A Study on Identifying the Causes of Hypoglycemia and to Implement a Process to Prevent Hypoglycemia Events in Diabetic Patients in a Tertiary Care Hospital, Hyderabad

Bhagya Lakshmi[1], Usha Prabhakar[2], Naga Sireesha[3], Maryline Flinsi[4], Dr. N. Balakrishna[5]

[1]Nursing Quality Coordinator-Apollo Health City, Hyderabad
[2]Regional Chief Nursing Officer-Apollo Telangana Region
[3]Nursing Superintendent -Apollo Health City, Hyderabad, [4]Principal Apollo School of Nursing-Delhi
[5]HOD- Department of Statistics, AHERF- Apollo Health City, Hyderabad

Corresponding Author: Bhagya Lakshmi

ABSTRACT

Background: Low blood glucose is common among people with type 1 diabetes and among people with type 2 diabetes who take insulin or oral Hyperglycemic agents. In a large global study of people with diabetes who take insulin, 4 in 5 people with type 1 diabetes and nearly half of those with type 2 diabetes reported a low blood sugar event at least once over a 4-week period. Therefore, this study helps in identifying the causes of hypoglycemia and to implement a process to prevent hypoglycemia events in diabetic patients. Before taking up the study we have noticed an increased number in Hypoglycemia events for 2 months Period. For which the Retrospective data was collected and analyzed to understand the most common factors causing Hypoglycemia

Aim: To identify the causes of Hypoglycemia and to implement a process to prevent Hypoglycemia events

Design: Initial retrospective analysis was done to understand the most common factors causing Hypoglycemia. Post Retrospective analysis we have initiated a structured training programme to all health care staff who are involved in the care of diabetic patients. Training was done over a period of 2 weeks, following an observation study done for duration of 6 months to analyze the occurrence of hypoglycemia events in details and implemented a process to identify and treat hypoglycemia in time.

Result: Mean Hypoglycemia was similar across age, gender, based on diet intake and also based on insulin duration of action. Mean Hypoglycemia was significantly (P<0.05) higher in evening (12 pm to 12 am) 58.8, then the morning (1 am to 12 pm). Asymptomatic glycemic events were significantly (P<0.05) higher by mean of symptomatic hypoglycemia.

Conclusion: Implementation of structured training program about the most common causes leading to hypoglycemia and the process of correcting event on time reduce morbidity related to hypoglycemia.

Recommendations: Training programme should be carried out for nurses related to process of preventing hypoglycemia and process in correcting hypoglycemia in time

Keywords: Hypoglycemia, Diabetes, Insulin, OHA

INTRODUCTION

Hypoglycemia is a true medical emergency, which needs prompt recognition and treatment to prevent morbidity and mortality. Knowledge about the prevention of hypoglycemia episodes plays a pivotal role in managing patients with diabetes patient[1].

Both the American Diabetes Association (ADA) and the European Medicines Agency have defined hypoglycemia as "any abnormally low plasma glucose concentration that exposes the subject to potential harm" with a proposed threshold plasma glucose value <70 mg/dl (<3.9 mmol/L) [2,3]

Diabetics with hypoglycemia symptoms such as dizziness, nausea, physical fatigue, often due to the overdose of oral drug and injection of insulin therapy[4,5].

Hypoglycemia is often defined by a plasma glucose concentration below 70 mg/dL; however, signs and symptoms may not occur until plasma glucose concentrations drop below 55 mg/dL. The symptoms of Whipple's triad have been used to describe hypoglycemia since 1938. For Whipple's triad, the practitioner must first recognize symptoms of hypoglycemia, then obtain low blood glucose, and finally, demonstrate immediate relief of symptoms by the correction of the low blood glucose with glucose treatment. Glucose is the primary metabolic fuel for the brain under physiologic conditions. Unlike other tissues of the body, the brain is very limited in supplying its glucose. Expectedly, the brain requires a steady supply of arterial glucose for adequate metabolic function. Potential complications can arise from an interruption in the glucose supply. As such, protective mechanisms to guard against low serum blood glucose (hypoglycemia) have evolved in the body[6].

The American Diabetic Association (ADA), AACE, and other guidelines recommend not to be too strict with glycemic control, especially in the elderly or patients with long duration of diabetes and with other significant co morbidities. Similarly, the recommendations emphasize on therapies that are least prone to cause hypoglycemia.[7, 8].

MATERIAL & METHODS

This was a prospective and observational study.

The data for this study was obtained from tertiary care hospitals between August 2021 to March 2022.

A total of 34 Hypoglycemia events data obtained among Hospitalized (ward) patients. For each patient the following information were collected: Age, gender, type of hypoglycemia event, events based on time line, Time taken for corrective action after hypoglycemia event, patient's diabetic history, Diet intake, and hypoglycemia events by insulin as per their duration of action. All the statistical analysis was done using the software.

Before taking up the study we have noticed an increased number in Hypoglycemia events for 2 months Period. For which the Retrospective data was collected and analyzed to understand the most common factors causing Hypoglycemia. The most common causes of hypoglycemia based on data collection and analysis for 20 samples has been shown in Table 1 and figure 1.

Post-Retrospective analysis we have initiated a structured training programme to all health care staff who are involved in the care of diabetic patients. Training was done over a period of 2 weeks.

We have done an observation study post training for a period of 7 months to monitor Hypoglycemia events. Figure 2 shows, A process flow to act promptly on time to treat Hypoglycemia based on symptoms to prevent complications related to it.
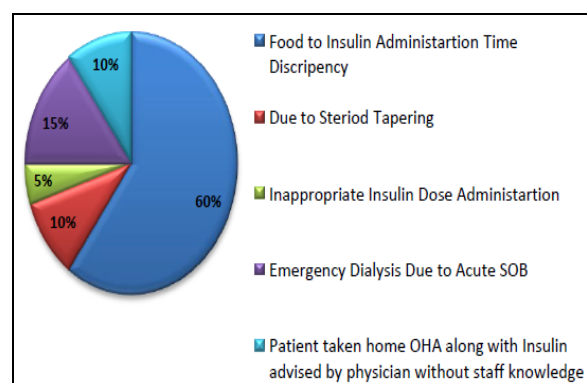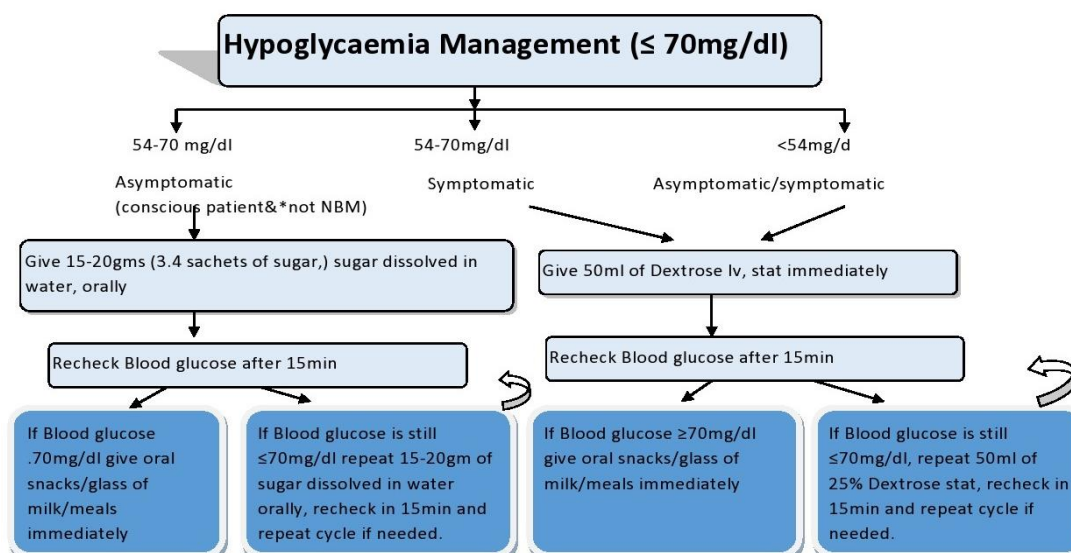

Figure 1: Hypoglycemia Causes

Figure 2: Process flow to treat Hypoglycemia promptly

Statistical Methods

Mean and SD values were calculated for Quantitative variables. Proportions (%) were calculated for Qualitative variables like age, gender, time of occurrence, hypoglycemia events association with symptoms, what was the action taken. Mean values of hypoglycemia events were compared by age, gender, time of occurrence, its association with symptoms as given in Table 1, by 't' test. Multiple linear regression mode; was performed to study the relationship of hypoglycemia with symptoms, time of occurrence and action taken. Level of significance was considered as 0.05. SPSS version 24 was used for all statistical methods.

RESULTS

Table 1

Baseline Characteristics	Categories	N	Mean In Relation To Hypoglycemia Event	SD	P-Value
Age	>=66	21	55.2	10.28	0.786
	<=65	13	54.2	11.44	
Gender	Male	24	53.1	11.19	0.157
	Female	10	58.8	8.08	
Time of Occurrence	Morning (12 am to 12pm)	18	51.2	11.07	0.035
	Evening (1 am to 12 pm)	16	58.8	8.65	
Hypoglycemia Events	Symptomatic	25	52.4	10.73	0.025
	Asymptomatic	9	61.4	6.95	
Action Taken	25 Dextrose	17	49.1	10.22	
	Oral Sugar Water	13	61.8	5.60	0.002
	IV FLUID	4	56.3	12.34	
Diet Intake	<75	24	54.3	10.28	0.760
	>75	9	55.6	12.31	
Events Based Action Of Insulin	OHA	8	55.0	11.88	
	Ultra short acting	13	52.3	10.58	
	Long acting	8	58.9	6.18	0.609
	Biphasic	5	54.4	14.84	

Note: Table 1 shows that Mean Hypoglycemia was similar across age, gender, based on diet intake and also based on insulin duration of action.

Mean Hypoglycemia was significantly ($P <0.05$) higher in evening (12 pm to 12 am) 58.8, then the morning (1 am to 12 pm).

Asymptomatic glycemic events were significantly ($P <0.05$) higher by mean of symptomatic hypoglycemia.

25 % Dextrose categories was significantly lower (49.1) compare to oral

sugar (61.8) water and intravenous fluids (56.3).

Table 2: Multiple Linear regression model of Hypoglycemic events with Symptoms, Time of occurrence and Action taken

Multiple Linear regression model of Hypoglycemic events with Symptoms, Time of occurrence and Action taken			
S no	Model	P^2 (%)	P value
1	46.9-4.441 Sympotoms+4.51 Time of occerence+8.977 Action taken	38.6	0.002
2	49.2+11.353*Action taken	29.7	0.001

Note: * Indicates Significant

Table 2 shows the relationship of hypoglycemia with symptoms, time of occurrence and action taken. Level of significance was considered as 0.05.

The most common causes were insufficient diet intake, and inadequate insulin doses management as per diet intake. Consequently, we implemented protocols to guarantee a minimal intake of CHO (intravenous and/or oral), and discussions with dietician team for same. In addition, we developed process to identify the hypoglycemia events and defined a process for prompt treatment of event to reduce severity. By these actions, the rate of hypoglycemia progressively reduced from (20 episodes in 2 Months period to34 episodes in 7 months duration).

DISCUSSION

This study provided baseline data regarding the common causes of hypoglycemia and process of correcting event on time which was included in structured training programme to all health care workers in order to identify, treat and prevent hypoglycemia. Mean Hypoglycemia was similar across age, gender, based on diet intake and also based on insulin duration of action.

Mean Hypoglycemia was significantly (P <0.05) higher in evening (12 pm to 12 am) 58.8, then the morning (1 am to 12 pm). Asymptomatic glycemic events were significantly (P <0.05) higher by mean of symptomatic hypoglycemia. 25 % Dextrose categories was significantly lower (49.1) compare to oral sugar (61.8) water and intravenous fluids (56.3). By these actions, the rate of hypoglycemia

progressively reduced from (20 episodes in 2 Months period to34 episodes in 7 months duration).

CONCLUSION

Implementation of structured training program about the most common causes leading to hypoglycemia and the process of correcting event on time reduce morbidity related to hypoglycemia. Counselling programme to the patients regarding hypoglycemia, its causes and symptoms, adverse effects as well as appropriate management should be encouraged. The knowledge about symptoms of hypoglycemia is an important step to self-care practice, because informed people are more likely to have better practice.[9] Having good knowledge about hypoglycemia is positively associated with good hypoglycemia prevention practice.[10]

REFERENCES

1. Muche EA, Mekonen BT. Hypoglycemia prevention practice and its associated factors among diabetes patients at university teaching hospital in Ethiopia: Cross-sectional study. PLoS One. 2020; 15(8):e0238094. Published 2020 Aug 21. doi:10.1371/journal.pone.0238094
2. American Diabetes Association Workgroup on Hypoglycemia. Defining and reporting hypoglycemia in diabetes. *Diabetes Care.* 2005;28:1245-9. [PubMed] [Google Scholar]
3. Guideline on clinical investigation of medicinal products in the treatment or prevention of diabetes mellitus. 2012. Available at: http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2012/06/WC500129256.pdf
4. Umpierrez G, Korytkowski M. Diabetic emergencies-ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. Nat

Rev Endocrinol. 2016; 12(4):222–32. https://doi.org/10.1038/nrendo.2016.15.

5. Jabbour, Serge et al. "Dapagliflozin in patients with type 2 diabetes mellitus: A pooled analysis of safety data from phase IIb/III clinical trials." Diabetes, obesity & metabolism vol. 20, 3 (2018): 620-628. doi:10.1111/dom.13124

6. Mathew P, Thoppil D. Hypoglycemia. 2022 Jan 4. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. PMID: 30521262.

7. Shriraam V, Mahadevan S, Anitharani M, et al. Reported hypoglycemia in Type 2 diabetes mellitus patients: Prevalence and practices-a hospital-based study. Indian J Endocrinol Metab. 2017; 21(1):148-153. doi:10.4103/2230-8210.196002.

8. Seaquist ER, Anderson J, Childs B, Cryer P, Dagogo-Jack S, Fish L, Heller SR, Rodriguez H, Rosenzweig J, Vigersky R. Hypoglycemia and diabetes: a report of a workgroup of the American Diabetes Association and the Endocrine Society. Diabetes Care. 2013 May; 36(5):1384-95.

doi: 10.2337/dc12-2480. Epub 2013 Apr 15. PMID: 23589542; PMCID: PMC3631867.

9. Peyrot M, Rubin RR (1994) Modelling the effect of diabetes education on glycaemic control. Diabetes Educ 20: 143-148. 10.1177/014572179402000210

10. Gebremichael GB, MariyeZemicheal T. Hypoglycemia Prevention Practice and Associated Factors among Diabetic Patients on Follow-Up at Public Hospitals of Central Zone, Tigray, Ethiopia, 2018. International Journal of Endocrinology.2020. March 13; 2020.

******