

Haemodialysis Line Locking Solutions

Key Points

- Maintain tunnelled line catheter patency.
- Minimise exit site and catheter line infections.
- Managing poor flows from tunnelled haemodialysis lines

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Abbreviations

CRBSI	Catheter Related Blood Stream Infection
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Summary

This guideline does not include patients who are visiting for holiday dialysis. Holiday dialysis patients with lines should continue to use the lock solution they routinely use at their base HD unit. If this is not a line lock routinely used at the Frimley Park Hospital Renal Unit the visiting patient is required to provide (on the first visit) sufficient supplies of their usual locking solution to cover their entire holiday. In addition a full and comprehensive protocol for the use of the lock must be submitted and approved by the patient's clinician at least 7 days before the patient is due to arrive. Alternatively the patient can request the use of the Trust line lock and this consent must be documented in the medical notes before the first dialysis session.

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Introduction

Haemodialysis may be performed through several types of vascular access. The gold standard is an arterio-venous fistula (ideally created prior to the requirement for haemodialysis). However, a variety of intravascular lines are available in the event that haemodialysis through a fistula is not possible. These range from temporary lines through to tunnelled lines which may be used as permanent vascular access.

The longer a line remains in situ, the greater the chance that the line may become colonised with bacteria. These bacteria may be present within the lumen or on the external surface of the line. Additionally, the bacteria may form a biofilm consisting of micro-colonies of bacteria buried within a matrix of proteoglycans. The presence of biofilm reduces the effectiveness of anti-microbial agents and may lead to persisting colonisation of the line despite appropriate anti-microbial therapy. Line colonisation with bacteria generally precedes systemic infection and so preventing line colonisation in the first place may help to reduce systemic infective complications.

The ideal is to have a greater proportion of patients receiving haemodialysis via a fistula. Where this is not possible, a number of methods are available to help prevent line colonisation and infection. These include the Saving Lives High Impact Interventions 1-3 which deal with central venous catheters, peripheral intravenous cannulae, and renal dialysis catheters.

*High Impact Intervention 3 – Renal dialysis catheter care bundle*⁵ lists a number of actions of good practice that are recommended to prevent line related infection. These are split into insertion and on-going care. It is beyond the remit of this guideline, but readers are advised to familiarise themselves with the current renal unit guideline on insertion and continuing care of renal dialysis lines.

One aspect of on-going care actions mentioned in the high impact intervention is the use of anti-microbial locks if indicated by local surveillance data. There is a paucity of clinical data on the use of antibiotic lock solutions specifically related to renal dialysis. However, there is some data that show catheter related bloodstream infections (CRBSI) decrease with use of anti-microbial lock solutions¹⁻⁴.

In drawing up these guidelines, current guidance from several sources has been collated. The first-line anti-microbial line lock is a combination preparation of Taurolidine and Heparin and comes premixed in a vial under the trade name

TauroLock Hep 500®. In the event of the first-line product being contraindicated then the second-line anti-microbial line lock should be considered. The second-line antibiotic lock therapy should be used as per renal consultants' and microbiologists' advice. There are 4 main haemocaths in use within the dialysis unit. Each one has slightly different volumes, ranging from 1.2 mls per lumen up to 2.2 mls per lumen.

Taurolidine, citrate and heparin solution (TauroLock™ HEP500) are a commercially available line lock licenced for administration into central venous lines. From 1st April 2015 TauroLock™ HEP500 became the renal unit's first-line line locking solution replacing the existing line locks such as heparin sodium, tri-sodium citrate or combinations of heparin sodium and Gentamicin. The main components of TauroLock™ HEP500 are (cyclo-) taurolidine, citrate (4%) and unfractionated heparin (500 units).

Alteplase – It is a thrombolytic treatment of occluded central venous access devices (including those used for hemodialysis). Alteplase is used to de-clot the central venous catheter whilst the patient is in a dialysis center.

Taurolidine and Urokinase 25,000 units (TauroLock™ U25000) is a line lock solution for central venous lines and is used as a lock in place of Urokinase alone in patients with potential line occlusions. The main components are Taurolidine & Urokinase.

TauroLock™ HEP500 and TauroLock™ U25000 are both classed as medical devices. The medical device categorisation is not the same classification as that of a pharmaceutical product (medicine). As such TauroLock™ HEP500 and TauroLock™ U25000 are not intended to be introduced into a patient's systemic circulation. Any line lock should only be introduced into the line in such quantities as to optimally fill the lumen.

The mechanism by which TauroLock™ HEP500 provides anticoagulation is two-fold. The citrate component of the product acts to remove ionised calcium in the extra-corporeal circuit by chelation. As calcium is an integral ion involved in the clotting cascade, local removal by citrate prevents the activation of clotting co-factors, factor X and prothrombin and hence the ultimate formation of fibrin. The second method of anticoagulation is produced by the unfractionated heparin component. Unfractionated heparin acts by inhibiting thrombin and by potentiating the naturally occurring inhibitors of activated Factor X (Xa).

Citrate is metabolised in the systemic circulation to bicarbonate in the liver and in the muscle tissue within 10 minutes of administration. Systemic unfractionated heparin is metabolised rapidly in the liver and the inactive metabolic products are excreted in the urine. For these reasons, if accidental systemic administration of TauroLock™ HEP500 occurred, long-term anticoagulation would not be expected.

In addition, TauroLock™ HEP500 exhibits an anti-microbial property through the Taurolidine component. Taurolidine acts as an anti-microbial by transferring methylol c-1 building blocks to the nucleophilic centres of microbial structural molecules. As a consequence, bacterial cell walls and fungi are destroyed.

Taurolidine is systemically non-toxic and is quickly degraded to the physiological amino acid taurine if inadvertently instilled into the systemic circulation.

Choice of line lock:

1. TauroLock™ HEP500 solution is to be used first line in all patients who dialyse through central venous dialysis lines unless the patient has a known sensitivity to one or more of the solution's components. TauroLock™ HEP500 line locking solution acts to maintain the patency of haemodialysis catheters between dialysis sessions by both treating and preventing causes of line sepsis and occlusion. Any patient with the central venous line on TauroLock™ HEP500 who fails to maintain a dialysis blood flow of 250mls per minute or above must be reviewed and a mechanical reason ruled out. Any patient who fails to dialyse with flow rates consistently above 250mls per minute on three consecutive haemodialysis sessions should be considered for TauroLock™ U25000 (see algorithm below).
2. TauroLock™ U25000 solution is to be considered for use as a line lock in patients whose dialysis flow rates are consistently no better than 250mls per minute on three consecutive HD sessions and in patients who have no known sensitivity to the solution's components. In addition, a mechanical fault e.g. kinking of the dialysis line must be ruled out prior to moving to Taurolock™ U25000. TauroLock™ U25000 is to be used at the end of haemodialysis for a fixed course of three consecutive sessions. At the end of the treatment course and if flows have improved to greater than 250mls per minute, the patient can return to locking with TauroLock™ HEP500 as per the guidance detailed above. If flow rates remain less than 250mls per minute a consultant or specialist registrar review must be obtained. Appendix 1 below shows when the TauroLock-Urokinase lock should be used.
3. After three consecutive haemodialysis sessions using TauroLock™ U25000, if a patient's line(s) remain unable to achieve consistent flow rates above 250mls per minute then consideration should be given to changing the dialysis line.
4. Any patient who has used the TauroLock™ U25000 treatment plan (described above) on three separate occasions within a three-month time period must be referred (at the time of the third treatment) for consultant or specialist registrar review.
5. Contraindications: TauroLock™ HEP500 and TauroLock™ U25000 line locks are contraindicated in patients with a known allergy to (cyclo)-taurolidine, citrate, unfractionated heparin or urokinase or when a patient is currently taking medication with known adverse interaction with citrate, (cyclo)-taurolidine, unfractionated heparin or urokinase. Any patient who is intolerant of the TauroLock™ HEP500 or TauroLock™ U25000 should have this recorded in the medical notes and an alternative line lock plan should be discussed with the patient's consultant. TauroLock™-HEP500 is also contraindicated for patients with heparin-induced thrombocytopenia or increased bleeding risk.

Aspirating line locking solutions

Before commencing a haemodialysis session, any previously instilled line lock should be aspirated. The total volume of the line locking solution originally instilled must be withdrawn from the line and discarded. Once aspirated, each line should be flushed with 10mls of sodium chloride solution 0.9% immediately prior to the initiation of haemodialysis, unless blood sampling is taking place at which point a further 10mls should be aspirated and discarded and then blood taken. The line can then be flushed as per guideline. This process should still occur even if the line(s) are not used as the access method for haemodialysis, as dilution of the intra-luminal line locking solution can occur over time, reducing its efficacy.

If after trying, you are unable to aspirate a line locking solution (TauroLock™ HEP500 or TauroLock™-U25.000), the contents of the line lumen can be safe to introduce into the systemic circulation (over 10-20 seconds per lumen). The tauridine will be metabolised to tauranimide, taurine, carbon dioxide & water. Heparin (500 units/ml) and citrate 4% are too low to have systemic effect. Luminal urokinase is no longer active after 30 minutes in the catheter.

Procedure for filling the haemodialysis line with TauroLock™ HEP500:

To be read in conjunction with the clinical guidelines for commencing and discontinuing dialysis protocol.

Immediately prior to the next haemodialysis session:

- 1 Aspirate and discard the old-line locking solution. Flush each port of the haemodialysis line with 10 mL of sodium chloride 0.9% solution as described in the aspirating line locking solutions above.

At the conclusion of the haemodialysis session:

- 1 Calculate the line priming volume of TauroLock™ HEP500 for your patient's lines and obtain an ampoule of TauroLock™ HEP500 (1 x 5mL). There is no need to mix or dilute the TauroLock™ HEP500, each ampoule contains pre-mixed solution that is ready to instil.
- 2 Obtain two appropriate sized syringes (usually 5ml) and attach a filter needle to each. Open the ampoule and using the syringes and an aseptic technique withdraw the exact amount of TauroLock™ HEP500 solution required to prime the patient's lines.
- 3 Remove the filter needles and dispose of in a sharps bin. Attach one syringe to each dialysis line. Slowly introduce into each line the priming volume of TauroLock™ HEP500. This process of introducing the TauroLock™ HEP500 is done slowly to prevent excess TauroLock™ HEP500 entering the systemic circulation. Each line should take 5-10 seconds per lumen to fill.
- 4 Close off the line and cap with red bungs and discard the syringes appropriately.

Method of central venous catheter clearance using Alteplase

The reconstituted solution should be instilled into the occluded central venous access device and is for immediate use.

Only 2 mg vials of alteplase are indicated for use in this indication. For instructions on how to reconstitute the product prior to administration, see section 6.6.

1. Reconstitute the content of an injection vial to a final concentration of 1 mg alteplase per ml. For catheters with a lumen volume greater than 2 ml, the reconstituted solution can be further diluted with sterile sodium chloride 9 mg/ml (0.9 %) solution for injection to the desired volume. I.e. for a catheter with internal volume of 2.5 ml the total dose of Actilyse Cathflo would be 2.0 mg in a volume of 2.5 ml.
2. Instil the appropriate dose of Actilyse Cathflo into the occluded central venous access device.
3. After 30 minutes of dwell time, assess catheter functionality by attempting to aspirate blood. If the catheter is functional, go to Step 6. If the catheter is not functional, go to Step 4.
4. After 120 minutes of dwell time, assess catheter functionality by attempting to aspirate blood and catheter contents. If the catheter is functional, go to Step 6. If the catheter is not functional, go to Step 5.
5. If catheter functionality is not restored after the first dose, a second dose of equal amount may be instilled. Repeat the procedure beginning with Step 1. If after a second dose of alteplase the catheter functionality has not been restored, consider catheter replacement.
6. If catheter functionality has been restored, aspirate 4–5 ml of blood in patients weighing 10 kg or more, or 3 ml in patients with a body weight below 10 kg to remove Actilyse Cathflo and residual clot, and gently irrigate the catheter with sterile sodium chloride 9 mg/ml (0.9 %) solution for injection.

Important points to note:

- 1 In patients with dual access, where the line is still in place and the fistula or graft is just starting to be needled, it is important to continue to change the catheter lock on a regular basis, even if the catheter is not being used, as the line lock will be diluted over time and its anti-bacterial and anticoagulant effects will be reduced. The minimum change times are as follows:

Taurolock™ HEP500 - Every 7 days

All other locks - Every HD session
- 2 For patients who dialyse less than 3 times a week the primary line lock should be Taurolock™ HEP500. If this line lock is not appropriate i.e. if patient is intolerant of one or more of the components, then the case should be referred to the patient's clinician for an alternative management plan to be put in place.
- 3 Anticoagulation for the dialysis circuit: unfractionated or low molecular weight heparin will still need to be used over the dialysis period to prevent clots forming in the circuits.

- 4 Line locking solutions are not intended to be used, or licensed, for systemic administration. Under no circumstances should TauroLock™ HEP500 or any of its constituent parts be used systemically for fibrinolysis.
- 5 When TauroLock™ HEP500 is used as a line locking solution; the manufacturer recommends that if blood samples need to be sent for the purposes of anticoagulation testing, the blood samples should be withdrawn from a peripheral vein and not through the dialysis line.

Adverse effects:

There are no known risks associated with concomitant systemic antibiotic therapy or exposure to magnetic fields. For both TauroLock™-HEP500, and TauroLock™-U25.000. The following undesired effects may occur: Anaphylaxis (very rare); Bleeding (very rare); mild hypocalcaemia (common).

TauroLock™ U25000 may cause mild hypocalcaemic symptoms (e. g. metallic taste) caused by the contents of 4% citrate if instillation is not done slowly as directed.

Pregnancy and Breastfeeding

No data are available for pregnant and breastfeeding women. For safety reasons therefore, TauroLock™-Hep500 and TauroLock™ U25000 should not be used during pregnancy and breastfeeding.

Alternative Line Locks (on consultant advice)

If the patient cannot tolerate the first line anti-microbial lock then the second-line anti-microbial lock should be considered. The second-line anti-microbial lock requires mixing immediately prior to administration. In order to simplify the process for making up the anti-microbial line lock solution, the following protocol gives 5 mL of anti-microbial line lock solution which can be used on lines with a total volume up to 5 mL. Lines with volumes above 5 mL should be discussed with the renal pharmacist for advice on the procedure to be used. Excess reagents and anti-microbial line lock solution should be discarded appropriately after use.

This second-line anti-microbial locking solution should be prepared under the instruction of the renal consultant, renal pharmacist and consultant microbiologist.

Audit

Records of the incidence of blocked catheters and catheter related bacteraemia in the patients using line locks will be audited and compared regularly to the historical tri-sodium citrate and heparin data. Reviews will be held in conjunction with the microbiology department, renal dialysis consultants and nurse specialists.

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This guideline has been registered with the Trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt, contact a senior colleague or expert. Caution is advised when using guidelines after the review date.

This guideline is for use in Frimley Health NHS Foundation Trust hospitals only. Any use outside this location will not be supported by the Trust and will be at the risk of the individual using it.

Version History

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