Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation

Glycaemic control in insulin requiring diabetes patients receiving exclusive enteral tube feeding in an acute hospital setting

P.M. Murphy [a], E. Moore [b], D.E. Flanagan [b,*]

[a] Nutrition and Dietetic Department, Derriford Hospital, Plymouth, United Kingdom
[b] Diabetes and Endocrinology Department, Derriford Hospital, Plymouth, United Kingdom

ARTICLE INFO

Article history:
Received 21 June 2013
Accepted 18 December 2013
Available online 25 December 2013

Keywords:
Hospital care
Glycaemic control
Hypoglycaemia
Glucose variability
Insulin
Enteral feeding

ABSTRACT

Aims: Optimising glycaemic control for insulin requiring individuals during enteral feeding is important but difficult. We compare 3 insulin regimens with the aim of improving glucose control and reducing hypoglycaemia.

Methods: Comparison of 3 insulin/feed regimens: (1) A 20 h feed using a 30:70 premixed insulin (2) Three bolus (4 h) feeds combined with short acting analogue insulin and a basal long acting insulin. (3) A 24 h feed combined with a long acting analogue insulin. The study combined a retrospective analysis of regimen (1) with consecutive prospective analyses of (2) and (3).

Results: Glucose concentrations were suboptimal with higher values during the feeds (12.6 mmol/L ± 4.4 vs 10.3 ± 4.1 $p < 0.001$). Although there was no overall difference in glucose control between groups there was a reduction in hypoglycaemia during the feed in the bolus group (no hypoglycaemia during intermittent feeds $p < 0.001$).

Conclusions: Glucose concentrations were relatively high overall. Short bolus feeding appears to reduce the frequency of hypoglycaemia. This is of clinical significance for this patient group.

1. Introduction

Although study evidence is limited the consensus view is that good glycaemic control for people with diabetes in hospital is important to aid recovery and reduce complications [1]. This needs to be balanced against the increased risk of hypoglycaemia associated with tight glycaemic control. Hypoglycaemia is probably more damaging to the frail elderly—a significant proportion of the hospital population [2–4].

Enteral feeding of people with diabetes requiring insulin is one particular area of difficulty. Standard feed regimens do not match the glucose lowering profiles of most insulin regimens. There is considerable variability between centres in the diabetes management of this group of patients, the optimal approach is unclear. There have been a number of trials of diabetes specific feed formulas suggesting some improvement in glucose control but these have not achieved wide clinical acceptance and do not entirely address the issue of matching glucose and carbohydrate during feeding and fasting [5].

In our centre, patients requiring enteral feeding were fed over 20 h with a 4 h rest period. Patients were fed to meet nutritional requirements as estimated by the dietitian. A premixed dose of short and intermediate acting insulin was commonly prescribed at the start of the feed. Our data suggested that this regimen did not provide optimal glucose

* Corresponding author. Tel.: +44 1752 439696; fax: +44 1752 517617.
E-mail address: danielflanagan@nhs.net (D.E. Flanagan).
0168-8227/$ – see front matter
http://dx.doi.org/10.1016/j.diabres.2013.12.007

control during the feed but also exposed the individual to the risk of hypoglycaemia between feeds. We therefore tried to match the feed regimen to the pharmacokinetic profile of the insulin being used. Firstly we tried this with short feeds matched to a short acting human insulin then a continuous feed matched to a long acting insulin analogue. Data presented are an analysis of the original protocol compared with the two subsequent strategies.

2. Methods

This study began with a retrospective analysis of our management diabetes during enteral feeding ($n = 18$). Our standard practice was to administer enteral feed over a 20 h period. A 30/70 premixed human insulin was prescribed at the beginning of the feed. Capillary blood glucose was monitored 6 h daily. The results highlighted a high incidence of hypoglycaemia and overall suboptimal glucose concentrations. We therefore considered other strategies to improve glycaemic control for these patients.

Over the next 18 months all patients with diabetes requiring enteral feeding were examined prospectively. Forty two patients were referred, of which 28 were evaluable. Only patients with normal gastrointestinal function, receiving active medical treatment and full nutritional needs met by enteral tube feeding were included. The first 13 consecutive patients were prescribed a basal bolus insulin regimen to match 3 intermittent/bolus daytime enteral tube feeds lasting 4 h (intermittent feed group). A short acting insulin analogue was given at the start of each feed with a long acting insulin analogue (Glargine Insulin) given at night. Following this, a further 15 consecutive patients received continuous feeding with a once or twice daily prescription of long acting analogue insulin (continuous feed group). Patients were excluded from analysis if the length of feed was likely to be less than 24 h or they were on a mixture of oral and enteral feeds. Patients continuing on any other insulin regimen were also excluded.

Blood glucose monitoring was recommended prior to commencing feeding, midway though each feeding episode and once during overnight rest period for intermittently fed patients. During continuous feeding, blood glucose monitoring was recommended four times daily. All patients were fed a standard 1 kcal/mL formula to meet estimated nutritional requirements. Patients were reviewed daily by a dietitian or diabetes specialist nurse. The majority of patients were receiving variable rate intravenous insulin (VRII) in combination with enteral feeding prior to commencing the subcutaneous regimens. Insulin dosage was calculated based on the previous 24 h VRII requirement. Insulin was then adjusted on a daily basis by the specialist team. Although data in the 20 h feed group was collected retrospectively and information about carbohydrate/protein were not available this is likely to have been comparable as our strategy did not change. The level of diabetes specialist input was the same across the three groups although there was less dietetic support for the 20 h feed group.

Data were analysed using one way ANOVA with the exception of non-parametric data where the Kruskal–Wallis ANOVA was used to compare differences across groups (IBM SPSS vs 20).

3. Results

There was no difference in age or BMI between the groups. The intermittent and continuous feed groups were matched for energy requirements and total daily protein requirements

Table 1 – Comparison of demographic data and measures of glucose control for the three study groups.

	20 h feed group ($n = 18$)	Intermittent feed group ($n = 13$)	Continuous feed group ($n = 15$)	
Sex	10 m 8 f	8 m 5 f	9 m 6 f	
Age (years) (SD)	77 (8)	70 (15)	67 (12)	
BMI (kg/m^2) (SD)	Not available	27 (3)	27 (6)	
Diabetes type	Type 2 $n = 16$ Type1 $n = 1$ Post pancreatectomy $n = 1$	Type 2 $n = 11$ Type 1 $n = 1$ Post pancreatectomy $n = 1$	Type 2 $n = 11$ Type 1 $n = 4$	
Previous diabetes treatment	Oral hypoglycaemic agent $n = 2$ Insulin $n = 15$ New diagnosis $n = 1$	Oral hypoglycaemic agent $n = 8$ Insulin $n = 3$ New diagnosis $n = 2$	Oral hypoglycaemic agent $n = 6$ Insulin $n = 8$ Diet $n = 1$	
Outcome	Discharge $n = 15$ Hospital mortality $n = 3$	Discharge $n = 4$ Progress to diet $n = 5$ Hospital mortality $n = 4$	Discharge $n = 1$ Progress to diet $n = 9$ Hospital mortality $n = 5$	
				p For difference across groups
Mean glucose during feed mmol/L (SD)	12.6 (5.4)	12.5 (4.2)	12.1 (5.0)	0.465
Mean glucose between feed mmol/L (SD)	10.6 (4.2)	10.1 (4.1)	–	0.271
% Hypoglycaemia during feed (SD)	4 (13)	0	7 (13)	0.004
% Hypoglycaemia between feed (SD)	14 (36)	5 (7)	–	0.069
Daily glucose variability expressed as standard deviation (SD)	3.1 (1.6)	4.1 (1.6)	4.2 (2.0)	0.164