tr>
<td>n CBG &lt;4mmol/l</td>
<td>26664</td>
<td>30339</td>
<td>23590</td>
</tr>
</tbody>
</table>
median time to repeat CBG:
green – Type 1 Diabetes | black – Type 2 Diabetes Insulin | red – Type 2 Diabetes SU
Distribution of TTR post index CBG 3-3.9mmol/l. First 6 hours

(hours post index CBG measurement vs. frequency)
Distribution of TTR post index CBG 3-3.9mmol/l. First 36 hours
Median time to repeat CBG Early AM measurement 0600-0900:
green – Type 1 Diabetes | black – Type 2 Diabetes Insulin | red – Type 2 Diabetes SU
summary/conclusion

overall performance in following guidelines poor across all types of diabetes

multiple factors influence the response to hypoglycaemia

type of diabetes and prescribed drugs associated with admissions are associated with differing levels of hypoglycaemia management performance

the group who probably have the greatest risk from moderate hypoglycaemia have the lowest level of adherence with management guidelines

an educational challenge – need to change perception of hypos in type 2 patients

? need to move away from OD CBG testing in patients on SUs