



TauroLock™

CE 0123

ANTIMICROBIAL CATHETER LOCK SYSTEM
TO PROVIDE PATENCY AND INFECTION CONTROL

Prophylaxis against catheter related bloodstream infections:

Central venous catheters (CVC) are used as short or long term vascular access devices in hemodialysis, oncology, ICU and total parenteral nutrition. High risks for CVC malfunction are catheter related infections (CRI). These infections may be triggered by microbial colonisation of the catheter and the microorganisms can spread from here to the bloodstream. CRI may develop septic symptoms which require the immediate removal of the catheter.

TauroLock™ catheter lock solutions **do not contain antibiotics** and were developed for prophylactic use. They reduce catheter related infections significantly (~ 90%).

The combination of citrate (4%) with (cyclo)-tauridine and heparin/urokinase has excellent anticoagulative and anti-microbial properties also against resistant microorganisms like MRSA und VRE.

Therefore TauroLock™ is recommended as an anti-microbial lock solution in different guidelines such as the German Dialysis Standard, the guidelines from the German Society of applied Hygiene in Dialysis and the evidence-based recommendations of the German Society for Paediatric Oncology and Hematology (GPOH).

Prophylaxis against biological occlusion in the catheter:

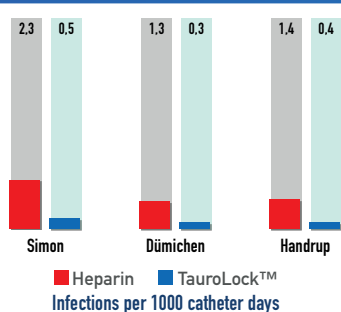
The TauroLock™ Catheter Lock System contains a threefold prophylaxis against occlusion in the catheter: All locking solutions contain 4% citrate as anti-coagulant. This concentration removes calcium safely and effectively from the clotting cascade.

The optional use of low concentrated heparin supports an additional anti-coagulative effect via binding to anti-thrombin. The prophylactic use of TauroLock™-U25.000 (which contains 25.000 IU of urokinase) achieves the best prophylaxis against occlusion by prevention of biological clotting.

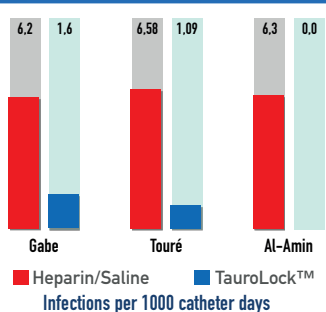
The decision which locking solution is most adequate depends on the individual patient situation. The alternative use of different locking solutions in the same catheter (e.g. TauroLock™-HEP500, TauroLock™-U25.000) is possible.

TauroLock™ prevents catheter infections:

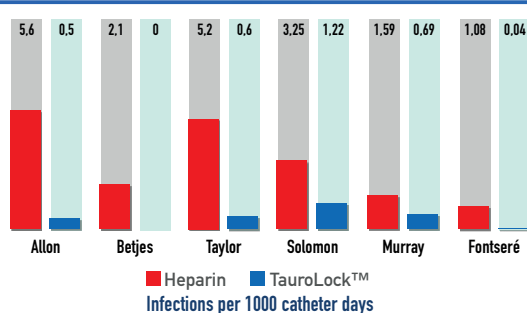
ONCOLOGY



PARENTERAL NUTRITION



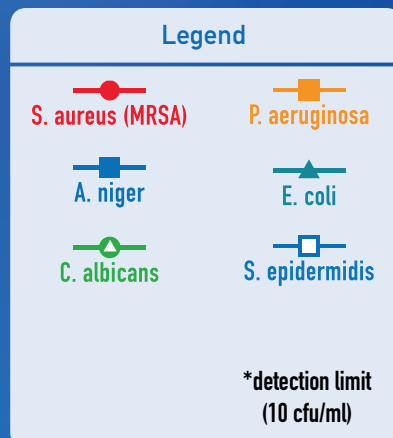
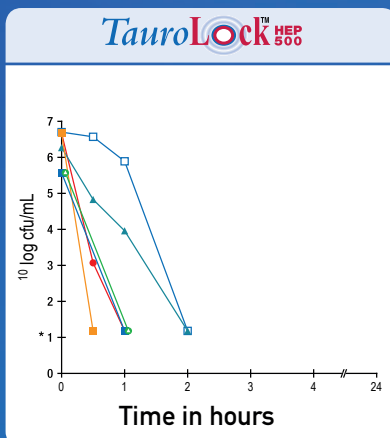
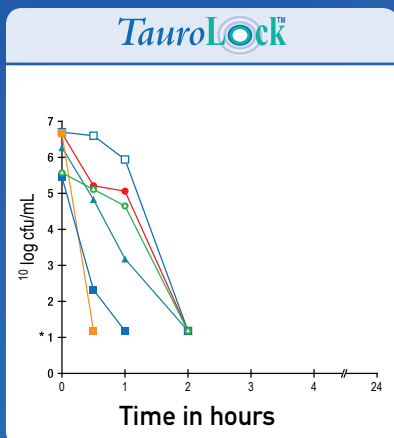
DIALYSIS



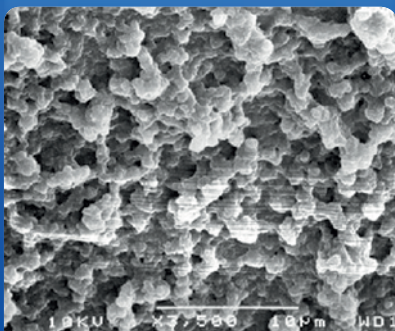
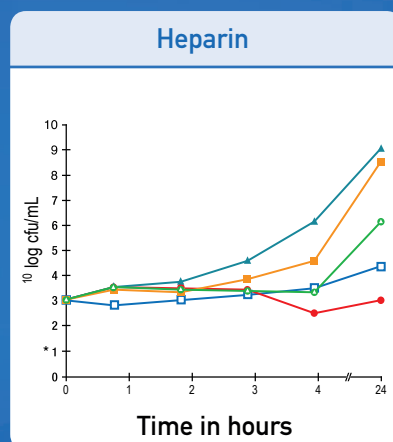
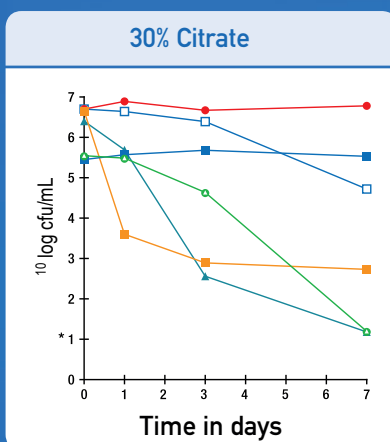
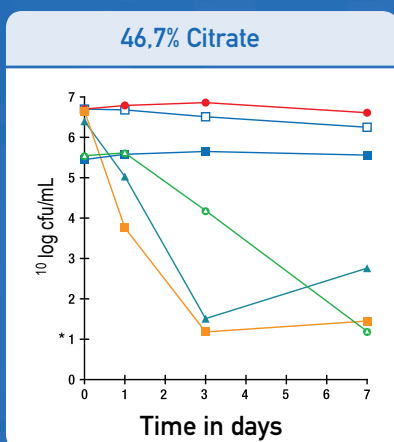
TauroLock™

CE 0123

TauroLock™ is bactericidal and fungicidal within 2 hours:

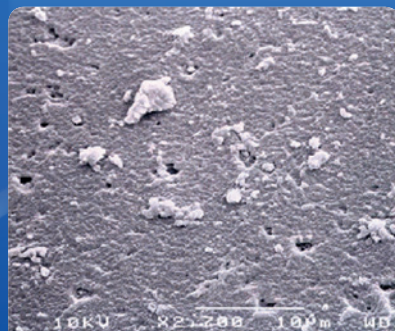


Clearly superior in comparison to the activity of Citrate and Heparin:



Heparin Lock – 7 months implanted – *S. epidermidis* biofilm covers surface completely

If used prophylactically, TauroLock™ prevents the development of a biofilm on the surface of the catheter lumen:



TauroLock™ 5 months implanted – No colonisation

TauroLock™ is safe:

The concentration of 4% citrate in TauroLock™ is safe and efficient - according to the recommendation of the FDA (ref.: FDA Warning Letter, April 2000).

No hypocalcaemic effects are observed in contrast to highly concentrated citrate solutions (30% resp. 46,7%) e.g. arrhythmia, cardiac arrest*, emboli**, tingling fingers and metallic taste***.

TauroLock™ is biocompatible and non toxic.

In contrast to highly concentrated citrate there is no protein precipitation if using TauroLock™ ****.

* Cardiac arrest following injection of concentrated trisodium citrate. Punt CD, Boer WE. Clin Nephrol. 2008 Apr;69(4):317-8

** Embolic complications from central venous hemodialysis catheters used with hypertonic citrate locking solution. Willicombe MK, Vernon K, Davenport A. Am J Kidney Dis. 2010;55(2):348-51

*** Risks related to catheter locking solutions containing concentrated citrate. Hans-Dietrich Polaschegg, Klaus Sodemann. Nephrol.Dial.Transplant. 2003;18(12):2688-90

**** Trisodium citrate induced protein precipitation in haemodialysis catheters might cause pulmonary embolism. Schilcher G, Scharnagl H, Horina JH, Ribitsch W, Rosenkranz AR, Stojakovic T, Polaschegg HD. Nephrol Dial Transplant. 2012;27(7):2953-7

Installation of TauroLock™

Follow the manufacturer's instructions that accompany the particular vascular access product utilised. Specific catheter lock volumes are associated with each device.

1. Flush the device with 10 mL of saline.
2. Withdraw TauroLock™ from the container using an appropriate syringe.
3. Instill TauroLock™ slowly (not more than 1 mL per second, infants and children less than two years of age not more than 1 mL per 5 seconds) into the access device in a quantity sufficient to fill the lumen completely. Consult the manufacturer's instructions for the specific fill volume or specify fill volume during implantation. The volume has to be strictly respected. TauroLock™ will remain inside the access device until the next treatment (up to a maximum of 30 days).
4. Prior to the next treatment, TauroLock™ must be aspirated (if desired and possible) and discarded in accordance with the institution's waste policy.
5. Flush the device with 10 mL of saline.

Product selection for application

Product	TauroLock™	TauroLock™ HEP 450	TauroLock™ HEP 550	TauroLock™ LHM 25000
Dialysis	●		● ● ●	● ●
Oncology	● ● ●	● ● ●		● ●
Parenteral Nutrition	● ● ●	● ● ●		● ●





Frequently Asked Questions

What is TauroLock™?

TauroLock™ is a catheter lock solution for tunnelled and non-tunnelled vascular access and port systems for the prevention of catheter-associated infections and catheter flow problems.

What are the ingredients of TauroLock™?

TauroLock™ contains (cyclo)-taurolidine as an antimicrobial ingredient and 4% citrate for maintaining patency.

Are there different formulations (products) available for patients with recurrent flow problems?

TauroLock™-Hep100 contains additional 100 IU/mL heparin

TauroLock™-Hep500 contains additional 500 IU/mL heparin

The most intense prophylaxis against catheter occlusion is attained through the regular use of TauroLock™-U25.000 (containing 25.000 IU urokinase, 5.000 IU/mL). This reduces flow problems in the catheter substantially; see recommendation on the page “Lock solutions in dialysis” on the website.

The decision as to which catheter lock solution is most advantageous depends on the situation of the individual patient. Alternating use (e.g. TauroLock™- Hep500, TauroLock™- U25.000) is feasible.

Why should I use TauroLock™?

To prevent infections in catheter and port systems. Heparin and 4% citrate only have an anticoagulant effect, but no bactericidal properties. Consequently, contamination of the catheter can lead to bacteraemia. Prophylactic use of TauroLock™ prevents the formation of a biofilm and thus improves the patency of the catheter and/or port.

Is TauroLock™ known to have side effects?

No topical or systemic side effects of the ingredients are known. Due to the citrate content (citrate content: 4%), overly rapid application into the bloodstream can lead to mild hypocalcaemic effects (e.g. metallic taste).

How to use TauroLock™?

1. Rinse the vascular access system with at least 10 mL of physiological saline in compliance with the “Pulsatile Flush Method” (Goossens, 2015). Then use a suitable syringe to remove TauroLock™ from the container.
2. Instill a sufficient amount of TauroLock™ into the vascular access system to fill the hollow space of the catheter. The specific filling volume is stated in the instructions of the manufacturer. TauroLock™ remains inside the access system until the next treatment.
3. TauroLock™ should be aspirated before the start of the next treatment - to the extent this is reasonable and possible.
4. Rinse the vascular access system with 10 mL of physiological saline.

What happens if TauroLock™ enters the body of the patient?

The antimicrobial ingredient of the lock solution is degraded extremely quickly in the body. The degradation produces taurine, an amino acid that is naturally present in the body. Accordingly, no harmful effects are known or expected to result from inadvertent instillation.



Frequently Asked Questions continued...

Is TauroLock™ approved?

TauroLock™ is approved as a medical device with CE registration since 2004. It is also TGA approved in Australia and available in New Zealand too.

Does TauroLock™ affect the catheter?

The effect of TauroLock™ on various catheter materials (polyurethane, silicone) has been investigated. All types of catheters are undamaged, even in long-term tests.

Why is the concentration of citrate only 4%? Would a higher citrate content be better for anticoagulation?

A citrate content of 4% is recommended by the US regulatory authorities and others. In the context of one case of fatality, the FDA issued an advisory not to use a product with a higher citrate content (Tricitrastol, 46.7 %). Lock solutions of this type had to be recalled from the US market. Their use is no longer approved. Likewise, over-instillation of less than 1 mL per lumen of a 30% citrate solution induced transient cardiac arrest in two cases in the Netherlands (Punt CD, Boer WE, Cardiac arrest following injection of concentrated trisodium citrate, Clinical Nephrology 2008, 69 (4), 317-318). A high citrate content (46.7%) can also lead to embolic events which might be triggered by protein precipitation (Davenport A, Willicombe MK, Vernon K, Embolic complications from central venous hemodialysis catheters used with hypertonic citrate solution, American Journal of Kidney Diseases, 2010, 55, 348-351 / Schilcher G, Scharnagl H, Horina JH, Ribitsch W, Rosenkranz AR, Stojakovic T and Polaschegg H-D, Trisodium citrate induced protein precipitation in haemodialysis catheters might cause pulmonary embolism, Nephrol Dial Transplant (2012) 0: 1–5).

Currently I use heparin as a lock solution - Can I change to TauroLock™ without any problems? When do I use TauroLock™-Hep100 and TauroLock™-Hep500?

The experience accumulated thus far with the heparin-containing TauroLock™ products shows that, for example in dialysis, a heparin 5,000 IU/mL solution can be replaced by a TauroLock™-Hep500 solution without any problems, i.e. the use of heparin can be reduced drastically. Accordingly, TauroLock™-Hep500 is the product of first choice in dialysis, whereas TauroLock™-Hep100 is used primarily in vascular access in haematology/oncology or in paediatric patients. TauroLock™-Hep100 or Hep500 needs to be aspirated prior to the next treatment.

Can I take coagulation test samples from a TauroLock™ locked catheter without falsifying the results?

Yes! After aspiration and disposal of the TauroLock™ (without heparin), rinse the catheter with saline. Then you can take the coagulation test sample. Even if minor traces of citrate remain in the catheter, this would not have an effect on the result of the analysis since the sampling tube is filled with a 3.13% citrate solution. In contrast, despite intensive rinsing, locking with heparin leads to relevant contamination of the blood sample that must be seen as an extreme problem especially with regard to the testing of the INR as part of the monitoring of patients receiving Marcumar™ therapy (possible under-dosing by false prolongation of the INR). Therefore, peripheral blood needs to be obtained in the presence of a heparin lock.

What should I do if TauroLock™ cannot be aspirated before the next treatment?

TauroLock™ can be injected slowly into the bloodstream without any risk (i.e. 1 mL per sec. in adults and 1 mL per 5 sec. in paediatric patients). If TauroLock™ supplemented with heparin is used; it is the responsibility of the user to assess the risk of the systemic administration of heparin.



TauroLock™ catheter lock solutions are available in different containers:

Product	TauroLock™	TauroLock™ HEP 100	TauroLock™ HEP 500	TauroLock™ UNIM 25000
Ampoule (10 x 3 mL)	●	●		
Ampoule (10 x 5 mL)	●		●	
Vial (100 x 10 mL)	●		●	
Vial (5 x 5 mL)				●

Manufacturer:



TauroPharm GmbH
Jägerstraße 5a
D-97297 Waldbüttelbrunn
Tel.: +49 931 304299-0
Fax: +49 931 304299-29

ISO13485

Distributor:



Rollex Medical
11 Vangeli Street, Arndell Park, NSW 2148
3/16 Curie Court, Seaford, VIC 3198
www.rollexmedical.com.au

44c Crooks Rd, East Tamaki, Auckland 2013
www.rollexmedical.co.nz

Email: sales@rollexmedical.com
dpashuwala@rollexmedical.com

1. GUIDELINES AND RECOMMENDATIONS

- 1.1. Deutscher Dialysestandard 2014 Deutsche Gesellschaft für Nephrologie in Zusammenarbeit mit dem Verband Deutsche Nierenzentren e.V. und mit der Gesellschaft für Pädiatrische Nephrologie (GPN), Kapitel B14.2 Infektionsprävention bei zentralvenösen Kathetern
- 1.2. Diagnosis, prevention and treatment of haemodialysis catheter-related bloodstream infections (CRBSI): a position statement of European Renal Best Practice (ERBP) R. Vanholder, B. Canaud, R. Fluck, M. Jadoul, L. Labriola, A. Marti-Monros, J. Tordoir, W. Van Biesen, NDT Plus (2010) 3: 234-246
- 1.3. Vascular Access for Haemodialysis Renal Association (United Kingdom), R. Fluck, M. Kummwenda (2011)
- 1.4. Leitlinien für angewandte Hygiene in der Dialyse Deutsche Gesellschaft für angewandte Hygiene in der Dialyse e.V., DGaHD 2013; Kapitel 9.5.8, Blocklösungen für ZVK und Port-Systeme, 3. Auflage
- 1.5. National Kidney Foundation (NKF): KDOQI Guidelines KDOQI Guideline, Guideline 7, update 2006.
- 1.6. Evidenz-basierte Empfehlungen zur Anwendung dauerhaft implantierter, zentralvenöser Zugänge in der pädiatrischen Onkologie A. Simon, Karin Beutel, Hans Jürgen Laws, Matthias Trautmann, Jeanette Greiner, Norbert Graf, Gesellschaft für Pädiatrische Hämatologie und Onkologie, GPOH 2013, 4. Auflage
- 1.7. S3-Leitlinie der Deutschen Gesellschaft für Ernährungsmedizin e.V. in Zusammenarbeit mit der AKE, der GESKES und der DGVS G. Lamprecht, U.-F. Pape, M. Witte, A. Pascher, und das DGEM Steering Committee, Aktual Ernährungsmed 2014;39:99-109
- 1.8. Guidelines for the Prevention of Intravascular Catheter-related Infections, 2011 CDC, Center of Disease Control, USA, 2011

2. PUBLICATIONS: PROPHYLAXIS OF INFECTION IN DIALYSIS

- 2.1. A Meta-analysis of Hemodialysis Catheter Locking Solutions in the Prevention of Catheter-Related Infection Y. Jaffer, N. M. Selby, M. W. Taal, R. J. Fluck, C. W. McIntyre, Am J Kidney Dis 2008; 51:233-241
- 2.2. Prevention of dialysis catheter-related sepsis with a citrate-taurolidine-containing lock solution M. G. H. Betjes, M. van Agteren, Nephrol Dial Transplant, 2004, 19:1546-1551.
- 2.3. Observational Study of Need for Thrombolytic Therapy and Incidence of Bacteremia using Taurolidine-Citrate-Heparin (TCH), Taurolidine-Citrate (TC) and Heparin Catheter Locks in Patients Treated with Hemodialysis L. R. Solomon, J. S. Cheesbrough, R. Bhargava, N. Mitsides, M. Heap, G. Green, P. Diggle, Sem Dial 2012;25(2):233-8
- 2.4. A Randomized Double-Blind Controlled Trial of Taurolidine-Citrate Catheter Locks (vs. Heparin (5000 IU/mL) for the Prevention of Bacteremia in Patients Treated With Hemodialysis L. R. Solomon, J. S. Cheesbrough, L. Ebah, T. Al-Sayed, M. Heap, N. Millband, D. Waterhouse, S. Mitra, A. Curry, R. Saxena, R. Bhat, M. Schulz, P. Diggle, American Journal of Kidney Disease, 2010; Vol 55, No 6, 1060 - 1068
- 2.5. Prophylaxis against Dialysis Catheter-Related Bacteraemia with a Novel Antimicrobial Lock Solution M. Allon, Clin. Infect Dis 2003, 36:1539-1544.
- 2.6. Two Years' Experience with Dialock and CLS™ (A New Antimicrobial Taurolidine-Citrate Lock Solution) K. Sodemann, H.-D. Polaschegg, B. Feldmer Blood Purif 2001;19:251-254.
- 2.7. A New Haemodialysis Catheter Locking Agent reduces infections in Haemodialysis Patients C. Taylor, J. Cahill, M. Gerrish, J. Little, J Ren Care 2008; 34 (3), 116-120.
- 2.8. Approaches to Prolong the Use of Uncuffed Hemodialysis Catheters: Results of a Randomized Trial V. Filiopoulos, D. Hadjiyannakos, I. Koutis, S. Trompouki, T. Micha, D. Lazarou, D. Vassopoulos; Department of Nephrology, Am J Nephrol 2011; 33:260-268.
- 2.9. Tunneled catheters with taurolidine-citrate-heparin lock solution significantly improve the inflammatory profile of hemodialysis patients. N. Fontseré, C. Cardozo, J. Donate, A. Soriano, M. Muros, M. Pons, J. Mensa, J.M. Campistol, J.F. Navarro-González, F. Maduell, Antimicrob Agents Chemother. 2014;58(7):4180-4; 2.10. Taurolidine-citrate-heparin catheter lock solution reduces staphylococcal bacteraemia rates in haemodialysis patients. E.C. Murray, C. Deighan, C. Geddes, P.C. Thomson, QJM.2014;107(12):995-1000

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- 3.2. Randomized controlled trial of taurolidine citrate versus heparin as catheter lock solution in paediatric patients with haematological malignancies M. J. Dümichen, K. Seeger, H. N. Lode, J. S. Kühl, W. Ebelt, P. Degenhardt, M. Singer, C. Geffers, U. Querfeld, J. Hospital Inf. 2012; 80: 304-309
- 3.3. Taurolidine-citrate lock solution (TauroLock) significantly reduces CVAD-associated gram-positive infections in paediatric cancer patients A. Simon, R. A. Ammann, G. Wiszniewsky, U. Bode, G. Fleischhack, M. M. Besuden, BMC Infectious Diseases 2008, 8:102.
- 3.4. Treatment of long-term catheter-related bloodstream infections with a taurolidine block: a single cancer center experience G.-M. Haag, A.-K. Berger, D. Jäger, J. Vasc. Access 2011;12(3):244-7
- 3.5. Taurolidine is effective in the treatment of central venous catheter-related bloodstream infections in cancer patients M. Koldehoff, J. L. Zakrzewski, Int. J. Antimicrobial Agents 2004; 24: 491-495.
- 3.6. First Report World-Wide of Clinical Use of Taurolidine — 4% Citrate Catheter Lock Solution To Treat an Intravascular Catheter Colonised With a Mycobacteria; With a Highly Successful Outcome T. A. Collyns, et al, Leeds Teaching Hospitals NHS Trust, Leeds, United Kingdom, Posterpresentation 47th ICAAC, Chicago.
- 3.7. Complications of total implantable access ports and efficacy of Taurolidine-citrate lock solution against catheter-related infections. E. Ince, P. Oguzkurt, A. Temiz, S.S. Ezer, H.Ö. Gezer, N. Yazici, A. Hiçsönmez, Afr J Paed Surg 2014;11(2):138-42

4. PUBLICATIONS: PROPHYLAXIS OF INFECTION IN PARENTERAL NUTRITION

- 4.1. Significant Reduction in Central Venous Catheter-related Bloodstream Infections in Children on HPN After Starting Treatment With Taurolidine Line Lock H.-P. Chu, J. Brind, R. Tomar, S. Hill, JPGN 2012; 55: 403-407.
- 4.2. Taurolidine Lock is highly effective in preventing catheter-related bloodstream infections in patients on home parenteral nutrition: A heparin-controlled prospective trial T. M. Bisseling, M. C. Willems, M. W. Versleijen, J. C. Hendriks, R. K. Vissers, G. J. Wanten, Clinical Nutrition 2010; 29: 464-468.
- 4.3. Taurolidine lock solution in the secondary prevention of central venous catheter-associated bloodstream infection in home parenteral nutrition patients A. Touré, M. Lauverjat, C. Peraldi, M. Boncompain-Gérard, P. Gelas, D. Barnoud, C. Chambrier, Clin Nutr, 2012 Aug;31(4):567-70
- 4.5. Efficacy of Taurolidine in prevention of catheter related bloodstream infections in patients on Home Parenteral Nutrition A. Al-Amin, J. Sarveswaran, J. Wood, C. Donnellan, D. Burke. Br. J. Surgery 2012;99: 83-222.
- 4.6. Taurolidine Lock — Experience from the West of Scotland P. S. Cullis, R. F. McKee, Clinical Nutrition 2011 Jun;30(3):399-400
- 4.7. Effectiveness of TauroLock™ in preventing recurrent catheter-related bloodstream infections in patients on home parenteral nutrition A. Taniguchi, J. Eastwood, A. Davidson, J. Nightingale, S.M. Gabe, Proceedings of the Nutrition Society (2009), 68 (OCE1), E58
- 4.8. Taurolidine Lock: The key to prevention of recurrent catheter-related bloodstream infections B. Jurewitsch, K. N. Jeebhoy, Clin. Nutrition (2005) 24, 462-465
- 4.9. Taurolidine locks significantly reduce the incidence of catheter-related blood stream infections in high-risk patients on home parenteral nutrition. J. Saunders, M. Naghibi, Z. Leach, C. Parsons, A. King, T. Smith, M. Stroud, Eur J Clin Nutr. 2015;69(2):282-4

5. PROVIDE PATENCY TO ACCESS DEVICES BY USING UROKINASE

- 5.1. Gefäßzugang zur Hämodialyse — Interdisziplinäre Empfehlungen deutscher Fachgesellschaften M. Hollenbeck, V. Mickley, J. Brunkwall, H. Daum, P. Haage, J. Ranft, R. Schindler, P. Thon, D. Vorwerk, Nephrologie 2009, 4: 158-176.
- 5.2. National Kidney Foundation, KDOQI Guidelines 2000, Guidelines for Vascular Access, guideline 6, Table III-2. Protocols for Urokinase Administration
- 5.3. Prophylactic Urokinase in the Management of Long-Term Venous Access Devices in Children: A Children's Oncology Group Study P. W. Dillon, G. R. Jones, H. A. Bagnall-Reeb, J. D. Buckley, E. S. Wiener, G. M. Haase, J Clin Oncology, 2004 (22): 2718-2723.
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6. PUBLICATIONS ON ANTIBACTERIAL ACTIVITY OF TAUROLOCK - PREVENTION OF BIOFILM

- 6.1. Antimicrobial Activity of a Novel Catheter Lock Solution C. B. Shah, M. W. Mittelman, J. W. Costerton, S. Parenteau, M. Pelak, R. Arseneault, L. A. Mermel, Antimicrob. Agents Chemother. 2002, 46; 1674-1679
- 6.2. Activities of Taurolidine In Vitro and in Experimental Enterococcal Endocarditis C. Torres-Viera, C. Thauvin-Eliopoulos, M. Souli, P. DeGirolami, M. G. Farris, C. B. Wennersten, R. D. Sofia, G. M. Eliopoulos, Antimicrobial Agents and Chemotherapy 2000, 44; 1720-1724.