

## Invited Editorial

# Hypoglycaemia in hospital: a preventable killer?

O. G. Mustafa and P. Choudhary

Department of Diabetes, King's College London, London, UK

Diabet. Med. 31, 1151–1152 (2014)

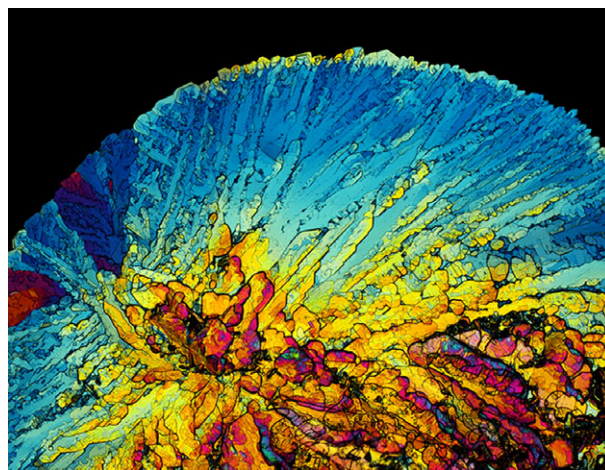
People with known diabetes admitted to hospital have a longer length of stay and higher mortality rates [1]. In addition to this, many patients without known diabetes have elevated glucose levels on admission, which is a marker for poor outcomes in almost all scenarios [2–4].

Through vehicles such as the National Diabetes Inpatient Audit, there has been increased visibility and greater focus on identifying and treating people with hyperglycaemia in hospital. There is, however, an ongoing debate about optimum glucose targets in different populations and the best means of achieving glucose control. In most cases, dysglycaemia is managed with insulin, which is usually prescribed and adjusted by junior doctors, who report low confidence in managing diabetes [5].

Hypoglycaemia has long been recognized as the major side effect of insulin therapy, but its dangers are only now being realized. Analysis of large datasets shows that up to 26% of people admitted to hospital have hypoglycaemia, and this mainly occurs overnight [6]. Hypoglycaemia in hospital is also associated with longer length of stay and increased risk of mortality in the year after admission [7]. Whether or not this is a causal effect is unknown, as the risk of hypoglycaemia may merely be a marker of the underlying disease processes causing the mortality, rather than a direct contributor to mortality.

In this issue of *Diabetic Medicine*, Rajendran and Rayman [8] survey adverse events related to inpatient hypoglycaemia. Twelve serious events (in 41 Trusts) were identified (defined as causing death, a cardiac or cerebral event or a fall resulting in permanent physical injury or fracture) and three of these events resulted in deaths. Insulin was implicated in 10 (83%) events and, in three events, hypoglycaemia followed the use of an i.v. infusion of insulin and dextrose to treat hyperkalaemia. Only one person had diabetes.

It is important to recognize the limitations of this study. Responses were received from only 42 out of 142 trusts invited to participate. Although the absence of data from over three quarters of the hospitals surveyed suggests that there may well be a large number of unreported events out



Cover image: Insulin crystals by light microscopy. Credit: Alfred Pasieka/Science Photo Library. Insulin is a common cause of hypoglycaemia in a hospital setting.

there, it is also possible that the study captured most of the severe events because of reporting bias.

This study also highlights the dangers of insulin-dextrose infusions in patients with hyperkalaemia. These patients are usually ill and may also have acute kidney injury, which prolongs insulin action time and reduces counter-regulatory protection from hypoglycaemia. The variability in treatment response between patients makes careful glucose monitoring a necessity [9].

Insulin has been highlighted as a high alert medication [10]. A review of the National Patient Safety Agency incidents (November 2003 to November 2009) revealed a total of 16 600 incidents involving insulin. Of these incidents, 24% involved harm to patients and 18 incidents resulted in fatal and severe outcomes [11]. Errors occurred at all stages of the medication journey, including prescription, dispensing, administration and monitoring. These incidents are regarded as unacceptable, eminently avoidable and preventable. Causes include using the abbreviation ‘u’ instead of ‘units’, failure to administer insulin using insulin-specific devices, failure to give insulin when correctly prescribed, or issues involving unclear or misinterpreted verbal instruction about the use of insulin. Gupta and Cook [12] reported that the unintentional use of a glucose-containing solution has resulted in artifactually high glucose

Correspondence to: Pratik Choudhary. E-mail: pratik.choudhary@kcl.ac.uk

concentrations in blood samples drawn from an arterial line, leading to insulin administration and causing hypoglycaemia and fatal neuroglycopenic brain injury. Rightly, death or severe harm as a result of maladministration of insulin by a health professional has been included in the NHS 'never events' list [13].

In a recent editorial [14], Jonathan Valabhji, National Clinical Director for Obesity and Diabetes at NHS England, highlighted the findings of the Francis report into failures leading to high mortality at Mid-Staffordshire NHS Foundation Trust. One of the deaths there was related to poor diabetes care [15]. He also drew attention to the 'never events' policy on maladministration of insulin. What is clear is that the mechanism to document and report these events is still not established.

Incidents as a result of insulin use can be multifactorial and the associated risks are often cumulative. Looking further into human errors reveals other contributory factors such as active failures (slips, lapses, mistakes and rule violations) and latent organizational failures. Those include conditions that make human errors more likely to occur and include individual factors, communication breakdown, equipment issues, and management of staffing levels [16].

In summary, despite the limitations of the data presented, this paper highlights three major messages:

1. Insulin-related severe adverse events are vastly under-reported and we need to develop robust systems to report hypoglycaemia to diabetes teams.
2. We need to ensure appropriate monitoring of i.v. insulin-dextrose infusions to protect a particularly vulnerable group.
3. As we move on from the National Diabetes Inpatient Audit, we should consider carefully whether there should be a National Confidential Enquiry into Patient Outcome and Death for severe hypoglycaemia.

#### Funding sources

None.

#### Competing interests

None declared.

#### References

- 1 Holman N, Hillson R, Young RJ. Excess mortality during hospital stays among patients with recorded diabetes compared with those without diabetes. *Diabet Med* 2013; **30**: 1393–1402.
- 2 Kowalczyk J, Mazurek M, Zielinska T, Lenarczyk R, Sedkowska A, Swiatkowski A *et al*. Prognostic significance of HbA1c in patients with AMI treated invasively and newly detected glucose abnormalities. *Eur J Prev Cardiol* 2014; doi: 10.1177/2047487314527850 [Epub ahead of print].
- 3 Tapia-Pérez JH, Gehring S, Zilke R, Schneider T. Effect of increased glucose levels on short-term outcome in hypertensive spontaneous intracerebral hemorrhage. *Clin Neurol Neurosurg* 2014; **118**: 37–43.
- 4 Tuna M, Manuel DG, Bennett C, Lawrence N, van Walraven C, Keely E *et al*. One- and five-year risk of death and cardiovascular complications for hospitalized patients with hyperglycemia without diagnosed diabetes: An observational study. *J Hosp Med* 2014; **9**: 365–371.
- 5 George JT, Warriner D, McGrane DJ, Rozario KS, Price HC, Wilmot EG *et al*. Lack of confidence among trainee doctors in the management of diabetes: the Trainees Own Perception of Delivery of Care (TOPDOC) Diabetes Study. *QJM* 2011; **104**: 761–766.
- 6 Jones GC, Casey H, Perry CG, Kennon B, Sainsbury CAR. Trends in recorded capillary blood glucose and hypoglycaemia in hospitalised patients with diabetes. *Diabetes Res Clin Pract* 2014; **104**: 79–83.
- 7 Nirantharakumar K, Marshall T, Kennedy A, Narendran P, Hemming K, Coleman JJ. Hypoglycaemia is associated with increased length of stay and mortality in people with diabetes who are hospitalized. *Diabet Med* 2012; **29**: e445–e448.
- 8 Rajendran R, Rayman G. Serious harm from inpatient hypoglycaemia: a survey of hospitals in UK. *Diabet Med* 2014; **31**: 1218–1221.
- 9 Schafers S, Naunheim R, Vijayan A, Tobin G. Incidence of hypoglycemia following insulin-based acute stabilization of hyperkalemia treatment. *J Hosp Med* 2012; **7**: 239–242.
- 10 National Patient Safety Agency (NPSA). Safer administration of insulin, 2010. Available at: <http://www.nrls.npsa.nhs.uk/alerts/?entryid45=74287>
- 11 Cousins D, Rosario C, Scarpello J. Insulin, hospitals and harm: a review of patient safety incidents reported to the National Patient Safety Agency. *Clin Med* 2011; **11**: 28–30.
- 12 Gupta KJ, Cook TM. Accidental hypoglycaemia caused by an arterial flush drug error: a case report and contributory causes analysis. *Anaesthesia* 2013; **68**: 1179–1187.
- 13 NHS England PSDT. The never events list; 2013/14 update, 2013. Available at: <http://www.england.nhs.uk/wp-content/uploads/2013/12/nev-ev-list-1314-clar.pdf>
- 14 Valabhji J. Excess inpatient mortality for those with diabetes in England. *Diabet Med* 2013; **30**: 1391–1392.
- 15 Gillian Astbury death: Mid Staffordshire NHS Trust sentence delayed. BBC News, 2014. Available at: <http://bbc.in/1mvirJD>. Last accessed 26 March 2014.
- 16 Lawton R, McEachan RRC, Giles SJ, Sirriyeh R, Watt IS, Wright J. Development of an evidence-based framework of factors contributing to patient safety incidents in hospital settings: a systematic review. *BMJ Qual Saf* 2012; **21**: 369–380.