

- If a hematoma develops, close assessment of the site, the AV access, and the adjacent extremity should be made, including measurement of swelling, assessment of the presence of flow in the AV access both proximal and distal to the hematoma, and circulation to the associated extremity. (Expert Opinion)

12.2 KDOQI considers it reasonable to use ultrasound to help determine direction of flow and proper needle placement in the AV access of select patients as needed and performed by trained operators, to prevent cannulation complications. (Expert Opinion)

Rationale/Background

Despite cannulation being an integral component of the HD procedure, there is very limited evidence to support practice. Knowledge, skill, and ability among cannulating nurses/dialysis personnel varies significantly across jurisdictions, with little to no minimum standards or standardization. Basic knowledge of vascular anatomy, patient-centered care, and the importance of provider-patient therapeutic relationships should be components of all cannulation training programs to reduce the frequency of complications. The complications that occur as a result of cannulation not only cause significant discomfort and distress to patients but, in some cases, may negatively affect their ability to have a functioning dialysis access in the future. For example, a single infiltration injury that occurs before successful 2-needle cannulation is associated with 56% lower odds of overall AVF maturation.¹⁵⁸ Infiltration injury is associated with frequent imaging, interventions, and prolonged need for a CVC.³ Indeed, unsuccessful cannulation attempts are associated with poorer AVF maturation success and outcomes.¹⁵⁸ Currently, complications related to cannulation are not consistently or well documented as part of the dialysis treatment.

Cannulation site bleeding can usually be corrected by direct pressure but occasionally requires the placement of a skin suture. Pressure should be applied directly to the bleeding site, and care should be exercised not to occlude the AV access outflow distal to the bleeding site because of the potential to increase the intraluminal AV access pressure to arterial levels. A “bad stick” that results in a significant hematoma often requires placement of a CVC and deferral of further AV access cannulations until the hematoma is resolved, a period that may last up to 3 months.³ Bleeding from a vascular access needle site that needs a skin suture or results in a very large hematoma is very suggestive of a venous outflow stenosis and requires a referral for a diagnostic angiogram.

Detailed Justification

Complications and Management

- Infiltration of the vein can occur when a needle is inserted and the tip is inadvertently advanced beyond the vein, perforating the side or back wall and resulting in some degree of swelling, bruising, and/or pain.
- Hematomas can develop as a result of an infiltration of the vein or due to leaking of blood around the puncture site during cannulation, during a dialysis treatment, or after removal of a needle at the end of a dialysis treatment. The size of hematomas can vary significantly, from a small diffuse area to a large, firm mass that can potentially compress the vessel, resulting in thrombosis of the AV access. The development of significant hematomas can also result in the development of stenosis at the site of hematoma. Every effort should be made to avoid these.
- Pain of various degrees is common and can occur in various sites, at various times, and with various intensity. Pain can develop at the time of cannulation, during the dialysis treatment at the site of or surrounding a site of cannulation, or along the arm or hand and continue after dialysis as a result of a hematoma, infiltration of the vein, or irritation of an adjacent nerve.
- Management of cannulation complications such as infiltration and resulting hematoma is dependent on the extent of swelling, pain and patient anxiety. The sharing of knowledge and providing support to the patient and family cannot be minimized. Providing comfort measures and/or analgesic administration must be assessed on an individual basis.

Prevention of Cannulation Complications

- AV access check or assessment before cannulation is required. Ensuring that flow is present in the AV access and determining the direction of flow to ensure optimal dialysis is required before needle placement. Observation of the full AV access and adjacent limb and auscultation and palpation along the AV access can detect many defects and aid in appropriate selection of sites for cannulation. The use of bedside ultrasound by a trained operator to aid in cannulation has been associated with an increase in nurse confidence and patient comfort and can help determine direction of flow within the AV access, but there is limited evidence at this point to recommend use in all patients. Please see Special Discussions under [Guideline 11](#) for discussions about the use of ultrasound to aid cannulation.
- Appropriate selection of cannulation sites based on assessment and input from patients can help avoid associated complications.