

# Prevalence and Clinical Outcome of Inpatient Hyperglycemia in a Tertiary Care Medical Centre

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DOI: <https://doi.org/10.52403/ijshr.20221041>

## ABSTRACT

**Aim:** To determine the association between hyperglycaemia and clinical outcome in children admitted to a tertiary care medical centre

**Methods:** A retrospective observational study was carried out on pediatric patients admitted to a tertiary care medical centre. A total of 160 cases were included. The details were recorded and the prevalence of hyperglycaemia and its association with clinical outcome was analysed.

**Results:** A total of 120 patients (75%) had an admission blood glucose  $\leq 120$  mg/dl [(mean  $97 \pm 1$  mg/dl ( $\pm$  SEM)], 31 children (19.3%) had an admission blood glucose level between 121–179 mg/dl (mean  $151 \pm 2$  mg/dl), and 9 patients (5.6%) had a blood glucose level  $\geq 180$  mg/dl (mean  $270 \pm 14$  mg/dl). Children with hyperglycemia were more likely to be admitted to the ICU ( $p < 0.001$ ) and had a longer length of ICU stay ( $p < 0.001$ ), but admission hyperglycemia was not associated with longer hospital stay or higher hospital mortality.

**Conclusion:** Hyperglycemia is present in one-fourth of children admitted to the hospital, most of them without a history of diabetes prior to admission. There was no in-hospital mortality but however there was a greater need for ICU care and longer ICU stay in hyperglycemic patients.

**Keywords:** Hyperglycemia, children, paediatrics, mortality, hospital stay

## INTRODUCTION

Among the most prevalent medical conditions among hospitalised patients is diabetes<sup>1,2</sup>. The majority of persons admitted to hospitals have hyperglycemia, and one-third of them have no prior history of diabetes, according to the literature. It is becoming more widely understood how inpatient hyperglycemia affects adult patients' clinical outcomes. Evidence suggests that hyperglycemia is a significant marker of a poor clinical outcome for people regardless of their history of diabetes<sup>3-12</sup>

Patients with severe illnesses who received intensive glycaemic management showed improvements in short- and long-term morbidity, multi-organ failure, systemic infection, and length of hospitalisation<sup>13-17</sup>. Adolescent patients who were admitted to medical wards are also subject to the significance of glucose control<sup>3,6,18</sup>.

In these patients, hyperglycemia is linked to a longer hospital stay, infection, impairment after discharge from the hospital, and mortality<sup>3,6,18</sup>. According to a number of

clinical investigations, adult acute illness outcomes under hyperglycemia are at risk. Adults with ischemic heart stroke, myocardial infarction, severe brain injury, and multiple system trauma exhibited hyperglycemia as a major and independent risk factor for mortality.

Similar to adults, hyperglycemia in children and its ongoing persistence appear to be significant risk factors for poor prognosis in people who have suffered brain injuries<sup>19,20</sup>. Even in non-diabetic people, hyperglycemia has been linked to decreased lung function and death from gunshot wounds to the brains in children<sup>21</sup>. Adults with hyperglycemia also experience prolonged stomach emptying and reduced small intestine motility<sup>22,23</sup>.

Other investigations have shown that infections can occur in both adults and children who have hyperglycemia<sup>24-26</sup>.

Therefore, in this research, we looked at the incidence of inpatient hyperglycemia and its effects on morbidity and mortality in young patients admitted to tertiary care hospitals.

## METHODOLOGY

The tertiary care medical center's children patients' medical records were examined. Prior to admission, the patients were separated into groups based on their blood glucose levels and any known histories of diabetes.

Patients without a previous history of diabetes and with normal plasma glucose made comprised the normo-glycaemic group. An admission or in-hospital blood glucose level greater than 120 mg/dl was deemed to be hyperglycaemia. After that, people with high blood sugar were split into two groups: those with blood sugar levels between 120 and 179 mg/dl and those who had blood sugar levels below 180 mg/dl. Information about the patient's demographic, blood glucose levels upon admission and while they were hospitalised, coexisting medical diagnoses, medical care, and hospital outcome were gathered.

In a tertiary care medical facility, the main goals of this study were to ascertain the

incidence of in-hospital hyperglycemia and to investigate the relationship between hyperglycemia and morbidity in youngsters with critical and non - critical illnesses.

The length of the hospital stay, the need for intensive care, and the management of hyperglycemia were all analysed in the study. Prognostic factors in addition to blood glucose levels were sex, age, body mass index, admission diagnosis, the presence of co-morbidities, and admission to an intensive care unit.

## RESULTS

The study involved 160 patients in total. 120 patients (75%) of this group had an entry blood glucose level that was less than or equal to 120 mg/dl [(mean 97.1 mg/dl (SEM), median: 91 mg/dl].

Nine patients (5.6%) had entry blood glucose levels higher than 180 mg/dl (mean 270.14 mg/dl, median: 201 mg/dl), while a total of 31 children (19.3%) had blood glucose levels between 121 and 179 mg/dl (mean 151.2 mg/dl, median: 144 mg/dl).

There were no significant differences in the mean age, gender, or body mass index among the three groups.

In the group of people with severe hyperglycemia, lung disease (18.8%), trauma or surgery (25%) and metabolic diseases (12.5%) were the most frequently diagnosed conditions. The majority of kids with hyperglycemia who were admitted had never had diabetes before. Six patients (15%) of the 40 children with admission hyperglycaemia (blood sugar > 120 mg/dl) had a known history of diabetes or were receiving treatment.

Children with initial hyperglycemia had a mean admission blood sugar of 164.3 mg/dl (range: 121–480 mg/dl), while those with a known history of diabetes had a mean admission blood sugar of 352.1 mg/dl (range: 145–678 mg/dl), both of which were statistically significant (p 0.01).

The majority of diabetes-related patients were admitted with severe hyperglycemia. One patient (10%) fell into the 121–179

mg/dL range, and five patients (55.5%) had blood sugar levels above 180 mg/dL.

	BG <120 mg/dl	BG 121–179 mg/dl	BG ≥180 mg/dl
No. of patients (%)	120 (75%)	31(19.3%)	9(5.6%)
Mean age (yr)	7.1 ± .3	6.7 ± .5	7.4 ± 1.2
Gender (M/F)			
Weight on admission (kg)	29 ± 2	26 ± 3	32 ± 6
Height on admission (cm)	79 ± 4	94 ± 9	74 ± 19
Body mass index (kg/m <sup>2</sup> )	17 ± 5	18 ± 4	37 ± 16 <sup>a</sup>
Mean admission BG	92 ± 1	143 ± 2 <sup>b</sup>	260 ± 18 <sup>b</sup>
Mean inpatient BG	96 ± 3	109 ± 5	159 ± 13 <sup>b</sup>
Mean length hospital stay	4.1 ± 0.1	5.4 ± 1.5	5.9 ± 1.8
Mean length ICU stay	0.7 ± 0.2	1.3 ± .3 <sup>a</sup>	3.4 ± 1.7 <sup>b</sup>

Results are ± SEM

<sup>a</sup>P < 0.05 vs. normoglycaemia.

<sup>b</sup>P < 0.001 vs. normoglycaemia.

Pediatric patients' admission-time hyperglycemia was not linked to a higher mortality rate or a longer hospital stay. During the study period, only one death was recorded, and it involved a patient who had bronchiolitis-related respiratory failure and had been admitted with an entrance blood glucose level of 151 mg/dl. The duration of stay for patients with normoglycemia was 4.1 ± 0.1 days, rising to 5.4 ± 1.5 days and 5.9 ± 1.86 days, respectively, for kids whose blood sugar levels were between 120 and 179 mg/dl and less than 180 mg/dl (p > 0.05).

Children with hyperglycemia had longer stays in the ICU and were also more likely to be hospitalised. It was necessary to admit children to the ICU in 11% of cases where their entrance blood glucose was less than 120 mg/dl, 20% of cases where it was between 120 and 179 mg/dl, and 45% of cases where it was greater than 180 mg/dl (p=0.01). Additionally, the length of stay in the ICU was considerably higher in children with hyperglycemia, especially for those with glucose levels under 180 mg/dl (p 0.001). Patients with normoglycemia spent an average of 0.7 ± 0.2 days in the ICU, while patients with blood sugar levels between 120 and 179 mg/dl and 180 mg/dl spent an average of 1.3 ± 0.3 days and 3.4 ± 1.7 days there, respectively (p 0.01).

Frequently, newly discovered hyperglycemia went untreated. Only 3 kids with hyperglycemia that was noted during their hospital stay and no history of diabetes were given insulin therapy. Regular insulin

was administered on a sliding scale to patients with new cases of hyperglycemia as the primary insulin regimen in the hospital. In contrast, during their hospital stays, all patients with a history of diabetes received treatment with insulin.

## DISCUSSION

In our study, we discovered that most children did not have a history of diabetes prior to admission and that hyperglycemia is a common symptom in children admitted with critical and non-critical illnesses. One-fourth of the children hospitalised had hyperglycemia at the time of admission. However, inpatient hyperglycemia was not linked to a greater hospital mortality rate or a prolonged hospital stay than children with normoglycemia. Children with hyperglycemia were much more inclined to be admitted to the ICU and had a prolonged duration of stay there.

Our findings imply that detection of inpatient hyperglycaemia can be enhanced because more than one-third of patients did not have their blood sugar levels checked while they were in the hospital.

Children's inpatient hyperglycemia prevalence varies depending on the illness's severity and the research population. The prevalence of hyperglycemia within 24 hours of ICU admission was shown to be 70.4% in patients with a glucose value >120 mg/dL, 44.5% in patients with a glucose value >150 mg/dL, and 22.3% in patients with a value >200 mg/dL by Faustino et al<sup>27</sup> in a study of 942 nondiabetic patients. We

discovered that inpatient hyperglycemia is a typical finding among hospitalised kids, which is similar to this study.

The overall mortality rate in children with hyperglycemia is much lower than that in adults and is related to the severity of the illness<sup>28</sup>. Hospital mortality in most severely unwell paediatric groups ranges from 2% to 5.3% and is higher in patients who have undergone major heart surgery and severe trauma<sup>29</sup>. Children hospitalised to general paediatric wards without a serious illness had a much reduced mortality rate<sup>28</sup>.

Generally speaking, diabetic children are obese, according to the literature<sup>30,31</sup>. Similar to this, our research discovered that hospitalised kids with a history of diabetes and blood sugar levels higher than 180 mg/dL had higher body mass indices (BMI) than kids with normoglycemia (p0.001). Children who are obese are more likely to have comorbid conditions and experience hospital complications<sup>32,33</sup>. Additionally, there is mounting proof that patients hospitalised to the intensive care unit (ICU) are more likely to be obese, which increases morbidity and lengthens hospital stays<sup>33</sup>. Therefore, diabetes should be closely monitored in obese youngsters.

## CONCLUSIONS

Children with and without serious illnesses frequently exhibit inpatient hyperglycemia. One-fourth of the children admitted to the hospital have hyperglycemia, the majority of whom had no prior history of diabetes. Although it lengthens ICU stays, hyperglycemia did not lead to greater hospital mortality.

### Declaration by Authors

**Ethical Approval:** Approved

**Acknowledgement:** None

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

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How to cite this article: Priyanka Narale, Suresh Waydande, Abhijit Shinde et.al. Prevalence and clinical outcome of inpatient hyperglycemia in a tertiary care medical centre. *International Journal of Science & Healthcare Research*. 2022; 7(4): 296-300.  
DOI: <https://doi.org/10.52403/ijshr.20221041>

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