Medical Grand Rounds
Parkland Memorial Hospital
November 30, 1967

ALCOHOL-INDUCED HYPOGLYCEMIC COMA

Case 1. [redacted]

This 57 year old woman was brought to the emergency room in coma. She was last seen alert by a friend at 9:40 the night before admission. The next morning at 8:30 AM she was found in a comatose condition. She responded immediately to intravenous glucose administration although she was somewhat confused and tremulous. Blood glucose prior to therapy was less than 20 mg%. After awakening she gave a history of heavy drinking for 3 days PTA with a poor intake of food for two days. She felt well but sleepy the night prior to the morning of admission but remembered nothing until awakening in the hospital. Blood ethanol 12 mg%, methanol neg. Urine showed large amounts of ketones. CO_2 19 mEq/L. Physical examination revealed a well developed, thin woman unresponsive and cold when first seen. Neurological examination except for some confusion and tremulousness was negative. Workup for other causes of hypoglycemia were negative. BSP 3%. Bilirubin 0.5 mg%. The patient recovered promptly without developing DTs and was discharged 5 days later.

Case 2. [redacted] - Alcohol induced hypoglycemia and metabolic acidosis

This 31 year old woman was admitted to [redacted] in [redacted] 1967 in coma. Her husband claimed that the patient usually became intoxicated at weekly intervals. However she drank only whiskey and vodka purchased at a local liquor store. She was in good health until 2 days PTA when her husband on returning from work found her apparently asleep in bed with the odor of alcohol on her breath. The next morning she was still asleep. On returning from work that evening her husband attempted to awaken her but found her incoherent and somnolent for which reason he brought her to the emergency room. In general she ate poorly but her husband remembered that she had a cheese sandwich and soup 2 days PTA.

Physical examination revealed an unresponsive, comatose, thin but not emaciated woman with Kussmaul respirations. T 100° B.P. 130/90 R. 44/min. Eyes showed searching nystagmoid movements. Corneal reflexes were gone but there were no ophthalmoplegia. Pupils reacted to light. Lungs and heart normal. No hepatomegaly noted. Extremities were tremulous and held in spastic extension. Occassional decerebrate posturing was noted. A slight response to deep pain could be elicited. No Babinski. Blood chemistries in the emergency room revealed sugar 31 mg%, CO_2 6 mEq/L, pH 7.28, pCO_2 <10, lactate 6 mEq/L, salicylate, methyl alcohol and glycols negative. Urine acetone strongly positive.

Despite immediate administration of IV glucose her neurological condition worsened with development of bilateral Babinskis, clonus and frequent decerebrate posturing. Her course was stormy and she died the next day after a cardiac arrest.

Case 3.

A 53 year old pilot was attempting to land at a field where he had landed many times before and in an aircraft with which he was very familiar. He made two erratic passes over the field and on the third attempt was ssen to slump over the wheel, stall and crash. Post-mortem revealed negative carbon monoxide and barbiturate levels but a blood alcohol of 98 mg% and a blood sugar of 20.5 mg%. His family stated that there was no food intake for 18 hours and little for 24 hours preceding the accident. The stomach was empty at autopsy. (Ref. #51)

Case 4. Personal Communication

Following a short bout of gastroenteritis this 44 year old physician had only tea and toast for breakfast. As a consequence of missing the previous day at the office he worked continuously without eating. On returning home that evening he felt well and was eager to go to an important cocktail party with his wife. During the evening his wife noted that while he was sipping his second martini he was inordinately intoxicated. In consideration of his past ability to drink she suspected something was wrong. She was certain that he was acting in an unusual manner in regard to the small amount of alcohol he had consumed. After persuading him to leave and while she was driving home, he exhibited brief convulsive-like movements and then became comatose. She went immediately to his hospital where blood was drawn and an IV of glucose and saline was started. The patient awoke immediately, was alert and not intoxicated. Blood sugar was 22 mg% and blood alcohol 38 mg%. No other cause for hypoglycemia was found during subsequent workup.

TABLE I

COMA, CONVULSIONS AND NEUROLOGIC DISORDERS IN ALCOHOLICS (ref. #1)

I. Metabolic

a. Acute alcoholic intoxication
b. Alcohol Withdrawal Syndromes - tremulous, hellucinatory, convulsive and delerious states
c. Wernicke's Encephalopathy - Cerebral Beri beri
d. Pellagra
e. Acute dilution hyponatremia
f. Hepatic encephalopathy
g. Poisonings - methanol, isopropyl alcohol, glycols, etc.
h. Hypoglycemia

II. Non-metabolic - Brain Trauma

Subdural hematoma, concussion, meningeal artery bleeding, etc.

TABLE II

HYPOGLYCEMIA IN ALCOHOLICS (ref. #1, 39-43)

1. Hepatic necrosis
2. Hepatoma in cirrhotics
3. Hepatic venous congestion
4. Alcohol-induced
5. Iatrogenic

TABLE III

SYMPTOMS AND SIGNS OF HYPOGLYCEMIA

I. SYMPATHETIC DISCHARGE - HYPEREPINEPHRINEMIA

Restlessness	Sweating
Anxiety	Tachycardia
Palpitations	Tremulousness

II. CNS - Inadequate Cerebral Delivery of Glucose

Mental Disturbances - Personality changes

Slow cerebration	Negativism
Irritability	Bizarre behavior
Aggressiveness	Disorders of speech and gait

Somnolent-agitated State

Somnolence alternating with agitated states
(tumbling, writhing, yelling)
Monoplegias, hemiplegis, blindness
Incoordination of eye muscles
Positive Babinski

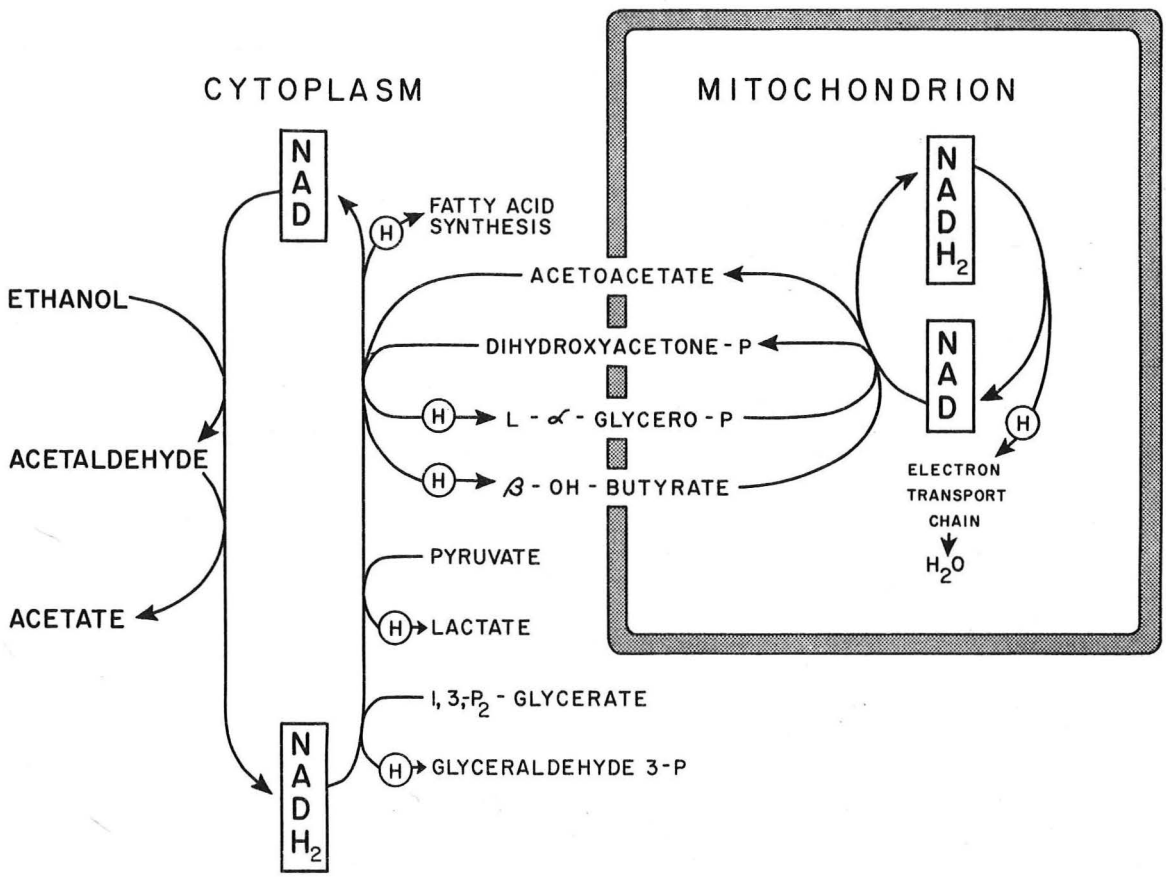
Deep coma

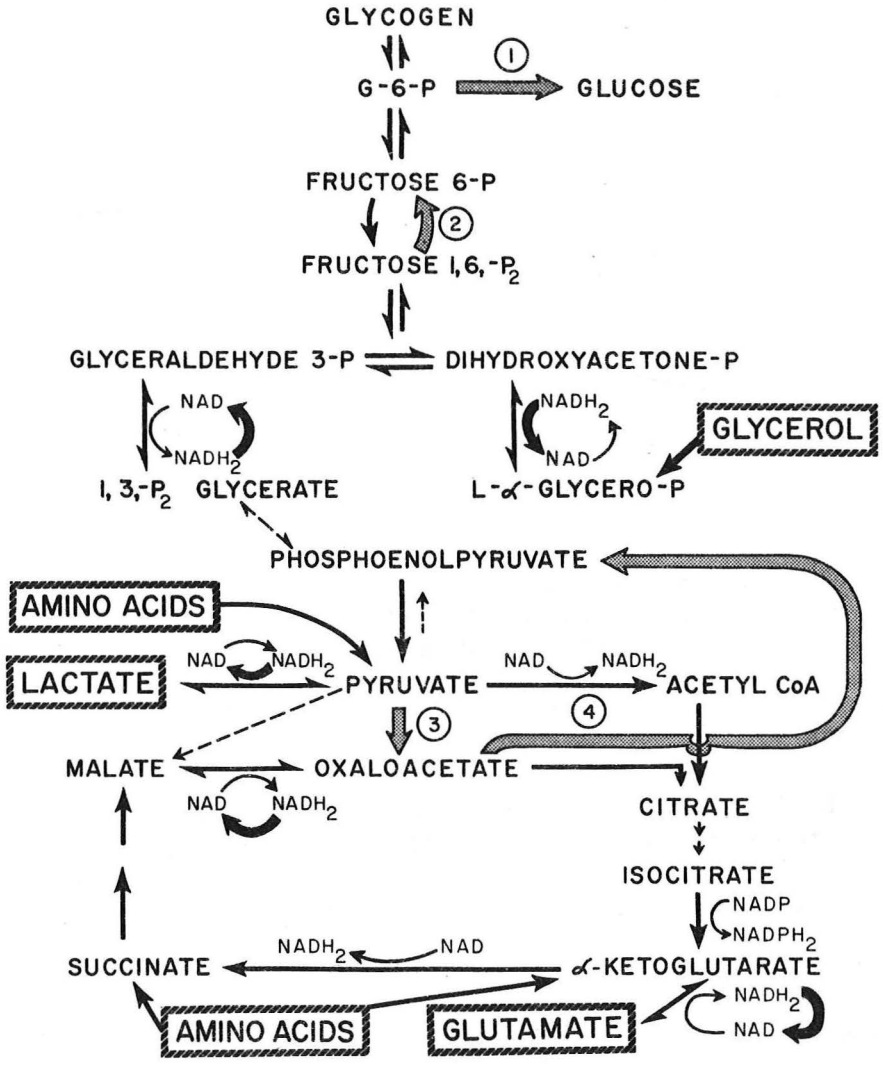
Flaccidity or decerebrate rigidity
Cold moist skin
Hypothermia
Trismus
Extensor Rigidity
Convulsions

TABLE IV

MOST COMMON NEUROLOGICAL FINDINGS IN ALCOHOL-INDUCED HYPOGLYCEMIA COMA

1. Hypothermia
2. Conjugate deviation of the eyes
3. Extensor rigidity of the extremities
4. Babinski - unilateral or bilateral
5. Trismus
6. Convulsions (especially in children)


CYTOPLASM
MITOCHONDRION
NAD
NADH2
FATTY ACID SYNTHESIS
ACETOACETATE
DIHYDROXYACETONE-P
L-α-GLYCERO-P
β-OH-BUTYRATE
ETHANOL
ACETALDEHYDE
ACETATE
PYRUVATE
LACTATE
1,3-P2-GLYCERATE
GLYCERALDEHYDE 3-P
ELECTRON TRANSPORT CHAIN
H2O


GLYCOGEN
G-6-P
1
GLUCOSE
FRUCTOSE 6-P
2
FRUCTOSE 1,6,-P2
GLYCERALDEHYDE 3-P
DIHYDROXYACETONE-P
NAD
NADH2
NADH2
NAD
GLYCEROL
1, 3,-P2 GLYCERATE
L-α-GLYCERO-P
PHOSPHOENOLPYRUVATE
AMINO ACIDS
LACTATE
NAD
NADH2
PYRUVATE
NAD
NADH2
ACETYL CoA
3
4
MALATE
OXALOACETATE
NAD
NADH2
CITRATE
ISOCITRATE
NADP
NADPH2
NADH2
NAD
SUCCINATE
α-KETOGLUTARATE
NADH2
NAD
AMINO ACIDS
GLUTAMATE

I. CLINICAL PICTURE OF ALCOHOL-INDUCED HYPOGLYCEMIA

A. General Review

1. Madison, L. L.: Ethanol-induced hypoglycemia. In Advances in Metabolic Disorders. Vol. III. Levine, R., and Luft, R., Eds. London, Academic Press. In press. Review of world's literature 101 cases (89 adults, 12 children) - clinical picture and mechanism of production of hypoglycemia.

B. In Adults

2. Brown and Harvey. Spontaneous hypoglycemia in "smoke drinkers. J.A.M.A. 117:12, 1941. (6 cases)

3. Tucker and Porter. Hypoglycemia following alcohol intoxication. Am. J. Med. Sci. 204:559, 1942. (4 cases)

4. Neame, P. B., and Joubert, S. M.: Postalcoholic hypoglycemia and toxic hepatis. Lancet 2:893-97, 1961. (22 cases)

5. Bottura, C., Neves, C. P., Matlar, E., de Oliveira, H. L., and Cintra, A.B.U.: Hipoglicemia e coma hipoglicemico consequentes a intoxicao aguda por alcool etilico. Rev. Hosp. Clin. Fac. Med. S. Paulo 4:133-40, 1949. (11 cases)

6. Neves, D. P., Faria, C. V., and Fujioka, T.: Hiperglicemia e hipoglicemia consequentes a intoxicao aguda e cronica pelo alcool etilico. Rev. Hosp. Clin. Fac. Med. S. Paulo 5:115-20, 1950. (17 cases)

7. Field, J. B., Williams, H. E., and Mortimore, G. E.: Studies on the mechanism of ethanol induced hypoglycemia. J. Clin. Invest. 42:497, 1963. (1 case)

8. Freinkel, N., Singer, D. L., Arky, R. A., Bleicher, S. J., Anderson, J. B. and Silbert, C. K.: Alcohol hypoglycemia. I. Carbohydrate metabolism of patients with clinical alcohol hypoglycemia and the experimental reproduction of the syndrome with pure ethanol. J. Clin. Invest. 42:1112, 1963. (9 cases)

C. In Children

9. Neves, D. P., Faria, C. V., and Fujioka, T.: Hiperglicemia e hipoglicemia consequentes a intoxicao aguda e cronica pelo alcool etilico. Rev. Hosp. Clin. Fac. Med. S. Paulo 5:115-20, 1950. (first reported case in child)

10. Peluffo, E., Scolpini, V., Grezzi, J., and Tarallo, N.: Coma hipoglucemico e ingestion de bebida cicoholicas en ninos. Arch. Pediat. Urug. 29:94, 1958. (2 cases)

11. Cummins, L.H.: Hypoglycemia and convulsions in children following alcohol ingestion. J. Pediat. 58:23, 1961. (2 cases)

12. Neame, P. B., and Joubert, S. M.: Post-alcohol hypoglycemia and toxic hepatitis. Lancet 2:893, 1961. (1 case)

13. Jeune, M., Cotte, J., and Nivelon, J. L.: Coma hypoglycemique au cours d'une intoxication alcoolique aiguë chez un enfant de quatre ans. Pédiatrie 15:664, 1960. (1 case)

14. Tolis, A. D.: Hypoglycemic convulsions in children after alcohol ingestion. Pediat. Clin. N. Amer. 12:423, 1965. (4 cases)

II. METABOLISM OF ALCOHOL

A. Accepted Pathways via alcohol and acetaldehyde dehydrogenase

15. Westerfield, W. W.: The intermediary metabolism of alcohol. Am. J. Clin. Nutrit. 9:426, 1961.

16. Westerfield, W. W. and M. P. Schulman: Metabolism and caloric value of alcohol. J.A.M.A. 170:197, 1959.

17. Seligson, D., H. H. Stone and P. Nemir, Jr.: The metabolism of ethanol in man. Surg. Forum. 9:85, 1959.

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B. Possible alternate pathways and extra-hepatic sities of alcohol metabolism

20. Keilin, D. and Hartree, E. F.: Properties of catalase. Catalysis of coupled oxidation of alcohols. Biochem. J. 39:293, 1945.

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25. Larson, J. A. Extrahepatic metabolism of ethanol in man. Nature 184:1236, 1959.

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III. METABOLIC EFFECTS OF ALCOHOL

Excellent General Reviews

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IV. MECHANISM OF ETHANOL-INDUCED HYPOGLYCEMIA

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44. Bondy, P. K.: Some metabolic abnormalities in liver disease. Am. J. Med. 24:428, 1958.

VI. METABOLIC ACIDOSIS IN ALCOHOLICS

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VII. AVIATION ACCIDENTS, ALCOHOL AND HYPOGLYCEMIA

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