Review Article

Urinary Tract Infection After Vaginal Repair Surgery

H. A. Schiøtz
Hamar Hospital, Hamar, Norway

Abstract: Catheter drainage of the bladder is commonly used after vaginal repair surgery to avoid urinary retention. Catheter use is the main risk factor for postoperative urinary tract infection, and the risk increases with the duration of catheterization. The risk is reduced with closed collecting systems and with suprapubic drainage. Prophylactic use of antimicrobial drugs may also reduce the risk, but the most important point is to keep the catheter time down. The article reviews the various aspects of asymptomatic bacteriuria and urinary tract infection after vaginal repair surgery and provides recommendations.

Keywords: Bacteriuria; Catheter; Infection; Urinary bladder; Vaginal surgery

Introduction

Vaginal repair operations may cause impaired postoperative voiding and urinary retention. Postoperative catheter drainage of the bladder is therefore often used, either by the transurethral or the suprapubic route.

Urinary tract infection (UTI) is the commonest nosocomial infection and mainly follows urinary catheterization [1]. In most cases the infection is mild and easily treated, but postoperative UTI is a cause of increased morbidity, cost and mortality [2-5] and prevention of catheter-associated bacteriuria reduces mortality [6]. When indwelling catheters are used, 5%-10% of patients develop bacteriuria each day [7-9]. Bacteremia occurs three times more often in patients with bacteriuria than in patients with sterile urine [10]. Although higher rates of postoperative UTI with longer operating time have been reported [11], the main risk factor for UTI after vaginal repair operations is the use of an indwelling catheter.

A number of different terms and definitions are in use. Commonly used terms include asymptomatic bacteriuria (AB), significant bacteriuria, catheter-associated bacteriuria, catheter-associated infection, significant infection and urinary tract infection. Different reports variously define infection as bacteriuria above a certain level (10^2-10^5 cfu/ml), with or without pyuria, and with or without symptoms or signs of infection. Few reports differentiate clearly between asymptomatic bacteriuria and symptomatic infection.

Definition

In every-day medical practice, urinary tract infection is usually defined as bacteriuria exceeding 10^5 colony-forming units (cfu) per ml in a culture specimen, without regard as to whether or not the patient is catheterized. This definition is based mainly on the work of Kass [12] who showed that bacteriuria >10^5 cfu/ml in a clean voided specimen from an uncatheterized patient was unlikely to be due to contamination. However, 10^5 is a statistically determined figure with an 80% confidence limit, and for single specimens a false positive rate of 20% is possible. Further, levels of bacteriuria below 10^2/ml do not exclude UTI. In women with pyuria and symptoms of UTI, counts of coliforms >10^2/ml may consistently be found in clean-catch specimens, indicating that 10^2 is a suitable cutoff in such patients [13].

In catheterized patients, low levels of bacteriuria will
usually progress above $10^5/ml$ within 72 hours if untreated [14]. Colony counts of $10^4$ [9], $10^3$ [5] or even as low as $10^2/ml$ [14] may more appropriately be considered significant in catheterized patients, and levels of $10^2/ml$ [15,16] or $10^3/ml$ [9,17] are in fact now more commonly chosen.

**Mechanisms of Infection**

The healthy urinary tract is normally sterile except for a few bacteria in the urethra [18,19], although AB is seen in from 2% of girls to 15% of postmenopausal women [20]. Whether asymptomatic bacteriuria eventually develops into symptomatic infection depends on the number of bacteria present in the bladder, their virulence and the bladder defense mechanism. This includes emptying of the bladder by voiding, the pH, osmolality, urea concentration and the uromucoid content of the urine, and mucosal factors such as secretory IgA and IgG and other anti-adherence mechanisms [21–24].

The normal bladder has a great capacity for resisting infection [21,25]. Bacteriuria in functionally intact urinary tracts in otherwise healthy individuals, e.g. after removal of a catheter, will not usually develop into clinical infection but will clear spontaneously [25,26].

An indwelling catheter with its drainage tube and collecting bag represents an extension to the urinary tract and provides direct access to the bladder. Organisms entering this system may multiply rapidly in the stagnant urine, out of reach of the bladder's defense mechanisms. The catheter may also irritate or damage the bladder mucosa, further predisposing to infection. Distension of the bladder, before a catheter is introduced or because of catheter obstruction, reduces blood flow in the bladder wall and may also inhibit bladder defense. This was Lapides' [27] rationale for advocating intermittent self-catheterization.

It is also possible that the general impact of an operation may weaken the bladder defenses, leading to an increased risk of postoperative infection. In one recent study [28], transient bacteriuria was seen in more than 20% of patients after vaginal or abdominal gynecological operations, in addition to symptomatic infection occurring in 40%. These rates were unrelated to catheterization.

**Routes of Infection**

Organisms causing catheter-associated UTI may ascend to the bladder in three ways: by introduction from the perineum or urethra during catheter insertion, through the catheter lumen, or in the mucofilm along the outside of the catheter.

Contamination due to catheter insertion may be reduced by rigorous attention to proper sterile technique but some bacteria from within the urethra will still be carried into the bladder. Prophylactic antibiotics given during insertion have been shown to reduce contamination and delay colonization [29].

Colonization of the collecting system rapidly leads to bacteriuria by intraluminal spread [14], and open drainage was previously the most important cause of catheter-associated bacteriuria [9]. Closed drainage is very important in reducing the risk of infection [6,7,30–32]. It is however, often difficult to maintain the closed system intact [6,7,32] as the catheter–tube junction may be broached for a variety of reasons, such as by accident or for irrigation. Catheters with a sealed drainage system may be preferable [6,33], since breaking their integrity is physically difficult and requires a conscious decision. Commercially available presealed units are more costly than standard catheters but their use may still be cost-effective [33]. When standard catheters are used the junction may be sealed with tape at low cost.

In a closed system, urine is drained from the collecting bag through a valve. Collecting systems where the bag is replaced when full are not truly closed, and carry about twice the risk of bacteriuria as an unbroken closed system.

The third route of infection is migration of bacteria in the pericatheter mucous sheath [15,34,35]. This becomes the major pathway when closed drainage is used [15]. When catheter-associated infection occurs, the infecting strain may often be found at the urinary meatus or in the perineum [15,17,35].

A variety of meatal care routines to reduce the risk of bacterial ascent have been tried, mostly with disappointing results [36], and several commonly used regimens actually increase the risk of infection [36]. They are unlikely to be cost-effective and are not recommended.

Also of importance is cross-infection in the ward [7,8,37], emphasizing the need for optimal hygienic measures for all catheter handling. Epidemics of nosocomial UTI have been caused by bacteria being carried from patient to patient on the hands of nursing personnel [37].

**Preoperative Risk Factors**

Female sex, old age, diabetes mellitus, debilitating disease and hospitalization are important general risk factors for catheter-associated bacteriuria [1,7,26] and other complications. Preoperative asymptomatic bacteriuria (AB) also predisposes to postoperative infection [20]. In eight studies (Table 1) which include information on AB before vaginal repair surgery, 94 of a total of 929 patients (10.1%) had AB, usually by E. coli [11,20,26,28,38–41]. The range was 7.0%–24.3%. This risk factor is avoidable by preoperative urine culture and appropriate treatment. It has also been shown that postmenopausal women with recurrent