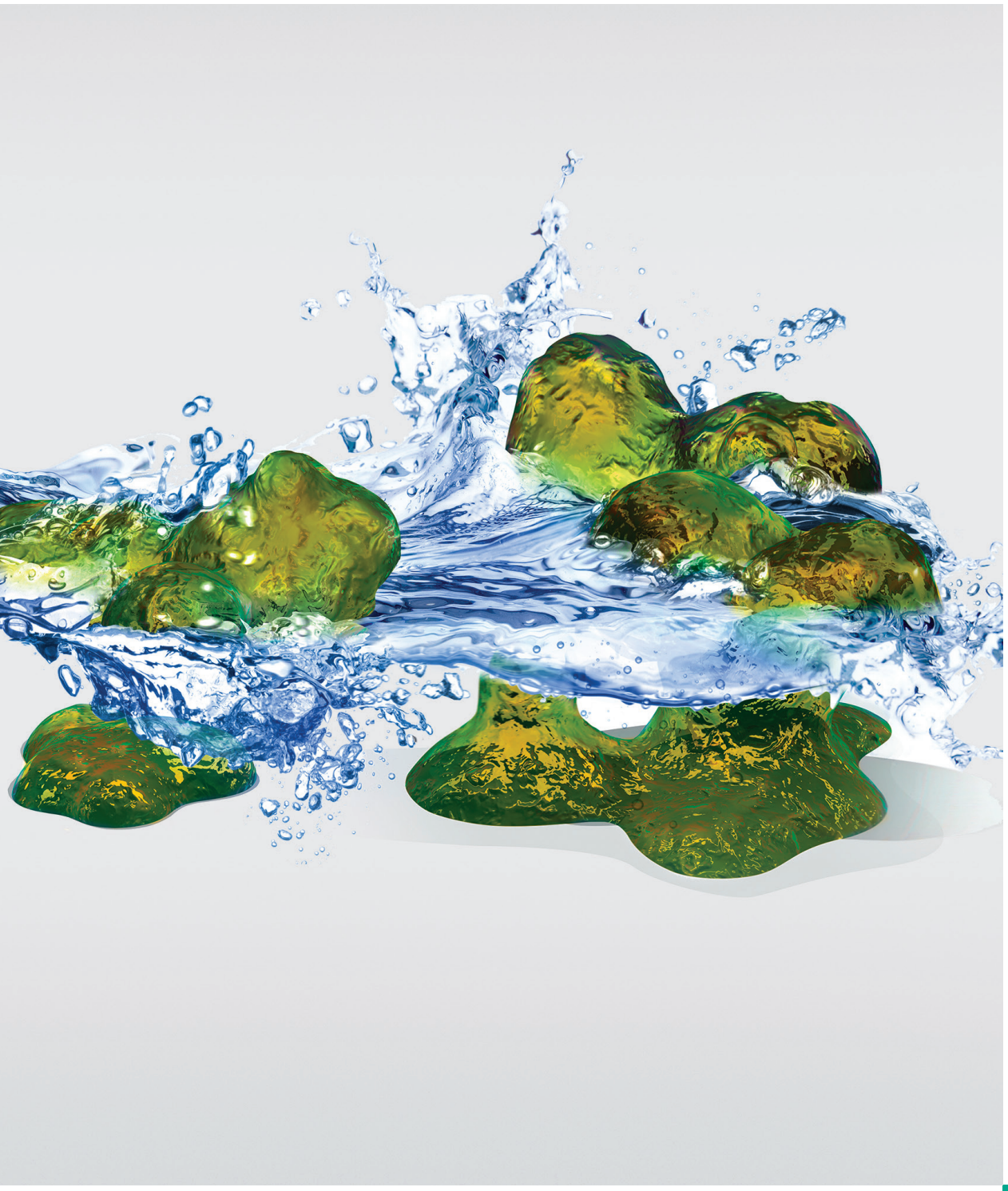
B BRAUN
SHARING EXPERTISE



IMPROVING PATIENT
QUALITY OF LIFE

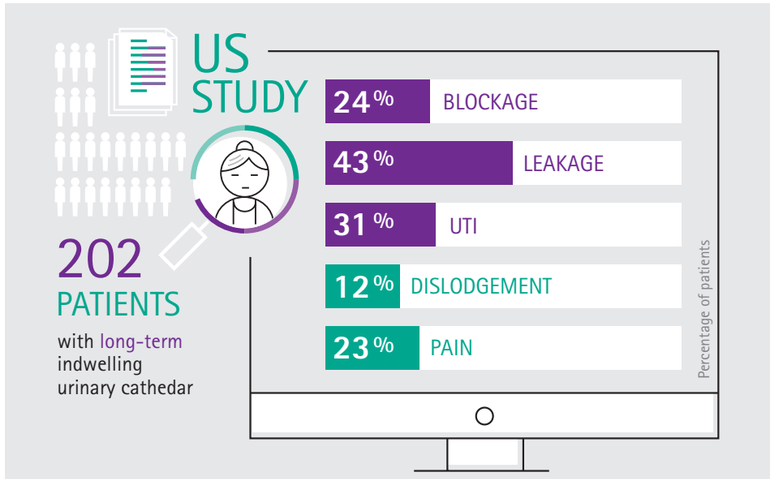
CATHETER MAINTENANCE

WITH Uro-Tainer® Polihexanide

The Rationale for Catheter Maintenance

Complications

Long-term catheterisation can lead to significant morbidity and mortality caused by associated complications.[1] The most common complications that occur are urinary tract infection (UTI) and catheter blockage, which can affect up to 70 % of catheterised patients.[2,3] Blockage, in turn can lead to leakage, or bypassing of urine and discomfort and embarrassment for the patient.[2] At least 50 % of catheterised patients suffer with encrustation which is one of the main causes of blockage (Figure 1).[4,5]



Adapted from: Wilde MH et al.[8] UTI=urinary tract infection

Figure 1: Catheter-Associated Complications in a Community-Based Population

You can find further information in the video Uro-Tainer® Polihexanide

Management options

Catheter removal may be the only management option for catheter blockage and recurrent infection.[6] However, frequently changing an indwelling catheter may lead to increased risk of infection and further discomfort and embarrassment for the wearer.[7,8] Therefore there is a strong rationale for a catheter maintenance strategy, which will help prevent the development of catheter-associated complications and frequent removal.

The following modules explore this rationale in more depth and also focus on the benefits of catheter maintenance with Uro-Tainer® and the newly developed **Uro-Tainer® Polihexanide.**

Bacterial Colonisation and Catheter-Associated Complications

The bacterial colonisation of urinary catheters is aided by the formation of biofilm, which protects the microorganisms and makes them difficult to eradicate.[9-11] This module focuses on the specific characteristics of biofilm and the role they play in catheter-associated complications.

Bacterial colonisation and urinary catheterisation

Therefore clinical prevention strategies are needed as

- Bacteria growing in the biofilm mode are resistant to antibiotics[12]
- Frequently changing an indwelling catheter due to encrustation can result in an increased risk of infection and discomfort for the catheter wearer[7,8]

Bacterial decolonisation: Preventing biofilm formation

Studies have shown that the lowest concentration required to eradicate bacterial biofilm for many antibiotics may exceed the maximum therapeutic dose level[12-16]

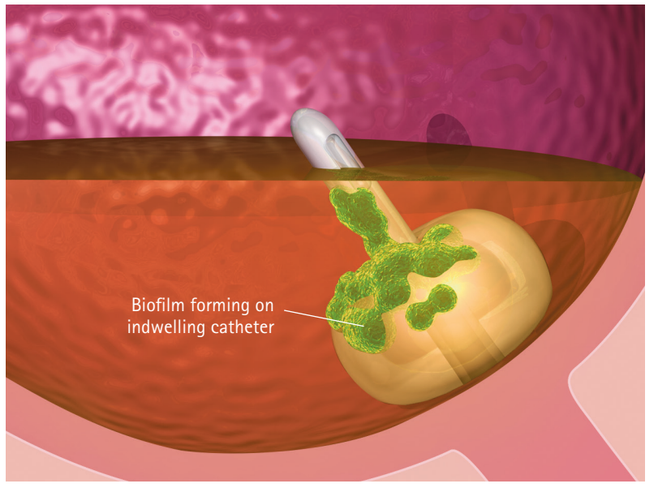
Therefore standard therapeutic doses of antibiotics may have little or no effect on bacteria in biofilm form in the patient i.e. in wounds or on the surface of medical devices[9]

There is evidence to suggest that physical removal i.e. mechanical rinsing is the best method of biofilm removal[9]

Regular cleansing is required to prevent regrowth of the biofilm[9]

Topical broad spectrum antimicrobial agents that kill rather than inhibit microorganisms may be the most appropriate agents to use for mechanical rinsing[9]

Polihexanide is a broad spectrum microbicidal antimicrobial which has been successfully used for bacterial decolonisation and prevention of biofilm formation in wound management[17]



Polihexanide in prevention of bacterial colonisation[18]

Study design

A clean silicone tube was incubated for a 10-week period with *P. aeruginosa*

The tube was cut into 24 sections for use as test and control carriers

The bacterial load of 16 control sections was calculated

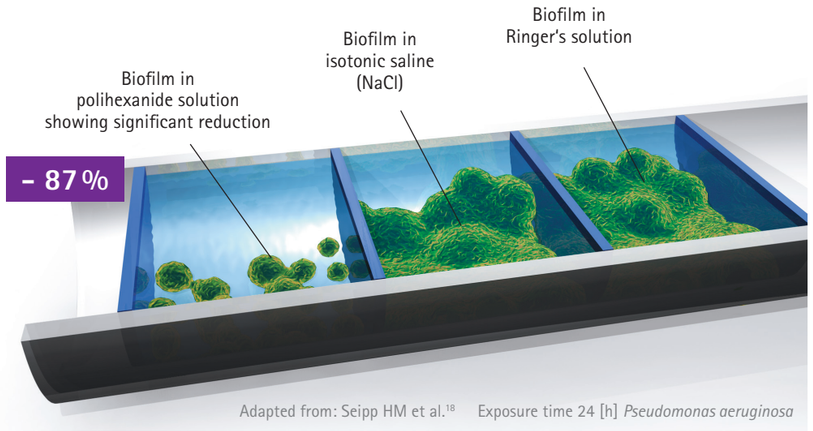
Eight test sections harbouring biofilm were incubated for 24 h with either isotonic saline (NaCl), Ringer's solution or polihexanide solution

Results

The baseline bacterial load (biofilm equivalent) of the test sections averaged 983 (± 394) EU/ml (Figure 5)

The polihexanide solution significantly reduced the baseline biofilm bacterial load after 24 h by a factor of 7.8 or 87 % (125 [± 67] EU/ml) (p<0.001)

The isotonic saline and Ringer's solution had no effect on the bacterial load (984 [± 233] EU/ml & 1022 [± 557] EU/ml



Adapted from: Seipp HM et al.[18] Exposure time 24 [h] *Pseudomonas aeruginosa*

Figure 2:
Efficacy Comparison of Irrigation Solutions on Formation of Bacterial Colorues.

Key Points:

- Biofilm formation is an important issue for patients with long-term indwelling urinary catheters as they
  - Act as a source of infection and are often resistant to antibiotic treatment and difficult to eradicate
  - Cause encrustation and blockage resulting in removal of the catheter
- Mechanical rinsing is the best method for biofilm removal and regular cleansing is required to prevent regrowth
- Topical broad spectrum antimicrobial agents that kill rather than inhibit microorganisms may be the most appropriate agents to use for mechanical rinsing
- Polihexanide solution has been shown in studies to significantly reduce bacterial biofilm load compared to a range of other irrigation solutions e.g. Ringer's solution

The Effect of Polihexanide on Biofilm Formation

In addition to its bactericidal properties polihexanide may also have an anti-adhesive effect due to its chemical nature (cationic).[19,20] This may help in turn to minimise biofilm formation by preventing microorganisms attaching to surfaces and forming colonies.[20] The anti-adhesive effect of polihexanide on biofilm formation has been evaluated in an *in vitro* study based on a human cell line.[20]

This study focused on the effect of polihexanide on a virulent strain of bacteria+, which is known to form biofilms which are particularly hard to eradicate

This type of bacteria is known form biofilms, which are particularly hard to eradicate as they adhere strongly to surfaces

This bacteria is part of the family of group B streptococci (GBS)

The most common GBS biofilms are formed on the surfaces of urethral catheters[21]

To test the anti-adhesive properties of polihexanide in isolation sub-bactericidal concentrations were used

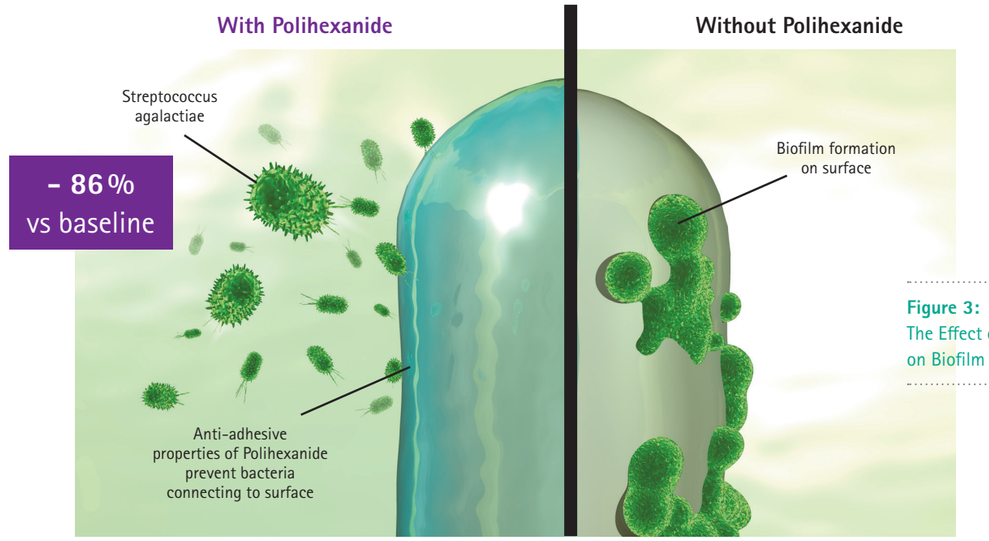


Figure 3:
The Effect of Polihexanide on Biofilm Formation

+ Streptococcus agalactiae (adapted from: Afinogenoua AG 60)

Results

The study demonstrated that for the *SspB1+* genotype a 0.5 µg/ml polihexanide concentration led to **significant decreases in the**:

- Adhesive strength of the biofilm **(95 % reduction)**
- Percentage of infected cells **(88 % reduced to 20 %)**
- Mean number of adherent cells (77 % reduction)
- Similar results were seen for the weaker genotype (*SspB1-*) and also for the 0.25 µg/ml polihexanide concentration

Conclusions

- Polihexanide prevents adhesion of bacteria and biofilm formation.

A further *in vitro* study has also demonstrated the positive effect of polihexanide (Prontosan®) on the development of MRSA biofilm compared to two saline solutions in a porcine wound model.[22]

Polihexanide in Catheter Maintenance

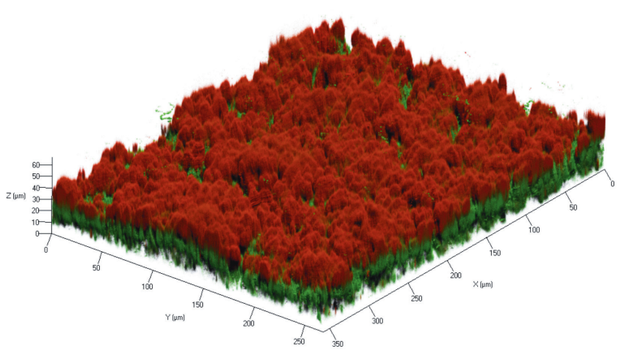
In laboratory tests a polihexanide solution has been shown to have bactericidal activity against a wide range of bacteria that are commonly associated with UTI in catheterised patients (e.g. *Proteus mirabilis*). Using a practice-like laboratory assay (i.e. standard silicone catheters incubated with clinically relevant bacteria) use of polihexanide solution for bacterial decolonisation was shown to be superior to both standard practice (i.e. no treatment) and also saline solution.

A study focusing on the tolerability of a polihexanide solution in catheterised patients is currently underway and results are expected to be available in 2017.

Using a practice-like laboratory *(in vitro)* assay the decolonisation potential of the UT-Polihexanide solution has been tested against both no treatment (standard practice) and also Uro-Tainer® 0.9 % NaCl (sodium chloride).[23-24]

Using similar methodology flourescent microscopy was used to visualise the effect of UT-Polihexanide vs. Uro-Tainer® 0.9 % NaCl on biofilm formation.[25] Figure 12 demonstrates the extensive effect of UT-Polihexanide on bacterial colonisation of the catheter surface.[25]

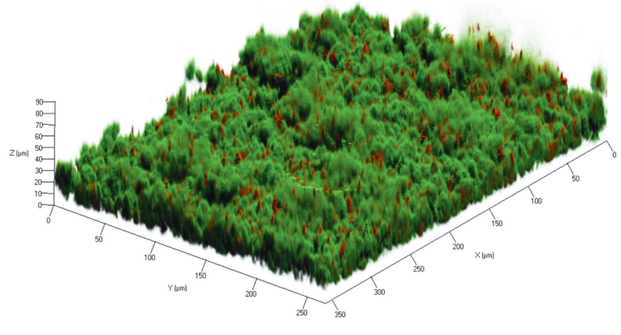
Figure 4: Uro-Tainer® Polihexanide vs. Uro-Tainer® 0.9 % NaCl on Biofilm Formation



Results:
Uro-Tainer Polihexanide

Most cells are red =

DEAD BACTERIA



Results:
Uro-Tainer 0.9 % NaCl

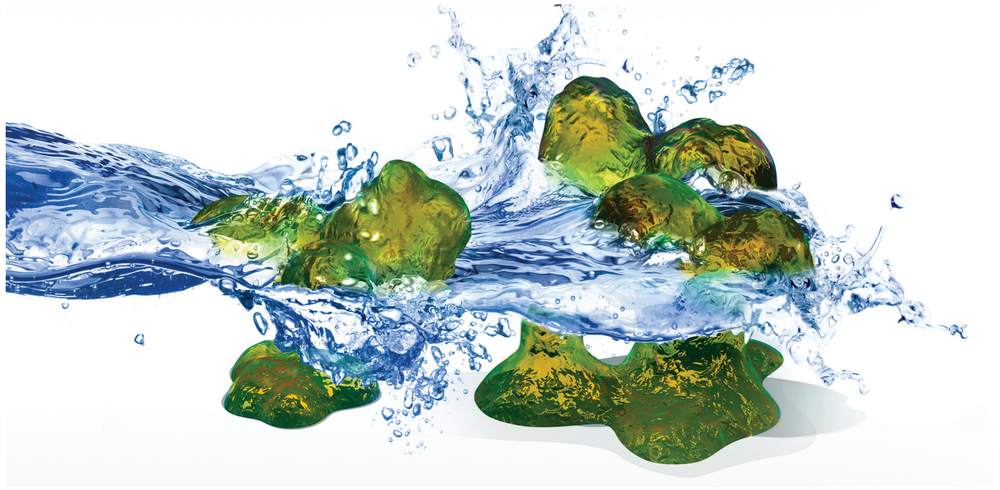
Most cells are green =

HEALTHY BACTERIA

The Polihexanide Experience

Polihexanide

Polihexanide has been shown to have distinct advantages over chlorhexidine as it has much higher tissue tolerability and is not so easily degraded.[19] Polihexanide has demonstrated good clinical safety, with no evidence of resistance and minimal toxicity.[17]



Uro-Tainer® Polihexanide

Table 1: Existing Uro-Tainer® Technology

Solution	*Intended Use*	*Characteristics*
NaCl 0.9 %	For routine rinsing of catheters (removal of small blood clots, tissue, debris).	Mechanical rinsing
Suby G (3.23 % citric acid)	Prevention and treatment of of encrusted catheters.	Chemical dissolution of crystals
Solutio R (6 % citric acid)	Prevention and treatment of of peristent encrustation; prior to catheter change.	Chemical dissolution of crystals
Chlorhexidine 1:5000	Treatment of infection	Physician prescription required Known side effects of chlorhexidine diacetate
Polihexanide 0.02 % NEW	Used for routine decolonization (removal of bacteria) of the catheter.	Mechanical rinsing

Portfolio Uro-Tainer®

B. Braun Uro-Tainer® Polihexanide

Mechanical rinsing

Indication: Uro-Tainer Polihexanide 0.02% is used for routine decolonisation (removal of bacteria) of the catheter through mechanical rinsing.

Recommend rinse frequency: The regimen to be used will vary from user to user. However, the tolerability of UT-Polihexanide is such that it can be used for up to two irrigations per day if required

Composition: Per 100 ml: polyhexamethylene biguanide (Polihexanide) 0.02 g, sorbitol in water for injections 5.0 g

B. Braun Uro-Tainer® Twin Suby G

Dissolution of encrustation

Indication: A mildly hypotonic fluid that is less irritating as a result of the addition of magnesium. This fluid is specially designed to prevent phosphate crystallization and dissolve existing calcification in indwelling catheters

Recommend rinse frequency: 2 to 3 times per week depending on the scope of the problem, unless prescribed differently by the doctor. The fluid must remain in the bladder for 2 x 5 minutes.

Composition: Per 100 ml: citric acid monohydrate 3.23 g, mild magnesium oxide, 0.38 g, sodium bicarbonate 0.7 g, edetate disodium 2H2O 0.01 g in water for injection. pH = 4.2

B. Braun Uro-Tainer® Twin Solutio R

Dissolution of encrustation

Indication: A mild hypotonic fluid that is specially designed for catheters with stubborn calcification where Suby G does not provide a sufficient result. This is due to its higher concentration of citric acid.

In addition, this fluid minimises trauma when removing an indwelling catheter

Recommend rinse frequency: 2 to 3 times per week depending on the scope of the problem, unless prescribed differently by the doctor. The fluid must remain in the bladder for 2 x 5 minutes

Composition: Per 100 ml: citric acid monohydrate 6.0 g, gluconolactone 0.6 g, mild magnesium carbonate 2.8 g, edetate disodium $2H_2O$ 0.01 g in water for injection. pH = 4

B. Braun Uro-Tainer® NaCl 0.9%

Mechanical rinsing

Indication: This isotonic fluid is used primarily for cleaning the bladder and catheters mechanically, e.g. in the case of debris formation in the bladder

Recommend rinse frequency: 1 to 2 times per day depending on the scope of the problem, unless prescribed differently by the doctor

Composition: Sodium chloride 0.9 %. pH=7

B. Braun Uro-Tainer® M NaCl 0.9% with injection port

Indication: The Uro-Tainer® M has an injection port that is specifically for administering drugs.

Dose: Depends on the doctor's prescription.

Drug instillations

Composition: Sodium chloride 0.9 %. pH = 7

Artikel	Einheit	Art.-Nr.
Uro-Tainer® NaCl 0.9 %	100 ml	FB99833
Uro-Tainer® M NaCl 0.9 %	100 ml	FB99853
Uro-Tainer® Twin Suby G	60 ml	9746609
Uro-Tainer® Suby G	100 ml	FB99839
Uro-Tainer® Twin Solutio R	60 ml	9746625
Uro-Tainer® Solutio R	100 ml	FB99841
Uro-Tainer Polihexanide	100 ml	FB99965

Design features

The design features of the new Uro-Tainer® PVC-free bags help improve handling and safety[26].

Improved handling & feel

Insertion of hanger for the Uro-Tainer® M
Enables easier administration of drugs

Softer plastic
Improves the feel of the product for the patient

Colour-coded conus and clamp
Improves identification in a busy working environment

New clamp design
Enables one-handed operation

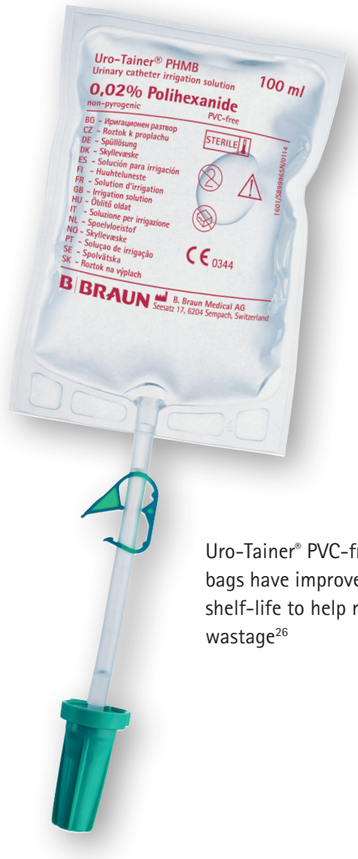
Improved administration & safety

Greater bag transparency
Easier to assess colour of the urine and observe debris

Improved seal for the Uro-Tainer® M injection port
Ensures one-way flow

Same flow rate as original product
No change in technique required

Drugs database
Enables healthcare professionals to assess compatibility of drugs used in combination with Uro-Tainer®



Uro-Tainer® PVC-free bags have improved shelf-life to help reduce wastage[26]

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