# 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

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Short Title: Cost effectiveness of taurolidine locks in HPN patients

Key words: home parenteral nutrition, taurolidine, cost effectiveness

**Background & Aims:** The use of long-term taurolidine locks (LTTL) seems to be effective in preventing catheter-related bloodstream infections (CRBSI), especially in patients on home parenteral nutrition (HPN). This work targets the cost-effectiveness of LTTL in a cohort of adult HPN patients.

**Methods:** A monocentric mirror-image design study was conducted in our referral centre among long-term HPN patients experiencing recurrent CRBSI. From 7th January 2011, LTTL were started after the third CRBSI episode within 12 months. CRBSI data was prospectively collected until 7th January 2013, in the same way as it had retrospectively been done before initiating LTTL. A cost-effective analysis was conducted to estimate the incremental costs and effects on CRBSI with LTTL. The efficacy of LTTL on CRBSI rate was assessed over 1,000 days of catheter use.

**Results:** A total of 31,100 catheter days were analysed in 37 patients (median [interquartile range (IQR)]) aged 58 [42 - 68] years. The mean ± SD proven CRBSI rate was 3.18 ± 3.51 per 1,000 catheter days before the introduction of LTTL and 0.39 ± 1.50 per 1,000 catheter days after its introduction ($p < 0.0001$). Considering both proven and probable CRBSI requiring hospital management, LTTL reduced (mean [bootstrap CI 95%]) -2.63 [-3.26 to -2.06] infections per patient (from 2.89 [2.31 to 3.49] before to 0.26 [0.13 to 0.41] after) as well as incremental costs by -7,258 [-10,450 to -4,016] € (from 11,176 [8,004 to 14,968] € before to 3,918 [2,390 to 5,445] € after).

**Conclusion:** Implementing LTTL to prevent recurrent CRBSI is cost-effective by dramatically decreasing their incidence.

# 1. Introduction:

Catheter-related blood stream infections (CRBSI) are the main complication in patients on long-term home parenteral nutrition (HPN) [1]. According to the systematic review by Dreesen et al., the incidence of CRBSI (where is defined as isolation of the same organism in paired blood cultures from peripheral vein and catheter lumen associated with clinical symptoms) varies from 0.38 to 4.58 episodes per 1,000 catheter days in adults and reaches 10.6 in the retrospective Walshe et al. study [2, 3]. CRBSI require hospitalisation and treatment with intravenous (IV) antibiotics combined or not with catheter locks; they complicate or limit the venous access and occasionally justify the replacement of the central venous access (CVA). Iterative replacements may lead to suspending HPN and making intestinal transplantation surgery necessary for patients at greater risk of death [4]. HPN patients fear CRBSI because they are aware of the impact on their quality of life [5].

While patient and nurse awareness is an essential aspect of CRBSI prevention, there is currently no consensus about the type and use of CVA locks for prophylaxis or treatment. Transient antibiotic locks should be adequate to salvage the CVA in uncomplicated infections, but this strategy has to be challenged, because of the induced risk of resistance and the limited effect on the biofilm that shelters bacteria [6-8]. Ethanol lock therapy, assessed in various adult cohorts has also been proposed to reduce CRBSI rate, but no licensed and ready-to-use product is available in Europe [9-11]. Currently, the ESPEN does not recommend locking with 70% ethanol because of the risk of systemic toxicity and catheter damage leading to reaspiration which increases the number of catheter manipulations [8].

Among the different types of locks tried, taurolidine, whose efficacy was first shown in hemodialysis, appears to be a promising candidate [8, 12]. Taurolidine is an antiseptic agent with bactericidal and fungicidal properties which attacks irreversibly the cell wall of both Gram positive and negative bacteria, as well as fungi via the methylol taurinamide, its hydrolysed form. Thanks to its action mechanism, it could also be effective on biofilm

1 eradication [13]. To date, no resistance has been described with taurolidine [14]. Different
2 studies have shown its efficacy in preventing both CRBSI and their recurrences and in
3 improving catheter salvage [14-24]. Unfortunately, there is little data about the cost-
4 effectiveness of this strategy.
5 The aim of this work was to evaluate the cost-effectiveness of long-term taurolidine locks
6 (LTTL) in preventing recurrent CRBSI in a cohort of adult patients receiving HPN.

# 2. Materials and methods:

## 2. 1. Patients

Patients recruited in the study were all followed by the referral centre for HPN patients at Lille University Hospital and were aged ≥18 years.

Patients included in the study were those receiving LTTL between 1st July 2011 and 1st July 2013, following a monocentric mirror-image design. Data prospectively collected during the LTTL period was compared for each patient to data collected in a similar retrospective period before LTTL (mirror period). Patients with fewer than 60 days' LTTL were not considered for the analysis. Non-compliant patients, patients who changed for another HPN centre or were hospitalised for a period longer than their home-stay during the 2-year study were excluded. In France, Ethical approval was not required for cohort monitoring before the Jardé law of 16th November 2016. A declaration to the National Commission on computer technology and freedom (CNIL) permitting data treatment and anonymity was made (ref Lille 18-12-2014 12:53).

## 2.2. Methods:

*Management of CRBSI*

Among patients receiving HPN, CRBSI were suspected when patients experienced hyperthermia (> 38°C), hypothermia (< 36°C) or chills during HPN infusion; patients were then admitted to the referral centre for exploratory tests (biological sampling) and hospital management.

Before 1st July 2011, apart from CRBSI episodes, the CVA was flushed with saline at the end of HPN infusion. Patients with suspected CRBSI were hospitalised. During both mirror and LTTL periods, the same procedure was applied to diagnose CRBSI. According to the ESPEN Guidelines, CRBSI was proven by a positive culture from the lumen of the CVA (when it was removed), or by paired qualitative blood cultures from a peripheral vein and from the CVA of the same microorganism, the delay for positivity being more than 2 hours shorter for the CVA

[8, 25]. In practice, patients with clinical signs suggesting septicemia with a pathogen identified from at least one catheter blood sample and not related to an infection at another site were also treated as probable CRBSI cases [8].

Treatment consisted in a 14-day period of intra-venous (IV) discontinuous or continuous (when vancomycin was required) anti-infectious treatment, according to the spectra of isolated bacteria or fungi. Treatment initiated at the hospital was pursued at home. Antibiotic CVA locks were empirically used daily for one month (25 mg/mL amikacin, 40 mg/mL gentamicine or 12.5 mg/mL vancomycin). These locks were initiated simultaneously or delayed by 14 days, depending on whether the anti-infective treatment was discontinuous or continuous. CVAs infected with *Staphylococcus aureus*, *Pseudomonas aeruginosa* or *Candida spp.*, were systematically removed immediately and replaced. CVA sterility was systematically checked by blood culture within the 2 weeks following the restart of saline locks.

Since 1st July 2011, the use of anti-infective systemic treatment has remained unchanged but thanks to the results of the Bisseling et al. study we decided to switch from short-term antibiotics followed by long-term saline CVA locks to LTTL [16]. Consequently, LTTL became part of the first 14 days of systemic treatment and were used for prophylaxis thereafter.

*Long-term taurolidine locks*

A formulation of 5 mL TauroLock® containing heparin (1.35% taurolidine, 4% citrate, 500 IU/mL heparin) was the only one available in France, although other formulations with various concentrations of taurolidine, heparin and citrate exist worldwide. This product (provided by Theradial, France) is considered as a medical device in Europe (CE marked, class IIb). According to the supplier's instructions, the lock must be removed by aspiration before using the catheter. Tolerance issues have been noted.

*HPN characteristics*

Patients received individualised all-in-one PN mixtures compounded by Baxter Fasonut, a pharmaceutical laboratory, according to their nutritional needs. HPN duration, type of CVA (implantable chamber or central catheter), number of HPN infusions per week were noted.

The data collected was: demographic (gender, age), duration of HPN, underlying disease, associated comorbidities and treatment with infection risk, type of CVA devices, laboratory values and blood cultures. Bacterial strains were collected in all cases of infection, once isolated and identified. Matrix-Assisted Laser Desorption/ionisation-time-of-flight mass spectrometry (MALDI-TOF MS) identification was performed using a Microflex mass spectrometer (Bruker Daltonics, Wissembourg, France). An accurate identification score to species level was assessed by a score value ≥ 2.0 according to manufacturer's recommended cutoff.

The dates of the onset of HPN and of LTTL therapy were noted; if required, the date and the cause of LTTL discontinuation (death, PN weaning, intolerance) also.

Retrospective CRBSI data collection included patient medical charts and mail, from original paper information, data in medical software, data in software from the microbiology laboratory, placing the hour, minute and date of positivity of microbial growth and encoding software from medical information departments, with keywords containing: catheter infection; infection following therapeutic injection, infusion or transfusion; infection and inflammatory reaction due to prosthesis, implants or cardiac and valvular grafts.

The number of catheter changes was sought in clinical charts, in notebooks from operating rooms, and in the software used for the traceability of implanted devices. When the catheter was set up the first time for PN it was not taken into account.

*Cost effectiveness of LTTL*

The economic evaluation was a cost-effective analysis in which we estimated the incremental costs ($\Delta C$) and incremental effects ($\Delta E$) attributable to the introduction of LTTL considering both proven and probable CRBSI cases requiring hospital management.

In line with current French recommendations for technology appraisal, the economic evaluation adopted the societal perspective [26]. The time horizon for the economic evaluation was equivalent to that of the data collection.

Unit cost estimation followed recent guidelines on pricing healthcare services as part of an economic evaluation [26]. Only the direct costs (medical and non-medical) at a single time point (2011) were considered [27]. A 4% discounting was applied to costs and health effects, as the time horizon for the economic evaluation was above one year in some patients [26]. Collected data provided the costs linked to primary outcomes/endpoints of the study. Hospital costs were evaluated according to diagnosis-related code-groups using the French National scale of costs [27]. Mean values for each item (acquisition of drugs, radiological and biological tests, physician and nurse work, logistics, etc.) were listed for every diagnosis-related code-group [27]. The diagnosis-related code-groups corresponding to hospitalisation for each patient due to a prior infection or any related event were indexed. Costs were modified in the case of hospitalisation in an intensive care unit. The cost of expensive antibiotics and replaced catheters not included in the standard costs of hospitalisation were added, as well as ambulatory antibiotic drugs and cost of delivery materials, taurolidine vials and patient transportation from home to the hospital.

*End points*

The main criterion of this mirror-image study was the cost-effectiveness of the LTTL strategy. However, we also studied the effect on the following parameters: efficacy on proven CRBSI rates per 1,000 catheter days according to ESPEN Guidelines, effectiveness on CRBSI management considering both proven and probable cases, the number, mean and total duration of hospital stays due to CRBSI management or any related event such as side effects caused by treatment or complications, the number of total CVA removals related to CRBSI.

*Statistical analysis*

Qualitative variables were expressed in frequencies and percentages. Quantitative variables were expressed by median [interquartile range (IQR)] and/or mean ± SD. For quantitative variables, the Wilcoxon's signed rank test was adopted to test the hypothesis that distributions for each variable were the same between the two periods. Due to multiple comparisons, the statistical significance threshold was defined at 0.01. The Kaplan-Meier method was used to estimate the cumulative incidence curves according to the ESPEN definition of CRBSI. The comparison of curves was made using the Log-rank test considering the mirror-period of each patient.

In common with economic evaluations, cost distribution was skewed. Consequently, a non-parametric estimation using the bootstrap method was adopted to obtain the 95% CI for mean effectiveness, costs and differences between the two strategies. Each of the confidence intervals was calculated using 1,000 bias-corrected bootstrap replications. Non-parametric bootstrap simulation was also performed to generate 1,000 replications of the cost effect pairs; these were subsequently represented graphically on a four-quadrant cost-effectiveness plane [28]. Mean hospital costs were expected to follow a lognormal distribution, reflecting the long right tail and leaning towards positive values according to cost data in the French diagnosis-related code-groups. Statistical analyses were performed with Stata software (Texas, USA, version 14.0).

## 3. Results:

Among the 48 patients who received at least one taurolidine lock between July 2011 and July 2013, 11 were excluded: 7 for LTTL use < 60 days, 2 for hospital stays longer than home stays and 2 for lack of data as indicated in the flow chart (figure 1). Among the 7 patients aged 48.5 ± 13.5 years excluded due to an LTTL duration < 60 days (43.7 ± 11.6 days) with newly initiated HPN (HPN duration of 53 ± 27 days), none had suspected or proven CRBSI or hospitalisation during the LTTL period. Two patients were not considered as receiving

HPN as they died in hospital because of an underlying disease. Finally, 37 patients were considered for analysis.

After LTTL implementation, 33 patients (89%) were free of CRBSI. After 2011, four patients were weaned from HPN thanks to surgery and 3 died from causes independent of CRBSI (cirrhosis and hepatic failure for a 58-year-old, palliative care after end of treatment for an 85-year-old, renal failure for a 65-year-old).

The study was therefore performed on 37 patients with recurrent CRBSI using a mirror-study period of 367 [226-700]; 420 ± 239 days*,* representing a total of 31,100 catheter days. The characteristics of patients at LTTL initiation are defined in Table 1. Six patients had balanced insulin-dependent diabetes: 2 apparent before HPN and 4 consecutive to HPN initiation. Seven patients with Crohn's disease received immunosuppressant treatment: 3 remained unchanged before and after LTTL; on LTTL initiation 1 switched from certolizumab to adalimumab and the other from budesonide and azathioprine to ustekinumab, 2 began adalimumab and intermittent corticotherapy during the ITTL period. Two other patients received treatment for cancer: 1 initiated imatinib before the mirror period and 1 received chemotherapy (paclitaxel and carboplatin) during the LTTL period. Body weights of patients were comparable at the beginning of mirror and at the start and end of LTTL periods (54 [47.4-61] kg and 55 [52-66] kg and 58 [52-67] kg; not significant), respectively. The number and duration of overall hospitalisations (including those not related to CRBSI) during mirror vs. LTTL periods were (4 [2-7] vs. 1 [0-2]; $p < 0.001$ and 7 [4-13] days vs. 3 [0-10] days; not significant), respectively. During the overall study, patients kept the same home and HPN referral centre healthcare givers; practices in prevention and management of CRBSI were unchanged except for LTTL introduction.

The rate of proven CRBSI according to the ESPEN definition was 3.18 ± 3.51 per 1,000 catheter days before the introduction of LTTL and 0.39 ± 1.50 per 1,000 catheter days after, $p < 0.0001$. The cumulative incidence curves for proven infections are presented in Figure 2. The overall rate of both proven and probable CRBSI requiring hospital management decreased in the same proportion from 8.21 ± 3.95 per 1,000 catheter days beforehand to

0.74 ± 1.79 per 1,000 catheter days after, $p < 0.0001$. Table 2 indicates patient outcomes before and after the introduction of LTTL. Cumulative hospital stays were 677 and 133 days, before and after the introduction of LTTL, respectively.

Effectiveness and costs are reported in Table 3. After versus before the introduction of LTTL, we observed a decrease in the number of infections per patient which required hospital management (mean [bootstrap CI 95%]) (-2.63 [-3.26 to -2.06]). This corresponds to an average reduction in total cost per patient of (mean [bootstrap CI 95%]) -7,258 [-10,450 to -4,016] €. Figure 3 indicates the variability around the estimate of cost-effectiveness. The fact that the totality of the bootstrapped replications of the cost-effect pairs was traced in the south-east quadrant of the cost-effectiveness plane indicated that the LTTL strategy was significantly more effective and less expensive.

## 4. Discussion

Our study shows LTTL cost-effectiveness to prevent recurrent CRBSI, the incidence of which dramatically decreased in our HPN adult cohort of patients. The 65% cost reduction we observed can be largely accounted for as previous hospitalisation and ambulatory medication costs were superior and not balanced by LTTL incremental cost.

Little published data has concerned infection management and their costs in HPN patients. A retrospective Spanish study including 13 patients reported a lower accumulated cost before and during a taurolidine period, but this difference has not been statistically tested. The randomised study by Tribler S et al. reported as a secondary objective a total cost divided by 2 in the LTTL group compared with the control group [21]. In this study fixed prices were used to determine costs while we determined individual costs per patient. To our knowledge, the present study is the first designed and conducted to assess the cost-effectiveness of LTTL in HPN patients. It is significant and can reach 19.8 euros per vial, but should appear even more cost-effective as, since we performed this work, the cost per vial has decreased from 7 to 5 euros [21]. Moreover, another recent randomised study (after excluding one non-

conform patient) confirmed a similar cost saving with LTTL because of an even lower price per vial of 3 USD [23]. However, it should be noted that taurolidine or saline locks were used with new catheters on 70% of the 102 enrolled patients.

Our results confirm that LTTL is successful in dramatically decreasing the recurrence of CRBSI as already reported by others in both randomised [16, 21, 23, 29] and cohort studies [14, 15, 17-20, 22, 24] and the rate of CRBSI before LTTL onset was also consistent with that reported in other research [15, 17-21, 24]. However, the accepted (grade A) ESPEN definition of CRBSI underestimates incidence today. In the present study, the CRBSI rate does not reflect incidence in our whole cohort of HPN patients as the 35 excluded patients did not experience any CRBSI till July 2011. In spite of LTTL efficacy, maintaining low sepsis rates requires careful catheter protocols, as well as a multidisciplinary nutrition support team and patient awareness. The patient is the key to minimising the CRBSI rate at home.

In practice, the decision to treat a patient is independent of the proven ESPEN CRBSI definition. Indeed, patients suffering from the clinical symptoms of CRBSI require hospitalisation and proper management of the suspected infection. This explains why we have also considered probable CRBSI when calculating cost effectiveness.

Nowadays, no data recommends LTTL use in primary prevention. This strategy has been assessed only in a cohort of 3 patients at high risk for vascular access [20]. In a randomised trial focusing on patients with a low infection rate (0.3 per 1,000 catheter days), taurolidine was no better than saline locks [29]. Consequently, in this case, the cost of taurolidine was significantly higher than the cost of saline. In our cohort, LTTL remains cost-effective when adding the cost estimated for its use in primary prevention over two years for the 42% (35/83) of patients who did not have CRBSI, but this was not the aim of the present study.

The sample size and duration of the lock period were shorter than those published by Olthof *et al* [19]. They compared two independent samples of patients before and after taurolidine lock introduction. This prevented a possible paired analysis as opposed to our study, i.e. a comparison for each patient liable to benefit from LTTL over a retrospective mirror-image

period. Our monocentric restricted cohort was larger in size than the prospective randomised study by Bisseling et al [16] in which HPN indications were more heterogeneous.

Our work has some important limitations that have to be discussed. Respecting the design of the first randomised study published by Bisseling *et al.* in 2010 involving patients who had developed an episode of CRBSI, we chose to exclude the 35 patients who had not experienced CRBSI during the prospective period corresponding to LTTL implementation [16]. The decrease in CRBSI rate after versus before LTTL should have been influenced by the phenomenon of regression to the mean in our high prevalence CRBSI cohort. It should be noted we did not select any patient a priori among our cohort as we considered only patients with CRBSI within a prospective period of 2 years to define a posteriori the retrospective mirror period. In the absence of blinding or control group, it cannot be excluded that both patients and healthcare workers may have experienced the Hawthorne effect modifying their behaviour and motivation in response to LTTL implementation. Although this was the only change made to our patient management, an awareness of being observed could introduce a bias in favour of the LTTL period since it did not exist during the retrospective mirror period. Conversely, it cannot be ignored that some caregivers may be tempted to think that with LTTL they can be less rigorous with catheter management. Because of an average participation of about 2.5 years, patient status may have changed between the retrospective and prospective periods and influenced our results. However, considering an overall average length of hospital stay (including those not related to CRBSI) of approximately 10 days for these two periods, we can consider that patients were relatively clinically stable at home, since their mean HPN duration was three times as long as their mean participation in the study. Their body weight and use of immunosuppressive or cytotoxic drugs were comparable during these two periods. Obviously, during the prospective period, patients were older, had a longer history of HPN and chronic diseases such as diabetes, but these factors worked against a reduction in CRBSI under LTTL. Moreover, both home and hospital HPN caregivers and CRBSI management were similar, except for LTTL implementation.

These promising results have to be confirmed by a larger, prospective, multicentre study which should evaluate direct benefits in terms of quality of life for HPN patients. It may also concern patients requiring parenteral nutrition during their hospital stay in surgery or in oncology.

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## Statement of Authorship

Damien Lannoy is the guarantor of the article.

Damien Lannoy, Alexia Janes, Xavier Lenne, Sebastien Neuville, Pascal Odou, Amélie Bruandet and David Seguy performed the research.

Damien Lannoy, Alexia Janes and Julien Bourry acquired the data.

Damien Lannoy, Alexia Janes, Xavier Lenne, Pascal Odou, Amélie Bruandet and David Seguy analysed and interpreted the data.

Damien Lannoy, Alexia Janes, Xavier Lenne and David Seguy conceived and designed the research study and wrote the article. Sebastien Neuville, Pascal Odou and Amélie Bruandet contributed to the design of the study and critically revised the article for important intellectual content.

Damien Lannoy, Alexia Janes, Xavier Lenne, Sebastien Neuville, Julien Bourry, Pascal Odou, Amélie Bruandet and David Seguy all state that they approve the final version of the article.

## Conflict of Interest Statement

The authors declare that they have no conflict of interest concerning this article.

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# List of figures:

**Table 1.** Characteristics of patients at LTTL initiation

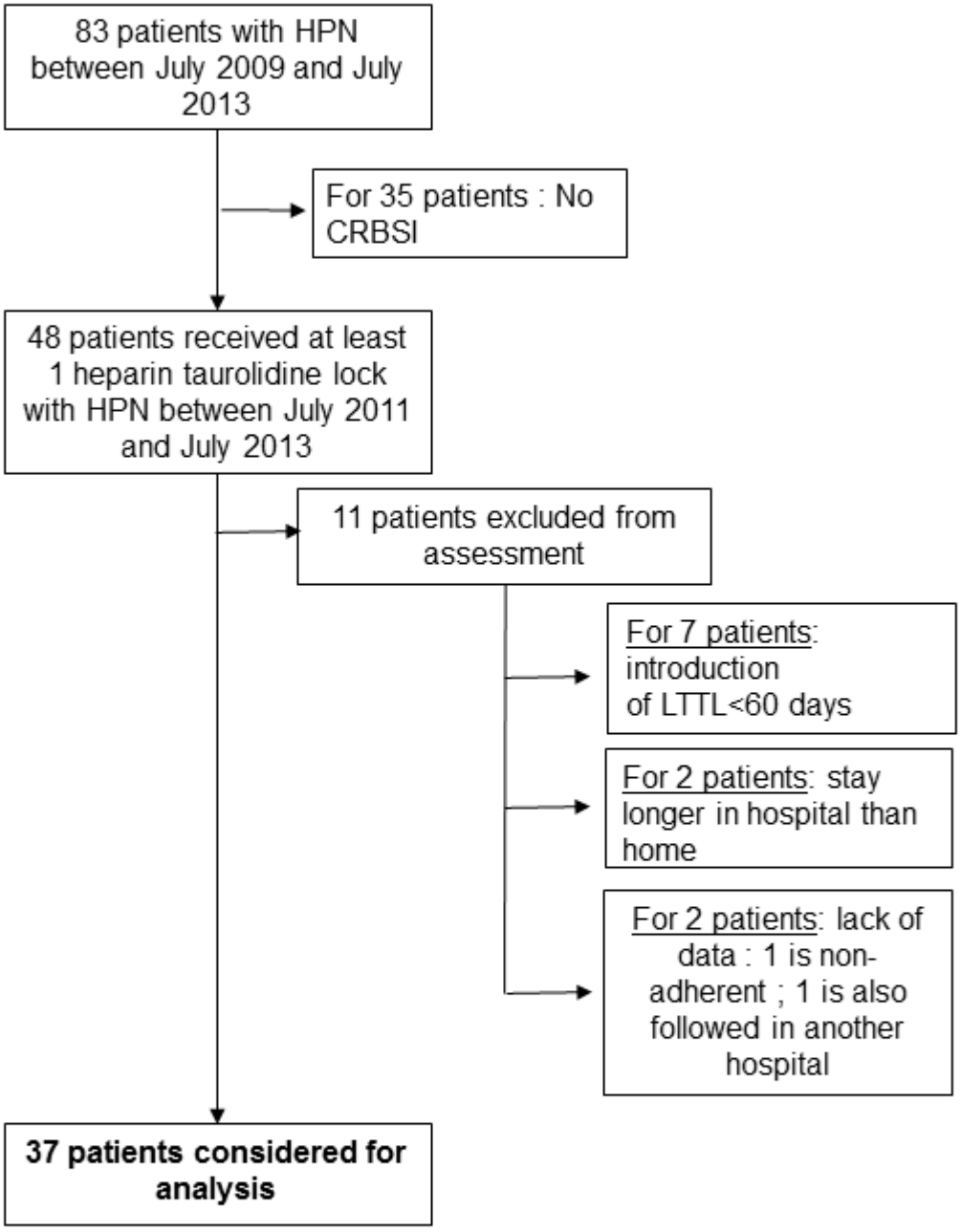
| | (n=37) |
|---|---|
| Gender, F/M | 25/12 |
| Age (yr), mean ± SD; median [IQR] | 55.5 ± 17.0; 58.1 [42.6-68.6] |
| Indication for HPN n (%) | Short bowel syndrome 35 (95) |
| | Crohn's disease 12 (32) |
| | Mesenteric infarction 10 (27) |
| | Cancer 5 (14) |
| | Surgery complications 7 (19) |
| | Radiation enteritis 1 (3) |
| | Motility disorders 2 (5) |
| | Cancer and Cytotoxic drugs 2 (5) |
| Associated comorbidities n (%) | Diabetes 6 (16) |
| | Immunosuppressants 7 (19) |
| | None 22 (60) |
| Type of central venous access n (%) | CVA 26 (70) |
| | Port-a-cath 11 (30) |
| HPN use in days, mean ± SD; median [IQR] | 1 996 ± 1 939; 1 388 [579-2 648] |
| LTTL use in days, mean ± SD; median [IQR] | 422 ± 238; 369 [226-700] |

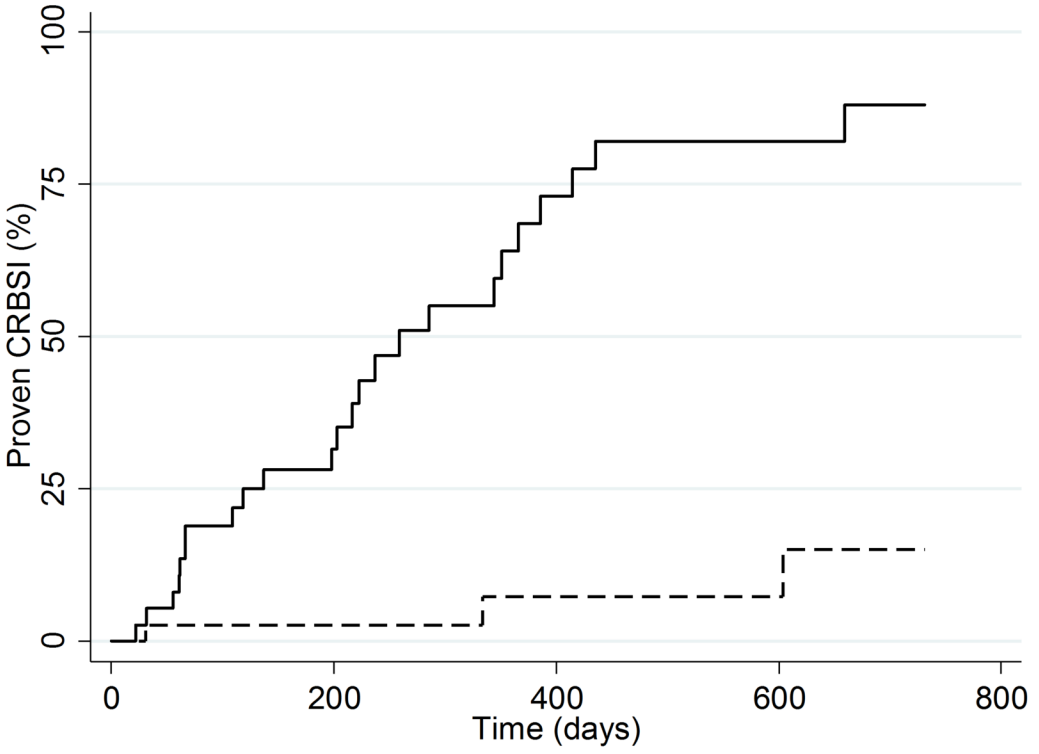
**Table 2.** Patient outcomes before and after the introduction of LTTL for overall proven and probable CRBSI requiring hospital management (Wilcoxon's signed rank test)

| | Before (n=37) | After (n=37) | p value |
|---|---|---|---|
| Overall CRBSI rate per 1,000 catheter days, mean ± SD; median [IQR] | 8.21 ± 3.95; 7.94 [5.56-10.94] | 0.74 ± 1.79; 0 [0-0] | < 0.0001 |
| Catheter replacement rate per 1,000 catheter days, mean±SD; median [IQR] | 1.79 ± 2.75; 1.37 [0-2.74] | 0.15 ± 0.55; 0 [0-0] | < 0.0001 |
| Number of hospitalisations per patient, mean ± SD; median [IQR] | 1.92 ± 1.80; 1 [1-3] | 0.22 ± 0.49; 0 [0-0] | < 0.0001 |
| Length of hospital stays per patient, mean ± SD; median [IQR] | 8.27 ± 7.96; 6.66 [4-11] | 3.26 ± 8.41; 0 [0-0] | = 0.0047 |

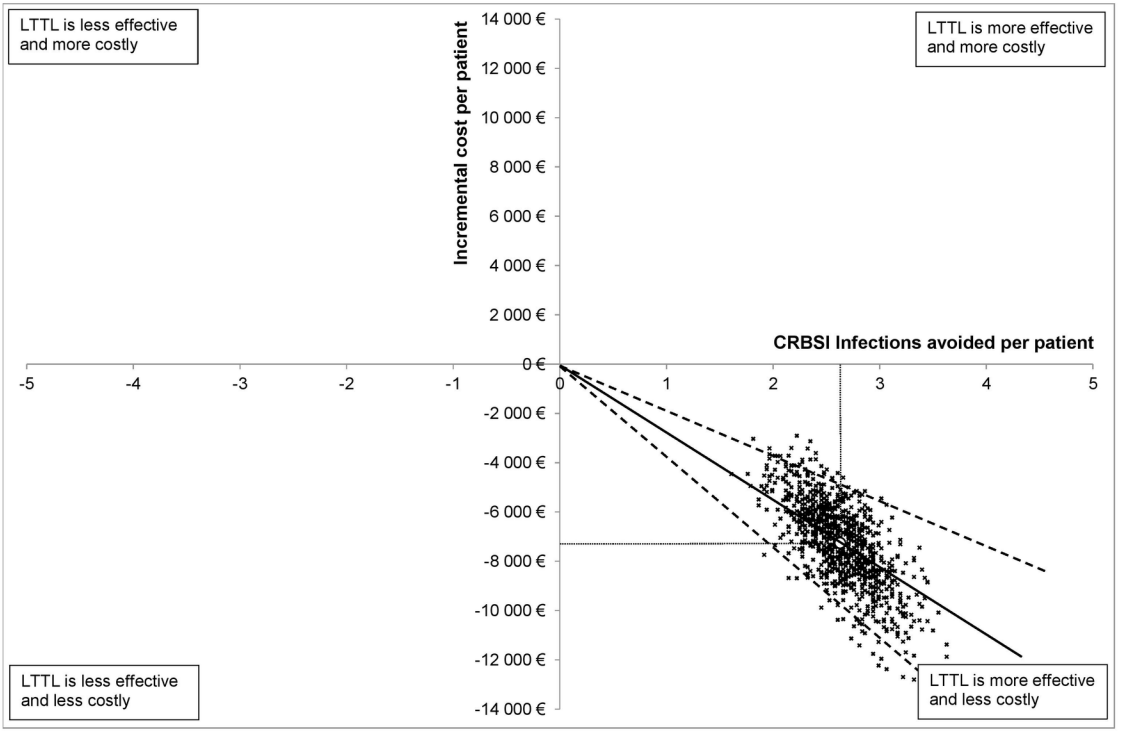
**Table 3.** Results of effectiveness and costs before and after the introduction of LTTL per patient considering proven and probable CRBSI requiring hospital management (mean [95% CI] non-parametric bootstrap)

| | Before (n=37) | After (n=37) | Δ |
|---|---|---|---|
| Number of infections | 2.89 [2.31 to 3.49] | 0.26 [0.13 to 0.41] | -2.63 [-3.26 to -2.06] |
| Hospitalisation costs | 9,625 [6,629 to 12,934] € | 1,687 [448 to 3,170] € | -7,939 [-11,382 to -5,053] € |
| Ambulatory medication costs | 1,234 [757 to 1,802] € | 57 [11 to 119] € | -1,177 [-1,739 to -697] € |
| Transportation costs | 200 [137 to 275] € | 23 [5 to 46] € | -178 [-253 to -118] € |
| Long term LTTL costs | - | 2,151 [1,734 to 2,573] € | 2,151 [2,573 to 1,734] € |
| Total costs | 11,176 [8,004 to 14,968] € | 3,918 [2,390 to 5,445] € | -7,258 [-10,450 to -4,016] € |


83 patients with HPN between July 2009 and July 2013
For 35 patients : No CRBSI
48 patients received at least 1 heparin taurolidine lock with HPN between July 2011 and July 2013
11 patients excluded from assessment
For 7 patients: introduction of LTTL<60 days
For 2 patients: stay longer in hospital than home
For 2 patients: lack of data : 1 is non-adherent ; 1 is also followed in another hospital
37 patients considered for analysis




| Number at risk | | | | | |
|---|---|---|---|---|---|
| After | 37 | 30 | 18 | 12 | 0 |
| Before | 37 | 20 | 6 | 3 | 0 |


LTTL is less effective and more costly
LTTL is more effective and more costly
LTTL is less effective and less costly
LTTL is more effective and less costly
Incremental cost per patient
CRBSI Infections avoided per patient
14 000 €
12 000 €
10 000 €
8 000 €
6 000 €
4 000 €
2 000 €
0 €
-2 000 €
-4 000 €
-6 000 €
-8 000 €
-10 000 €
-12 000 €
-14 000 €
-5
-4
-3
-2
-1
0
1
2
3
4
5