Screening for inpatient hyperglycaemia in surgical patients under 40 years at the time of securing intravenous access on the operative table

INTRODUCTION

Traditionally, Type 2 diabetes is considered as a disease afflicting older population, but due to modern lifestyles, increasingly younger people are being diagnosed as diabetics. 8–45% of newly diagnosed patients include paediatric and young adults, depending on the geographical location.[1] Fasting blood sugar levels (BSLs) are not done routinely in this population presenting for surgery.[2,3] Thus, hyperglycaemia may be missed in many of them during hospital admission. Inpatient hyperglycaemia can produce several adverse outcomes.[3] The venous blood residue from the intravenous cannula can easily be measured, thus serving as an effective bedside screening tool for hyperglycaemia, bringing a large patient population in the purview of diabetes screening at the time of securing an intravenous access on the operating table.

METHODS

After institutional ethical committee approval and written informed patient consent, 135 fasting patients belonging to American Society of Anesthesiologists physical status I and II, aged 1–40 years, non-diabetic on history, scheduled for elective surgeries were included. Starvation status of all the patients (30 paediatric patients and 105 adults) was confirmed. Diabetes was clinically ruled out at the time of the pre-anaesthesia checkup. After instituting standard anaesthesia monitoring, 22G or 20G intravenous (IV) cannula was inserted in the vein on the dorsum of the hand of the patients. Correct placement of cannula was checked by collection of blood in the flashback chamber at the top of the catheter needle. The residue of blood left in the IV catheter needle was pushed out of the tip of the needle by removing and forcefully reapplying the stopper at the top of the needle. This blood was then collected on the glucometer strip and utilised for checking the venous sugar level with the help of Contour TS® glucometer (Bayer Healthcare LLC, USA). Repeat testing intraoperatively was advised if the glucose was above >125 mg%. According to the World Health Organisation (WHO), fasting plasma glucose >110 mg% is considered as impaired fasting glucose level (IFG) (pre-diabetes state) and >125 mg% as diabetes mellitus.[4] And venous plasma glucose should be the standard method for measuring glucose concentrations in blood. Unlike the laboratory testing, glucometer provides a point of care measurement of the BSLs, which has been found to be similar or slightly higher than laboratory values.

RESULTS

30 paediatric and 105 adult patients were tested. [Table 1] Of the 30 paediatric patients, 3 patients had BSL between 110 and 125 mg%, and only one child had a BSL of 200 mg%. Of 105 adult patients, 10 patients were found to have BSL between 110 and 125 mg%, and 7 patients had BSL above 125 mg%, the highest being 230 mg%.

DISCUSSION

India ranks the highest globally for the number of diabetes mellitus patients.[4] As high as 50–70% patients remain undiagnosed, presenting directly with diabetic complications.[4] The incidence and prevalence of diabetes mellitus Type 2 are as high as 8–45% in various populations.[1]

The spectrum of inpatient hyperglycaemia includes (a) undiagnosed diabetes, (b) stress-induced hyperglycaemia (SIH) and (c) IFG and impaired glucose tolerance (pre-diabetes stage).[5] Undiagnosed diabetics are patients in whom hyperglycaemia persists even after discharge from hospital.[5] Persistent hyperglycaemia may lead to many complications such as exacerbated

Table 1: Pre-operative venous glucose values of the patients

BSL values	<100 mg/dl	100-124 mg/dl	>125 mg/dl
Adult male	20	4	0
Adult female	68	6	7
Paediatric	26	3	1

inflammation, delayed wound healing, infection and cardiovascular complications.[3,5] SIH has been defined as transient hyperglycaemia occurring only during times of stress such as surgery and anaesthesia, due to excessive secretion of hormones such as glucagon, corticosteroids, epinephrine and pro-inflammatory mediators, such as cytokines; with no prior history of diabetes.[3,5] Not only adults but also infants and paediatric patients can have hyperglycaemia in response to perioperative stress.[6-8] Egi *et al*. have found an increased mortality in hyperglycaemia requiring insulin in critical care setting in patients without diabetes as compared to those with diabetes inspite of lower average blood sugar values.[9] It has been postulated that undiagnosed diabetes and SIH both act through different pathological pathways to produce adverse effects.[9]

Fasting BSLs are not done routinely as a part of pre-anaesthetic checkup in younger patients.[2] Thus, diabetes may be missed in many of them inspite of a hospital admission. Two most commonly used tests for diabetes screening are fasting and post-prandial BSLs.[4] In the immediate pre-anaesthetic period, these patients are already fasting for 8–10 h. Without giving an additional prick to the patient, venous sugar levels can easily be checked in these patients.

Grek *et al*. proved this to be cost-effective and easily implemented screening test for pre-operative hyperglycaemia.[10] Comparison of blood sugar values obtained from the glucometer have been compared with laboratory values, with different glucometers, different sites and both capillary and venous blood, and have been found to be similar or slightly higher than the reference laboratory values.[11-14] Only those paediatric patients whose veins could be cannulated with 22G IV cannula were included as it is very difficult to collect the blood residue from IV cannulas of 24G and below.

The main limitation of this study was the lack of post-operative follow-up. Estimation of HbA1c postoperatively can be used for further screening of inpatient diabetes, which we did not do.[3]

CONCLUSION

Pre-operative screening on the operating table, especially in patients under 40 years age, can be effective and useful in bringing a large patient population in the purview of hyperglycaemia screening. Any patient with high perioperative blood glucose levels needs to undergo further evaluation later in an unstressed ambulatory setting.

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Conflicts of interest

There are no conflicts of interest.

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