

Injecting drug use, the skin and vasculature

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ABSTRACT

Damage to the skin, subcutaneous tissues and blood vessels are among the most common health harms related to injecting drug use. From a limited range of early reports of injecting-related skin and soft tissue damage there is now an increasing literature relating to new drugs, new contaminants and problems associated with unsafe injection practices. Clinical issues range from ubiquitous problems associated with repeated minor localised injection trauma to skin and soft tissue and infections around injection sites, to systemic blood infections and chronic vascular disease. The interplay of limited availability and access to sterile injecting equipment, poor injecting technique, compromised drug purity, drug toxicity and difficult personal and environmental conditions give rise to injection-related health harms. This review of injecting-related skin, soft tissue and vascular damage focuses on epidemiology and causation, clinical examination and investigation, treatment and prevention.

Keywords Arteries, blood vessels, injecting, drug use, skin, vascular, veins.

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INTRODUCTION

Injection drug use, if practiced unsafely, can be an extremely harmful mode of non-medical drug use. Once the skin has been damaged or breached problems can arise at the site of injection, in and beneath the skin, in the blood vessel that has been penetrated, in the subcutaneous fascia and muscle tissue and at remote sites in distant organs in the body. Blood vessels form part of the structure of all tissues and organs in the body and are, therefore, the entry point for contaminated products or foreign bodies to be introduced into organs such as the lungs, kidneys, the heart, brain or liver but also into muscle and bone tissue. Many subsequent problems are because of bacterial, viral or fungal infections but drug toxicity, irritants and contaminants can also cause aseptic damage to all these organs and structures. Repeated trauma to vessels gives rise to superficial or deep damage.

Description of blood-borne viruses, bacterial sepsis and contamination, endocarditis, and rarer infectious conditions (i.e. candidal endophthalmitis, deep infections in end organs and internal toxic effects of micro-organisms and contaminants), will be explored elsewhere in this series. In this article, we will address injecting-related skin

and soft tissue and vascular infections (SSTVI) and other issues affecting blood vessels, with a focus on identification and treatment of common presentations and their sequelae, as well as issues related to engaging marginalised populations with care.

We shall overview SSTVIs and other vascular damage, with a focus on epidemiology and causation, clinical examination and investigation, treatment and prevention.

EPIDEMIOLOGY

Blood vessel and vascular damage can be relatively superficial but can also lead to severe infections distal to the injection site. SSTVIs, sometimes referred to as cutaneous injection-related infections (CIRI), are infections of the surface of the skin or subcutaneous tissues causing damage. These problems are the most reported injection-related injury with wide geographical variation in lifetime prevalence. Due, in part, to a policy and practice focus on blood-borne viruses such as HIV and hepatitis C among people who inject drugs (PWID), they have been described as a 'hidden epidemic of suffering' [1].

Reports of injection-related injury show a range of problems and frequencies in different geographical

localities [2]. Lifetime prevalence is reported to range from 6% (Australia) to 69% (Ireland) [3]. Hospitalisation for related complications are high with 49% of hospital admissions in PWID being related to an SSTVI, over a 4-year period in Vancouver and up to 10% of PWID in the United Kingdom reporting SSTVI-related admissions per year [4–8]. Other studies show a lifetime prevalence of injecting complications among PWID ranging from (0.5–12%) including sepsis (2–10%), bone and joint infections (0.5–2.0%), and thrombosis and emboli (3–27%) [3,4]. The majority of hospital admissions may be avoidable and are often related to delays in access to simple interventions in the community and suboptimal health care facilities targeted at PWIDs [3].

SSTVIs among PWID costs the National Health Service, in England, an estimated £47 million annually and intensive care admission is common [5]. Severity and frequency of an SSTVI is variable in geographical location and individual situation depending on multiple factors and associated health and social problems [6–10]. Differences in drug markets, administration practices, service availability and other local factors may all influence the appearance and patterns of SSTVIs. Examples of other situations exacerbating vascular problems are fragmented drug supply chains, limited provision of injecting equipment and environments hostile to drug use such as custody situations.

The nature of the drug and material injected is important. Preparations differ in their solubility and consequently their suitability for injection. Types of heroin used vary from country to country. Powder heroin from South East Asia is most common in the United Kingdom and Europe whereas black tar heroin, a resinous low grade type from Mexico and South America, is more common in the part of the United States and white 'Chinese' heroin is common in Australia. The heroin common in Oceania is easily dissolved and prepared for injection but less used as a smoked product. The United States seems to be divided into east and west when it comes to availability and quality of heroin, powder from Columbia being the most available type in the east side and black tar from Mexico in the west [11,12]. These variations in injecting materials have implications for the methods of injection solution preparation and the associated impact on vascular sites [13].

Skin and vascular problems tend to impact the most marginalised, those who are homeless or unstably housed, people living with multi-morbidities and those who are economically insecure. Women who inject drugs are disproportionately impacted with power relations playing an influence (women may be less likely to be in control of the injection preparation and administration process) [14]. The stigma, shame, pain, unpleasant odour and mobility restrictions associated with complications such as chronic leg ulcers, can restrict social integration, access to care and the possibility of accumulating recovery capital,

therefore exacerbating and entrenching social exclusion. Homelessness, lack of safe or private injecting spaces, limited access to harm reduction information and equipment or hygiene and cleaning facilities can all exacerbate risks of contamination and unsafe injecting technique. In this way, injecting practices, and the environments and social relations in which they take place interplay to determine injection-related health harms.

CLINICAL PRESENTATION, ACUTE AND CHRONIC CONDITIONS

Injection-related medical problems can be related to several factors: lack of skin and hand hygiene, trauma to the skin or subcutaneous tissues, the use of non-sterile or shared equipment and contamination and toxicity of the substances injected.

Damage can occur during or after intravenous injection causing phlebitis, inflammation or infection, such as a localised sore or abscess. These problems are characterised by swelling, irritation and pain or, if clotting or thrombosis occurs, by hard tender swellings. Long term persistent injecting into superficial vein can cause fibrosis of the vein leading to subcutaneous, palpable, swellings at the sites of valves or around injection sites leading to subsequent loss of patency. Skin lesions such as hypodermatitis are indurated chronic ulcerated lesions related to venous insufficiency. 'Puffy hands' result from longstanding injecting into veins on the dorsum of the hand and chronic lymphatic damage [15,16].

Folliculitis, cellulitis and abscesses are sometimes comparatively trivial and self-limiting but not infrequently require medical and hospital interventions and occasionally lead to septicæmia, tissue sepsis and infection such as endocarditis [17].

Chronic venous insufficiency or unresolved infection can lead to ulceration at, and distal to, injection sites such as the groin. These open wounds can be extensive, penetrating and frequently become infected. They are often difficult to manage and slow to heal.

Subcutaneous bacterial infections leading to superficial erysipelas or deeper cellulitis present as painful, swollen red areas often spreading via the lymphatic system. This can be associated with fever, rigors and systemic symptoms of irritability confusion and vomiting [18,19]. Untreated, dehydration can lead to sepsis, shock, acute renal injury and the requirement for admission to hospital and occasionally to intensive care treatment.

Localised bleeding from an injection site or into soft tissues can arise from traumatic injecting practice or indicate an underlying condition such as liver failure or, rarely, a bleeding disorder. Penetration of an artery by accident may result in more serious haemorrhage manifesting as bright red blood, soft tissue swelling and pain at, or distal to, the injection site.

Whereas injecting into a vein in the hand or upper limb may result in damage and introduction of infection, injection into muscle or deeper vein is potentially more damaging. Femoral or neck veins are used preferentially in some places [20,21]. Longer term injecting into a femoral vein can give rise to a sinus formation, establishing a track with new skin lining (Fig. 1).

Damage or trauma to a deep vein such as the femoral vein can result in a deep vein thrombosis causing swelling of the limb and general pain in the area. Dislodgement and movement of a chunk of a clot, known as an embolus, from the original site might allow transmission of this material to the heart and from there to the lungs causing a pulmonary infarction manifested by sharp chest pain, breathlessness or sudden death. Injecting into subcutaneous tissues or muscle is also common and damage, when it occurs at these sites, may be locally problematic or lead to systemic problems. More dangerous and rare infections include necrotising fasciitis manifesting as a dramatic, painful, swollen ulcerated area caused by contamination of injecting materials with a combination of anaerobic and aerobic organisms [22,23].

Arterial problems are less frequent than venous but have, potentially, more damaging consequences. Variations in injecting behaviours such as injecting into open wounds

or use of unusual site for the injection exist and may complicate recovery and obscure causation.

Arterial spasm and stroke because of stimulants may occur because of haemorrhage or thrombosis or vasospasm. The drug type may be important, cerebral haemorrhage being implicated more with methamphetamine and cocaine and stroke caused by vasospasm with Ecstasy [24–29].

CAUSAL MECHANISMS

The most prominent and available sites for injection into a vein are usually in the cubital fossa or on the dorsal surface of the hands. Surface markings and visibility of veins are more variable than the arterial system but conform to a roughly familiar pattern throughout the body. Females have the same vascular architecture but less surface visibility because of greater subcutaneous soft tissue adipose tissue due in part to physiology. Body mass index (BMI) and gender may be significant factors in accessing veins [30,31].

In both sexes, difficulty in identifying and accessing a suitable vein for injection can lead to the use of other sites such as the femoral vein and veins on the legs or foot and the external jugular vein. Less commonly, often in



Figure 1 Femoral vein sinus from longstanding injecting [Colour figure can be viewed at wileyonlinelibrary.com]

desperation, veins in other parts of the body such as the scalp, breast or penis can be used. Choice of injecting site is determined by multiple factors but with care, a single vessel can sometimes be used for many years. Over a prolonged period of injecting, however, peripheral veins may become thrombosed, painful or obstructed leading to the use of sites in areas other than the arm.

The need for covert use may result in use of a choice of a lower limb vein and the femoral vein is the largest and most easily identified by its proximity to the pulsation of the femoral artery, which can usually be palpated in the groin.

The anatomy of the femoral vein is important because it is closely situated next to the femoral artery and nerve (Fig. 2). This proximity leads to some of the more serious complications of injecting such as bleeding, thrombosis or, when material is injected into an artery by mistake to arterial insufficiency, arteriovenous fistula, aneurysm formation and damage to the supply of oxygenated blood to the limb. Rarely, injecting into a nerve can result in acute or longer standing neuropathic pain.

Poor hygiene when preparing the injection site is commonly the cause of skin irritation and the introduction of infection. When infection is present the bacteria involved are, most commonly, a variety gram-positive bacteria such as streptococcus and staphylococcus (and occasionally the resistant variety methicillin-resistant *Staphylococcus aureus*) [32–35]. These can be the cause of folliculitis, cellulitis, sepsis and septicaemia.

Less common, and usually occurring in clusters because of contaminated batches of heroin, are the gram-positive gas and toxin-producing bacteria varieties such as clostridium and the spore forming *Bacillus anthracis* that are encountered when there is gross contamination of

materials from soil or animal materials. These outbreaks tend to be severe and are associated with considerable morbidity and mortality but are usually self-limiting and geographically quite localised [22,23,36–38].

Unusual infections such as anthrax and clostridial types might initially appear to be a comparatively trivial skin or subcutaneous problem but can rapidly escalate to systemic sepsis, necrotising fasciitis, tissue or organ damage.

Injection sites contaminated with anaerobic organisms are more likely to become a problem when the injection is subcutaneous or intramuscular where oxygen levels are lower and anaerobic infections flourish.

Because injected materials are introduced into the venous system in the body drugs and contaminants, sterile or septic, either soluble or in particulate form, will be transmitted first to the right side of the heart and then to the lungs where the blood goes for reoxygenation. The lungs can act as a filter for insoluble materials larger than microorganisms and form a locus for any foreign material introduced into the circulation. Oral preparations consist largely of fillers such as talc or starch and this insoluble particulate matter accumulates in the pulmonary capillaries. These can provoke a foreign-body giant cell reaction, potentially causing thrombosis and fibrosis, and at longer term, pulmonary hypertension. [39] Thrombosis can occur in femoral, iliac and, more rarely, inferior vena cava veins.

Although the most common drugs of injection are opiates and stimulants, there are reports of damage caused by injection of prescription drugs not manufactured for injection. These include pharmaceuticals such as benzodiazepines, methadone tablets, oxycodone, morphine sulphate, methylphenidate and antidepressants [27,40]. Drugs

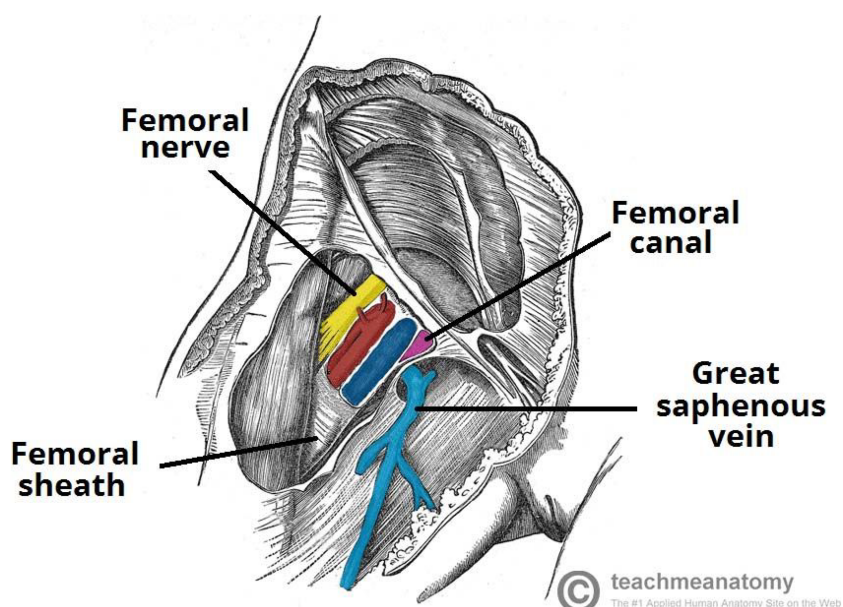


Figure 2 Anatomy of femoral area showing close proximity of vein, artery and nerve [Colour figure can be viewed at wileyonlinelibrary.com]

prepared in pill, powder or capsule form for oral use are likely to increase vascular damage if used by injection without adequate filtration to remove large particulates. There are some drugs such as such as mephedrone and methadone injectable solution that can cause vein damage because of their irritant quality. Cocaine is damaging to blood vessels when injected, through its irritant, anaesthetic and vasoconstrictive properties. This is compounded by the increased frequency of its use due to its short duration of action. Crack cocaine requires acidification to render it soluble for injection—overuse of acidifier can cause additional venous problems [41].

Superficial infections can be a commonplace experience among PWID. Considerable barriers to medical care access, normalisation of pain and limited perceptions of severity mean that self-management is common [42].

Contaminated drug preparation and reused injecting equipment are important factors informing skin and tissue damage. Widespread low-threshold availability of sterile needle and syringes is critical to reduce injection-related risk practices and infections. Service restrictions and closures because of the COVID-19 pandemic highlight the need to invest and support innovative modes of distribution, including street outreach, vending machine provision and secondary supply through peer networks [43].

Injecting culture and practice are geographically variable. Brown 'Afghani' powder heroin available in most of Europe is not water soluble without the addition of an acidifying agent such as lemon juice, vitamin C or citric acid. The solution requires heat, which can kill contaminating bacteria although may encourage spores from clostridial infection to germinate [35]. Citric acid and vitamin C are provided by most needle and syringe programmes (NSP), given the risk of systemic candidiasis infections from use of lemon juice [44]. It is crucial, however, that minimal acidifier is used in injection preparation, because excess citric acid use has been identified as a causal factor in venous sclerosis and subsequent SSTI risk [41]. Clean water to prepare injection solutions can be difficult to access when injecting in constrained circumstances; reports of saliva used as a water alternative in injection preparation are concerning, given potential for severe systemic infection [45].

The environment in which drugs are injected has significant effects on frequency of sharing equipment, materials used and infection risk. Injection in public places, for example, can increase risk of venous trauma through hurried injections and transitions to injecting in the femoral vein to expedite ease of injection and hide injection sites. A dearth of sterile injection equipment in most custodial settings places individuals at risk of viral and bacterial infections by necessitating equipment sharing. Hospitals have also been identified as environments where

risky injection practices can take place, because of a lack of timely opiate replacement therapy provision [42].

ASSESSMENT

Examination of infection sites is a crucial part of management. Serious or unresolving injury to skin or infection in tissue surrounding a vein or artery can present as local pain, swelling, warmth and discolouration. Abscesses at an injection site or in surrounding tissue, can be comparatively superficial and easily observed as a hot red swelling. They may be or less obvious when deeper in subcutaneous tissue or muscle. Here, the diagnosis might be more difficult and general signs such as fever and nausea can require further investigations such as ultrasound or soft tissue MRI scanning. Visual examination may be enough to identify the need for treatment, but caution is needed to prevent progression to more serious conditions. Superficial skin infections and infestations should be carefully diagnosed and actively treated.

More general symptoms such as malaise, fever, nausea and vomiting, and rigors caused by transient bacteraemia, may indicate sepsis or generalised septicaemia. The presence of gangrene or deep sepsis may be suspected clinically when there are skin changes, crepitus indicating gas under the skin and a characteristic smell of a wound, associated with clinical deterioration, high temperature toxicity, and signs of systemic disease such as rigors, shock and renal failure. The organism responsible may be identified and confirmed by bacteriological sampling of material at the site or by blood culture. As with other complications of drug use, simple tests to detect anaemia, white cell count, impaired renal function and blood-borne virus screening are part of any assessment.

The presence of swelling or groin pain in PWIDs raises the clinical suspicion of thrombosis in a femoral vein [46]. Preliminary investigations to exclude deep vein thrombosis include a Well's score and positive D-dimer test, to assess the presence of thrombosis, followed by venography, ultrasound scanning and intra-vessel angiography to demonstrate deep vein thrombosis or soft tissue scanning to measure the extent of abscess or deep-seated infection [47–49].

More severe consequences such as critical limb ischaemia from intra-arterial injection may be more common than reported [48]. Femoral artery aneurysms result from damage to the wall of the blood vessel. Symptoms and signs of vascular insufficiency in the lower limb include pain on walking, or even at rest, loss of hair, mottling of the skin, absent pulses and skin ulceration. Urgent assessment by vascular specialist is required. Acute arterial insufficiency can lead to tissue necrosis and, in extreme cases, gangrene and limb amputation.

TREATMENT AND PROGNOSIS

Although most skin and vascular complications are common and relatively easily managed, there are situations that, because of late presentation, are likely to make diagnosis more difficult, treatment more complicated and the outcome less favourable. Because infected injection sites are common, they are usually self-managed and, in most cases, resolve with minimum adverse consequences. Knowledge among PWID about SSTVI care and complications can be poor. Coupled with barriers to care, this can result in practices such as lancing abscesses, obtaining antibiotics from informal sources and poor adherence to treatment [33,50]. Self management is not always as protective as medical interventions and progressive and cumulative damage to the vein is common.

The mainstay of treatment of SSTVIs is local hygiene and dressing care combined with broad spectrum antibiotics. Cleaning injecting sites with alcohol pads or soap and water is protective against skin infections. Adequate provision of swabs and wipes for people who are street injecting and/or unstably housed is important, because access to clean water cannot be guaranteed [45]. Deeper infections that show signs of spread beyond the original site are usually treated with fluid and intravenous antibiotics.

Skin ulceration because of unresolved infection and exacerbated by chronic venous insufficiency requires careful management. Early nursing and medical care might avert more serious consequences of infection. Complications associated with delayed SSTVI care include septicaemia, sepsis, gangrene, endocarditis, chronic venous ulcers leading to surgical debridement, limb amputation, renal failure and death.

Recurrence of SSTVIs among PWID is associated with repeat hospital visits, poor antibiotic adherence, the need for surgical intervention and hospital discharge against medical advice. Primary care and community-based interventions have been shown to reduce SSTVI-related hospital admissions by as much as 35% and operating room procedures by 70% [51].

Treatment of vein thrombosis may be by surgical removal of the clot in the leg or, more commonly anticoagulation with low molecular weight heparin or warfarin in the acute phase of treatment, following on during recovery a shorter or longer period of daily injections to prevent a return of clotting in a traumatized vein [52–55]. In some cases, where the problem has been recurrent, ongoing treatment with an anticoagulant may be necessary for as long as injecting continues. This should be weighed against the increased risk of anaemia and prolonged bleeding after injection.

Incision and drainage are the most common surgical interventions in treatment of injection site abscesses. The diagnosis or suspicion of vasospasm may suggest a

diagnosis of temporary damage to blood flow rather than thrombosis or endarteritis and indicate a non-invasive treatment [56].

The presence of cellulitis at an injection site may initially seem something to be treated with oral antibiotic but diagnosis of a more invasive infection may lead to necrotising fasciitis and clearly requires early and urgent intervention.

For arterial problems, anticoagulation may be required and surgical drainage of abscess or infection may be necessary. Complications such as necrotising fasciitis may require urgent surgical interventions. Operative treatment uses procedures such as wide incision, subfascial examination, aggressive debridement and excision of necrotised tissue. In more critical infections, or when irreversible limb ischaemia is present, amputation of part or all of the limb may be required. Rarely, contamination with gas and organisms (e.g. *Clostridium perfringens* or *Clostridium novyi*) requires urgent tissue excision. Additional clinical management includes oral or intravenous broad spectrum antibiotics, critical care support and reconstructive procedures [57,58].

Pseudoaneurysm formation is a serious consequence of injecting into an artery and is most common in the femoral artery where proximity to the femoral vein makes it a common adverse risk. Pseudoaneurysms are less common, but not unknown, in the upper limb [59]. For femoral aneurysms vessel ligation is reported as the safest option with a low amputation risk. A high proportion of patients have subsequent longer term symptoms of circulation problems such as venous insufficiency [60].

The complexity and extent of wound care may require prolonged nursing care. This contact may allow the opportunity to engage the patient and build trust [61]. Engagement is frequently associated with other interventions such as medically assisted prescribing (opiate agonist treatment) and syringe equipment programmes [62,63]. Advice can also include alternative, and potentially less damaging, ways of using the substance such as smoking, sniffing or by rectum ('plugging').

Technical opportunities for identifying veins for injection should be used at safer injecting facilities. This can prevent unnecessary trauma and vein damage. Figures 3, 4, 5 and 6 illustrate the device used and demonstrate the illumination of the veins in the hand. This can be used to identify veins in other parts of the body and is available in injecting room and heroin-assisted treatment clinics.

Where injection cessation is required to obtain improvement, it is important to recognize how difficult this may be for the individual involved. Support in switching to other routes of administration, including though equipment provision, can be helpful [64]. In case of a completely deficient venous system, an extreme measure such as insertion of a central venous catheter (CVC) to facilitate



Figure 3 Veins in hand highlighted by detecting device [Colour figure can be viewed at wileyonlinelibrary.com]



Figure 4 Veins in hand highlighted by detecting device [Colour figure can be viewed at wileyonlinelibrary.com]

drug intake has been tried but this poses several practical and ethical questions for the care givers. Such an intervention in an exceptional situation still lacks data on long-term effects and cost benefits (Barbara Broers, personal communication).

Outcomes for skin and soft tissue infections are, inevitably, variable and depend on a variety of factors and circumstances. Treated promptly and with proper expertise recovery is usually achieved and damage minimised. Poor outcomes depend on factors such as the constituency of the infectious or toxic agent present, the delay before

intervention and the recurring nature of the traumatic process. Access to sterile drugs and clean injecting equipment has, in many localities, made a significant impact on the problems described in this article.

OTHER CONSIDERATIONS RELATING TO ASSESSMENT AND MANAGEMENT

Outreach services recognise the importance of early intervention and support with injecting practices and access to equipment. Limited access to injection supplies and



Figure 5 Veins in hand highlighted by detecting device [Colour figure can be viewed at wileyonlinelibrary.com]



Figure 6 Vein locating device [Colour figure can be viewed at wileyonlinelibrary.com]

experiencing withdrawal are frequently reported barriers to using risk reduction interventions [65]. Engaging marginalized people in care is increasingly recognized as an area of policy and management importance [66,67].

People from more supported backgrounds with added personal resources are likely to be able to avoid some of these risk factors. Required initiatives include comprehensive support for wound care, including provision of bandages and dressings, education and equipment to support injection site hygiene, safe injection preparation practices and transitions from injecting, where desired. Initiatives

to reduce stigma toward PWID in hospital and other care settings are crucial to enhance engagement. These can include employment of peer workers and cultural safety informed training for health care professionals [68].

Among these newer initiatives are educational programmes on wound care, injection site hygiene, equipment provision and measures to be taken when problems arise and early hospitalization for infection and sepsis [69–73]. Needle and syringe availability are critical to the prevention of vasculature problems either from inappropriate equipment or contamination and tissue trauma from

reuse and sharing. The training of health care workers is likely to help in conveying correct messages to drug users.

The political and structural framework of drug control and legislation has considerable impact on many substance use related problems including vascular problems. Attention has been drawn to neglect of political and policy interest into the causes and solutions for skin and soft tissue infections and the importance of supportive interventions such as safe injecting environments [62]. The rapid rise in opiate use and overdose in the United States and the inadequate response to this 'epidemic' has contributed to an increase in use of illegal opioids, injecting and subsequent sepsis complications [74–76]. The impact of HIV/AIDS and hepatitis C infection has had a significant effect on injection practices and the delivery of services for PWID, highlighting the importance of harm reduction [77].

Safer injecting facilities in sites such as Vancouver, Geneva, Amsterdam, and a new heroin-assisted treatment clinics in Glasgow and Middlesbrough are important to engage people with care, including through implementation of the broader programmes of health and social care interventions recommended by World Health Organization [78]. In the United States, state laws have a significant impact on NSP availability, with subsequent collateral damage when this is restricted [75].

The need for integrated and robust support for PWID includes mental and physical health and a non-judgemental approach to essential delivery of opiate agonist treatment and injecting equipment. This is available in several countries around the world but often with a limited range of services [66].

In conclusion, skin and vascular problems are frequent in PWID and vary widely in severity in a constantly changing environment. The impact of COVID-19 remains to be seen but is likely to impact on service access, particularly in relation to NSP access. Prevention includes access to harm reduction measures such as sterile injection equipment, a safe consumption environment, and education on safe drug use and alternative ways of using drugs, and access to drug treatment. Clinical examination for PWID should include a respectful request to discuss safe injection practices and to inspect injection sites including the groin and the neck. Treatment of skin and vascular problems occurs in the community and in specialist care facilities. All social and medical care workers have a role to play in reducing vascular harms. Engaging out-of-treatment and marginalised populations remains an important priority.

Declaration of interests

None.

Author contributions

Roy Robertson: Conceptualization; resources; writing-original draft. **Barbara Broers:** Conceptualization; resources; writing-original draft. **Magdalena Harris:** Conceptualization; resources; writing-original draft.

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