

Catheter-associated urinary tract infection (CA-UTI) incidence in an Internal Medicine Ward of a Northern Italian Hospital

Studio di incidenza di infezioni delle vie urinarie in pazienti sottoposti a cateterismo urinario (CA-UTI) presso una Unità Operativa di Medicina Generale

Ilaria Izzo¹, Donatella Lania², Daniele Bella¹, Cesare Formaini-Marioni¹, Romana Coccaglio³, Paolo Colombini^{1,2}

¹Unità Operativa di Medicina Generale;

²Gruppo operativo per il controllo delle infezioni ospedaliere;

³Direzione Sanitaria, Azienda Ospedaliera Mellino Mellini, Chiari (Brescia), Italy

■ INTRODUCTION

Catheter-associated urinary tract infections (CA-UTIs) constitute the most frequent nosocomial infections (40% of world's total) [1-3]. The indwelling urinary catheter (UC) is applied to 15% to 25% of inpatients and is often left in site for a lot span of time [4]. The incidence of UC associated bacteriuria is 3% to 8% for each day of catheterization and the length of catheterization represents the main risk factor for the development of CAUTI [5]. The most recent IDSA (Infectious Disease Society of America) guidelines indicate a series of interventions to be implemented to reduce the risk of CA-UTI. In particular, these are the reduction of use of UC, the use of a sterile approach, and the use of closed circuit system [6]. The necessity of evaluating the frequency of CA-UTI inside our hospital was related to the introduction of the close circuit system, which, albeit considered in literature a strongly recommended practice, does not exclude the keeping of a correct behaviour in management of the UC. The current investigation

has a dual scope: to calculate the basic data of CA-UTI and to monitor through time the efficacy of preventive measures, included use of close circuit.

■ MATERIALS AND METHODS

The inquest took place between June, 2010 and March, 2013. We included in the present study all patients which had a urinary catheter applied during stay in our ward. Patients with bacteriuria or UTI (urinary tract infection) at admission, UC bearers and patients with less than 24 hours catheterism were excluded. All these subjects corresponded to 40% of inpatients. Given the small cohort of patients enrolled in the study, we decided to prolong the observation beyond the scheduled time. We implemented a UTI surveillance form which was presented to the nursing staff. One nurse was established as reference for the data recording. We drew 2 samples of urine before positioning UC for culture and for chemical/physical test. The same operation was performed after removing the UC. On weekly basis health operator picked the forms and checked, assessing the outcome of the surveillance. CA-UTI diagnosis was posed on CDC guidelines criteria (2009) [6]. The study purported five phases:

Corresponding author

Ilaria Izzo

E-mail: izzo.ilaria@hotmail.it

- 1) base epidemiological data with open circuit urinary drainage;
- 2) implementation of closed circuit drainage;
- 3) direct observation of operators behaviour in the management of UC and introduction of improvements, e.g. disposable lubrication catheter, biological sampling device disinfection, improvement of urine bag fixing system;
- 4) surveillance over number of days of catheter permanence, organization of operators formation involving the nurses in project and teaching as leaders for the respective wards. Class was held in four editions between November, 2011 and January, 2012 with the scope of eliminating incorrect attitudes and transferring behaviour of established efficacy in the task of preventing CA-UTI, all in a general environment;
- 5) maintenance of improvement and follow-up strategies.

■ RESULTS

Patients included in the study corresponded to 40% of inpatients. Basic analysis (June, 2010- September, 2010) showed an elevated percentage of CA-UTI: 6 infection over 18 patients (incidence 33%, rate 43.4/1000 days/catheter). During phase 2 (October, 2010-January, 2011), notwithstanding the introduction of close circuit drainage, we reckoned four infections over 10 patients (incidence 40%, rate 39.6/1000 days/catheter). We implemented corrective interventions which during phase 3 (March, 2011-June, 2011) haven't noticed a reduction of the number of cases in CA-UTIs: 10 infections over 25 patients (incidence 40%, rate 39.8/1000 days/catheter). Nonetheless we decided to continue with the prospective analysis; in parallel, we implemented formation stage with the scope of analysis and improvement of management of UC by the nurse staff. During phase 4 (July, 2011-October, 2011) a reduction of number of cases was observed: 8 infections over 25 patients (incidence 32%, rate 35.3/1000 days/catheter). During the following year the formation trail has been concluded; we kept a high alert on the application of all prevention procedures. We reported the incidence study to evaluate results over time (phase 5: October, 2012-March, 2013). We reckoned a net reduction of the incidence of UTI (incidence 7.5% rate 13.6/1000 days/cathe-

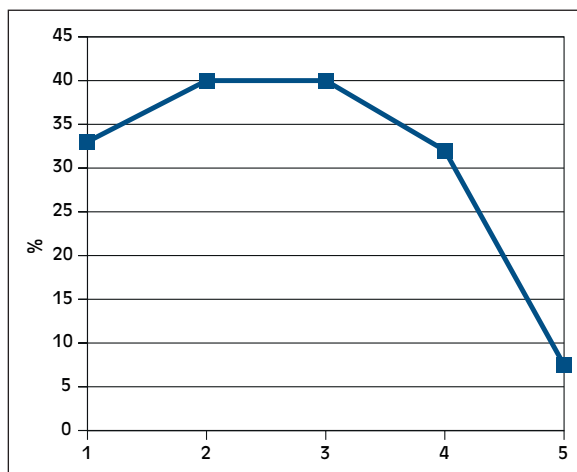


Figure 1 - Incidence of catheter-associated urinary tract infections.

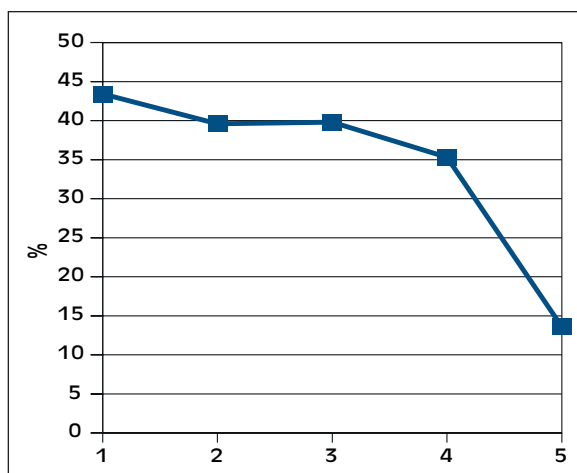


Figure 2 - Rate of infection per 1000 days/catheter.

Table 1 - Microbiological aetiology of CA-UTI.

Phase	No. CA-UTIs	Microbiological aetiology
Phase 1	6	3 <i>Escherichia coli</i> 3 <i>Klebsiella pneumoniae</i>
Phase 2	4	3 <i>Enterococcus faecalis</i> 1 <i>Citrobacter koseri</i>
Phase 3	10	5 <i>Escherichia coli</i> 4 <i>Enterococcus faecalis</i> 1 <i>Morganella morganii</i>
Phase 4	8	6 <i>Escherichia coli</i> 2 <i>Enterococcus faecium</i>
Phase 5	2	1 <i>Proteus mirabilis</i> 1 <i>Escherichia coli</i>

CA-UTIs = catheter-associated urinary tract infections.

ter, Figure 1 and Figure 2; $p=0,025$, phase 1 to 5). Microbiological aetiology of CA-UTI is shown in Table 1.

■ DISCUSSION

The basic analysis has shown a UC related infection incidence of 33% attributed to the use of the open circuit drainage system. Nevertheless in phase 2 with the introduction of the closed circuit drainage system, as suggested by data in literature, we did not obtain the expected reduction of infection date (40%) [7]. From a critical analysis of the data emerged at least two biases which limit the correct interpretation of data: the small number of cases involved (related to the low statistic power of study), and the difficulty of discrimination of asymptomatic bacteriuria from CA-UTI, particularly in UC diabetic bearers, in which the symptomatology is less evident. Independently from any possible biases, the obtained results brought us to reflect on positioning procedures and management of the indwelling UC by nursing staff; these are fundamental as well in the prevention of CA-UTI [8]. Where we found improvable assistant procedures (*e.g.*, disposable lubrication catheter, biological sampling device disinfection, improvement of urine bag fixing system) we

implemented several correction facts, albeit these didn't yield a significant reduction of CA-UTI cases in phase 3 (40%). This datum could be justified by the lack of awareness by nursing staff regarding the importance of the suggested intervention which were felt as an imposition from the health coordinator. We therefore implemented formation stage with the scope of analysis and improvement of management of UC by the nurse staff. Such an educational action determined a net reduction in the number of cases of CA-UTI in the last period of the study (2 over 27 patients incidence 7.5% rate 13.6/1000 days/catheter).

Albeit limited by a low statistical power, the implementation of the closed circuit drainage system, a multimodal approach with the direct involvement of operators in the formation process, peer to peer formation, the sharing of the knowledge, a tenacious approach to the critical analysis of operational situations, have shown a continuous behavioural improvement which has directly translated into an efficacious prevention of CA-UTI.

ACKNOWLEDGEMENTS

Special thanks go to the nursing staff of the internal medicine ward, Chiari Hospital.

Keywords: urinary tract infection, urinary catheterism, nurse training.

SUMMARY

Catheter-associated urinary tract infections (CA-UTI) are estimated to be the most frequent nosocomial infections (40%). A catheter is introduced to 10-25% of inpatients, and is often left on site for a long period of time. We carried out a prospective study on inpatients of our Internal Medicine ward to assess the incidence of CA-UTI under the implementation of corrective action. All inpatients who underwent introduction of a urinary catheter upon or after admission to our ward were included in the study. Patients with bacteriuria or positive urine culture before catheterization, others with less than 24 hours catheterism, or bearing a catheter on admission were all excluded from the study. CA-UTI diagnosis was assessed on the basis of CDC 2009 guidelines. The investigation was held between June 2010 and March 2013 in five steps or phases. In the first phase open circuit drainage catheterism was used, in the second phase close circuit drainage catheterism was introduced, while in the third phase disposable lubrication was added to closed circuit drainage catheter-

ism. In the next step (phase 4) we introduced number of days of catheterism control and nurse training; in the last phase (5) emptying urine collection bags on a container was added. In phase 1 we estimated six UTIs out of 18 patients (incidence 33%), in phase 2 we had four infections out of 10 patients (40%). Given the results, we had to reflect on the quality of the procedures of catheter positioning and management. Where feasible, we improved technical practices and during follow-up there was evidence of CA-UTI in 10 patients over 25 (phase 3, 40%), and eight infections over 25 (phase 4, 32%). Once all these steps had been implemented, in phase 5 we determined a sharp reduction in CA-UTI (2 patients over 27, or 7.5%, $p=0.025$). This improvement was particularly evident in the rate of infection per days of catheter, which was reduced from 43.4/1000 to 13.6/1000. Although the statistical power of the present study has its limitations, we attained a significant reduction in catheter-associated UTIs through the implementation of close circuit catheterism and improvements in care practices.

RIASSUNTO

Le infezioni delle vie urinarie correlate al cateterismo vescicale (CA-UTI) costituiscono le più frequenti infezioni nosocomiali (40%) nel mondo. Il catetere urinario viene posizionato al 15-25% dei pazienti ricoverati e viene spesso mantenuto in sede a lungo.

Abbiamo condotto uno studio prospettico presso la Unità Operativa di Medicina Generale del nostro Ospedale allo scopo di valutare l'incidenza delle CA-UTI in relazione alla messa in atto di interventi correttivi. Sono stati inclusi nello studio tutti i pazienti a cui veniva posizionato un catetere urinario durante la degenza; sono stati esclusi i soggetti con batteriuria o urinocoltura positiva al momento del cateterismo, cateterizzati per meno di 24 ore e portatori di catetere al momento del ricovero. La diagnosi di CA-UTI è stata posta sulla base dei criteri riportati dalle Linee Guida dei CDC del 2009. L'indagine è stata svolta dal giugno 2010 al marzo 2013 in 5 fasi. In una prima fase è stato utilizzato il cateterismo con drenaggio a circuito aperto, in una seconda fase è stato introdotto drenaggio a circuito chiuso, successivamente (fase 3) è stata aggiunta la lubrificazione monouso del catetere. Nella quarta fase è stato introdotto il controllo sui giorni di cateterismo ed è stato formato il personale infermieristico, infine (fase 5) a tutte le misure introdotte in

precedenza è stato aggiunto lo svuotamento delle sacche con utilizzo di bidoncino.

Nella fase 1 dello studio sono state individuate 6 infezioni delle vie urinarie in 18 pazienti (tasso di incidenza del 33%), nella fase 2, 4 infezioni su 10 pazienti (tasso di incidenza 40%).

Tali risultati hanno portato a riflettere anche sulla qualità delle procedure di posizionamento e di gestione del catetere vescicale. Laddove sono state individuate pratiche assistenziali migliorabili, sono stati posti interventi correttivi. Nelle fasi successive si sono evidenziate 10 infezioni in 25 pazienti (fase 3, 40%) e 8 infezioni in 25 pazienti (fase 4, 32%).

Una volta messi in atto la totalità degli interventi correttivi, nella fase 5 si è assistito ad una netta riduzione dell'incidenza di infezioni delle vie urinarie (2 su 27 pazienti, 7,5%, $p=0,025$). Tale miglioramento è stato particolarmente evidente nel tasso di infezioni delle vie urinarie su 1000 giorni catetere, che si è ridotto dal 43,4/1000 giorni di cateterizzazione al 13,6/1000 giorni di cateterizzazione.

Pur nei limiti relativi alla potenza statistica dello studio, attraverso l'utilizzo del sistema di drenaggio a circuito chiuso e il miglioramento delle pratiche assistenziali, abbiamo ottenuto una netta riduzione dell'incidenza di CA-UTI.

REFERENCES

[1] Tambyah P.A. Catheter-associated urinary tract infections: diagnosis and prophylaxis. *Int. J. Antimicrob. Agents.* 24, S44-S48, 2004.

[2] Esposito S., Emmi V., Mennini F.S., Montorsi F., Sganga G., Leone S. Management and prevention of catheter-associated urinary tract infections: current opinions and clinical practice. *Infez. Med.* 19, 74-90, 2011.

[3] Esposito S., Noviello S., Leone S. Catheter-associated urinary tract infections: epidemiology and prevention. *Infez. Med.* 16, 130-143, 2008.

[4] Garibaldi R.A., Burke J.P., Dickman M.L., Smith C.B. Factors predisposing to bacteriuria during indwelling urethral catheterization. *N. Engl. J. Med.* 291, 215-219, 1974.

[5] Classen D.C., Larsen R.A., Burke J.P., Stevens L.E. Prevention of catheter-associated bacteriuria: clinical trial of methods to block three known pathway of infection. *Am. J. Infect. Control.* 19, 136-142, 1991.

[6] Hooton T.M., Bradley S.F., Cardenas D.D., et al. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin. Infect. Dis.* 50, 625-663, 2010.

[7] Kunin C.M., McCormack R.C. Prevention of catheter-induced urinary-tract infections by sterile closed drainage. *N. Engl. J. Med.* 274, 1155-1161, 1966.

[8] Oman K.S., Makic M.B., Fink R., et al. Nurse-directed interventions to reduce catheter-associated urinary tract infections. *Am. J. Inf. Contr.* 40, 548-53, 2012.