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SEVERE HYPOGLYCEMIA DUE TO CRYPTIC INSULIN USE IN A BODYBUILDER

Matthieu Heidet, MD, MPH,*† Abdel Abdel Wahab, MD,* Vahid Ebadi, MD,‡ Yann Cogne, MD,*‡ Charlotte Chollet-Xemard, MD,* and Mehdi Khellaf, MD, MPH‡§

*Assistance Publique–Hôpitaux de Paris, Hôpitaux Universitaires Henri Mondor, Créteil, France, †Université Paris-Est Créteil, Créteil, France, ‡Assistance Publique–Hôpitaux de Paris, Hôpitaux Universitaires Henri Mondor, Service d'Accueil des Urgences, Créteil, France, and §Université Paris-Est Créteil, Institut National de la Santé et de la Recherche Médicale U955, Créteil, France

Reprint Address: 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

☐ **Abstract—Background: Bodybuilding is a demanding sport, which requires high-volume, high-resistance weight training and augmented nutritional intake, toward an increase of overall body muscle mass accompanied by an overall decrease of body fat percentage and mass. Among bodybuilders, the use of various legal and illegal supplements is common. These supplements may be naturally occurring or man-made. Case Report: We discuss the case of a 30-year-old male bodybuilder presenting with coma due to severe hypoglycemia from unknown cause, necessitating iterative glucose infusions, which was subsequently found to be related to cryptic insulin injections. Why Should an Emergency Physician Be Aware of This?: In strength athletes, especially amateurs, the recourse to performance-enhancement drugs (e.g., insulin) is frequent. Beyond the specificity of care required for surreptitious insulin intoxication, emergency physicians should be alert to the possibility that exogenous insulin has been injected for use as an ergogenic aid by bodybuilders and others seeking to increase their body muscle mass when they encounter a patient with a decreased level of consciousness and treatment-refractory hypoglycemia. Moreover, in case of suspicion of such intoxication, the use of other illegal supplements should be screened, due to potentially associated risks of complication.**

☐ **Keywords—emergency medicine; insulin intoxication; drug abuse; bodybuilding**

INTRODUCTION

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

CASE PRESENTATION

An emergency medical services team was dispatched for a 30-year-old male, with no medical history and no chronic illness, in a coma. His wife found him unconscious and unarousable in his bed at night. He was clinically assessed as follows: Glasgow Coma Scale (GSC) score of 3, spontaneous stertorous breathing with no sign of hypoxemia, blood pressure 120/80 mm Hg, and pulse rate 71 beats/min. The glucose blood test was 14.4 mg/dL. The rest of the clinical examination was normal.

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

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

DISCUSSION

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

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

Insulin misuse can be difficult to diagnose because of the concomitant natural endogenous secretion of the hormone (10). The treatment of insulin overdose relies upon early recognition and glucose infusion, which sometimes must be provided for 24 h or more. High doses of infused glucose may be required for massive intoxications (11). Except in rare cases, glycemic control is not difficult to maintain and does not impact outcomes (12,13). Underlying mechanisms of dissociation between massive doses and the severity of hypoglycemia are not clear to date. Nevertheless, the duration of the risk of recurrence of hypoglycemia seems to be linked to the nature of insulin, the mode of administration, the total administered dose, the existence of lipodystrophies, and the initial glucose blood peak (11). Regular insulin reaches its peak within 20 min and can maintain effect up to 8 h, whereas the half-life of NPH insulin is 8 to 10 h. This pharmacokinetics should be considered when taking care of insulin intoxications, and patients should not be released from the emergency department until maintenance of euglycemia can be assured.

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

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

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

WHY SHOULD AN EMERGENCY PHYSICIAN BE AWARE OF THIS?

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

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