

## 2,4-Dinitrophenol Poisoning Presenting as a Sepsis-like Syndrome

Kevin C Ma<sup>1</sup>, Alejandro Pino<sup>2</sup> and Dana Zappetti<sup>1</sup>

<sup>1</sup>Division of Pulmonary and Critical Care, Department of Medicine, Weill Cornell Medicine, 1300 York Ave, New York, NY 10065, USA

<sup>2</sup>Division of Internal Medicine, Department of Medicine, Weill Cornell Medicine, 1300 York Ave, New York, NY 10065, USA

\*Corresponding author: Alejandro Pino, Division of Pulmonary and Critical Care, Department of Medicine, Weill Cornell Medicine, 1300 York Ave, New York, NY 10065, USA, Tel: 13058981646; E-mail: [pino.s.alejandro@gmail.com](mailto:pino.s.alejandro@gmail.com)

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### Abstract

2,4-Dinitrophenol (DNP) is a former weight loss supplement that has been banned by the Federal Drug Administration since 1938 due to its narrow therapeutic window and a high risk of fatal poisoning. However, DNP is still used in unregulated markets for its ability to rapidly shed body fat. Symptoms of DNP toxicity, such as tachycardia, tachypnea, diaphoresis, fever, lactic acidosis, and shock, are non-specific and can often mimic other illnesses including sepsis. Here we report a case of inadvertent DNP toxicity in a young man presenting with shortness of breath and fever that was treated with supportive care and recovered. In cases of young individuals presenting with a sepsis-like picture, especially those who admit to active bodybuilding or dieting, DNP poisoning should be considered and possible ingestions need to be elucidated from the clinical history.

### Introduction

2,4-Dinitrophenol (DNP) is an oxidative phosphorylation decoupling agent first described as a potential weight loss supplement in 1933 [1]. After its initial release, DNP was attributed to numerous poisonings in the span of several years and it was eventually banned in the United States by the Federal Drug Administration in 1938. It continues to be used illegally in bodybuilding and fitness circles for its ability to rapidly shed body fat. The convenience in which this medication can be purchased online and consumed has led to resurgence in the number of case reports of overdose and fatalities [2]. Here we report a case of inadvertent DNP toxicity in a young man presenting with shortness of breath and fever.

### Case Presentation

A 28 year old man without prior medical history presented to a cardiologist's office with 5 days of diaphoresis, shortness of breath, fatigue and subjective fevers. An office echocardiogram revealed vegetation on the aortic valve and he was initially referred to our emergency department for management of presumed infective endocarditis and sepsis.

On arrival he was noted to have a blood pressure of 118/53; a heart rate of 110 beats per minute; a respiratory rate of 30 breaths per

minute; a SpO<sub>2</sub> of 98% on 2 liters per minute of oxygen by nasal cannula; a temperature of 38.5°C. He was noted to be profoundly diaphoretic with both tachypnea and platypnea, speaking in short sentences though fully alert and oriented. He had an II/VI systolic flow murmur at the left lower sternal border. His pulmonary and abdominal exams were unremarkable. No rashes, flushing, edema, or piloerection were noted. An echocardiogram revealed vegetation on the medial side of the aortic valve without other pathologic findings.

He was admitted to the medical intensive care unit. On arrival, the patient admitted to taking DNP 500 mg orally twice a day, starting just prior to the onset of his symptoms. He noticed diaphoresis on the first day of intake followed by progressive shortness of breath and fatigue after subsequent doses. Aggressive intravenous fluid resuscitation was started, totaling 6 liters over the first 12 h. Twenty four hours into his admission his liver transaminases were: aspartate aminotransferase (AST) 231 IU/L, alanine aminotransferase (ALT) 64 IU/L and total bilirubin 2.0 mg/dl but improved to 146 IU/L, 61 IU/L, 1.3 mg/dL, respectively, at the time of his discharge. Serum creatinine peaked at 1.3 mg/dL then improved to 1.04 mg/dL at 24 h. His serum lactate and methemoglobin levels remained normal (Table 1). The vegetation on the echocardiogram was concluded to be a Lambd's excrescence based on repeatedly negative blood cultures. He was discharged home 48 h after admission.

	On admission	24 hours after admission
Aspartate aminotransferase	231 IU/L	145 IU/L
Alanine aminotransferase	64 IU/L	61 IU/L
Total Bilirubin	2.0 mg/dl	1.3 mg/dl
Creatinine	1.33 mg/dl	1.04 mg/dl
Lactate	1.5 mmol/L	NA

Methemoglobin	1.6%	NA
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**Table 1:** Laboratory values on admission and at 24 hours.

## Discussion

DNP was first reported in a series of poisonings among French munitions workers during the First World War. Animal studies soon followed, characterizing the chemical's ability to augment basal metabolism and highlighting its weight loss potential [1]. DNP uncouples oxidative phosphorylation, preventing generation of ATP from glucose with energy wasted as heat. The first human case reports were published by Cutting and Tainter in 1933 and a case series of 113 patients soon followed showing a 4 kg weight loss over 40 days [1]. Unfortunately, cases of poisoning, both intentional and accidental, soon followed, leading to its eventual discontinuation in the United States in 1938 [3]. The uncoupling of oxidative phosphorylation leads to shunting of pyruvate to lactate for generation of 2 ATP vs the 36 typically generated via oxidative phosphorylation. This leads to the buildup of lactate and a metabolic acidosis. Severe cases of poisoning are characterized by hyperthermia, methemoglobinemia, lactic acidosis, seizures, or convulsions [2]. Fatalities are usually characterized by shock followed by cardiopulmonary collapse. In this case report we describe a fortunate case that manifested many of the cardinal features of 2,4 DNP poisoning such as tachycardia, tachypnea, and diaphoresis but, luckily, did not progress to the more significant complications. A review of multiple online retailers and bodybuilding websites describe a common daily dose of 5-8 mg/kg. Our patient consumed over twice this common daily dose, a total of 5 g over a span of 5 days. It is unknown whether this reflects a commonly fatal dose due to the limited data and publication bias. However, fatal cases have been reported at or below this dose (5 grams over 5 days) in prior case reports [4-8]. Treatment of DNP overdose is largely supportive with correction of hyperthermia and fluid resuscitation. One report by Kumar et al. suggests that the use of dantrolene to control hyperthermia, similar to its use in malignant hyperthermia, may be beneficial [9]. Intravenous lipid emulsion therapy was considered for our patient based on published data in acute poisonings from a variety of lipophilic medications without other known antidotes [10]. However, due to his clinical improvement, such treatment was deferred.

This case also highlights the many similarities of DNP toxicity to sepsis such as tachycardia, tachypnea, diaphoresis, fever, possible lactic acidosis, and shock. In cases of young individuals presenting with a sepsis-like picture, especially those who admit to active bodybuilding or dieting, DNP poisoning should be considered and possible ingestions need to be elucidated from the clinical history.

## Disclosure

The authors declare that there is no conflict of interest regarding the publication of this paper.

## References

1. Tainter ML, Stockton AB, Cutting WC. (1933) Use of dinitrophenol in obesity and related conditions: A progress report. J Am Med Assoc 19: 1472-1475.
2. Grundlingh J, Dargan PI, El-Zanfaly M, Wood DM (2011) 2,4-Dinitrophenol (DNP): A Weight Loss Agent with Significant Acute Toxicity and Risk of Death. J Med Toxicol 7: 205-212.
3. Tainter ML (1935) Treatment of acute dinitrophenol poisoning. J Am Med Assoc 13: 1071-1072.
4. Poole Fe, Haining Fb (1934) Sudden death from dinitrophenol poisoning: Report of a case with autopsy. J Am Med Assoc 102: 1141-1147.
5. McFee RB, Caraccio TR, McGuigan MA, Reynolds SA, Bellanger P (2004) Dying to be thin: a dinitrophenol related fatality. Vet Hum Toxicol 46: 251-254.
6. Silver S (1934) A new danger in dinitrophenol therapy: Agranulocytosis with fatal outcome. J Am Med Assoc 103: 1058-1058.
7. Siegmuller C, Narasimhaiah R (2010) Fatal 2,4-dinitrophenol poisoning... coming to a hospital near you. Emerg Med J 27: 639-640.
8. Bartlett J, Brunner M, Gough K (2010) Deliberate poisoning with dinitrophenol (DNP): an unlicensed weight loss pill. Emerg Med J 27: 159-160.
9. Kumar S, Barker K, Seger D (2002) Dinitrophenol-induced hyperthermia resolving with dantrolene administration. Clin Toxicol 40: 599-673.
10. Cave G, Harvey M (2009) Intravenous lipid emulsion as antidote beyond local anesthetic toxicity: a systematic review. Acad Emerg Med 16: 815-824.