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Acute hand ischemia after inadvertent intra-arterial injection of crushed zolpidem tablets. A case report and literature review

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Abstract

We report the case of a 26-year-old man with a history of drug addiction who presented to our emergency department with forearm pain and signs of acute ischemia following an inadvertent intra-arterial injection of zolpidem tablets dissolved in tap water. Although relatively rare, this occurrence carries a high risk of inducing acute limb ischemia, which can lead to severe complications such as amputation or even death. The pathophysiology of limb ischemia is multifactorial, influenced by factors including the site of injection, the physicochemical properties of the drug, and the volume injected. Symptoms can range from severe pain without visible lesions to acral ischemia. In all suspected cases of intra-arterial injection, it is crucial to gather information regarding the time of injection, the type of drug used, and whether microcrystalline cellulose is present in the formulation. Current literature underscores the importance of timely diagnosis and a multidisciplinary approach in reducing the risk of amputation. In this case, the immediate combination therapy, including ketamine, iloprost, anticoagulation, and antibiotics was effective in treating the patient.

Key words: hand ischemia, intraarterial injection, drug abuse, zolpidem, microcrystalline cellulose.

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Highlights

- Inadvertent intraarterial injection of dissolved crushed tablets of zolpidem is a rare but potentially devastating phenomenon with high risk of amputation;
- The most common site of injections are radial and cubital arteries;
- The first symptom is a severe pain followed by vasospasm, thrombosis, and acral ischemia;
- No current evidence-based guidelines are available. Anticoagulation, antibiotics, and intravenous vasodilators are mandatory to avoid the progression of ischemia towards necrosis;
- The only factor able to modify the outcome is the delay between injection and management.

Case Report

A 26-year-old man with a history of acute psychosis, hypochondriacal delusions secondary to a personality disorder, and opioid use disorder (methadone and buprenorphine), presented to our emergency department with severe left arm pain and cyanosis of his left hand. This occurred after he self-administered 2 crushed zolpidem tablets diluted in non-sterile water directly into an artery, rather than as planned into a vein. Previously, he had developed a thrombosis in his internal saphenous vein after injecting unspecified substances for recreational purposes and treated with Subcutaneous (SC) injections of low molecular weight heparin. His condition indicated acute ischemia of the left hand (Figure 1), confirmed by an Echocolor Doppler study, which showed absent

flow in the palmar and dorsal arches. Following a vascular surgeon's recommendation, he was started on iloprost (2 ng/Kg/min) and Intravenous (IV) Unfractionated Heparin (UH) with an initial loading dose of 60 IU/kg, followed by adjustment to maintain a mean aPTT level that is 1.5 to 2.3 times higher than normal. Given the patient's history of drug addiction, pain management was achieved using ketamine at an analgesic IV dose of 0.3 mg/kg.

After consultation with the Pavia Poison Control Center and National Toxicology Information Centre, which confirmed cases of ischemia following arterial injection of zolpidem, the patient was admitted to our Emergency Medicine ward. The infusion of iloprost and UH was continued, combined with ceftriaxone (2 g IV) and steroids (methylprednisolone 40 mg IV). After 24 hours of therapy, the left hand showed normal perfusion with preserved sen-

sitivity and well-controlled pain. Following four days of treatment and further clinical improvement (Figure 2), along with no increased inflammation indices, he was switched to Subcutaneous (SC) Low Molecular Weight Heparin (LMWH) (enoxaparin 6000 IU) and antiplatelet therapy (acetylsalicylic acid 100 mg daily).

Due to his history of addiction to sedatives and multiple attempts to steal these medications from the ward’s carts, he was discharged after eight days with instructions to continue LMWH for another five days, along with antiplatelet therapy. Five days later, he returned to the emergency room for anxiety. At that time, he did not report any pain in his left hand, nor did he mention it on subsequent visits occurring three to four times monthly.

Discussion

Accidental Intra-Arterial (IA) drug injections can occur as an iatrogenic inadvertent complication¹ or as a result of attempted intravenous injections in drug users.^{2,3} Historically, the medications most commonly associated with serious morbidity and mortality after unintentional IA administration were barbiturates and benzodiazepines and most of these medications were used for

sedation or general anaesthesia.¹ Actually, the large majority of patients in whom IA injections occur are IV drug abusers. The increased incidence in injection of crushed oral formulations can be attributed to the easier availability and lower costs of these drugs and is associated with more complications.⁴

Most of the cases are reported in the upper extremity, particularly the radial and cubital arteries due to easier accessibility and proximity to major target veins such as the cephalic and basilic vein⁵ with severe consequences including limb ischemia and limb loss.⁶ To date, four cases of IA injection of a crushed tablet of zolpidem have been reported in literature.^{4,6-8} The cases described concern drug abusers between 24 and 31 years old. Complete resolution of the clinical condition was recorded in just one case; amputation was required in the other cases. As summarized in Table 1, this condition is rare but extremely serious for the devastating sequelae.

The primary challenge for an emergency physician is making an accurate diagnosis, as many intravenous (IV) drug abusers arrive at the emergency department after a significant delay and may have an unclear history of drug use. The signs and symptoms can vary widely, depending on the different types of substances injected, and there is often no clear mechanism to guide effective management. There are very few publications to date that discuss

Table 1. Case reports of intra-arterial (IA) zolpidem injections. ED, emergency department; yo, year old; hrs, hours; UH, unfractionated heparin.

Authors	Year of publication	Patient (sex, age)	Delay between IA injection and time to arrival to the ED	Site of IA injection	Treatment	Outcome
Chang and Lin ⁶	2003	Woman, 24 y.o.	48 hrs	Right brachial artery	UH, vasodilators, prostacyclin, hyperbaric oxygen	Amputation of 4 fingers
Boucher <i>et al.</i> ⁷	2008	Man, 35 y.o.	4 hrs	Right radial artery	UH, vasodilators and iloprost	Amputation of the middle finger distal phalange
Ipaktchi <i>et al.</i> ⁴	2008	Man, 33 y.o.	3 hrs	Right ulnar artery	IA thrombolysis with Urokinase	Complete resolution
Détriché <i>et al.</i> ⁸	2020	woman, 31 y.o.	3 days	Left brachial artery	UH and iloprost	Amputation of the intermediate and distal phalanges of 3 fingers



Figure 1. Acute ischemia of the left hand. Significant bluish discoloration of ischemic hand and wrist at few hours post injection.



Figure 2. Complete resolution of the hand ischemia after 4 days of treatment.

the management of limb ischemia following IA drug injections in IV drug abusers. As a result, there are currently no evidence-based criteria for this condition. For these reasons, a multidisciplinary team, including an emergency physician, vascular surgeon, radiologist, and a consultant from the Poison Centre, represents an effective strategy for managing this rare condition and can help avoid severe consequences or fatal outcomes.

The pathophysiology

Although the clinical syndrome of IA injections is well defined, the underlying pathophysiologic mechanism remains unclear, and many theories have been proposed.¹ Several factors contribute to the advent of limb ischemia, including the site of injection, the physicochemical drug properties and volume of the injected drug. As reported in literature, IA injections of crushed tablet preparations have a higher risk for inducing ischemia that can be attributed to physicochemical, pharmacological and galenic-formulation properties of the injected drug.

Highly acidic or hyperosmolar substances can cause direct tissue necrosis at the injection site leading to the obstruction of vascular flow. This has been observed in cases involving the injection of dissolved flunitrazepam tablets.⁹ Among various pharmacological properties, vasoconstrictive effects pose the greatest challenges in IA injections. Sympathomimetics, such as oxymetazoline, cocaine, and methylphenidate, can lead to prolonged vasospasm and inadequate tissue perfusion.^{10,11} The galenic formulation can lead to ischemic complications, which may be influenced by the drug carrier. For instance, the use of micro-particle drug carriers, commonly found in tablet preparations, can result in non-dissolving blockages in the terminal blood vessels of the fingers and toes, leading to acral necrosis. In a study by Chang *et al.*,⁶ the injection of crushed zolpidem – identical in drug type and method of administration to our case – resulted in gangrenous loss of several digits, despite aggressive therapeutic management. The authors attributed this severe outcome to the microcrystalline cellulose used as the drug carrier in zolpidem. As reported by Kai *et al.*,¹² microcrystalline cellulose is the primary excipient used in pharmaceutical oral formulations due to its very low reactivity with active ingredients. It is insoluble in water and most organic solvents, resistant to degradation in water, and possesses water-absorbent properties, which help reduce particle agglomeration. These excipients are typically globular in shape and vary in diameter from 150 to 500 µm. They are uniform and accurately calibrated in size. The small diameter of microcrystalline cellulose can lead to cases of ischemia and digital necrosis, as the microspheres can completely occlude very small-calibre arteries. The beads can migrate distally, resulting in a complete and permanent occlusion. Their tendency to travel to vessels with diameters similar to their own leads to a significant embolic effect. Goldberg and Yosipovitch¹³ conducted a study on the components of crushed codeine tablets that were self-injected intra-arterially by a 37-year-old man, which resulted in gangrene of the upper extremity. They separately injected the following substances into the femoral arteries of dogs: codeine, lactose, gelatin, carboxymethyl cellulose, calcium stearate, talc, and microcrystalline cellulose. The results of the study clearly indicated that the unique component responsible for the gangrene was microcrystalline cellulose, while the injection of pure codeine was found to be harmless.

Diagnosis

Since the large majority of patients in whom IA injections occur are IV drug abusers, the diagnosis cannot be done promptly.

This patient population does not often seek immediate medical care, and delays in presentation often preclude clinicians from maximizing therapeutic interventions. In addition, the diagnosis can be initially overlooked because the patients do not offer a history of drug abuse and cannot appear like the stereotypical drug user. These patients may be seen early or several months after their accidental IA injection. With the increase in drug abuse today, all segments of society can be affected. For all these reasons, emergency clinicians should consider this diagnosis in any patient with unexplained digital or limb ischemia² and should identify the signs of disease progression that can be useful in gauging prognosis and in managing the patient.

The clinical evaluation for all patients suspected of IA drug injections must include a detailed medical history. This should cover the identification of the injected drug, the injection site, and the onset of symptoms. Diagnostic evaluation should always include the Allen test and a Colour Doppler study to test the extremity pulses, including palmar arch and digital pulses. Currently, CT angiography is still the gold standard technique for diagnosis and allows for interventional therapy.

Clinical manifestations

Acute and chronic symptoms must be always considered after an unintentional IA injection. Many patients experience immediate discomfort, often occurring within seconds. This discomfort can range from local irritation to intense pain distal to the injection site, in the absence of skin colour changes or clear signs of limb ischemia.¹ When involved the hand, the patient can experience immediate painfulness and tenderness extending from the site of injection to the hand – a symptom commonly described as a “hand trip”.¹⁴

Soon thereafter, patients frequently report sensory problems such as tingling, burning sensations, and paraesthesia. Altered motor function, which may include involuntary muscle contractions and muscle weakness, as well as skin changes like flushing and mottling, have also been reported.

Within 7 to 10 days, further signs of vascular compromise due to arterial thrombosis and tissue necrosis may become evident. Pulselessness, pain, cyanosis, paraesthesia, pallor, and paralysis may indicate the onset of compartment syndrome. If left untreated, this can lead to tissue necrosis, gangrene, and permanent functional deficits. The long-term consequences might include disfigurement, functional impairments, chronic pain, and complex regional pain syndrome in the affected limb.

Treiman *et al.*¹⁵ developed a “Tissue Ischemia Score” based on signs and symptoms at presentation of 48 patients with IA drug injections. Patients were assigned either a 0 or a 1 (for the absence or presence) for 4 symptoms: cyanosis, cool extremity, delayed capillary refill, and sensory deficit. Among patients with a Tissue Ischemia Score of 2 or lower, 92% achieved a normal outcome. In contrast, only 41% of patients with a score greater than 2 had a normal extremity, the rest experienced tissue necrosis or permanent neurological dysfunction. Therefore, monitoring the progression of symptoms can help clinicians correlate the presenting signs with the expected prognosis.

Management

The therapeutic management aims at restoring flow in ischemic limbs, preventing thromboembolic complications, and preserving limb function by avoiding secondary muscle ischemia and necrosis due to compartment syndrome.¹⁵

Due to the lack of established standard treatment options for

unintentional IA injections, various therapeutic interventions have been tried with mixed success, and no clear guidelines currently exist. Most of these interventions are largely empirical, focusing on maintaining blood flow to the areas distal to the site of injury. Effective management should be based on five key clinical endpoints: i) pain relief; ii) cessation or reversal of arterial spasm; iii) maintaining and/or reestablishing blood flow to the distal portions of the extremity; iv) treating any sequelae of vascular injury and ischemia (edema, compartment syndrome, infection, necrosis, and gangrene) that may occur; v) rehabilitation.¹ If the IA injection is iatrogenic, the IA catheter should not be removed. Maintaining the IA catheter allows for the immediate delivery of various medications to the injury site. Additionally, if the patient requires evaluation through angiography, the catheter will enable direct injection of contrast dye into the affected blood vessels.

Pain relief

Providing immediate pain relief is a priority. Multiple case reports suggest that simple interventions consisting of analgesia with opioids or ketamine for severe pain – as in our case –, elevation,^{13,16,17} massage,¹⁷ and initiation of therapy with passive motion devices are all critical for treatment and recovery.¹

Cessation or reversal of arterial spasm

Multiple options have been reported in literature, ranging from non-invasive methods to procedures that require specialist-driven care and close monitoring. The clinician must determine which specific intervention would benefit the patient the most. The different options will be described in detail below.

Local anesthetic infiltration with procaine¹⁸ and lidocaine¹⁹ have often been performed to prevent reflex vasospasm, but, as reported by Ghouri *et al.*, the procedure is associated with a risk of damaging the artery and thereby compromising the blood supply to the already affected limb.¹⁷ In addition, central nervous system and cardiac toxicity must always be considered.

Arterial Vasodilators such as calcium beta-blockers^{20,21} can also be used.

Iloprost, a prostacyclin analogue, is used for various ischemic conditions such as atherosclerotic disease, thromboangiitis obliterans, Raynaud syndrome, and ischemic leg ulcers due to its vasodilatory and platelet inhibiting properties. Samuel *et al.*²² reported significant improvement within 4 hours in a case of IA injection of heroin in which an IV infusion of iloprost (2 ng/kg/min) was used in combination with heparin. Similarly, Andreev *et al.*²³ reported a case of full functional recovery using iloprost (2 ng/kg/min) as part of the treatment regimen. This occurred even after initial therapies with heparin, corticosteroids, analgesics, and thrombolytics (streptokinase at 100,000 IU/h) provided only temporary relief of symptoms.

Hyperbaric Oxygen Therapy is non-invasive and has minimal adverse effects.⁶ In a case described by Adir *et al.*,²⁴ hyperbaric oxygen therapy was initiated 12 days after a patient experienced ischemic complications from an IA of methadone and flunitrazepam. The initial treatment regimen, which included systemic vasodilators, low-molecular-weight dextran, and aspirin, was ineffective. Hyperbaric oxygen therapy resulted in nearly complete recovery. The role of phosphodiesterase inhibitors such as sildenafil has to be determined in this regard in the future.⁴

Maintaining and/or reestablishing blood flow to the distal portions of the extremity

Heparin anticoagulation is the first step in treating IA injec-

tions and should be initiated promptly, as thrombosis is a key factor in most cases. Currently, there is no consensus on the initial bolus amounts, appropriate target ranges for activated Partial Thromboplastin Times (aPTT), or the duration of therapy. However, similar to guidelines for treatment of pulmonary emboli,²⁵ an initial loading dose of heparin of 60 IU/kg, followed by adjustment to maintain a mean aPTT level that is 1.5 to 2.3 times higher than normal, is recommended. The duration of therapy can be guided by resolution of symptoms, angiographic evidence of clot resolution, or the need for surgical intervention.¹ The role of LMWH in contrast to IV heparin has not been addressed thus far.⁴

IA injection of thrombolytics with urokinase has proven effective in restoring blood flow, with the complete resolution of symptoms such as edema, cyanosis, and pain, without long-term side effects.^{4,26-28} In a retrospective study by Ratio and Keski-Nisula,²⁹ the authors evaluated the angiographic findings of patients who have inadvertently injected oral formulations of drugs into an upper extremity artery. The worst clinical results were found among the patients whose angiographic examinations showed absent flow. Two patients who were treated with local thrombolysis had no better results compared to the other five patients. The study concluded that findings of delayed flow and absent flow in angiography should lead to intensified conservative treatment, especially among patients who have clinical findings of delayed capillary refilling or/and impaired muscular strength.

According to the Cochrane review for acute limb ischemia,³⁰ there is currently no evidence in favour of either initial thrombolysis or initial surgery as the preferred option in terms of limb salvage, amputation, or death at 30 days, six months, or one year. Low-quality evidence suggests that thrombolysis may be associated with higher risk of haemorrhagic complications and ongoing limb ischemia (distal embolization). The higher risk of complications must be balanced against risks of surgery in each individual case. Trial results show no statistical difference in stroke, but the confidence interval is very wide, making it difficult to interpret whether this finding is clinically important.

Surgical thrombectomy has been successfully described for occlusions proximal to the midforearm.^{31,32} Although two cases of digital artery micro-embolotomy have been reported,³³ the treatment of distal arterial occlusion is controversial. There is no commercial embolotomy catheter available, and fibrinolytic agents may not be effective after prolonged periods of ischemia.

Treating any sequelae of vascular injury and ischemia

Antibiotic therapy should be initiated empirically to target gram-positive organisms and anaerobes, particularly in patients who use IV drugs, as they are at a heightened risk for infections like cellulitis, gangrene, and septicemia. If an infection is suspected, it is important to identify the causative organism through blood cultures. Of note, IV antibiotics may have poor penetration into necrotic tissue, often making it difficult to assess the effectiveness of the therapy. Necrotic tissue debridement must be considered in selected cases.¹ Corticosteroids can be useful to reduce effectively inflammation and are associated with a lower amputation rate, but their prescription remains cautious given the lack of knowledge on their effects in this context, in contrast with the increased risk of infection.⁵

Rehabilitation

Physical/occupational therapy and chronic pain management are the key points of a correct rehabilitation.¹

Prognosis

No effective medical treatment against the progression of lesions is reported. The risk of necrosis seems higher after benzodiazepine IA injection than with other drugs.⁸ The only factor able to modify the outcome is the delay between injection and management by a specialized vascular team.⁵

Conclusions

Intra-arterial drug injections in the extremities can lead to severe consequences, including limb loss, amputation, and even death. Emergency physicians should always pay attention to any sign of drug abuse in patients presenting with acute upper extremity ischemia or unexplained severe pain. The onset of limb ischemia may be delayed, so patients should be closely monitored for 24 hours, even if there are no clear signs of ischemia, such as pallor or cyanosis. In the absence of evidence-based guidelines, a prompt diagnosis is the only way to manage correctly this condition. From a treatment perspective, the best options include immediate recognition of the situation, assessment of disease progression, pain control, anticoagulation, and specific therapy.

This case report highlights the importance of having a thorough understanding of drug composition, the injection route, and the early identification of signs and symptoms related to intravenous drug injection. Such knowledge is crucial in preventing serious complications and reducing patient morbidity. Collaborating with a multidisciplinary team, which includes an emergency physician, vascular surgeon, radiologist, and a consultant from the Poison Centre, is an effective strategy for managing this rare but life-threatening condition.

References

- Sen S, Chini EN, Brown MJ. Complications after unintentional intra-arterial injection of drugs: risks, outcomes, and management strategies. *Mayo Clin Proc* 2005;80:783-95.
- Charney MA, Stern PJ. Digital ischemia in clandestine intravenous drug users. *J Hand Surg Am* 1991;16:308-10.
- Righini M, Angellillo-Scherrer A, Gueddi S, et al. Management of severe ischemia of the hand following intra-arterial injection. *Thromb Haemost* 2005;94:219-21.
- Ipaktchi K, Ipaktchi R, Niederbichler AD, et al. Unrecognized hand ischemia after intraarterial drug injection: successful management of a "near miss" event. *Patient Saf Surg* 2008;2:32.
- Devulapalli C, Han KD, Bello RJ, et al. Inadvertent Intra-Arterial Drug Injections in the Upper Extremity: Systematic Review. *J Hand Surg Am* 2015;40:2262-2268.e5.
- Chang MY, Lin JL. Irreversible ischemic hand following intraarterial injection of zolpidem powder. *J Toxicol Clin Toxicol* 2003;41:1025-8.
- Boucher A, Assaad S, Pariset C, Descotes J. Ischémie digitale après injection d'un comprimé pilé de zolpidem, amélioration tardive par l'iloprost [Digital ischemia following injection of a crushed tablet of zolpidem: tardive improvement with iloprost]. *Thérapie* 2008;63:463-7. French.
- Détriché G, Goudot G, Khider L, et al. Acute digital ischemia after arterial injection of crushed zolpidem tablets: role of microcrystalline cellulose? A case report. *Front Pharmacol* 2020;11:560382.
- Pratikto TH, Strubel G, Biro F, Kröger K. Intra-arterial injection of dissolved flunitrazepam tablets. *Vasa* 2004;33:52-4.
- Shukla PC. Acute ischemia of the hand following intra-arterial oxymetazoline injection. *J Emerg Med* 1995;13:65-70.
- Thalhammer C, Aschwanden M, Kliem M, et al. Akute Ischämie nach intraarterieller Drogeninjektion [Acute ischemia after intraarterial drug injection]. *Dtsch Med Wochenschr* 2004;129:2405-8. German.
- Kai Y, Hamada J, Morioka M, et al. The utility of the microcrystalline cellulose sphere as a particulate embolic agent: an experimental study. *AJNR Am J Neuroradiol* 2000;21:1160-3.
- Goldberg I, Bahar A, Yosipovitch Z. Gangrene of the upper extremity following intra-arterial injection of drugs. A case report and review of the literature. *Clin Orthop Relat Res* 1984;188:223-9.
- Gay GR. Intra-arterial injection of secobarbital sodium into the brachial artery: sequelae of a "hand trip". *Anesth Analg* 1971;50:979-81.
- Treiman GS, Yellin AE, Weaver FA, et al. An effective treatment protocol for intraarterial drug injection. *J Vasc Surg* 1990;12:456-65; discussion 465-6.
- Gould JD, Lingam S. Hazards of intra-arterial diazepam. *Br Med J* 1977;2:298-9.
- Ghouri AF, Mading W, Prabaker K. Accidental intraarterial drug injections via intravascular catheters placed on the dorsum of the hand. *Anesth Analg* 2002;95:487-91, table of contents.
- Kinmonth JB, Shepherd RC. Accidental injection of thiopentone into arteries: studies of pathology and treatment. *BMJ* 1959;2:914-8.
- Sadat-Ali M, Chowdhary UM, Mohanna M, Brismar J. Drug-induced arterial spasm relieved by lidocaine: case report. *Acta Chir Scand* 1986;152:697-9.
- Ali AT, Montgomery WD, Santamore WP, Spence PA. Preventing gastroepiploic artery spasm: papaverine vs calcium channel blockade. *J Surg Res* 1997;71:41-8.
- Boudaoud S, Jacob L, Lagneau F, et al. Successful treatment of vasospastic acute ischaemia with intra-arterial nicardipine. *Eur J Anaesthesiol* 1993;10:133-4.
- Samuel I, Bishop CC, Jamieson CW. Accidental intra-arterial drug injection successfully treated with iloprost. *Eur J Vasc Surg* 1993;7:93-4.
- Andreev A, Kavarakov T, Petkov D, Penkov P. Severe acute hand ischemia following an accidental intraarterial drug injection, successfully treated with thrombolysis and intraarterial iloprost infusion: case report. *Angiology* 1995;46:963-7.
- Adir Y, Halpern P, Nachum Z, Bitterman H. Hyperbaric oxygen therapy for ischaemia of the hand due to intra-arterial injection of methadone and flunitrazepam. *Eur J Vasc Surg* 1991;5:677-9.
- European Society of Cardiology. 2019 Guidelines on Acute Pulmonary Embolism (Diagnosis and Management of). Available from: <https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Acute-Pulmonary-Embolism-Diagnosis-and-Management-of#>
- Vangerven M, Delrue G, Brugman E, Cosaert P. A new therapeutic approach to accidental intra-arterial injection of thiopentone. *Br J Anaesth* 1989;62:98-100.
- Geschwind JF, Dagli MS, Lambert DL, Kobeiter H. Thrombolytic therapy in the setting of arterial line-induced ischemia. *J Endovasc Ther* 2003;10:590-4.

28. Bittner Ch, Zuber M, Eisner L. Akute Ischämie der Hand bei einem Drogenabhängigen nach akzidenteller intraarterieller Injektion [Acute ischemia of the hand in a drug addict after accidental intra-arterial injection]. *Swiss Surg* 2002;8:281-4. German.
29. Rautio R, Keski-Nisula L. Inadvertent intra-arterial drug injections: the role of angiographic and clinical findings. *Acta Radiol* 2006;47:554-8.
30. Darwood R, Berridge DC, Kessel DO, Robertson I, Forster R. Surgery versus thrombolysis for initial management of acute limb ischaemia. *Cochrane Database Syst Rev* 2018;8:CD002784.
31. Kretz JG, Weiss E, Limuris A, et al. Arterial emboli of the upper extremity: a persisting problem. *J Cardiovasc Surg (Torino)* 1984;25:233-5.
32. Zeller T, Frank U, Bürgelin K, et al. Treatment of acute embolic occlusions of the subclavian and axillary arteries using a rotational thrombectomy device. *Vasa* 2003;32:111-6.
33. Hudson DA, Duminy F. Microembolectomy in the treatment of arterial occlusion of the hand: report of two cases. *J Hand Surg Am* 1996;21:884-7.

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