

The Most Common In-Hospital Causative Agent of Bladder Catheter-Associated Lower Urinary Tract Infection

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ABSTRACT

Urinary tract infections are caused by an erroneous placement of catheters, This is because it is considered an invasive technique of very common hospital use, which will provide a great benefit to the patient and quite useful for the doctor.

The identification in the different hospital centres of the correct technique has to be achieved to achieve an effective sterile placement and obtain a benefit rather than a harm to the patient. However, the fact of having to identify the correct techniques has shown certain deficiencies among health personnel who are in charge of these procedures.

It is known that the placement of catheters by extraluminal route, has a higher incidence of infection because it is placed ascendingly and is the most common way to cause a urinary tract infection.

In a large majority of infections, its causative agents are given by Gram-negative bacteria and with the appearance of resistance to antimicrobials, it has become a great concern on the part of health personnel. At the same time, it is necessary to recognize the need to indicate antimicrobial therapy when placing the catheter.

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INTRODUCTION

Urinary tract infection is defined as the set of signs and symptoms that occur at the time when the anatomical areas that cover the urinary tract are colonized by bacteria, fungi and viruses, capable of producing an immune response and therefore reflecting symptomatology in the patient.

Reports have been found where urinary tract infections are positioned in the first places of frequency worldwide, and that has been a constant increase related to various factors involved, such as a misuse of drugs such as antibiotics, causing a diverse resistance to pathogens, making them fewer effects against treatment schemes.

The pathogenesis of this entity includes a damage to the long urinary tract, where its integrity is affected. Among the factors that could favour bacterial colonization are: poor hygiene, sexual relations, and the use of vesicles probes commonly used in the hospital environment.

These factors allow the easy entry of pathogens into the urinary sterile environment, most often accessed by ascending route.

In this research work, the pathology of Urinary Tract Infections acquired in an intrahospital manner through the use of urethral probes will be exposed, focusing on presenting the most common pathogens that cause these infections both in patients who use the probe acutely, as well as in those patients who both their in-hospital stay and the use of a probe is chronic.

Also, important aspects that have influenced the progressive increase of these infections will be presented, as well as the reason why there is antimicrobial resistance at this level.

In addition, it will talk about how the development of bacterial colonization begins once a bladder catheter is installed, and therefore the development of some methods that allow preventing the key point of pathogenesis.

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Important aspects of antibiotic therapy therapies will be reflected, as well as some steps for decision-making when indicating them to patients taking into account the pathogen involved, as well as the time of evolution that is had with the probe and with the infection.

THEORETICAL FRAMEWORK

A urinary tract infection (UTI) is applied to a wide variety of clinical conditions that vary according to their anatomical location, presenting asymptomatic infections which may go unnoticed,

And even a more complicated picture where there could be an anatomical compromise of the affected area, the prevalence is an increase in the female sex, given the anatomical location of the urethra.

They are classified by their location into:

- Superior: (ascending route) pyelonephritis and renal abscess.
- Lower: cystitis, urethritis and prostatitis
- Associated with bladder catheters¹

The infection can occur at different points in the urinary tract, including:

- Kidneys: An infection of one or both kidneys is called pyelonephritis or kidney infection.
- Bladder: A bladder infection is also called cystitis or bladder infection.
- Urethra: An infection of the tube that carries urine from the bladder to the outside is called urethritis.²

Urinary tract infections are the second leading cause of hospital-acquired infections. Where it is estimated that about 145,000 people had an infection in 2010 and increasing. Strategies such as avoiding the use of the catheter, aseptic insertion, and a short time of use are recommended, which can reduce up to 50% of getting a urinary tract infection.³

Urinary tract infections associated with bladder catheters are one of the invasive techniques that most frequently occur in hospitals to establish a drainage route, temporary, permanent or intermittent, from the bladder to the outside for diagnostic and/or therapeutic purposes and is the most predisposing factor to develop a urinary tract infection, affecting approximately 75% of urinary tract infections. InWhichere are different routes of access of microorganisms to the bladder:

- a) During catheter insertion when microorganisms present at the distal end of the urethra are dragged inward.
- b) Once the bladder catheter is placed, microorganisms can access the bladder by two mechanisms:

- Extraluminal or perisonal route. It is the most frequent route. Once the bladder catheter is in place, the layer of periurethral mucus that lies in the space between the outer surface of the urethra and the probe would make it easier for germs to ascend through a retrograde motion.
- Endoluminal pathway. The bacteria reach the bladder by the internal light of the bladder catheter, playing here a very important role in the prevention of the closed drainage system. The most frequently contaminated points are the connection of the probe and the collection tube and the drain valve of the closed-loop bag.⁴

Urinary tract infections continue to be one of the most important nosocomial infections in the Intensive Care Unit. Like the rest nosocomial infections, urinary tract infection causes a prolongation of the hospital stay (an average of 4 days), patient discomfort as well as an increase in health costs. In this way, a decrease in the incidence of these infections would be an indicator of the quality of patient care.⁵ Although the placement of intravesical catheters in hospitalized patients is a very common process, especially in those undergoing surgical processes. The national guidelines mention that the removal of the catheter should be as timely as possible, as long as it is no longer necessary for the patient's health, while most expert surgeons mention that such removal should not exceed 2 days. Since these measures are established by the fact that the presence of such devices predisposes to colonization by bacteria and the subsequent development of a UTI. The bacterial resistance associated with urinary tract infections acquired in the hospital environment, it has been increasing by 40% over the last few years.⁶

The most isolated pathogens in this type of infection have been Gram-negative bacteria, candida spp., and Gram-positive bacteria and above all have been found associated with patients who are subjected to instrumentation with intravesical catheters 25%. As well as the incidence, mortality and hospital stay of people have increased.⁷

It has also been found that the deficiency of knowledge of doctors and staff in charge of the placement of bladder catheters is a problem since they do not always carry a procedure in the placements of the same, so the risk of acquiring a urinary infection, as a result, has increased. Although most of the personnel in charge knew how to prevent catheter-associated urinary tract infections (UTIs), not all the personnel in charge knew how to identify it, as a more common consequence were urinary tract infections and

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a lower percentage of some doctors knew the appropriate and inappropriate indications for a good catheterization in different clinical scenarios obtaining a satisfactory result.

In addition to the fact that in some hospitals there are several specialities which with a higher percentage were observed that in the Intensive Care Unit (ICU) of Resuscitation, Neurosurgery, Internal Medicine, General Surgery, Neurology, were the ones that had the most bladder catheter infections. The measures taken to avoid these consequences were that the catheter should be changed at least once a day in intensive care patients (ICUs). As well as the effectiveness of some types of bladder catheters, since compared to common polyurethane catheters, given the ability to inhibit bacterial proliferation, most of the time they are not the most effective.⁸

It is also known that in some research that was carried out in the field of medicine, it was determined that latex catheters with silver alloy did not present a marked difference compared to polyurethane catheters. On the other hand, the silicone probe impregnated with nitrofurantoin like the other types of the probe did not develop any infection. This relationship is associated with the fact that Nitrofurantoin has a lower propensity to develop bacterial resistance, in addition to the fact that silicon would contribute to a greater and better antimicrobial effect, compared to probes made with latex.⁹

It is important to know the techniques used for urinary catheterization, as well as the technique used for it. In several studies, the following have been obtained:

- Periurethral cleaning done with tap water, sterile water, and antiseptic solution (chlorhexidine and PVP-I) were not associated with urinary tract infection
- Intermittent catheterization is the safest procedure and has the lowest rate of complications and UTIs, compared to permanent catheterization
- The clean technique can be used as an alternative to the sterile technique in intermittent self-probing at home
- Catheters coated with silver alloy and antibiotics, when used for a period of up to a week, compared to common catheters (silicone, silicone hydrogel with, latex and PVC) reduce bacteriuria and UTI and silver alloy coated catheters reduce bacteriuria and UTI, even when the catheter remains in situ for an extended period
- The use of lubricating gel with PVP-I reduces contamination of the bladder with microorganisms during self-catheterization and in intermittent catheterization carried out by family members and caregivers at home.
- It is recommended that indwelling catheters remain in place for 24 hours after surgery to reduce rates of symptomatic UTIs and other complications

- Early removal of indwelling catheters in surgical patients is associated with a reduction in the risk of urinary tract infection and shorter hospital stays, but also with an increased risk of urinary retention removed at midnight is recommended in patients undergoing urological and gynaecological surgery¹⁰.

Beyond the component or material of which the probe is composed, it has been found that persistence by not removing them in time or the unjustified use of urinary catheters allows, in addition to bacterial colonization, to serve as an immunostimulant that generates specific damage, this by mechanisms such as sterile inflammation, oedema, which consequently will bring production of cytokines and inflammation of myeloid cells, all this in just 24 hours after catheterization, this generates damage to the cell wall of the structures that make up the urinary tract thus generating abnormal entry pathways for infectious agents.

The importance of taking into account these data is that in the hospital environment it is well known that hospitalized patients who require a catheter are mostly patients who are immunosuppressed which makes them a risk group to suffer or develop a UTI associated with catheterization¹¹.

Currently, the use of probes in most health services is stigmatized, this means that in many cases the clinical situation in which the patient is is not analyzed and falls into the error of placing probes in patients who do not have pathologies or conditions that make them suitable to receive them, Many health organizations have begun to notice this phenomenon, which is why they have begun to implement protocols where patients in health services in both the private sector and the general sector are subjected to an evaluation, where they are evaluated, to see if they are candidates to receive probing, to cite an example: probe those patients suffering from an obstructive condition or urinary retention.¹²

The protocol is based on 4 measures

- 1- an aseptic technique during catheter insertion.
- 2- Daily review of the need to maintain the catheter, removing it as soon as possible.
- 3- Avoid the unnecessary use of time urinary catheters.
- 4- Maintain the use of urinary catheters (UC), only when they are based on the recommended guidance documents.

The implementation of the protocol in intensive care units presents a linear negative correlation to the reduction of cases of incidence of urinary tract infection over the course of the months.

In addition, it is also important that patients who are hospitalized leave the health unit promptly since it is

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beneficial to reduce the length of stay of patients receiving treatment for infections since mortality is reduced.

Similarly, continuing education and protocol maintenance may have favourable effects in reducing cases of urinary tract infections¹³.

In the same way, all health members must be willing to follow up on patients and thus remove the probes promptly in those patients who no longer need them and thus avoid, triggering a mechanism of bacterial colonization plus immune response which facilitates the probed patient to develop a UTI.

That is why emphasis must be placed on the need for health professionals, regardless of their hierarchy, position or level in their institutions, to implement protocols that avoid the misuse of probes by classifying patients who are actually candidates to receive urinary catheterization, as well as avoiding their unnecessary use leaving aside the stigmatization that has been generated, by placing urinary catheters to all types of patients without knowing their history or the reasons for their admission to whatever the health unit where they are treated and encouraging the timely removal of them to prevent the catheter from ceasing to be a therapeutic measure and functioning as an environment conducive to the development of urinary tract infection, it is important to go down steps and educate the patient from the first contact, and carry this information in a systematized way for a good management of the patient, consistency is needed when ordering the placement of urinary catheter, and verify if the patient being treated is actually a candidate for it, and thus avoid unnecessary expenses and most importantly perpetuate the integrity of the patient.¹⁴

DISCUSSION

Urinary tract infections associated with hospital services are frequent and represent a serious problem for health personnel and patients, given that it has been proven through the studies mentioned in this work, that there is a greater probability of death, greater hospital stay, higher prevalence of complications and a much higher expenditure by health services. It is also clear and has been proven in various research papers, that instrumentation, particularly the placement of intravesical catheters, is the most frequent cause of development of urinary tract infections, as has been seen in works such as those of B.G. Mitchell et.al. in which it was observed that 17% of hospital infections in general, are IVUs. The study we present aims to determine the generalities of in-hospital IVUs, and particularly the data associated with the etiological agents most related to these infections.

In general terms, the epidemiological data obtained were quite similar in almost all the studies, except for some discrepancies that were observed in some investigations, for example, only one of the 10 articles reviewed for this work obtained that the population most affected by intrahospital

IVUs were *Keten men et.al.*, while the rest concluded that women have a higher risk of presenting these infections, especially due to the fact of the anatomy of the female urethra, likewise in this same study it was concluded that the most frequently isolated organisms in the cultures of patients with in-hospital IVUs were *Klebsiella* and *Candida spp.*, while in all other studies *E.coli*, was the most related bacterium. This can perhaps be explained by the fact that it is a study conducted in Turkey and the intrahospital pathogens in that country have a different virulence than those in other countries.

In some studies, in particular, prophylactic methods were also reviewed, to prevent these infections from attacking patients and thus reduce the rate of complications associated with them, of the studies, reviewed perhaps the most conclusive were those of *Pickard et.al.* and *Falci-Ercole et.al.*, in which it was observed that the most practical ways to prevent the development of IVUs Intrahospital, were the use of an adequate technique for the placement of the same and the use of catheters impregnated with antimicrobials, particularly those made of latex with nitrofurantoin.

CONCLUSIONS

In this study it was possible to know that there is certainly a close relationship between the placement of an indwelling catheter to a patient during his hospital stay with an increase in the incidence of urinary tract infections, this is mainly given by irregularities in the technique applied at the time of placing a catheter by health personnel. Where no differences were found in terms of catheter material, however, the different techniques of glove placement, hand washing and even the use of sterile material that is contaminated are some factors that contribute to an increase in the incidence of urinary tract infections in the hospital type.

It was further recognized that the use of antimicrobial prophylaxis after removing the indwelling urinary catheter experienced a reduction in the number of infections, however, one of the main drawbacks found is based on antimicrobial resistance, which causes conflict for doctors, which is worrying.

It was concluded that it is of vital importance to reduce the time of in-hospital stay to avoid other possible complications and expenses for the patient. Since it is a very commonly used invasive technique, correct placement is necessary.

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