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# Severe hypoglycemia due to cryptic insulin use in a bodybuilder

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2 **Severe hypoglycemia due to cryptic**  
3 **insulin use in a bodybuilder**

4 ABSTRACT

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5 **Background:** Bodybuilding is a demanding sporting activity, which requires  
6 high volume, high resistance weight training and augmented nutritional intake,  
7 toward an increase of overall body muscle mass accompanied by an overall  
8 decrease of body fat percentage and mass. Among bodybuilders, the use of  
9 various legal and illegal supplements is common. These supplements may be  
10 naturally-occurring or man-made.

11 **Case report:** We discuss the case of a 30-year-old male bodybuilder presenting  
12 with coma due to a severe hypoglycemia from unknown cause, necessitating  
13 iterative glucose infusions, and subsequently found to be related to cryptic  
14 insulin injections.

15 **Why should an emergency physician be aware of this:** in strength athletes,  
16 especially amateurs, the recourse to performance-enhancement drugs (of which  
17 insulin) is frequent. Beyond the specificity of care required for surreptitious  
18 insulin intoxication, emergency physicians should be alert to the possibility that  
19 exogenous insulin has been injected for use as an ergogenic aid by bodybuilders  
20 and others seeking to increase their body muscle mass, when they encounter a  
21 patient with a decreased level of consciousness and treatment-refractory  
22 hypoglycaemia. Moreover, in case of suspicion of such intoxication, the use of  
23 other illegal supplements should be screened, due to potentially associated risks  
24 of complication.

25 **1. Introduction**

26 Bodybuilding is a highly demanding sport, associated with a drastic,  
27 intentional reduction of body fat, marked increase of skeletal muscle mass, and  
28 repeated, intense bouts of high-resistance weight training. To enhance their  
29 performance, body builders may utilize dietary modifications, sometimes in  
30 association with potentially dangerous non-prescription and surreptitious uses  
31 of pharmaceuticals. Insulin is one pharmaceutical that is utilized surreptitiously  
32 as an ergogenic aid by some bodybuilders to augment their ability to quickly gain  
33 muscle mass as a result of high resistance weight training (1-3).

34 **2. Case presentation**

35 An EMS team was dispatched for a 30-year-old male, with no previous  
36 medical history and no chronic illness, in a coma. His wife found him  
37 unconscious and unarousable in his bed at night. He was clinically assessed as  
38 follows: GCS 3, spontaneous stertorous breathing with no sign of hypoxemia,  
39 blood pressure 120/80 mmHg and pulse rate 71 bpm. The glucose blood test  
40 was 14.4 mg/dL. The rest of clinical examination was normal.

41 He was infused with repeated intravenous boluses of glucose (80 mL of 30%  
42 glucose) until return to normoglycemia (160 mg/dL 30 minutes after first  
43 infusion) and GCS 15. Before his referral to the emergency department of the  
44 university hospital, he was asked to eat a plain pasta dish. At hospital, he  
45 required a continuous glucose infusion (D10, 1L over 24 hours) along with one  
46 more bolus of 10 mL D30, due to the recurrence of severe hypoglycemia (36  
47 mg/dL 6 hours after first infusions). Biological exams remained normal.

48 The initially-suspected cause for this coma was exercise-related  
49 hypoglycemia related to caloric restriction before the physical activity of  
50 weightlifting. According to his wife, he had been following an intense  
51 preparation regimen, consisting of high-volume, high-resistance weight training,  
52 along with ingestion of a high-protein, low-carbohydrate diet for several days  
53 previously. However, the severity of and persistence of the hypoglycemia  
54 precipitated questioning of this provisional diagnostic hypothesis. Once his  
55 cognitive functional status returned to normal, the patient admitted to numerous  
56 injections of insulin for several days, at an unknown dosage. No other drug use  
57 was acknowledged. After exclusion of any underlying psychosis or suicidal trend,  
58 the patient was informed of the risky nature of such a practice, and was released  
59 from the emergency department 28 hours after admittance.

### 60 **3. Discussion**

61 Insulin misuse is not uncommon among athletes performing high strength  
62 activities such as bodybuilding, and is more prevalent among weightlifters and  
63 bodybuilders than among other athletes (3,4). As bodybuilding is a sport  
64 associated with a goal of development of a high muscle mass and a low body fat  
65 percentage, up to 70% of such athletes may recourse to dietary modifications  
66 and strategies to facilitate their morphologic goals. This tactic is especially  
67 prevalent among young amateurs seeking aesthetic improvement (5). Standard  
68 nutritional support with a high-protein diet to augment the effects of weight  
69 training helps induce skeletal muscle hypertrophy and an increase of total  
70 muscle strength (6). To enhance these effects, athletes regularly misuse World  
71 Anti-Doping Agency (WADA)-prohibited medications, including anabolic-

72 androgenic steroids (AAS), growth hormone (GH), and insulin growth factor or  
73 insulin.

74 Insulin is an anabolic hormone, favoring the creation of larger molecules  
75 from smaller ones. Insulin prevents proteolysis and favors building of proteins  
76 from amino acids, and storage of glycogen and nutrients (7). It also stimulates  
77 the endogenous secretion of growth hormone (GH), which possesses lipolytic  
78 effects and possibly enhances muscle hypertrophy and strength (8). The  
79 hyperinsulinemia of gestational diabetes explains the fact that infants born to  
80 mothers with gestational diabetes are at elevated risk for macrosomia. Insulin is  
81 then used in a theoretical and non-demonstrated anabolic way (9).

82 Insulin misuse can be difficult to diagnose because of the concomitant natural  
83 endogenous secretion of the hormone (10). The treatment of insulin overdosage  
84 relies upon early recognition and glucose infusion, which sometimes must be  
85 provided for 24 hours or more. High doses of infused glucose may be required  
86 for massive intoxications (11). Except in rare cases, glycemic control is not  
87 difficult to maintain and does not impact outcomes (12,13). Underlying  
88 mechanisms of dissociation between massive doses and the severity of  
89 hypoglycemia are not clear to date. Nevertheless, the duration of the risk of  
90 recurrence of hypoglycemia seems to be linked to the nature of insulin, the mode  
91 of administration, the total administered dose, the existence of lipodystrophies,  
92 and the initial glucose blood peak (11). Regular insulin reaches its peak within  
93 20 minutes and can maintain effect up to 8 hours, whereas the half-life of NPH-  
94 insulin is 8 to 10 hours. This pharmacokinetics should be considered when

95 taking care of insulin intoxications, and patients should not be released from the  
96 emergency department until maintenance of euglycemia can be assured.

97 Hypoglycemia can be multifactorial in athletes. Hypoglycemia can be  
98 primarily due to reduction in carbohydrate intake, to a reduction of overall  
99 caloric intake, or to prolonged efforts without nutritional support. Muscle is  
100 responsible for 90% of the overall body's' glucose uptake; hence, hypoglycemia  
101 is not infrequent during exercise but is quite rare at rest or in healthy non-  
102 athletic patients (14,15). This brought the theory of a simple exercise-related  
103 cause into question for our patient.

104 Drug misuse or intoxication in athletes should lead to the screening of other  
105 medical abuses. Standard dietary supplements easily found in shops often  
106 contain hidden AAS (96%) (16), the latter associated to severe health  
107 complications, including lipid profile modification, atherogenesis, nephrotoxicity  
108 and hepatotoxicity (17). When voluntarily used, AAS are almost always injected  
109 (up to 95%). Even though weak, the infectious risk should not be minimized for  
110 injection use (1). Finally, chronic elevated secretion of GH can result in  
111 acromegaly, itself responsible for several life-threatening complications (18).

112 Therefore, physicians treating patients at risk for abuse of WADA-proscribed  
113 ergogenic aid medications need to be aware of the associated risks inherent with  
114 use of such medications, and should orient their patients toward specific  
115 education, training and medical supervision.

116 **4. Why should an emergency physician be aware of this ?**

117 Insulin abuse is not uncommon among athletes, especially those pursuing  
118 power sports such as bodybuilding, despite the dangers from such abuse. The  
119 hypoglycemia that can ensue after exogenous insulin administration, when not  
120 medically indicated, can be easily controlled by insulin infusions, and can  
121 necessitate prolonged correction and surveillance. Because bodybuilders often  
122 use various performance-enhancing drugs as ergogenic aids, physicians should  
123 be aware of the associated health risks.

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