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CASE REPORT

Administration error of benzathine penicillin G in a Saudi male

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Abstract

Background: Benzathine penicillin G is indicated for intramuscular (IM) administration. There have been reports of unintentional intravenous (IV) administration, which has been associated with cardiorespiratory arrest and death. This article reports on a case of inadvertent IV administration of benzathine penicillin G instead of IM injection.
Clinical details: A 29-year-old Saudi army male with no history of any chronic illness visited the Security Forces Hospital in Makkah because of injuries to his left hand and left ear as a result of a bomb blast. The patient underwent surgery, and was conscious, oriented and vitally stable after the operation. He was prescribed benzathine penicillin G to prevent wound infection, but the injection was incorrectly administered IV instead of IM.
Outcomes: The patient did not exhibit any visible clinical symptoms after receiving the drug via the wrong route. The patient's vital signs were fine and he did not have a fever. The full complete blood count was normal, except for a mild elevation in the neutrophil count (84%) and a mild decrease in lymphocytes (8.8%). Random blood glucose was 149 mg/dL and the activated partial thromboplastin time was 39.3 s. All other laboratory investigations were within the normal range. The creatinine concentration fluctuated between 0.8 and 1 mg/dL.
Conclusion: This was an obvious case of a drug-related problem categorised as a 'wrong route error'. The role of clinical pharmacists in preventing such errors is important to ensure patient safety.

Keywords: allergic reaction, anaphylactic shock, drug-related problem, penicillin, route of administration, toxic dose.

INTRODUCTION

Benzathine penicillin G is a β-lactam antibiotic, bactericidal in nature, that acts against penicillin-susceptible microorganisms and is commonly used for rheumatic fever prophylaxis and the treatment of streptococcal meningitis and syphilis.[1,2] Benzathine penicillin G acts by inhibiting the biosynthesis of cell wall mucopeptides. Benzathine penicillin G has low solubility, and is hydrolysed by penicillinase-producing bacteria. After intramuscular (IM) administration, because of its low solubility, benzathine penicillin G is slowly released from the administration site. This, combined with hydrolysis by penicillinase-producing bacteria, results in the maintenance of blood levels that are much lower than those of other parenteral penicillins and a prolonged duration of action.[2] This preparation of penicillin is indicated for IM administration and should never be administered intravenously (IV).[3] Inadvertent IV administration of benzathine penicillin G has been associated with cardiopulmonary arrest and death.[4] If injected near an artery or a nerve, benzathine penicillin G causes permanent neurological damage and/or gangrene.[4] Benzathine penicillin G is also vulnerable to medication error because of its sound-alike name with other drugs, such as penicillamine.[5]

Herein we report on a case of administration error in which the patient received benzathine penicillin G IV instead of IM.

CASE REPORT

A 29-year-old Saudi male working in the army, with no history of any chronic illness, visited the Security Forces

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Hospital, Makkah because of injuries to his left hand and left ear as a result of a bomb blast. On Day 1 (the day of presentation after the bomb blast), the patient underwent debridement with closure and Kirschner wire fixation of the left little finger and was prescribed IM benzathine penicillin G, administered to the patient as prophylaxis against wound infection. On Day 3, the open fracture was fine; the patient was conscious, oriented and vitally stable after the surgery. The dressing was changed daily, and the wound was dry and clean. The patient was attended by the general surgery team, and a computed tomography scan was done on Day 3, which indicated a left mastoid fracture. Thereafter, the surgical team referred the patient to the neurosurgery team. At 14:28 h on Day 3, the clinical pharmacist discovered an administration error of benzathine penicillin G. The patient should have received benzathine penicillin G 2 million IU (single dose), IM, daily, but had instead been administered benzathine penicillin G 1.2 million IU, four times daily for six doses (total 4.8 million IU/day) through the IV route. This error presumably occurred due to a lack of understanding among the nurses, poor awareness regarding look-alike and sound-alike preparations, and/or similar appearance of the dosage form (both injections). The Pharmaceutical Care Network of Europe (PCNE) classifies this sort of error as a drug therapy-related problem (DTRP) related to the 'drug use process', in which the impending 'drug [is] administered through the incorrect route'.[6]

On observation, the patient exhibited no systemic symptoms or signs of infection. His complete blood count (CBC) indicated no leucocytosis. The wound was covered with a plaster. A swab culture from the hand wound indicated no organisms. The infectious disease consultant recommended a tetanus vaccine if the patient had not already received one and IM benzylpenicillin 2 million units every 6 h for Gram-positive coverage. The patient's condition was reviewed to determine if further duration of the antibiotic was required. The patient was fine after receiving the long-acting benzathine penicillin G, and had not exhibited any clinically significant symptoms.

The concern was that the patient had received the antibiotic via the IV rather than IM route. The vital signs observed on Day 3 were good and the patient had no fever. The CBC findings were normal, except for a mild elevation in the neutrophil count (84%) and a mild decrease in lymphocytes (8.8%). Random blood glucose was 149 mg/dL and the activated partial thromboplastin time was 39.3 s. All other laboratory investigations were within the normal range. Creatinine concentrations ranged from 0.8 to 1 mg/dL.

DISCUSSION

This patient received six doses of IM penicillin through the IV route (total 48 million IU/day), which can be fatal; however, the patient survived and did not exhibit any allergic reaction or any anaphylactic shock. In general, at high concentrations (40–100 million units/day), IV penicillin can be toxic, especially in renally impaired patients.[3] In addition, benzathine penicillin G is not indicated for IV use. There have been reports of the inadvertent IV administration of benzathine penicillin G that has been associated with cardiorespiratory arrest and death.[3] Inadvertent intra-arterial injection or injection near the major peripheral nerves or blood vessels may lead to severe neurovascular damage, tissue cyanosis or necrosis, severe oedema or gangrene, and because of the increased risk in infants and small children, prompt management is required.[3]

Penicillin is generally non-toxic; however, it may become toxic from its cations and from substituents if large doses are administered. In these cases, patients will experience nausea, vomiting, pruritus, urticaria, wheezing, laryngeal oedema and eventually, cardiovascular collapse.[3]

In the present case, although the patient received six doses of IM penicillin via the IV route, which can be fatal, the patient survived and did not experience any harm as a result of the incorrect administration. However, this suggests that it is possible that many such errors could occur because of confusion among these formulations and dosage forms. Hence, the authors recommend the need for clinical pharmacists to be involved in the reconciliation of drug therapy to prevent such DTRPs in future. The presence of clinical pharmacists as part of the multidisciplinary team will certainly help in the early identification of such medication errors and promote detailed root cause analysis, which, in turn, will help minimise the occurrence of similar errors.

Conflicts of interest statement

The authors declare no conflicts of interest.

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