Near-Complete Hand Loss Following an Unintentional, Intra-arterial Medicine Injection in an Infant

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Abstract

Unintentional, intra-arterial administration of medicines can lead to very serious sequelae, including limb loss. We present a case of a 13-week-old boy who was unintentionally given phenobarbital into his right radial artery, which resulted in a near-complete hand amputation. Pediatric patients are under increased risk of such injuries due to their small vessel size and their inability to express immediate complaints, which often leads to a delayed recognition of the condition. As no specific treatment algorithms have been established, the mainstay of therapy is supportive care aimed at maintaining vascular patency. Prompt recognition is imperative in avoiding potentially detrimental effects; therefore, all personnel administering intravenous therapy should be aware of this possibility and be acquainted with the initial supportive measures.

Keywords

- intra-arterial injection
- hand amputation
- phenobarbital
- infant

Introduction

The incidence of unintentional intra-arterial drug application reported in the literature varies from 1/56,000 to 1/3,440.^{1,2} The aftereffects can range from long-term functional hand problems, paresthesia, heat/cold intolerance, the need for prolonged rehabilitation, and absence from work,³ to long-lasting skin changes,⁴ devastating skin and soft tissue loss, limb gangrene, and amputation.^{5,6} Given the devastating consequences, even the lowest reported incidence merits an awareness of this possibility in personnel administering intravenous (IV) therapy as well as knowledge of the measures to alleviate its potentially disastrous effects.

The problem is often compounded in the group of patients undergoing general anesthesia, IV drug users, unconscious patients, mentally handicapped,³ and especially in infant patients⁵ due to their inability to express any immediate complaints, such as severe pain, flushing, numbness, and weakness, which usually appear within seconds of the application. A preexisting vascular anomaly is another risk factor often overlooked as a possible cause of these injuries.⁷

Case Report

A 13-week-old infant was transferred from a maternity hospital because of an acutely developed vascular compromise in his right hand. Following delivery at 28 weeks' gestational age, the patient was being treated for bronchopulmonary dysplasia and recurrent pneumonia and was also diagnosed with grade II bilateral retinopathy and grade II intracerebral bleeding. The therapy at the moment of transfer included piperacillin/tazobactam, methylprednisolone, ranitidine, phenobarbital, spironolactone, acetylsalicylic acid, fentanyl, and salbutamol inhalation. Methylprednisolone, phenobarbital, and fentanyl were administered daily at 8 am. The boy had an IV cannula inserted in the left forearm as well as a second cannula inserted in the radial/volar side of the right wrist, but, unfortunately, it was not documented which medications he received through which cannula.

The observed vascular compromise of his right hand was noted around 10 am the day before the transfer, when a nurse noted swelling and bluish discoloration of that hand. The on-call neonatologist decided not to remove the cannula, elevate

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Fig. 1 (A) Appearance of dorsum of the hand 30 hours after the intra-arterial injection. (B) Appearance of palm of the hand 30 hours after the intra-arterial injection.

the right hand, and continue IV therapy through the IV cannula in the left forearm. The swelling increased by the following morning, as did the intensity of the bluish skin color. The right hand was also colder than the left.

At 10 am a referral was made to the pediatric intensive care unit at the clinical hospital center, and the boy was transferred 2 hours later. A vascular cannula was present in the radial/volar side of the right wrist, and the on-call pediatrician decided to remove the cannula, which was followed by a pulsatile bleeding that stopped following digital compression. A referral was made to the on-call plastic and pediatric surgeons.

Examination revealed a swollen, dark blue, and cold right hand and wrist (→Fig. 1A, B) with more than 10 seconds of pressure needed to achieve incomplete blanching of the skin and over 15 seconds for the blue color to reappear. A digital pulse oximeter failed to register the patient's oxygen saturation. After removal of the bandages that were applied to control the bleeding from the cannula site, there was no change in the appearance of the right hand. Doppler ultrasound signal was registered over the ulnar and radial arteries and the palmar arch, but not in the digital arteries.

A systemic heparin therapy was instituted, as well as acetylsalicylic acid and dextran. The hand was elevated and covered with heparin-soaked gauze. With this therapy, there was a noted improvement in the appearance of the hand in the next 12 hours. The bluish discoloration grew slightly lighter and moved from just distal of the wrist crease to a mid thenar-hypothenar line (→Fig. 2). No further improvement was noticed over the next few days, and the affected parts slowly developed a dry gangrene (→Fig. 3). In an effort to preserve as much length as possible to facilitate subsequent hand reconstruction, the dry gangrenous parts of the hand were left to separate on their own 42 days later. The boy was kept in the pediatric unit for another 3 months until his pulmonary status allowed for discharge. Twelve months after the injury, he is stable and under consideration for hand reconstruction procedures, including double second toe-to-hand transfer (→Fig. 4).

Discussion

The multitude of possible pathways including vasoconstriction, thrombosis, crystallization, chemical endarteritis,

Fig. 2 Appearance of the hand 45 hours after the injury.

Fig. 3 Dry gangrene of all digits and distal palm 3 weeks after the injury.

Fig. 4 Appearance of the hand 12 months after the injury.

direct cytotoxicity, venous constriction, lipid solubility, and high osmolarity clearly demonstrates that not all medications will cause the injury through the same mechanism. Thrombogenesis seems to be a common endpoint for all of the proposed mechanisms.³ It is thus understandable that no specific therapeutic algorithms have been established and that the mainstay of our efforts relies on the prevention of thrombosis and maintenance of vascular patency.

Most reviews on this subject advise that the inadvertently placed intra-arterial cannula be left in place to allow immediate delivery of medications to the site of injury, blood sampling for gas analyses, and to facilitate contrast injection if a decision to perform angiography is reached.³ It is unclear which medication was unintentionally given through the intra-arterial cannula in this case, but from the available literature we concluded that it was most likely phenobarbital.³ Measures to maintain vascular patency include systemic heparinization, extremity sympathectomy, or application of vasodilators.

In our patient, the time elapsed from the moment of injury to the recognition and start of supportive measures, which is recognized from the available reports as one of the critical factors in the prevention of tissue loss, is estimated at more than 24 hours. Anticoagulation was initiated with systemic heparin therapy, which is widely accepted as the initial intervention method. Acetylsalicylic acid and dextran

were added to the therapy regimen due to their antithrombotic effect. Even though the therapy was started 30 hours after the incident, the amount of tissue loss was reduced, which is of great importance for subsequent reconstruction procedures. With this in mind and considering that the first symptoms were noted only 2 hours after drug administration, it is likely that the extent of tissue loss would have been significantly smaller had therapy been initiated at that time.

Another critical point in the care of this patient was the removal of intra-arterial cannula, which is considered the preferred way of administering therapy in the immediate period after the incident. Unintentional intra-arterial administration of medicines carries a great risk for potentially disastrous consequences. Prompt recognition and start of supportive measures are the most important factors in preventing or reducing tissue loss. Therefore, medical personnel administering IV medications should be alert for signs of these injuries, especially in the groups of patients who are under increased risk. This could be achieved through institutional training changes, such as including this topic in the curriculum of cannulation and IV therapy courses, and through implementing a checklist system that would evaluate the possibility of inadvertent intra-arterial cannula placement by the presence of most common symptoms, such as flashback pulsatility, flashback redness, palpable pulse proximal to the cannula, distal signs of ischemia, and painful cannula placement.

References

- 1 Cohen SM. Accidental intra-arterial injection of drugs. *Lancet* 1948;2(6524):409–417
- 2 Dundee JW. Thiopentone and other barbiturates. London: ES Livingstone Ltd. 1956:197–243
- 3 Sen S, Chini EN, Brown MJ. Complications after unintentional intra-arterial injection of drugs: risks, outcomes, and management strategies. *Mayo Clin Proc* 2005;80(6):783–795
- 4 Ang BL. Prolonged cutaneous sequelae after intra-arterial injection of propofol. *Singapore Med J* 1998;39(3):124–126
- 5 Sengupta S. Gangrene following intra-arterial injection of procaine penicillin. *Aust N Z J Med* 1976;6(1):71–73
- 6 Aghoutane EM, Fezzazi R, Elhaouati R, Boumzebra D. [Fingers necrosis after an accidental intra-arterial injection of flucloxacillin: case report] [in French]. *Chir Main* 2011;30(2):120–122
- 7 Hazzlet JW. Superficial ulnar artery with reference to accidental intraarterial injection. *Can Med Assoc J* 1949;61(3):289–293