

THE BLOOD GLUCOSE LEVELS OF INFANTS WITH ACUTE CONGESTIVE HEART FAILURE DUE TO INFECTIONS

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Prolonged and severe hypoglycemia can damage the central nervous system during the neonatal period and in early infancy, but if it is recognized and treated early, irreversible brain damage can be prevented¹. Although a number of conditions can precipitate hypoglycemia, acute congestive heart failure has been stressed as one of the main etiological factors².

The purpose of this study is to present data on blood glucose levels, the relationship between hypoglycemia and the duration of illness; serum protein and hemoglobin levels and weights of the patients with acute congestive heart failure due to infections during the first two years of life. The role of correction of hypoglycemia in the treatment of congestive heart failure in these patients is also discussed.

Material and Methods

Fifty-four patients ranging from two days to two years of age and suffering from acute cardiac failure due to infections were randomly selected for the study. Twenty of the patients were girls (37%) and 34 were boys (63%). Glucose levels were determined by the Somogyi-Nelson method³ on blood samples taken prior to intravenous fluid administration. The diagnosis of hypoglycemia was based on the criteria established by Cornblath and Schwartz².

Blood sugar values below the following levels are accepted as establishing hypoglycemia:

20 mg/dl for premature and low birthweight babies,
30 mg/dl for normal full term babies (up to 72 hours),
40 mg/dl for older babies.

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In addition to the treatment of congestive heart failure, intravenous glucose solution was given to hypoglycemic patients. It brought about a rapid recovery from all the symptoms in a great majority of the patients in our series.

The correlation between blood glucose levels and the duration of illness, serum protein levels, weights of the patients and hemoglobin levels was also studied.

Results

Seventeen of the 54 patients studied were definitely found to have hypoglycemia. A further 14 infants had glucose levels which were low (40-50 mg/dl) but still within the normal limits for their age group. The remaining 23 patients had normal glucose levels.

Twenty-nine of the 54 patients in this series died, in 19 of whom the postmortem examination confirmed the clinical diagnosis of congestive cardiac failure. The types of infections and associated illnesses and conditions of the patients are given in Table I.

TABLE I
**Types of Infections and Other Diseases and Conditions Associated
with Acute Congestive Heart Failure**

Infections	Number of Cases*
Bronchopneumonia	44
Gastroenteritis	14
Septicemia	3
Pneumonia	2
Abscess of the lung	1
Myocarditis	1
Other diseases and conditions	
Anemia	17
Convulsion	8
Congenital heart disease	4
Poststreptococcal glomerulonephritis	1

* There is overlapping in the presence of infections, diseases and conditions in the patients.

No relationship was found between the presence of hypoglycemia, the duration of illness, serum protein levels and the patients' weights. Hemoglobin levels were found to be low in 10 of the 17 patients (58.8%) with hypoglycemia and in 11 of the 37 patients (29.7%) with normal blood glucose levels, a difference which is statistically significant ($p < 0.05$) (Tables II-IV).

TABLE II
Distribution of Body Weights, Total Serum Protein and Hemoglobin Values According to Blood Glucose Levels in 54 Patients with Acute Congestive Heart Failure Due to Infections *

<u>Blood Glucose Levels</u>	<u>Body Weight</u>			<u>Total Serum Protein Levels</u>				<u>Hemoglobin Levels</u>		
	<u>Normal</u>	<u>Low</u>	<u>Total</u>	<u>Normal</u>	<u>Low</u>	<u>Unknown</u>	<u>Total</u>	<u>Normal</u>	<u>Low</u>	<u>Total</u>
Normal	11	26	37	17	11	9	37	26	11	37
Low	5	12	17	8	6	3	17	7	10	17
Total number of patients	16	38	54	25	17	12	54	33	21	54

* Figures indicate number of patients.

TABLE III
Distribution of Duration of Illness According to Blood Glucose Levels in Acute Congestive Heart Failure Due to Infections *

<u>Duration of Illness</u>	<u>Blood Glucose Levels</u>		<u>Total</u>
	<u>Normal</u>	<u>Low</u>	
Less than 24 hours	4	1	5
24 to 48 hours	1	2	3
48 to 72 hours	6	1	7
More than 72 hours	26	13	39
Total number of patients	37	17	54

* Figures indicate number of patients.

TABLE IV

**Statistical Correlation of Patients' Body Weights, Protein Levels,
Duration of Illness and Hemoglobin Levels with Low Blood Glucose Levels in
Acute Congestive Heart Failure Due to Infections**

	<u>n</u>	<u>SD</u>	<u>"t"</u>	<u>df</u>	<u>p</u>
Duration of illness	54	0.141	0.472	52	p > 0.05
Blood protein levels	42	0.161	0.222	40	p > 0.05
Body weight	54	0.134	0.024	52	p > 0.05
Hemoglobin levels	54	0.143	0.037	52	p < 0.05

* Degrees of freedom.

Discussion

The first study concerning the correlation between hypoglycemia and acute congestive heart failure was published in 1969 by Benzing et al⁴ who observed the two conditions occurring simultaneously. Electron microscopic and biochemical studies of the liver biopsies performed on four newborns in that study showed a marked reduction in hepatic glycogen.

Amatayakul et al⁵ reviewed retrospectively the chest x-rays of 16 infants with hypoglycemia. Cardiomegaly was observed in 12 of the cases. While no cardiac anomaly was found, four of the infants with cardiomegaly also had acute congestive heart failure. The authors concluded that hypoglycemia in the newborn is frequently associated with cardiomegaly and cardiac failure.

Reid et al⁶ found acute congestive heart failure and pulmonary edema in 6 out of 52 infants with hypoglycemia and observed rapid recovery of these conditions following treatment of the hypoglycemia. Cases of spontaneous hypoglycemia in adults with acute congestive heart failure have been reported, but to date no statistical analysis has been published concerning a large number of adult patients⁷.

Acute congestive heart failure in childhood may be due to many conditions and diseases⁸⁻¹⁰. Viral and bacterial infections can frequently cause heart failure in infancy¹¹. Infection was the main cause of heart failure in the 54 patients of this study. However, anemia, congenital heart disease and other factors (Table I) associated with infection also precipitated cardiac failure. There was a statistically significant difference between the frequency of hypoglycemia in anemic and non-anemic patients. Heart failure is more likely in cases where anemia is accompanied by infection, but anemia cannot be considered as the sole agent causing cardiac failure. Many other factors can play a role in its onset. Hypoglycemia can be caused

by poor circulation due to heart failure and a resulting acute stasis, as well as by fatty degeneration in the liver and edema and infection in the bowel.

In conclusion, the results of our study point to the fact that the presence of hypoglycemia is not rare in acute congestive heart failure due to infections in the 0 to 2 year age group, since it occurred in 17 of our 54 patients (31.48%). The incidence of hypoglycemia in anemic patients was statistically significant ($p < 0.05$). It would therefore be useful to determine hemoglobin and blood glucose levels in patients with acute congestive heart failure, so as to prevent possible complications. Administration of intravenous glucose solution would be helpful in obtaining rapid results in the hypoglycemic patients.

Summary

In this study, 54 randomly selected patients with acute congestive heart failure due to infections in the 0 to 2 year age group were investigated. Hypoglycemia was found in 17 of the 54 cases (31.48%). The incidence of hypoglycemia in anemic patients was found to be statistically significant.

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