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REPAIRS Delphi: A UK and Ireland Consensus Statement on the Management of Infected Arterial Pseudoaneurysms Secondary to Groin Injecting Drug Use

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WHAT THIS PAPER ADDS

This modified Delphi consensus statement provides a valuable and contemporary insight into both the operative and overall management of patients with infected arterial pseudoaneurysms secondary to groin injecting drug use in the UK and Ireland. It draws from the experience of consultant vascular surgeons in a geographical region with a high prevalence of illicit drug use and related harms. This study also represents a robust framework for the management and standard of care for those patients with this surgical pathology in which high quality evidence is deficient.

Objective: Consensus guidelines on the optimal management of infected arterial pseudoaneurysms secondary to groin injecting drug use are lacking. This pathology is a problem in the UK and globally, yet operative management options remain contentious. This study was designed to establish consensus to promote better management of these patients, drawing on the expert experience of those in a location with a high prevalence of illicit drug use.

Methods: A three round modified Delphi was undertaken, systematically surveying consultant vascular surgeons in the UK and Ireland using an online platform. Seventy five vascular surgery units were invited to participate, with one consultant providing the unit consensus practice. Round one responses were thematically analysed to generate statements for round two. These statements were evaluated by participants using a five point Likert scale. Consensus was achieved at a threshold of 70% or more agreement or disagreement. Those statements not reaching consensus were assessed and modified for round three. The results of the Delphi process constituted the consensus statement.

Results: Round one received 64 (86%) responses, round two 59 (79%) responses, and round three 62 (83%) responses; 73 (97%) of 75 units contributed. Round two comprised 150 statements and round three 24 statements. Ninety one statements achieved consensus agreement and 15 consensus disagreement. The Delphi statements covered sequential management of these patients from diagnosis and imaging, antibiotics and microbiology, surgical approach, wound management, follow up, and additional considerations. Pre-operative imaging achieved consensus agreement (97%), with computerised tomography angiography being the modality of choice (97%). Ligation and debridement without arterial reconstruction was the preferred approach at initial surgical intervention (89%). Multidisciplinary management, ensuring holistic care and access to substance use services, also gained consensus agreement.

Conclusion: This comprehensive consensus statement provides a strong insight into the standard of care for these patients.

Keywords: Delphi consensus study, Groin sepsis, Infected arterial pseudoaneurysm, Injecting drug use, Intravenous drug user, People who inject drugs
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INTRODUCTION

People who inject drugs (PWID) are at risk of injecting related infections and injuries that can threaten life and limb, including infected arterial pseudoaneurysms.[1–5] This pathology is represented by a defect in the arterial wall, with haemorrhage contained by surrounding soft tissues, compressed thrombus, and no endothelial lining.[6] The cause is typically non-sterile injecting resulting in infective arterial trauma, either directly or through severe, invasive perivascular sepsis.[5,7–9] PWID are also at risk of necrotising soft tissue infections, contributing to complexity.[4,10] Arterial integrity can be further compromised by injecting practices such as overacidification.[11,12] The groin is the most frequently reported anatomical region for infected arterial pseudoaneurysms in PWID.[5,8]

Management of infected arterial pseudoaneurysms is contentious.[5,8] Surgical options include ligation and debridement alone or with arterial reconstruction.[13–18] However, the latter can be confounded by contamination of the surgical field (often in the context of a scarred, inflamed groin), lack of autologous conduit (owing to venous thrombosis and sclerosis), and fear of further infection with risk of catastrophic haemorrhage.[5,8,13] PWID may also have other concomitant sources of sepsis, such as a bacteraemia, infected deep venous thrombosis, septic pulmonary emboli, and infective endocarditis.[2,4,19]

The UK has one the highest rates of illicit drug use in Europe, with largely unremitting rises in drug related deaths in recent years.[20–22] Drug deaths have been most marked in Scotland, representing the highest in Europe and rivalling the USA, which is also in the midst of a drug deaths epidemic.[22–24] Beneath these drug deaths crises lie morbidity. This is reflected in increasing hospital admissions for skin and soft tissue infections in PWID in the UK and USA.[25,26]

No consensus has been reached on the optimal management of infected arterial pseudoaneurysms secondary to groin injecting drug use. A systematic review of the literature identified low level case series evidence.[27] In the absence of higher quality data, this study was designed to establish consensus on this topic and promote better management of these patients.

MATERIALS AND METHODS

Study design

A modified Delphi methodology was instituted for this study, with systematic, iterative rounds to reach consensus on the management of infected arterial pseudoaneurysms secondary to groin injecting drug use.[28–32] Consultant vascular surgeons based in the UK and Ireland were considered to be the experts because vascular surgeons exclusively manage these cases in this location. Seventy five vascular surgery units were identified across the UK and Ireland using a register from the Vascular Society of Great Britain and Ireland, which was updated to reflect changes with centralisation of units.

The Delphi was pragmatically predicated on the response of one consultant from each unit who investigated and provided a consensus on unit practice. Failure to respond in one round did not preclude involvement in subsequent rounds. Jisc Online Surveys (Bristol, UK) was used to conduct the Delphi.[33] An invitation explaining the background, rationale, and outline of the Delphi process was sent through Jisc, with weekly reminders. Personalised e-mails were also sent to ensure that the platform invitation was not blocked by e-mail servers. Each round of the survey, initially open for four weeks, was extended to six weeks to capture late responses. All responses were anonymised during analysis, and data were handled in line with the General Data Protection Regulation. The Delphi took place between March 2022 and March 2023, and was managed by the steering committee (C.S.M., J.N., S.A.S., M.S.J.W., and N.R.). The steering committee comprised two senior consultant vascular surgeons (with over 10 years consultant practice), a vascular surgery specialty trainee, an infectious diseases consultant, and a consultant general surgeon (with an interest in trauma). All members of the steering committee had experience of working in a centre with a high incidence of this pathology.[2,4] One member also had extensive experience in conducting Delphi studies.[29,34–36] The study was carried out in accordance with Conducting and Reporting Delphi Studies (CREDES) guidelines (Supplementary Material S1).[28] Ethical approval was not required.

Delphi rounds

The modified Delphi involved three rounds, which was predetermined at the study inception, as were the consensus thresholds. The first round (devised by C.S.M., J.N., and S.A.S.) asked questions to capture as many practices and concepts concerning the management of this pathology as possible. This was divided into sequential phases of management: diagnosis and imaging; antibiotics and microbiology; surgical management; and follow up. It concluded with a free text box. All closed questions were followed by free text boxes with prompts for explanation (Supplementary Table S1). The timing of arterial reconstruction was divided into immediate (at the time of the initial surgical intervention), non-immediate (any time after the initial surgical intervention and during the acute admission episode), and delayed (any time after the discharge date of the acute admission episode). The survey design was based on local experience from a unit serving a population with one of the highest rates of drug related harms in Scotland and examination of available literature, which was formalised into a systematic review.[2,4,27] The survey was piloted and evaluated by all members of the steering committee before distribution.

Following round one, free text answers for each question were thematically analysed.[37] This was conducted independently by two authors (C.S.M. and J.N.) and evaluated by a third (S.A.S.). These statements were then reviewed and revised by the steering committee and piloted before dissemination for round two. A free text box was also

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included at the end of round two. A five point Likert scale (1, strongly disagree; 5, strongly agree) was used to grade each statement. The steering committee decided upon a consensus threshold of 70% or over (Likert 4 + 5), consistent with other Delphi studies.[29–31,38] Consensus disagreement (Likert 1 + 2) was also levelled at 70% or over.

After round two, responses were analysed using Likert score percentages. Statements that reached consensus were not included in round three. Statements that failed consensus were reassessed by the steering committee. Free text comments informed statement revisions. The steering committee was able to remove, replace, merge, or re-present statements as appropriate. New statements were added based on the responses. Statements that were re-presented were accompanied by round two levels of agreement and disagreement, as such feedback has been described to promote consensus.[39] This round was also piloted.

The results of round three were analysed as for round two, tabulated, and reviewed by the steering committee. The finalised statements were those that achieved consensus agreement or consensus disagreement.

RESULTS

Seventy five vascular units were invited to participate in this Delphi, 64 (86%) responded in round one, 59 (79%) in round two, and 62 (83%) in round three. The mean response rate was 82%. In total, 73 (97%) of the 75 units contributed. A flowchart of the Delphi process is presented in Figure 1.

Delphi rounds

Sixteen closed and three open questions were agreed by the steering committee. The questions and results are presented in Supplementary Table S1. There were 64 (86%) responses. Consensus agreement was achieved in 13 questions. There was consensus disagreement (83%) on undertaking immediate arterial reconstruction. No consensus was reached on whether non-immediate arterial reconstruction should follow arterial ligation and debridement, or whether proceeding to immediate major limb amputation would be considered after arterial ligation. Free text responses following round one were assessed and used to construct statements for round two.

Analysis of round one responses generated 150 statements, of which consensus agreement was achieved in 83, consensus disagreement in 14, and no consensus in the remainder (Supplementary Table S2). Free text responses following round two were evaluated to compose statements for round three.

Analysis of round two generated a further 24 statements, of which consensus agreement was achieved in eight, consensus disagreement in one, and no consensus in 15 (Supplementary Table S3). Responses from all rounds were collated into consensus statements. Ninety one statements reached consensus agreement (statement 20 being composed of six consensus sub-statements) (Tables 1 – 5) and 15 reached consensus disagreement (Table 6).

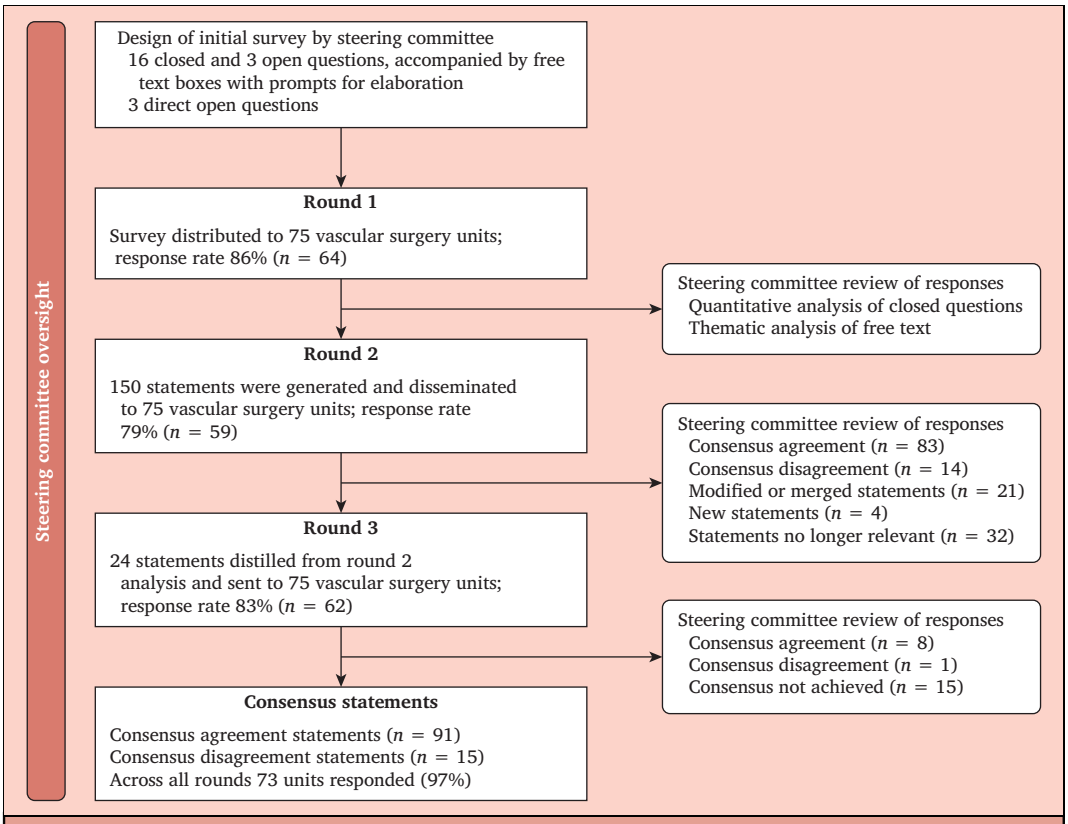

Figure 1. Delphi process flowchart.

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Table 1. REPAIRS Delphi UK and Ireland overall consensus statements: diagnosis and microbiology.

Statement	Agreement rate – %
Diagnosis and imaging	
1. If the patient is actively haemorrhaging, they should be taken straight to theatre.	56 (95)
2. Pre-operative imaging should be obtained for all suspected cases who are sufficiently haemodynamically stable, i.e., no circulatory or septic collapse.	57 (97)
3. Computerised tomography (CT) angiogram is the imaging modality of choice.	57 (97)
4. CT imaging can inform which specialty the patient would be best cared for under.	53 (86)
5. CT angiogram (dual arterial and venous phase) is the imaging modality of choice to resolve arterial and venous pathologies from surrounding inflammatory reaction or abscess.	59 (95)
6. CT angiogram guides diagnosis, operative planning, and directs drainage.	57 (97)
7. There should be a low threshold for imaging other regions of the body to assess for septic foci or complications, e.g., chest.	43 (73)
8. Further imaging, such as CT angiogram, is still required if duplex detects an arterial pseudoaneurysm.	49 (83)
Antibiotics and microbiology	
9. Local empirical antibiotic protocols should be based on previous experience of infected arterial pseudoaneurysms secondary to groin injecting drug use.	49 (83)
10. Empirical antibiotic therapy should be started on admission for patients.	55 (93)
11. These cases should be considered as polymicrobial until proven otherwise, with antibiotic coverage of gram positive, gram negative, aerobic, and anaerobic bacteria.	58 (98)
12. There should be a high index of suspicion for necrotising soft tissue infections (NSTI) in these cases.	57 (92)
13. Antibiotics should be commenced after taking available microbiology samples (blood cultures and wound/pus swabs) when possible.	42 (71)
14. Blood cultures should be taken at the time of admission, when the patient is pyrexial and if there is suspicion of infective endocarditis.	56 (95)
15. The preferred route of antibiotic administration is intravenous.	55 (93)
16. Durable venous access, e.g., a peripherally inserted central catheter, mid or central line, should be established early and removed as soon as no longer indicated.	44 (75)
17. Stepdown to oral antibiotics should be considered as soon as clinically indicated when agents with high target tissue bioavailability and appropriate culture sensitivities are identified.	57 (97)
18. Intra-operative tissue samples, e.g., localised thrombus, pus, pseudoaneurysm wall, and locally involved muscle, should be obtained in all cases.	57 (97)
19. During the acute admission episode, infectious diseases and microbiology advice should be sought.	56 (88)
20. Involvement of infectious diseases and microbiology should always be obtained in cases with:	
Any complex infection, e.g., bacteraemia, NSTI, unusual pathogen	58 (98)
Antibiotic resistance	58 (98)
Challenging intravenous access or need for oral administration due to patient factors	51 (86)
Cases in which the infecting organism cannot be identified	52 (88)
Multiple antimicrobial allergies	58 (98)
Patient clinically not improving despite debridement and antibiotic therapy	57 (97)
21. In patients who are not progressing appropriately following adequate debridement and ongoing antibiotic therapy, further clinical and radiological assessment of the primary site of sepsis and possible concomitant peripheral sites should be undertaken, e.g., for bacteraemia, septic emboli, and infective endocarditis.	59 (100)
22. The presence of a fungal component should be considered.	59 (100)
23. All patients should be screened for blood borne viruses (hepatitis C/B and human immunodeficiency virus) with onward referral as appropriate.	51 (86)
24. A multidisciplinary team approach, e.g., vascular surgery, infectious diseases, and microbiology, and the substance use team, should be considered in all cases.	53 (90)

CT = computerised tomography; NSTI = necrotising soft tissue infection.

DISCUSSION

To the authors' knowledge, this is the first consensus statement on the management of infected arterial pseudoaneurysms secondary to groin injecting drug use. The study draws from the experience of those working in a geographical location with a high prevalence of drug use.[20–22,25] There was a high level of engagement among the vascular surgery community in the UK and Ireland, which contributed to the robustness of the study. The consensus spans the range of management options for infected arterial pseudoaneurysms from diagnosis and imaging, antibiotics and microbiology, intra-operative approach, surgical wound management, follow up, and additional considerations.

Diagnosis and imaging

The importance of imaging for diagnosis and facilitating operative planning was confirmed with a consensus level of 97%. This aligns with early studies on PWID groin sepsis in PWID in the 1980s and 1990s advocating pre-operative imaging, acknowledging the diagnostic difficulties and surgical pitfalls associated with these cases.[13,40] In the present study, computerised tomography angiography (CTA) was the imaging modality of choice (97%) because of its

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Table 2. REPAIRS Delphi UK and Ireland overall consensus statements: surgical timing and approach.

Statement	Agreement rate − %
Surgical management: timing of theatre after diagnosis	
25. Patients should be taken to theatre for surgical management at the earliest opportunity.	50 (85)
26. Patients who are septic, with signs or concerns of necrotising soft tissue infections (NSTI), should be taken to theatre immediately, with appropriate ongoing resuscitation (antibiotics, fluids) up until that point.	53 (90)
27. Patients who are haemodynamically stable should be taken to theatre at the earliest opportunity, with appropriate ongoing antibiotic management.	51 (87)
28. Patients who are haemodynamically stable with no signs of imminent external bleeding, sepsis, or suspicion of NSTI may be able to wait until daytime hours to be taken to theatre, with ongoing appropriate antibiotic management.	52 (88)
Intra-operative approach and considerations	
29. The operative management of an infected arterial pseudoaneurysm secondary to groin injecting drug use requires a bespoke approach.	50 (85)
30. Vessel control should always be obtained remote from the site of sepsis and in a healthy portion of artery.	50 (85)
31. Occlusion balloon catheters can be used for vascular control in open, hybrid, and endovascular approaches.	44 (75)
32. Vessel ligation, oversewing, or both, must extend to healthy artery proximally and distally.	54 (92)
33. Non-absorbable suture material, e.g., Prolene, nylon, is preferred for vessel ligation and oversewing.	55 (93)
34. Drainage (pus and haematoma) and debridement (infected and necrotic tissue) should be thorough.	58 (98)
35. Collateral vessels and continuity of the superficial femoral artery and profunda femoris artery junction should be preserved when possible.	47 (80)
36. Adjacent venous involvement that may require ligation and oversewing should always be considered.	46 (78)
37. A consultant vascular surgeon should be present for operative management of these cases.	50 (85)
38. Longitudinal or lazy S (extendable) groin incisions are recommended for optimal exposure and access rather than transverse (non-extendable).	56 (90)
39. The inguinal ligament can be divided to improve access.	43 (73)
40. When approaching such cases a damage control philosophy should be adopted.	50 (85)

NSTI = necrotising soft tissue infection.

accessibility, rapidity, ease of interpretation, better delineation of the surrounding anatomy, and assessment for retroperitoneal sepsis.

There was consensus (76%) that health boards should have clear pathways for appropriate investigation of groin sepsis in PWID to guide admission to the most suitable specialty, with most recommending CTA (86%). Anecdotal increasing involvement of vascular surgery in the management of PWID with groin sepsis, in the absence of vessel compromise, was noted, possibly because of greater surgical subspecialisation and vascular service centralisation.[2,4] This was reflected in several free text comments (Supplementary Material S2).

These cases are challenging as the groin and surrounding tissues are distorted by inflammation and scarring from repeated injecting trauma. The reticence in managing perivascular soft tissue sepsis by non-vascular surgeons may be related to curricular changes and centralisation of vascular services. The UK vascular surgery curriculum ensures the appropriate diagnostic and surgical skill sets for managing such cases, regardless of vascular injury.[41] Although general, orthopaedic, and plastic surgery have included soft tissue sepsis management within their curricula, this study suggests that the burden of care for PWID with groin sepsis falls to vascular surgery.[42–44] This observation has been reported.[2,4] Comparatively, vascular surgery is a small specialty, and this drift in workload necessitates appropriate material and workforce resourcing.

Antibiotics and microbiology

PWID presenting with an infected arterial pseudoaneurysm or groin sepsis can be complex with concurrent pathologies, reflected in statements seven and 21.[2,4,19] Presentations are resource intensive, potentially requiring multiple theatre attendances, critical care, multispecialty input, and prolonged inpatient stays. Further, many require central or long term peripheral access for extended antibiotic courses.[2] Work is ongoing to assess the safety and feasibility of outpatient parenteral antibiotic therapy for PWID, suggesting it as effective if individualised and well supported.[45] Interest has also grown in lipoglycopeptides (parenteral agents with longer half lives) and earlier use of oral antibiotics to improve compliance.[45] Indeed, recent robust evidence suggests that high bioavailability oral antimicrobials are as effective as parenteral regimens, even in challenging infections such as infective endocarditis, with international guidelines supporting this.[46,47] The need for multidisciplinary management and close liaison with infectious diseases and microbiology was frequently highlighted by respondents.

Intra-operative approach and considerations

The use of trauma algorithms was emphasised, with 85% applying a damage control philosophy. The preferred initial intervention was arterial ligation and debridement alone (89%), the primary objectives being haemorrhage and sepsis control. Endovascular management by stent graft

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Table 3. REPAIRS Delphi UK and Ireland overall consensus statements: surgical management and arterial reconstruction.

Statement	Agreement rate − %
Immediate arterial reconstruction (at the time of the initial surgical intervention) for ligation and oversewing	
41. Ligation, oversewing, and debridement without immediate arterial reconstruction (at the time of the initial intervention) is recommended for initial management of these cases.	55 (89)
42. Autologous vein is preferable for immediate arterial reconstruction for ligation and oversewing.	42 (71)
Non-immediate arterial reconstruction (any time after the initial surgical intervention and during the acute admission episode) following ligation and oversewing	
43. Arterial reconstruction following ligation and oversewing should be delayed for as long as possible to assess for improvement in limb ischaemia, resolution of local and distant sepsis, and to evaluate patient engagement with medical and substance use services, specifically injecting abstinence.	35 (76)
44. Non-immediate arterial reconstruction following ligation and oversewing should only be considered when there is no ongoing source of sepsis.	46 (74)
45. Autologous vein is preferable for non-immediate arterial reconstruction following ligation and oversewing.	48 (81)
46. Non-immediate arterial reconstruction following ligation and oversewing should be routed (*in situ* or extra anatomically) depending on patient factors and surgical judgement.	48 (81)
47. Non-immediate arterial reconstruction following ligation and oversewing decisions requires multidisciplinary team (MTD) discussion.	51 (86)
Delayed arterial reconstruction (any time after the discharge date of the acute admission episode) following arterial ligation and oversewing	
48. Delayed arterial reconstruction following ligation and oversewing should be done in selected cases.	42 (71)
49. Delayed arterial reconstruction following ligation and oversewing should only be considered for limb threatening ischaemia.	46 (78)
50. Delayed arterial reconstruction following ligation oversewing should only be considered when there is no ongoing source of sepsis.	50 (85)
51. Autologous vein is preferable for delayed arterial reconstruction following ligation and oversewing.	50 (85)
52. Delayed arterial reconstruction following ligation and oversewing should be routed (*in situ* or extra anatomically) depending on patient factors and surgical judgement.	47 (80)
53. Delayed arterial reconstruction following ligation and oversewing decisions require MDT discussion.	50 (85)
Arterial reconstruction considerations	
54. Non-immediate and delayed arterial reconstruction should only be considered in patients who engage with medical treatment and substance use services, specifically injecting abstinence.	47 (76)
55. An extended course, e.g., 6−12 weeks, of antibiotics should be prescribed following immediate and non-immediate arterial reconstructions (open and endovascular).	46 (74)
56. Following reconstructions *in situ*, sartorius, gracilis, and rectus femoris muscle flaps should be considered to ensure graft coverage in case of wound failure for immediate and non-immediate reconstructions (open and endovascular).	50 (85)

MDT = multidisciplinary team.

exclusion of the pseudoaneurysm reached consensus disagreement (statements five and 15). Endovascular exclusion, however, is described in this setting and was cited as a management strategy by some respondents.[48,49]

The responses for non-immediate arterial reconstruction indicated consensus agreement on important considerations. These included the absence of ongoing sepsis, and patient engagement with medical treatment and substance use services. Intermittent claudication was not deemed an indication for arterial reconstruction (81% disagreement), and limb threatening ischaemia also failed consensus (63% agreement).

Delayed arterial reconstruction received more support (75% agreement; 71% in selected cases), with sepsis clearance and engagement with medical treatment and substance use services being key considerations. Consensus agreement was reached on limb threatening ischaemia as an indication for reconstruction (78%). However, there was consensus disagreement for intermittent claudication (78%), and no consensus on severe, quality of life limiting claudication (20% agreement, 56% disagreement).

Autologous vein was the consensus conduit at any time interval. Although options for vein can be limited in PWID, the use of alternatives, e.g., prosthetic, biological, and biosynthetic, were mentioned. Consensus was reached on the necessity of multidisciplinary team discussion to inform decisions about reconstruction. The safety of reconstruction, in the context of ongoing injecting and haemorrhage risk, was a persistent concern. Selected comments on arterial reconstruction are presented in Supplementary Material S2.

Surgical wound management

There was consensus that wound management approach should be individualised. The preferred options were leaving the wound open (83%) or partially closed (75%), with the potential adjunct of negative pressure wound therapy (92%). Primary closure over drains was advocated by 45% to make the wound more manageable as an inpatient, or if early discharge against medical advice. Those endorsing wound closure acknowledged a low threshold to re-explore

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Table 4. REPAIRS Delphi UK and Ireland overall consensus statements: surgical management and amputation.

Statement	Agreement rate − %
Immediate major limb amputation (at the time of the initial surgical intervention)	
57. Immediate major limb amputation (at the time of the initial surgical intervention) following ligation and oversewing or failed immediate arterial reconstruction is indicated in the presence of life threatening lower limb sepsis and ischaemia.	43 (73)
58. The decision to amputate should be delayed unless life is threatened by the limb.	53 (90)
59. In the absence of life threatening sepsis and ischaemia, the viability of the limb should be assessed for at least 12−24 h after ligation and oversewing before deciding on an amputation.	48 (81)
60. In the absence of life threatening sepsis and ischaemia, the viability of the limb should be assessed for at least 24−48 h after ligation and oversewing before deciding on an amputation.	52 (88)
61. In the absence of life threatening sepsis and ischaemia, amputation should be delayed to allow for patient counselling and assessment by physiotherapists and occupational therapists.	53 (90)
Non-immediate major limb amputation (any time after the initial surgical intervention and during the acute admission episode)	
62. Non-immediate major limb amputation (any time after the initial surgical intervention and during the acute admission episode) is indicated where there is ongoing lower limb sepsis or necrosis beyond the control of local surgical debridement and antimicrobial management.	53 (90)
63. Non-immediate major limb amputation is indicated if the limb becomes non-viable, non-functional, or both.	57 (97)
64. Non-immediate major limb amputation is indicated in patients with limb threatening ischaemia where arterial reconstruction is not possible.	47 (80)
65. Non-immediate major limb amputation should be considered following patient request in the presence of severe symptomatic limb ischaemia.	49 (83)
Delayed major limb amputation (any time after the discharge date of the acute admission episode)	
66. Delayed major limb amputation (any time after the discharge date of the acute admission episode) is indicated if the limb is non-viable, non-functional, or both.	55 (93)
67. Delayed major limb amputation should be considered for patients presenting with limb threatening ischaemia where arterial reconstruction is not possible.	54 (92)
68. Delayed major limb amputation should be considered following patient request in the presence of severe symptomatic limb ischaemia.	49 (83)

the wound if required. The use of muscle flaps reached consensus (93%); however, challenges in mobilising tissues were noted.

Miscellaneous and additional comments

Consensus for a holistic management strategy for PWID beyond their immediate presentation was reached. This consisted of ensuring adequate analgesia and treatment of withdrawal, which can be poorly managed precipitating agitation, disruptive behaviours (real and perceived), and early discharge.[50,51] It can lead to mistrust and erratic engagement with healthcare services, and delayed presentations.[50,52,53] PWID are the subject of stigma, even reflected by some hospital opioid withdrawal policies, and such sentiments may contribute to the reticence of some specialties to manage these patients.[54] Stigmatising attitudes were alluded to in responses (Supplementary Material S2).

These presentations are opportunities to reduce harm in a marginalised, often young population with considerable health inequalities and poor outcomes.[4,52] More work is required to institute effective preventative measures, e.g., care bundles (as used in alcohol related liver disease) and harm reduction packages, including patient education (safer injecting practices), improved involvement of substance use teams, and peer support, as well as staff training.[45,54−59] The American Heart Association released a scientific statement on infective endocarditis in PWID, emphasising the importance of treating the underlying substance use that has caused the presentation. It reinforced the benefits of multidisciplinary team management, citing endocarditis teams, with addiction medicine, psychiatry, pharmacists, nurses, and social workers to facilitate comprehensive, holistic care. In line with this study, the need to manage pain and withdrawal appropriately for these patients was highlighted, and the uncertainty that may exist for some healthcare staff when confronted with these issues.[58] An educational toolkit for healthcare workers has previously been reported to be effective in addressing this deficit.[60] The benefits of collaborative multidisciplinary management are supported by involvement of teams, such as addiction medicine and substance use services, improving outcomes for PWID in better opiate agonist therapy uptake, treatment completion, reduced re-admissions, and decreased deaths.[61−64]

Recent studies have highlighted missed opportunities for simple harm reduction measures, such as blood borne virus testing, with one study reporting 19.7% of admissions within a PWID cohort to have been tested, and 25.5% of those identified to be hepatitis C positive, a treatable condition.[4,19] Drug related harm figures are sobering, with the mean age of drug related death in Scotland being 44 years, and in the rest of the UK 45 − 49 years.[21,22] If these drug related harms are to be reduced, more proactive, sincere, and coordinated multilevel engagement is required.

Strengths and limitations

Although this study benefitted from a large volume of responses, the authors acknowledge limitations. Regional variation in experience with this pathology may have

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Table 5. REPAIRS Delphi UK and Ireland overall consensus statements: wound management, follow up, and additional comments.

Statement	Agreement rate – %
Surgical wound management	
69. Modality of surgical wound closure should be determined on a case by case basis depending on local and patient factors.	53 (90)
70. Groin wounds following vessel ligation and oversewing can be packed and left open to close by secondary intention.	49 (83)
71. Groin wounds following vessel ligation and oversewing can be partially closed and packed.	52 (88)
72. Negative pressure wound therapy (NPWT), e.g., vacuum assisted closure or PICO dressings, can be used to expedite wound healing.	54 (92)
73. NPWT can be applied to open, partially closed, and closed groin wounds.	44 (75)
74. NPWT should not be applied directly to exposed vessels.	48 (81)
75. NPWT should only be applied when exposed vessels are covered by a layer of fascia, granulation tissue, or a muscle flap.	52 (88)
76. Fascial coverage, muscle flaps, or both (sartorius, gracilis, or rectus femoris), should be considered to protect exposed ligated and oversewn vessels, arterial repairs, or open and endovascular reconstructions, and to reduce debridement voids.	55 (93)
77. Plastic surgery advice can be sought to facilitate wound closure, e.g., split skin grafts and flaps.	42 (71)
78. There should be a low threshold for second looks (under anaesthetic) at these wounds in theatre.	51 (86)
Surgical follow up on discharge	
79. There should be routine follow up on discharge to assess wound healing and limb perfusion.	42 (71)
80. Arterial reconstructions (open or endovascular) should have graft surveillance to assess for patency and infective complications.	45 (76)
81. All patients should be referred to substance use services, preferably as an inpatient.	56 (95)
Miscellaneous and additional comments	
82. Clear pathways need to be developed by health boards for the investigation and management of patients presenting with groin sepsis secondary to injecting drug use to facilitate admission to the appropriate specialty.	45 (76)
83. Patients who present with groin sepsis secondary to injecting drug use who require surgical intervention can be managed by specialties other than vascular surgery, unless there is active haemorrhage, concern regarding an infected arterial pseudoaneurysm, or an abscess deep to, or surrounding, major vessels.	42 (71)
84. There should be early involvement of the substance use team with access to harm reduction measures, rehabilitation, and community support.	54 (92)
85. Adequate analgesia and management of withdrawal are key to support overall treatment in this cohort.	53 (90)
86. Patients who present with an infected arterial pseudoaneurysm secondary to groin injecting drug use require holistic management with assessment of social and non-medical needs.	54 (92)

NPWT = negative pressure wound therapy.

Table 6. REPAIRS Delphi UK and Ireland consensus disagreement statements from all rounds.

Statement	Disagreement rate – %
1. Duplex scan is the imaging modality of choice.	42 (71)
2. Absorbable suture material, e.g., Vicryl, is preferred for vessel ligation and oversewing.	45 (76)
3. Prosthetic and biological patch repair can be considered if the defect is small and adjacent artery healthy.	48 (81)
4. Immediate arterial reconstruction for ligation and oversewing should be done in all cases.	54 (92)
5. Immediate endovascular arterial reconstruction should be considered as an alternative to ligation and oversewing.	43 (73)
6. Immediate arterial reconstruction for ligation and oversewing should always be routed anatomically.	46 (78)
7. Non-immediate arterial reconstruction following ligation and oversewing should always be done.	52 (88)
8. Non-immediate arterial reconstruction following ligation and oversewing should be considered in intermittent claudication.	48 (81)
9. Non-immediate arterial reconstruction following ligation and oversewing should always be routed anatomically (*in situ*).	42 (71)
10. Delayed arterial reconstruction (any time after the discharge date of the acute admission episode) following ligation and oversewing should never be done.	43 (73)
11. Delayed arterial reconstruction following ligation and oversewing should always be done.	55 (93)
12. Delayed arterial reconstruction following ligation and oversewing should be considered in intermittent claudication.	46 (78)
13. Delayed arterial reconstruction following ligation and oversewing should always be routed anatomically (*in situ*).	43 (73)
14. There should be no follow up.	51 (86)
15. A covered stent, if anatomically suitable, with wound debridement as required can be considered.	45 (73)

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influenced responses. However, this study reflects current practice and encompasses regions with greater familiarity in managing these cases in an overall location with high rates of illicit drug use. It also achieved 91 consensus agreement and 15 consensus disagreement statements. Despite this study being national, it is hoped that the experience distilled into this Delphi is applicable internationally.[2,65]

The Delphi was limited to vascular surgeons, as this specialty exclusively manages this pathology in UK and Ireland. However, the steering committee included an infectious diseases consultant as well as a consultant general surgeon to provide external perspectives.

The Delphi relied upon a single point of contact to provide a consensus view of practice within their unit. The authors acknowledge that this may have biased any viewpoint to the responder. Many responses, however, did outline variations if they occurred. The five point Likert scale allowed respondents the option to remain neutral on statements. Whilst it could be argued that experts should have been able to give weighted answers, certain scenarios may have been hypothetical if not practised, such as immediate arterial reconstruction, therefore, a neutral response was deemed appropriate. This may also have been reflected by some responses in which operative options were considered but uncommonly practised. Finally, despite Delphi studies being based on collective expert responses, they are still fundamentally expert opinion, which is regarded as the lowest level of scientific evidence.[66,67] Well designed, prospective studies would be required to build upon this work.

Conclusions

Infected arterial pseudoaneurysms are a complication of groin injecting drug use, however, evidence is deficient on optimal management. Injecting drug use is a persistent problem globally.[65] This UK and Ireland consensus statement provides a robust insight into the practice and standard of care within a geographical region with a high prevalence of illicit drug use and related harms. It provides a framework for the management of this pathology, and underscores the need for holistic, multidisciplinary management with better integration of harm reduction measures.

CONFLICTS OF INTEREST

None.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejvs.2024.04.016.

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