

## Urinary Tract Infections in Neurology and Neurosurgery Indoor Patients Can be Reduced by Simple Infection Control Precautions

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### Abstract

Urinary tract infections are the most prevalent hospital acquired infections. Despite knowledge of risk factors for UTI have been known for years, relevant precautions have not been implemented in all departments.

The aim of this study was to monitor the effect of reduced preadmission duration of urinary tract catheters in Neurological and Neurosurgical patients by incidence rates and incidence densities.

Incidence registration was performed in a Neurosurgical department, a Neuro-intensive care department and a Neurological department. In the Neurosurgical department an active policy for reducing the duration of urinary tract catheters was introduced. In the other two departments there was no specific intervention program but the close contact between the departments may have increased the awareness of urinary tract catheters as a source of infection.

In the Neurosurgical department the incidence rate (UTI per 1000 bed days) was reduced by 57% and the incidence density (UTI per 1000 catheter days) was reduced by 94%. In the Neuro-intensive care department the reduction in incidence rate was 4% and in incidence density 71% and in the Neurological department the reduction in incidence rate was 67% and in incidence density 50%.

As expected the intervention had the greatest effect on the incidence density even though the number of patients included and the number of HAUTI are small in this study. The great reductions in UTI the departments have obtained have brought them to a level comparable to the literature. It is our intention to reduce the usage of urine catheters, as well as the duration of catheter usage when applied.

**Keywords:** Urinary Tract Infections; Neurology; Neurosurgery

### Introduction

Regularly national prevalence surveys have been part of the infection control program in Denmark since 1974. Based on prevalence surveys from 1979 to 1999, the total prevalence rate of hospital acquired infections (HAI) decreased from 12% to 8% in this period [1]. This reduction in the prevalence rate of HAI was mainly caused by a decrease in urinary tract infections (UTI) and skin infections. Hospital acquired urinary tract infections (HAUTI) were reduced from 5.5% to 2% from 1979 to 1999 [1]. In this period, there was an increased focus on urinary tract catheters and the prevalence of HAUTI in patients with urinary tract catheters decreased from 60% to 20% [1]. De-

spite of this reduction in HAUTI, the UTI is still the most prevalent cause of HAI with 43 UTI pr. 10,000 days of risk in 2012 corresponding to approximately 14,000 patients with HAUTI per year in Denmark [2]. A European multicenter study from 2000 found HAUTI incidence rate of 3.5 episodes per 1000 patient days [3]. An international multicenter study from 2004-2009 found rates of nosocomial catheter associated urinary tract infections (CAUTI) in intensive care units of 14 episodes per 1000 catheter days in a neurological ICU and 6 episodes per 1000 catheter days in neurosurgical ICU [4].

It has been estimated that the risk of HAUTI increases with 5% for each day of catheterization [5-7]. The most serious complication to UTI is bacteremia where mortality rates of 10 - 30% have been found [7]. The average extended length of stay because of HAUTI is approximately 4 days [8,9]. No Danish studies have been done on the extended length of stay because HAUTI, but if the extended stay after HAUTI is of the same level in Denmark 14,000 patients getting HAUTI per year will result in about 56,000 extra bed days used because of HAUTI corresponding to about 200 full time beds only used for extra stay because of HAUTI.

The majority of HAUTI are endogenous infections caused by the patient's own flora [5,6]. The main risks factors for UTI are 1) urinary catheter, 2) duration of the catheterization, 3) age of the patient, 4) the preoperative stay and 5) female gender [6-10]. Most studies find that the duration of urinary catheterization is the most important risk factor. Guidelines often focus on this aspect of HAUTI [7]. Studies have investigated the effect of infection control precautions. These studies include aspects such as daily evaluation of the indication for catheterization, choice of catheter type, hand hygiene, and training of staff and nursing in the correct indications and care for urinary tract catheters [5,6,11-13].

### Aim of the Study

The aim of this project was to investigate the effect of infection control precautions, mainly the preadmission duration of catheterization, on hospital acquired urinary tract infections in a neurosurgical ward, a neuro-intensive care ward and a neurological ward measured by incidence investigations (incidence rates and incidence densities).

### Materials and Methods

#### Wards

In 2009 an incidence registration of HAUTI was performed for four weeks in the neurosurgical ward (231 patients included) and the neuro-intensive care ward (27 patients included). In October 2010 there was a change in the Neurosurgical department as all head/cranium injured patients in the Capital Region of Copenhagen were admitted to Rigshospitalet, whereas all spinal injured patients were admitted to another hospital. The incidence registration of HAUTI were repeated in 2011 and 2012 in the neurosurgical ward (84 and 170 patients included), the neuro-intensive care ward (11 and 36 patients included) and a neurological ward (155 and 77 patients included).

#### Incidents registration

In 2009 an incidence registration was performed in the neurosurgical ward and the neuro-intensive care ward by the Infection Control Staff looking through patients records daily. All new patients admitted to the ward during a period of 4 weeks were included in the registration, which continued until discharge of the patients from the ward. Thus, the registration included the full length of stay for all patients admitted in these 4 weeks. All patients who were in the ward at 8 a.m. were included in the registration. The criteria for hospital acquired infections were in accordance with the CDC criteria except that bacteriological levels for UTI were  $10^4$  CFU/ml instead of  $10^5$  CFU/ml [12]. The results are expressed as incidence rate (number of hospital acquired infections per 1000 bed days) and incidence density (number of hospitals acquired infections per 1000 catheter days). The incidence registration in 2011 and 2012 were done in the same manner by the nurses in the department after intensive instruction and supervision by the Infection Control Staff.

**Interventions**

Following the incidence registration in 2009 infection control intervention against UTI's were established to reduce the number of nosocomial UTI's in the neurosurgical ward. The infection control interventions against nosocomial UTI in the neurosurgical ward included mainly a reduced urinary tract catheter time in the patients. The time where patients were in the post-operative recovery ward was reduced from 16 - 24 hours to less than six hours before they were transferred to the neurosurgical ward where the urinary tract catheters were removed immediately. In the neuro-intensive care ward and the neurological ward the general infection control precautions were underlined. Because of the close connection between the wards some of the principles from the neurosurgical ward were adapted in the other wards. In 2011 and 2012 there was an increased focus on bed cleaning and the incidence registration increased the focus on nosocomial UTI. Throughout the study period several hand hygiene campaigns were carried out at the hospital.

**Statistical analyses**

Data was analyzed with the chi square test. A p-value less than 0.05 was considered significant.

**Results**

231 patients from the neurosurgical ward and 27 patients from the neuro-intensive ward were included in the incidence registration in 2009. In 2011, 84 patients were included from the neurosurgery ward, 11 patients from the neuro-intensive care ward and in 2012, 170 neurosurgical and 36 neuro-intensive patients were included. At the incidence registration in 2011, 155 patients from the neurological ward were included and in 2012, 77 neurological patients were included.

The data obtained on incidence registration of HAUTI are shown in table 1 and 2. The incidence rate is the total number of HAUTI in patients independent of risk factors, whereas the incidence density is the number of HAUTI in patients at risk because of urinary tract catheter. There is a reduction in all wards in both incidence rate and incidence density during the study period. Most pronounced is the reduction in incidence density of about 90% in the neurosurgical ward where a systematical reduction in the duration of urinary tract catheters was introduced.

Year	Department	No of patients	HA UTI	Incidence rate	Reduction in incidence rate	Incidence density	Reduction in incidence density
2009	Neurosurgery	231	8	7	-	99	-
2011	Neurosurgery	84	4	7	0%	16	84 %
2012	Neurosurgery	170	2	3	57%	6	94%
2009	Neuro-intensive	27	6	25	-	99	-
2011	Neuro-intensive	11	1	13	48%	23	77%
2012	Neuro-intensive	36	7	24	4%	29	71%

**Table 1:** Incidence rate and incidence density of hospital acquired urinary tract infections in a neurosurgical and a neuro-intensive ward in 2009, 2011 and 2012.

HAUTI = Number of patients with hospital acquired urinary tract infections. Incidence rate = HAI UTIs per 1000 bed days. Incidence density = HAUTIs per 1000 urinary tract catheters days.

Year	Department	No of patients	HA UTI	Incidence rate	Reduction in incidence rate	Incidence density	Reduction in incidence density
2011	Neurological	155	15	15	-	38	-
2012	Neurological	77	2	5	67%	19	50%

**Table 2:** Incidence rate and incidence density of hospital acquired urinary tract infections in a neurological ward in 2011 and 2012.

HAUTI = Number of patients with hospital acquired urinary tract infections. Incidence rate = HAI UTIs per 1000 bed days. Incidence density = HAUTIs per 1000 urinary tract catheters days.

In the neurosurgery ward a significant decrease in the number of HAUTI was seen from 2009 to 2011 ( $p < 0.001$ ) and from 2011 to 2012 ( $p < 0.001$ ) so there was a significant decrease in HAUTI from 2009 to 2012 ( $p < 0.001$ ). In the neuro-intensive unit a significant decrease in the number of HAUTI was seen from 2009 to 2011 ( $p < 0.001$ ) but a significant increase in HAUTI was seen from 2011 to 2012 ( $p < 0.001$ ) which result in no significant difference between 2009 and 2012 ( $p < 0.1$ ). In the neurology ward a significant decrease in the number of HAUTI was seen from 2011 to 2012 ( $p < 0.001$ ).

### Discussion and Conclusion

In the neurosurgical ward and the neuro-intensive care ward there has been an increased focus on UTI in relation to duration of urinary tract catheters since 2010. This focus together with the incidence registration and the general infection control precautions caused a significant decline in the number of patients with HAUTI of more than 75% ( $p < 0.001$ ) (Table 1). It is well known that when focus is on specific subjects such as the UTI in this case, the incidence decreases, but it is surprising that the decrease is as high as 50%. Very few studies have been done in HAUTI in neurosurgical wards and thus there is very little literature to compare with. The neurosurgical ward has changed their procedures so that the duration of having urinary tract catheter has been reduced from about 24 hours to less than 6 hours. However, the number of patients included and the number of HAUTI in this study are small and the decline in HAUTI might be a coincidence. It could also be due to the administrative change in the admission of patients to the neurosurgical ward and the different staff doing the incidence registration in the different years.

Despite this tremendous reduction in HAUTI only the neurosurgical ward reaches a level of the average incidence densities obtained in multicenter studies including 36 countries (6 episodes per 1000 catheter days). There is a great variation in the incidence density from 5 to 21 HAUTI per 1000 catheter days [14,15]. Even so, there are still room for improvement in the neuro-intensive care ward and the neurological ward and probably also the neurosurgical ward. In the year between the incidence registration in 2011 and 2012 there was a trail with antibacterial coating of beds going on in all three departments. This may have some effect on the reduction of UTI as there was no special focus on duration of urinary tract catheters in the neurological department, but the duration of urinary tract catheters seems to be the major factor in the reduction of nosocomial UTI as the greatest effect is seen between 2009 and 2011.

Our recommendation for further reduction in HAUTI is a reduction the usage of urinary tract catheters and a reduction in the length of catheters usage when it is applied. For example, the urinary tract catheter should be removed immediately after an operation or at least as soon as the patient is awake. If catheterization is necessary thereafter single use catheterization should be used. In other wards this principle of removing urinary tract catheters and use single use catheters should also be adapted. Even in incontinent patients' other alternatives to urinary tract catheters should be preferred. Even though this will cost extra manpower the cost will be saved by the reduction in extra bed days because of HAUTI. As the majority of HAUTI are endogenous infections the aseptic procedures when installing urinary tract catheters as well as the aseptic nursing of catheters that are not removed within few hours are important factors that should be included in the infection control precautions for preventing HAUTI.

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