Case Report

Procalcitonin elevation induced by sympathomimetic drug overdose

Sota Kodama, Masahiro Kashiura, and Takashi Moriya

Department of Emergency and Critical Care Medicine, Saitama Medical Center, Jichi Medical University, Saitama, Japan

Background: Procalcitonin, a biomarker used to detect systemic bacterial infection, can be elevated in other conditions. Some case reports have suggested procalcitonin elevation induced by drug overdose.

Case Presentation: A 20-year-old woman with insignificant medical history presented with vomiting, fever, and impaired consciousness. Her vital signs showed an altered mental status (Glasgow Coma Scale score, 11 [E4V1M6]) and high fever (38.0°C), and no significant neurological signs were detected. Laboratory tests revealed that her serum procalcitonin level was significantly high (>10 ng/dL). Gradually, her level of consciousness improved, and she admitted that she had taken an overdose of sympathomimetic drugs. She was discharged from the hospital on day 5 without any problems.

Conclusion: Drug overdose is seldom mentioned as one of the causes of serum procalcitonin level elevation. Sympathomimetic drug overdose can be one of the causes of procalcitonin elevation.

Key words: Caffeine, drug overdose, ephedrine, procalcitonin, sympathomimetic drug

INTRODUCTION

PROCALCITONIN (PCT) IS a biomarker used to detect systemic bacterial infection.[1,2] Despite its high specificity for bacterial infections, PCT can be elevated in other conditions. Inflammatory cytokine release stimulates PCT production in whole organs because of severe invasion, such as in surgery, trauma, or acute pancreatitis.[3] However, few case reports have suggested PCT elevation induced by drug overdose.

Caffeine and ephedrine are common causative agents of drug addiction or overdose. Herein, we report a case of elevated PCT in a young woman who presented with fever and impaired consciousness due to sympathomimetic drug overdose, which was initially misdiagnosed as bacterial meningitis. This is the first report to address the relation between caffeine and PCT elevation.

Corresponding: Masahiro Kashiura, MD, Department of Emergency and Critical Care Medicine, Saitama Medical Center, Jichi Medical University, 1-847 Amanuma-cho, Omiya-ku, Saitama 330-8503, Japan. E-mail: kashiura@me.com.

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CASE

A 20-year-old woman with insignificant medical history was referred to our emergency department from another hospital for vomiting, fever, and impaired consciousness with a tentative diagnosis of bacterial meningitis. She had taken an over-the-counter antihistamine for pollinosis. Her vital signs on arrival were as follows: blood pressure 175/84 mmHg, heart rate 134 b.p.m., respiratory rate 28 breaths/min with an oxygen saturation of 96% on room air, and body temperature 38.0°C. Her Glasgow Coma Scale was 11 (E4V1M6), and we could not detect any significant neurological signs such as weakness of her limbs. Her pupils were bilaterally dilated to 5 mm. No nuchal rigidity or other meningeal signs were observed. Laboratory tests revealed glutamic oxaloacetic transaminase 30 IU/L, glutamic pyruvic transaminase 14 IU/L, C-reactive protein 0.43 mg/dL, white cell count 17,180/μL, (band cells 6.4%, segmented cells 89.4%, lymphocytes 2.2%, and monocytes 1.8%), and PCT over 10 ng/mL. Urine test, chest X-ray, computed tomography of the head, and cerebrospinal fluid test showed normal findings. We initially suspected systemic bacterial infection because of her fever and impaired consciousness, which is why we tested PCT. Although the cerebrospinal fluid test was normal, we cannot completely rule out

bacterial infection due to the PCT elevation; therefore, we started treatment with empiric antimicrobials. Gradually, her level of consciousness improved; she confessed that she had taken 100 tablets of an ephedrine extract (Lipodrene, Hi-Tech Pharmaceuticals. Inc., Norcross, GA, USA), which contains caffeine (10 g), theophylline (amount unknown), yohimbine (amount unknown), and ephedrine (2.5 g), intending to commit suicide. We speculated that her low Glasgow Coma Scale on arrival was due to selective mutism because she had suicidal ideation and mood disorders. Her general condition stabilized, and blood tests showed no aggravation. Blood and cerebrospinal fluid culture results were negative on day 4. The PCT level decreased to 0.32 ng/mL on day 5, and she was discharged from hospital on the same day.

DISCUSSION

WE HAVE ENCOUNTERED a case in which sympathomimetic drug overdose caused serum PCT level elevation without bacterial infection, suggesting that sympathomimetic drug overdose could be one of the causes of PCT elevation when a bacterial infection is ruled out.

Although PCT is a precursor of calcitonin secreted from thyroid C cells, it is produced from organs and immune cells due to tissue injury.[3] Procalcitonin is a useful biomarker for early diagnosis of sepsis in critically ill patients on the grounds of its sensitivity of 0.77 and specificity of 0.79.[1] Although an elevated PCT level is rarely seen with normal metabolism, it can be seen under conditions such as cardiogenic shock, trauma, acute pancreatitis, rhabdomyolysis, autoimmune disorders, and malignancies.[4]

Several case reports have suggested a relationship between PCT elevation and drug overdose without bacterial infection, especially with drugs such as amphetamine and mitragynine.[4,5] These reports have not described clear mechanisms for PCT elevation. However, the common characteristics among these drugs are sympathetic nervous system stimulation and possible trigger of cytokine release.[4,5]

In this case, the drugs that might have elevated the PCT level were caffeine, theophylline, yohimbine, and ephedrine. We want to classify them into two groups based on their characteristics; one group comprising caffeine, theophylline, and yohimbine, and the other, ephedrine. In general, caffeine inhibits phosphodiesterase, an enzyme that degrades the β-adrenergic messenger and elevates catecholamine concentration.[6] Theophylline is one of the caffeine metabolites with similar characteristics and pharmacokinetics. Moreover, yohimbine combined with mitragynine could overstimulate the central nervous system, similar to the effects seen on its concomitant use with caffeine.[7] In summary, caffeine, theophylline, and yohimbine can mimic the actions of mitragynine, suggesting that these drugs elevate PCT levels.

Ephedrine has a strong effect on the sympathetic nervous system, and its pharmacokinetic mechanism is similar to that of amphetamine.[8] Therefore, ephedrine can also affect PCT production similar to amphetamine. Moreover, combining ephedrine and caffeine can enhance sympathetic nervous system stimulation due to their pharmacodynamic interactions.[9]

This report is limited because we could not determine which drug component had the largest impact on PCT elevation. In addition, we have detected a narrower range of PCT elevation compared to former studies. Hence, another mechanism could exist in this case, considering the circumstances. In any case, inappropriate usage of sympathomimetic drugs can lead to elevation of PCT. Physicians could consider the possibility of an overdose on sympathomimetic drugs when PCT levels are still high despite having ruled out bacterial infection.

CONCLUSION

SYMPATHOMIMETIC DRUG OVERDOSE can be one of the causes in cases of elevated PCT levels. However, further research is required to determine the underlying pathophysiological mechanisms of PCT elevation.

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DISCLOSURES

Approval of the research protocol: N/A.
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Registry and the registration no. of the study/trial: N/A.
Animal studies: N/A.

Conflict of interest: None.

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