

TauroLock™

TRIPLE EFFICACY

Anti-Infection

Anti-Occlusion

**TauroLock™
lock solutions**

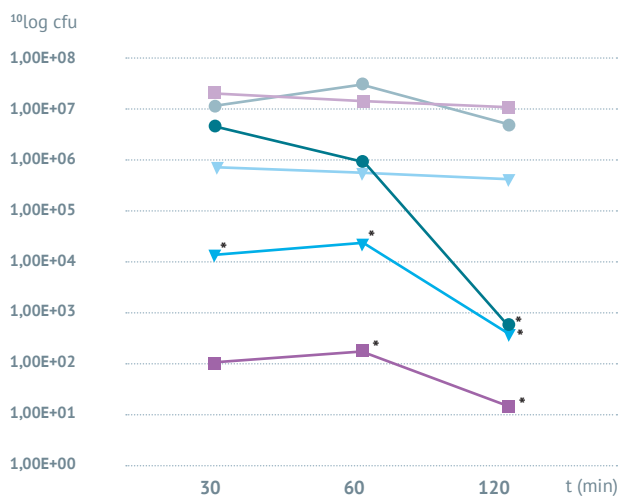
Anti-Biofilm

**TAUROLOCKED
LINES SAVE
LIVES**

20 YEARS

Antimicrobial catheter lock solutions with **triple efficacy** against the threat of biofilm, infection and malfunction.

1 Prevention and eradication of biofilm – in vitro and in patients



Eradication of biofilm (see lit. 7.6)

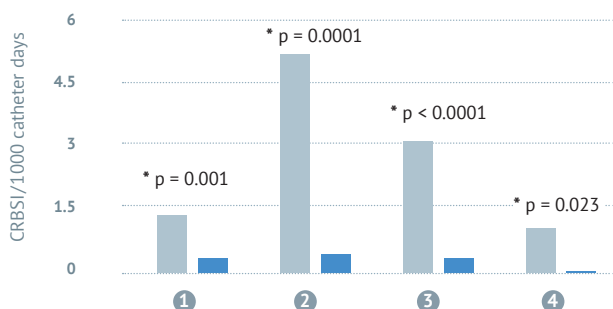
All of our products contain taurolidine, an antimicrobial agent which has been investigated for decades in numerous studies. Taurolidine has proven cidal against more than 500 germs: gram-positive and gram-negative bacteria, including antibiotic resistant strains, and also fungi (see lit. 7.1, access via QR code). It was found to eradicate biofilm of various germs (see lit. 7.2; 7.5 and 7.6). In another study, **TauroLock™** inactivated various strains of *S. aureus* (including MRSA) even in aged biofilm (see lit. 7.4). This **antibiofilm effect** was not only detected in in vitro-trials, but also in patients: Taurolidine was found **“completely safe and effective”** in the removal of bacteria and fungi such as Staphylococci, *E. coli*, Enterobacter, *Pseudomonas aeruginosa*, *Clostridium perfringens* (see lit. 4.3 and 5.2).

* p ≤ 0.05

S. aureus	P. aeruginosa	C. albicans
● control	■ control	▼ control
● TauroLock™	■ TauroLock™	▼ TauroLock™

2 Prevention of infections

Numerous clinical trials document the protection of CVCs against infections with taurolidine-based lock solutions.

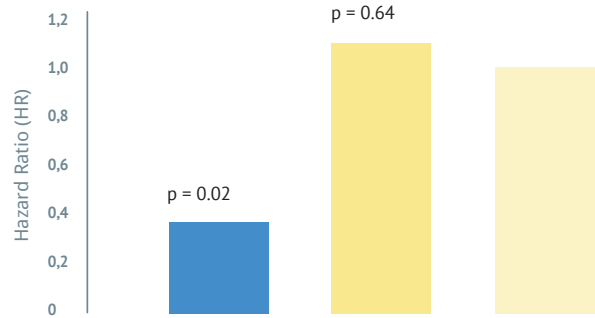
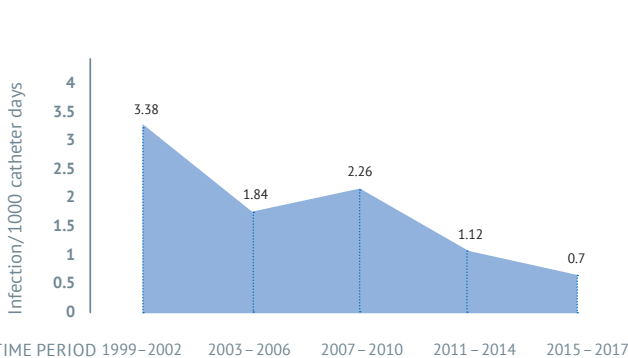


Prevention of CRBSI with **TauroLock™** products in oncology (1, 2), parenteral nutrition (3), dialysis (4)



■ Comparator ■ TauroLock™ product

- 1 TauroLock™-HEP100 (see lit. 4.1)
- 2 TauroLock™ (see lit. 4.2)
- 3 TauroLock™-HEP500 (see lit. 6.4)
- 4 TauroLock™-HEP500 (see lit. 3.6)



CVC exchange due to infection

Observational multi-centre HD trial (see lit. 3.3)

- TauroLock™-HEP500
- Highly concentrated citrate (46.7% citrate)
- Low concentrated citrate (4% and 30% citrate), set as reference

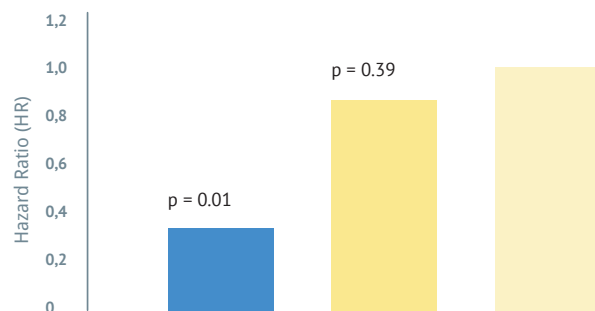
19 years survey: The incidence of infection fell from 2.36 per 1000 catheter days to 0.3 per 1000 catheter days (rate ratio 7.87, $p < 0.001$). Use of **TauroLock™-HEP** starting in 2002 in pat. with > 3 Inf./year is associated with reduction of catheter-related bloodstream infections (see lit. 6.2).

3 Prevention of thrombosis and occlusion

All **TauroLock™** products contain the anticoagulant citrate (4 %), which is recommended by FDA, ERBP and others as safe in the prevention of blood clotting. In haemodialysis, many patients require a stronger anticoagulant effect. This is why **TauroLock™-HEP500** was developed: It maintains patency even better (see lit. 3.3; 3.4 and 3.7).

The combination of an antimicrobial agent with an anticoagulant was found to be most effective (see lit. 2.4). Experts are asking for a combination product: "...the most promising results are obtained when antibacterial compounds are added to a citrate or heparin lock" (see lit. 2.3).

Strongest efficacy is achieved with **added thrombolytic urokinase**, as in **TauroLock™-U25.000**, a modern and **unique approach** (see lit. 3.1 and 3.2).



CVC exchange due to malfunction

Observational multi-centre HD trial (see lit. 3.3)

- TauroLock™-HEP500
- Highly concentrated citrate (46.7% citrate)
- Low concentrated citrate (4% and 30% citrate), set as reference

Biofilm formation and blood clotting should be prevented from the start due to the risk of: silent inflammation, thrombosis, bloodstream infection, insufficient success of antibiotic treatment or even resistance to antibiotics, and catheter exchanges because of infection or malfunction.

Prevention is better than cure!

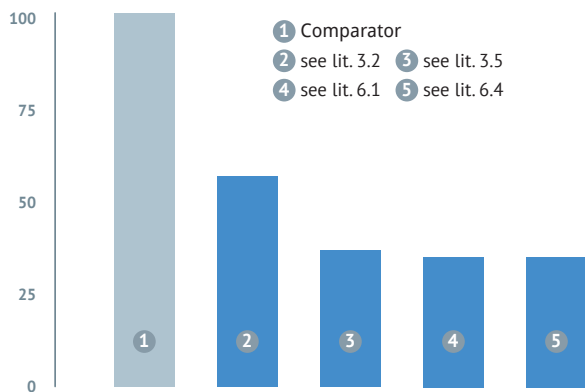
4. Safety

TauroLock™, TauroLock™-HEP100, TauroLock™-HEP500, and NutriLock™ are approved for use from birth onwards, including neonatal children (for clinical data see lit. 4.1; 5.1; 5.2 and 6.3). For more details see IFU.

TauroLock™ products have also shown to improve the inflammatory profile of patients (see lit. 3.6; 3.7 and 3.8).

5. Cost savings

TauroLock™ products not only protect patients from complications. They also reduce catheter-associated expenses compared to other lock solutions.



Catheter-associated costs incl. lock solution
Comparator lock set as 100 %



GUIDELINES



Position statement of European Renal Best Practice (ERBP) 2010

“B.3.1 The preventive use of antimicrobial locks is advocated to reduce the rate of CRBSI... The 46.7 and 30% [citrate] concentration ranges have been considered unsafe. For that reason, the low 4% concentration might be preferred, as also proposed by the American Society of Diagnostic and Interventional Nephrology (ASDIN).”



Guideline of the German Society of Nephrology 2019

“...Blocking with antibacterial lock solutions may be part of measures against overly high bloodstream infections in catheter patients (Cat. IB)...taurolidine and gentamicin exert only antimicrobial effectiveness...
...An additional option is the intermittent (once weekly) use of urokinase in the lock solution (Cat IB)...”



Australian guidelines for haemodialysis catheters

National Health and Medical Research Council (NHMRC) 2015. Print.

Taurolidine has been found to:

- have a very broad-spectrum antimicrobial activity.
- decrease development of biofilms
- be associated with a reduced CRBSI rate compared to heparin



GAVeCeLT consensus 2016

“...the drugs most likely to be used as antibacterial lock are taurolidine and citrate, which have optimal characteristics in terms of safety, efficacy and cost effectiveness.”



INS 2024

61.B.8.d.i. Taurolidine was effective in prevention of catheter-related bloodstream infections (CR-BSIs) for patients on HPN... (I)



ESPEN guideline on home parenteral nutrition 2020

Recommendation 34: As an additional strategy to prevent CRBSIs, taurolidine locking should be used because of its favorable safety and cost profile. Grade of Recommendation B - Strong consensus (100% agreement)

Manufacturer:



TauroPharm GmbH

August-Bebel-Straße 51
D-97297 Waldbüttelbrunn

Tel. +49 931 30 42 99 0
Fax +49 931 30 42 99 29

Distribution:

Publications on safety and efficacy

1. GUIDELINES AND RECOMMENDATIONS

- 1.1.** Infusion Therapy Standards of Practice 2024
Nickel et al. *J Infus Nurs* 2024. DOI: 10.1097/NAN.0000000000000532
- 1.2.** Diagnosis, prevention and treatment of haemodialysis catheter-related bloodstream infections (CRBSI): a position statement of European Renal Best Practice (ERBP)
Vanholder et al. *NDT Plus* 2010. DOI: 10.1093/ndtplus/sfq041
- 1.3.** Guideline for infection prevention and hygiene 2019 in addition to the German dialysis standard
German Society of Nephrology (Deutsche Gesellschaft für Nephrologie, DGfN) 2019. Print.
- 1.4.** Australian guidelines for haemodialysis catheters
National Health and Medical Research Council (NHMRC) 2015. Print.
- 1.5.** FDA issues warning on tricitrasol dialysis catheter anticoagulant
Food and Drug Administration, U.S. Department of Health and Human Services. 2000. Print.
- 1.6.** Evidence-based criteria for the choice and the clinical use of the most appropriate lock solutions for central venous catheters (excluding dialysis catheters): a GAVeCeLT consensus
Pittiruti et al. *J Vasc Access* 2016. DOI: 10.5301/jva.5000576
- 1.7.** ESPEN guideline on home parenteral nutrition
Pironi et al. *Clin Nutr* 2020. DOI: 10.1016/j.clnu.2020.03.005
- 1.8.** ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Venous access
Kolaček et al. / ESPGHAN/ESPEN/ESPR/CSPEN working group on pediatric parenteral nutrition. *Clin Nutr* 2018. DOI: 10.1016/j.clnu.2018.06.952
- 1.9.** Prevention of infections related to central-venous catheters – for patients, adults and children, receiving short- or long-term parenteral nutrition (SFNCM)
Schneider et al. *French Society for Clinical Nutrition and Metabolism (SFNCM)* 2019. Print.

2. META-ANALYSES, REVIEW, SURVEY

- 2.1.** Meta-analysis of the efficacy of taurolidine in reducing catheter-related bloodstream infections for patients receiving parenteral nutrition
Vernon-Roberts et al. *J Parenter Enteral Nutr* 2022. DOI: 10.1002/jpen.2363
- 2.2.** A multi-national survey of experience and attitudes towards managing catheter related blood stream infections for home parenteral nutrition
Joly et al. *Clin Nutr ESPEN* 2023 doi: 10.1016/j.clnesp.2023.06.032.

2.3. Any use for alternative lock solutions in the prevention of catheter-related blood stream infections?
Labriola et al. *J Vasc Access* 2017 Mar 6;18(Suppl. 1):34-38. DOI: 10.5301/jva.5000681.

2.4. Citrate versus heparin lock for hemodialysis catheters: a systematic review and meta-analysis of randomized controlled trials
Zhao et al. *Am J Kidney Dis* 2014. DOI: 10.1053/j.ajkd.2013.08.016

3. CLINICAL STUDIES: DIALYSIS

- 3.1.** Safety and efficacy of taurolidine/urokinase versus taurolidine/heparin as a tunneled catheter lock solution in hemodialysis patients: a prospective, randomized, controlled study
Al Ali et al. *Nephrol Dial Transplant* 2018. DOI: 10.1093/ndt/gfx187
- 3.2.** Taurolidine-based catheter lock regimen significantly reduces overall costs, infection, and dysfunction rates of tunneled hemodialysis catheters
Winnicki et al. *Kidney Int* 2018. DOI: 10.1016/j.kint.2017.06.026
- 3.3.** The best solution down the line: an observational study on taurolidine- versus citrate-based lock solutions for central venous catheters in hemodialysis patients
Van Roeden et al. *BMC Nephrology* 2021. DOI: 10.1186/s12882-021-02519-3
- 3.4.** Observational study of need for thrombolytic therapy and incidence of bacteremia using taurolidine-citrate-heparin, taurolidine-citrate and heparin catheter locks in patients treated with hemodialysis
Solomon et al. *Semin Dial* 2012. DOI: 10.1111/j.1525-139X.2011.00951.x
- 3.5.** A new haemodialysis catheter-locking agent reduces infections in haemodialysis patients
Taylor et al. *J Ren Care* 2008. DOI: 10.1111/j.1755-6686.2008.00027.x
- 3.6.** Tunneled catheters with taurolidine-citrate-heparin lock solution significantly improve the inflammatory profile of hemodialysis patients
Fontseré et al. *Antimicrob Agents Chemother* 2014. DOI: 10.1128/AAC.02421-14
- 3.7.** Effect of taurolidine citrate and unfractionated heparin on inflammatory state and dialysis adequacy in hemodialysis patients
Ezzat et al. *J Vasc Access* 2023. DOI: 10.1177/11297298211023295
- 3.8.** Patients on HD with central catheters locked with taurolidine have a similar inflammatory profile to subjects with native arterio-venous fistula
Navarro-González et al. *Nephrol Dial Transplant* 2023. DOI:10.1093/ndt/gfad063b_3195

4. CLINICAL STUDIES: ONCOLOGY/HAEMATOLOGY

4.1. Central venous catheters and catheter locks in children with cancer: a prospective randomized trial of taurolidine versus heparin
Handrup et al. *Pediatr Blood Cancer* 2013. DOI: [10.1002/pbc.24482](https://doi.org/10.1002/pbc.24482)

4.2. Taurolidine-Citrate Line Locks Prevent Recurrent Central Line-Associated Bloodstream Infection in Pediatric Patients
Clark et al. *Pediatr Infect Dis J* 2019. DOI: [10.1097/INF.0000000000002191](https://doi.org/10.1097/INF.0000000000002191)

4.3. Taurolidine lock in the treatment of colonization and infection of totally implanted venous access devices in cancer patients
Brescia et al. *J Vasc Access* 2023. DOI: [10.1177/112972982111026453](https://doi.org/10.1177/112972982111026453)

5. CLINICAL STUDIES: INTENSIVE CARE

5.1. Effects of prophylactic use of taurolidine-citrate lock on the number of catheter-related infections in children under 2 years of age undergoing surgery
Łyszkowska et al. *J Hosp Infect* 2019. DOI: [10.1016/j.jhin.2019.04.022](https://doi.org/10.1016/j.jhin.2019.04.022)

5.2. Use of 2% taurolidine lock solution for treatment and prevention of catheter-related bloodstream infections in neonates: a feasibility study
Savarese et al. *J Hops Infect* 2024. DOI: [10.1016/j.jhin.2023.11.003](https://doi.org/10.1016/j.jhin.2023.11.003)

6. CLINICAL STUDIES: PARENTERAL NUTRITION

6.1. Taurolidine-citrate-heparin lock reduces catheter-related bloodstream infections in intestinal failure patients dependent on home parenteral support: a randomized, placebo-controlled trial
Tribler et al. *Am J Clin Nutr* 2017. DOI: [10.3945/ajcn.117.158964](https://doi.org/10.3945/ajcn.117.158964)

6.2. The incidence and management of complications of venous access in home parenteral nutrition (HPN): A 19 year longitudinal cohort series
Leiberman et al. *Clin Nutr ESPEN* 2020. DOI: [10.1016/j.clnesp.2020.03.025](https://doi.org/10.1016/j.clnesp.2020.03.025)

6.3. Strategies to Reduce Catheter-Related Bloodstream Infections in Pediatric Patients Receiving Home Parenteral Nutrition: The Efficacy of Taurolidine-Citrate Prophylactic-Locking
Lambe et al. *Parenter Enteral Nutr* 2018. DOI: [10.1002/jpen.1043](https://doi.org/10.1002/jpen.1043).

6.4. Cost-effectiveness of taurolidine locks to prevent recurrent catheter-related blood stream infections in adult patients receiving home parenteral nutrition: a 2-year mirror-image study
Lannoy et al. *Clin Nutr* 2021. DOI: [10.1016/j.clnu.2021.01.017](https://doi.org/10.1016/j.clnu.2021.01.017)

7. STUDIES: IN VITRO AND BIOFILM

7.1. Activities of taurolidine in vitro and in experimental enterococcal endocarditis
Torres-Viera et al. *Antimicrob Agents Chemother* 2000. DOI: [10.1128/AAC.44.6.1720-1724.2000](https://doi.org/10.1128/AAC.44.6.1720-1724.2000)

7.2. Antimicrobial activity of a novel catheter lock solution
Shah et al. *Antimicrob Agents Chemother* 2002. DOI: [10.1128/AAC.46.6.1674-1679.2002](https://doi.org/10.1128/AAC.46.6.1674-1679.2002)

7.3. Microbiocidal effects of various taurolidine containing catheter lock solutions
Olthof et al. *Clin Nutr*. 2015. DOI: [10.1016/j.clnu.2014.04.023](https://doi.org/10.1016/j.clnu.2014.04.023)

7.4. In Vitro Approach for Identification of the Most Effective Agents for Antimicrobial Lock Therapy in the Treatment of Intravascular Catheter-Related Infections Caused by *Staphylococcus aureus*
Hogan et al. *Antimicrob Agents Chemother* 2016. DOI: [10.1128/AAC.02885-15](https://doi.org/10.1128/AAC.02885-15)

7.5. Antimicrobial activity of hemodialysis catheter lock solutions in relation to other compounds with antiseptic properties
Pjatkowska et al. *PLoS ONE* 2021. DOI: [10.1371/journal.pone.0258148](https://doi.org/10.1371/journal.pone.0258148)

7.6. In vitro comparison of the effectiveness of various antimicrobial locks with taurolidine in the treatment and prevention of catheter-related bloodstream infections in patients receiving parenteral nutrition
Višek et al. *Nutrition* 2023. DOI: [10.1016/j.nut.2023.112115](https://doi.org/10.1016/j.nut.2023.112115)