Severe Hypoglycemia Due to Cryptic Insulin Use in a Bodybuilder

Matthieu Heidet, Abdel Abdel Wahab, Vahid Ebadi, Yann Cogne, Charlotte Chollet-Xemard, Mehdi Khellaf

► To cite this version:

Matthieu Heidet, Abdel Abdel Wahab, Vahid Ebadi, Yann Cogne, Charlotte Chollet-Xemard, et al.. Severe Hypoglycemia Due to Cryptic Insulin Use in a Bodybuilder. *Journal of Emergency Medicine*, 2019, 56, pp.279 - 281. 10.1016/j.jemermed.2018.10.030 . hal-03486075

HAL Id: hal-03486075

<https://hal.science/hal-03486075>

Submitted on 20 Dec 2021

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Distributed under a Creative Commons Attribution - NonCommercial| 4.0 International License

Severe hypoglycemia due to cryptic insulin use in a bodybuilder

Matthieu HEIDET^{a,b}, Abdel ABDEL WAHAB^a, Vahid EBADI^c, Yann COGNE^{a,c},
Charlotte CHOLLET-XEMARD^a, Mehdi KHELLAF^{c,d}

^aAssistance Publique – Hôpitaux de Paris, Hôpitaux Universitaires Henri Mondor, SAMU 94, Créteil, France

^bUniversité Paris-Est Créteil, EA-4390 (ARCHES), Créteil, France

^cAssistance Publique – Hôpitaux de Paris, Hôpitaux Universitaires Henri Mondor, Service d'accueil des urgences, Créteil, France

^dUniversité Paris-Est Créteil, INSERM U955, Créteil, France

Dr Matthieu HEIDET, MD, MPH

Assistance Publique – Hôpitaux de Paris, Hôpitaux Universitaires Henri Mondor, SAMU 94,
51 boulevard du Maréchal de Lattre de Tassigny, 94000 Créteil, France

matthieu.heidet@aphp.fr

00331 45 17 95 29 (pro)

00336 70 34 25 56 (mobile)

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

4 ABSTRACT

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 ins
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.

124 **5. Acknowledgements**

125 Every author listed participated in the care of the patient reported and/or in
126 the writing of the article.

127 **6. Funding**

128 This research did not receive any specific grant from funding agencies in the
129 public, commercial, or not-for-profit sectors.

131 **References**

- 132 1. Cohen J, Collins R, Darkes J, Gwartney D. A league of their own: demographics,
133 motivations and patterns of use of 1,955 male adult non-medical anabolic steroid
134 users in the United States. *J Int Soc Sports Nutr.* 2007;4(1):12.
- 135 2. Helms ER, Aragon AA, Fitschen PJ. Evidence-based recommendations for natural
136 bodybuilding contest preparation: nutrition and supplementation. *J Int Soc Sports*
137 *Nutr.* 2014;11(1):20.
- 138 3. Ip EJ, Barnett MJ, Tenerowicz MJ, Perry PJ. Weightlifting's risky new trend: a case
139 series of 41 insulin users. *Curr Sports Med Rep.* 2012 Aug;11(4):176–9.
- 140 4. Sonksen PH. Insulin, growth hormone and sport. *J Endocrinol.* 2001 Jul;170(1):13–
141 25.
- 142 5. Sobal J, Marquart LF. Vitamin/Mineral Supplement Use among Athletes: A Review of
143 the Literature. *Int J Sport Nutr.* 1994 Dec;4(4):320–34.
- 144 6. Slater G, Phillips SM. Nutrition guidelines for strength sports: Sprinting,
145 weightlifting, throwing events, and bodybuilding. *J Sports Sci.* 2011
146 Jan;29(sup1):S67–77.
- 147 7. Fink J, Schoenfeld BJ, Nakazato K. The role of hormones in muscle hypertrophy. *Phys*
148 *Sportsmed.* 2018 Jan 2;46(1):129–34.
- 149 8. Anderson LJ, Tamayose JM, Garcia JM. Use of growth hormone, IGF-I, and insulin for
150 anabolic purpose: Pharmacological basis, methods of detection, and adverse effects.
151 *Mol Cell Endocrinol.* 2018 Mar;464:65–74.
- 152 9. Ivy JL. Muscle glycogen synthesis before and after exercise. *Sports Med Auckl NZ.*
153 1991 Jan;11(1):6–19.
- 154 10. Holt RIG, Sönksen PH. Growth hormone, IGF-I and insulin and their abuse in sport.
155 *Br J Pharmacol.* 2008 Jun;154(3):542–56.
- 156 11. Fasching P, Roden M, Stühlinger HG, Kurzemann S, Zeiner A, Waldhäusl W, et al.
157 Estimated Glucose Requirement Following Massive Insulin Overdose in a Patient
158 with Type 1 Diabetes. *Diabet Med.* 1994 Apr;11(3):323–5.
- 159 12. Elkin SL, Brady S, Williams IP. Bodybuilders find it easy to obtain insulin to help
160 them in training. *BMJ.* 1997 Apr 26;314(7089):1280.
- 161 13. Evans PJ. Insulin as a drug of abuse in body building. *Br J Sports Med.* 2003 Aug
162 1;37(4):356–7.
- 163 14. Brun JF, Dumortier M, Fedou C, Mercier J. Exercise hypoglycemia in nondiabetic
164 subjects. *Diabetes Metab.* 2001 Apr;27(2 Pt 1):92–106.
- 165 15. Wasserman DH. Regulation of glucose fluxes during exercise in the postabsorptive
166 state. *Annu Rev Physiol.* 1995;57:191–218.

- 167 16. Abbate V, Kicman AT, Evans-Brown M, McVeigh J, Cowan DA, Wilson C, et al.
168 Anabolic steroids detected in bodybuilding dietary supplements - a significant risk
169 to public health: Anabolic steroids detected in bodybuilding dietary supplements; a
170 significant risk to public health. *Drug Test Anal.* 2015 Jul;7(7):609–18.
- 171 17. Kafrouni MI, Anders RA, Verma S. Hepatotoxicity Associated With Dietary
172 Supplements Containing Anabolic Steroids. *Clin Gastroenterol Hepatol.* 2007
173 Jul;5(7):809–12.
- 174 18. Melmed S, Casanueva FF, Klibanski A, Bronstein MD, Chanson P, Lamberts SW, et al.
175 A consensus on the diagnosis and treatment of acromegaly complications. *Pituitary.*
176 2013 Sep;16(3):294–302.