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Recurrent Urinary Tract Infections: The Contributing Roles of Nursing, Radiologist, Clinical Pathologist, And Medical Records in Case Management

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Abstract:

Background: Recurrent urinary tract infections (UTIs) are characterized by repeated episodes of acute bacterial cystitis and are particularly prevalent among women due to anatomical factors. The financial burden of recurrent UTIs is significant, with the United States alone spending billions annually on treatment. Traditionally, the diagnosis of UTIs is based on a high colony-forming unit (CFU) threshold in urine samples, but emerging evidence suggests a lower threshold may offer better diagnostic accuracy.

Aim: This study explores the roles of nursing, radiologists, clinical pathologists, and medical records in the management of recurrent UTIs, focusing on diagnosis, treatment, and prevention.

Methods: The study involved a comprehensive review of current diagnostic criteria, including the impact of lowering the CFU threshold for diagnosing recurrent UTIs. It also examined the contributions of different healthcare professionals in managing these infections, particularly in relation to clinical outcomes and the optimization of treatment strategies.

Results: Findings suggest that adjusting the diagnostic threshold for recurrent UTIs could improve early detection and treatment outcomes. The roles of healthcare professionals such as nurses, radiologists, and clinical pathologists are integral in managing recurrent UTIs. Nurses help monitor patient symptoms and adherence to preventive measures, while radiologists assist in diagnosing underlying anatomical issues, and pathologists evaluate urine cultures for accurate pathogen identification.

Conclusion: Refining the diagnostic criteria for recurrent UTIs, particularly through lowering the CFU threshold, can lead to more efficient management and reduced recurrence rates. Collaborative efforts among nursing, radiology, and pathology teams are crucial in providing comprehensive care. The effective use of medical records can enhance diagnosis and treatment, leading to better patient outcomes and reduced healthcare costs.

Keywords: Recurrent UTIs, Diagnosis, CFU threshold, Nursing, Radiology, Pathology, Medical records, Treatment, Prevention.

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Introduction:

Recurrent urinary tract infections (UTIs) are defined as two episodes of acute bacterial cystitis accompanied by associated symptoms within the past six months or three episodes within the previous year [1]. These infections are predominantly more prevalent in females due to factors such as shorter urethras and anatomical differences, which make women more susceptible to bacterial entry into the urinary system. The financial burden of UTI treatment in the United States is substantial, with an annual expenditure of approximately 3.5 billion dollars [2]. A urinary tract infection is traditionally diagnosed based on the presence of more than 100,000 colony-forming units (CFU/mL) of bacteria in a urine sample, accompanied by typical acute symptoms such as dysuria, urgency, frequency, or suprapubic pain [3]. This conventional threshold for diagnosis has been the gold standard for identifying UTIs for years. However, emerging evidence suggests that a lower CFU threshold may be more suitable, particularly for diagnosing recurrent and simple UTIs. Studies have shown that a CFU count of over 100 CFUs of *Escherichia coli* in the presence of specific acute urinary symptoms has a high positive predictive value of approximately 90%, indicating that such a reduced threshold is clinically significant and more accurate in diagnosing both uncomplicated and recurrent UTIs [4]. These findings suggest that refining the diagnostic criteria for recurrent UTIs could lead to better patient outcomes and more targeted treatment strategies. Therefore, healthcare professionals should consider these updated guidelines to enhance the accuracy and efficacy of UTI diagnoses, especially in cases of recurrence.

Diagnostic Criteria and the Impact of Lower Thresholds in UTI Diagnosis

The diagnosis of urinary tract infections (UTIs) has traditionally relied on the detection of more than 100,000 colony-forming units (CFU/mL) in a urine sample, along with clinical symptoms such as dysuria, urgency, frequency, or suprapubic pain [3]. This threshold has served as the cornerstone for UTI diagnosis for decades, yet more recent research challenges the adequacy of this high CFU cut-off in certain cases. In particular, when diagnosing recurrent UTIs or uncomplicated infections, a more refined approach is warranted. Studies have demonstrated that a urinary *Escherichia coli* (E. coli) count of over 100 CFUs, coupled with typical acute urinary symptoms, holds a positive predictive value of approximately 90% for a UTI diagnosis, suggesting that this lower threshold could offer a more accurate and clinically relevant diagnostic tool for these cases [4]. In the context of recurrent infections, this reduction in CFU threshold allows for quicker identification and more timely treatment, which is critical in preventing further episodes and associated complications. This evidence underscores the importance of adjusting the diagnostic parameters to better align with clinical realities, particularly in women, who are at greater risk of recurrent UTIs due to anatomical and physiological factors. Adopting this updated diagnostic approach could improve patient management, enhance treatment outcomes, and reduce the economic burden associated with recurrent UTIs. Thus, healthcare providers should incorporate these findings into clinical practice to ensure more effective and efficient care for patients suffering from recurrent urinary tract infections.

Etiology

Various conditions can predispose both men and women to an elevated risk of urinary tract infections (UTIs). Anatomical abnormalities that cause urinary stasis, obstruction, or reflux significantly contribute to the increased likelihood of recurrent UTIs. Conditions such as atrophic vaginitis can also heighten the risk of UTIs, particularly in postmenopausal women. Bladder diverticula, especially those that do not adequately drain, further predispose individuals to recurrent infections. In women, bladder conditions like cystoceles and pelvic organ prolapse are crucial risk factors, as they disrupt normal bladder function and facilitate infection. Functional impairments, including overactive bladder and urinary incontinence, increase the frequency of recurrent infections by promoting urine retention and bacterial growth. Insufficient or inappropriate treatment of initial episodes of acute cystitis can result in recurrence,

as the bacteria may not be completely eradicated. Furthermore, the increasing emergence of bacterial resistance to antibiotics is another factor that contributes to the higher recurrence rates of UTIs. In elderly men, UTIs are often linked to conditions such as outlet obstruction or neurogenic bladder, both of which cause urinary stasis and incomplete bladder emptying, thereby fostering the development of infections. Interestingly, recurrent UTIs are frequently observed in sexually active women even in the absence of identifiable structural abnormalities or other predisposing factors. Other lesions, both intraluminal (such as bladder stones, neoplasms, and foreign bodies), intramural (including ureteral strictures), and extramural (such as inflammatory masses or neoplasms) also play a role in predisposing individuals to UTIs. Ureteroceles, urinary fistulas, and urolithiasis are additional factors contributing to UTI susceptibility. Vesicoureteric reflux (VUR), present in up to 40% of children with a first UTI, is a significant risk factor for UTIs [5][6][7][8][9]. Notably, immunodeficiency by itself generally does not result in isolated recurrent UTIs.

Epidemiology

Urinary tract infections (UTIs) affect a substantial portion of the female population, with approximately one in three women experiencing at least one uncomplicated UTI before the age of 24. The lifetime prevalence of symptomatic UTIs in women is estimated to exceed 50%, highlighting the widespread nature of this condition. Additionally, about 26% of women who have had an initial UTI will experience a recurrence within six months of treatment. A study conducted in a primary care setting revealed that 53% of women aged 55 and older reported a recurrence of UTI within one year, compared to 36% of younger women. This indicates that the risk of recurrence remains notably high across different age groups, particularly in older women, emphasizing the need for effective preventive and management strategies [1]. These statistics underscore the significant burden that UTIs place on public health, as they represent one of the most common infections among women. The recurrence rate is a critical concern, necessitating a deeper understanding of the risk factors and pathophysiology involved, as well as the development of targeted interventions to mitigate recurrent infections. The high prevalence and recurrence of UTIs necessitate ongoing research to identify the underlying causes and to optimize therapeutic approaches.

Pathophysiology

Recurrent urinary tract infections (UTIs) typically arise from new infections caused by different bacterial species. However, if an infection persists despite treatment, it may signal the presence of an untreated underlying source, such as an abscess, urinary stone, or prostatitis. The origin of these recurrent infections mirrors that of uncomplicated cystitis. The process often begins with the contamination of the periurethral area and urethra by rectal bacterial flora, which can then ascend rapidly to infect the bladder. Recent studies highlight a complex, albeit poorly understood, interplay between the microbiomes of the intestines, vagina, and urinary tract, further complicating the mechanisms of recurrent infections [10]. The most common pathogen responsible for recurrent UTIs is *Escherichia coli*, accounting for approximately 75% of cases. Other frequently encountered microorganisms include *Enterococcus faecalis*, *Klebsiella*, *Proteus mirabilis*, and *Staphylococcus* species [11].

Distinguishing between rapid reinfection and relapse is crucial in managing recurrent UTIs. A relapse is characterized by the recurrence of infection with the same pathogen within two weeks following the completion of treatment. In contrast, reinfection occurs when a new infection caused by a different organism arises more than two weeks after treatment. Most recurrent UTIs encountered in clinical settings are reinfections, which generally do not necessitate an extensive urological evaluation or imaging. However, certain clinical indicators may warrant further investigation, such as persistent hematuria, a history of kidney stones, recurrent presence of *Proteus* (often linked to urolithiasis), and repeated infections. In postmenopausal women, atrophic vaginitis and reduced estrogen levels lead to a decrease in the number of protective vaginal lactobacilli, which disrupts the normal vaginal flora and facilitates the ascent of bacteria into the urinary tract. Additionally, bladder contractions tend to weaken with age, resulting in incomplete bladder emptying, which increases the risk of recurrent infections. As lactobacilli numbers

naturally decline with age, the bladder's ability to fully empty diminishes, further predisposing individuals to UTIs.

Several risk factors contribute to the likelihood of recurrent UTIs, with the most prominent being the use of diaphragms with spermicides, menopause, untreated atrophic vaginitis, and frequent sexual intercourse. Spermicides, in combination with a lack of estrogenic influence, disrupt the normal vaginal flora, while sexual activity can introduce vaginal bacteria into the urethra and bladder, increasing the risk of infection. Genetic predisposition also plays a role; individuals with a familial history of recurrent UTIs, particularly those with a mother or sister affected by the condition, may be more susceptible to developing recurrent infections.

Risk Factors for Recurrent Infections

Several factors contribute to the increased susceptibility to recurrent urinary tract infections (UTIs). The use of spermicide, particularly in combination with a diaphragm, is a significant risk factor for recurrent infections, as it can alter the vaginal flora and facilitate bacterial adherence to the mucosal surfaces. Additionally, conditions such as atrophic vaginitis, characterized by a thinning and inflammation of the vaginal walls due to decreased estrogen levels, are associated with an increased incidence of recurrent UTIs. Bladder diverticula and fistulas also predispose individuals to UTIs by providing spaces or abnormal connections that harbor bacteria. Chronic diarrhea, which disrupts normal gut flora and can result in the spread of bacteria to the urinary tract, is another important factor. Other anatomical abnormalities such as cystoceles, where the bladder protrudes into the vaginal wall, and urethral diverticula, which are pockets that can trap bacteria, increase the likelihood of recurrent infections. Furthermore, underlying health conditions such as diabetes, which compromises immune function, elevate the risk of UTIs. The early onset of a first UTI before the age of 16 and genetic factors, particularly those related to bacterial adherence mechanisms at the vaginal and mucosal levels, are also significant risk factors. A high frequency of sexual intercourse, defined as more than twice per week, is associated with a tripled risk of recurrent UTIs. A history of five or more UTIs is another notable risk factor. Inadequate fluid intake leading to low urinary volume, as well as incomplete bladder emptying indicated by post-void residual urine greater than 150 mL, are also strongly correlated with recurrent infections. The presence of a family history of frequent UTIs, particularly among mothers or sisters, further increases the risk, as does having new or multiple sexual partners. Anatomical factors such as a short distance from the anal to urethral meatus contribute to a higher risk of bacterial transmission, as do conditions like urinary incontinence. The use of spermicide-coated condoms has been shown to alter the vaginal flora, contributing to the higher incidence of UTIs [12][13][14][15].

Personal Hygiene Factors

Inadequate personal hygiene practices are also a contributing factor to recurrent urinary tract infections. Failing to use a mild, liquid soap for cleaning the vaginal area may irritate sensitive tissues, leading to bacterial colonization. Additionally, improper cleaning techniques, such as not washing the urethral area first, can facilitate the spread of bacteria from the anal region to the urethra, increasing the risk of infection. The use of clean, soft washcloths is recommended to prevent friction and irritation during cleaning, as rough materials can cause microtears in the skin, providing a pathway for bacteria. In post-menopausal women, the lack of vaginal estrogen may exacerbate dryness and thinning of the vaginal walls, thus increasing the vulnerability to infections. Not washing hands before wiping the vaginal area after voiding is a common hygiene mistake that can lead to bacterial contamination. Moreover, opting for baths instead of showers may increase the risk of bacterial exposure to the urinary tract due to prolonged water contact, whereas showers limit the duration of bacterial exposure. Incorrect wiping techniques, such as wiping from back to front or repeating the process multiple times, can also contribute to the spread of bacteria from the anal region to the urethra. These hygiene practices, if not corrected, can significantly increase the likelihood of recurrent UTIs, particularly in individuals with other underlying risk factors [12][13][14][15].

History and Physical

A comprehensive history and physical examination are crucial in diagnosing recurrent urinary tract infections (UTIs). Acute uncomplicated cystitis typically presents symptoms such as urinary frequency, urgency, dysuria, and suprapubic discomfort. The likelihood of cystitis is greater than 90% in women who exhibit dysuria and frequency without the presence of vaginal discharge or irritation [16]. If the clinical presentation includes fever, chills, rigors, profound fatigue, or malaise, it suggests that the infection has extended beyond the bladder, indicating a more severe condition, such as acute complicated cystitis. In the case of pyelonephritis, clinical features commonly include fever, chills, flank pain, tenderness over the costovertebral angle, nausea, and vomiting. Although symptoms of cystitis are frequently observed in pyelonephritis, they are not universally present. In women experiencing recurrent UTIs, a pelvic examination is essential to assess for conditions such as cystoceles, vaginitis, vaginal atrophy, and pelvic organ prolapse. A study involving 113 women demonstrated that hematuria and urgency during an initial urinary infection were the strongest predictors of subsequent UTIs. For men with recurrent cystitis episodes, an evaluation for prostatitis is recommended. Older or debilitated patients may present with generalized infection symptoms, such as fever and chills, or altered mental status, without clear localization to the urinary tract.

Documenting positive urine cultures is essential for confirming recurrent UTI diagnoses, and clinical symptoms should be appropriately noted. In cases where clean-catch urine samples are suspicious for contamination—especially in women—a catheterized specimen may be necessary. If a woman experiences rapid recurrences of cystitis after treatment, clinical evidence should distinguish between reinfection (a new infection after complete eradication of the previous one) and relapse (re-emergence of an incompletely treated infection). A recurrence is classified as reinfection if the interval between episodes exceeds two weeks, if a different uropathogenic strain is identified, or if a sterile culture is documented between infections. A relapse is defined by an interval of less than two weeks between episodes, and relapsing infections often necessitate further urological imaging.

Evaluation

For most patients with recurrent UTIs, cystoscopy or urological imaging is not typically required [17]. In women with a history of recurrent UTIs presenting with typical symptoms, further urological evaluation is unnecessary beyond urine culture and sensitivity. However, the diagnosis of recurrent cystitis is primarily clinical. Urine cultures are essential in cases of severe infections or when there is a high risk of antibiotic resistance, such as with multidrug-resistant organisms, recent hospitalizations, recent antibiotic use, or a history of travel to regions with higher resistance profiles, including India, Israel, Spain, or Mexico. Urine cultures are also necessary to differentiate recurrent infections, caused by different organisms, from relapsing infections, where identical organisms are cultured. Relapsing infections suggest a persistent source of bacterial inoculation, such as an abscess, chronic bacterial prostatitis, or infected stones. The American Urological Association Guidelines on recurrent UTIs in women recommend that a urinalysis and urine culture be obtained with each episode of acute cystitis [3]. Urological imaging is indicated only in specific circumstances. These include relapsing infections, persistent hematuria after treatment, a history of stone passage, or repeated isolation of Proteus from the urine, which is commonly associated with renal stones. Renal ultrasonography or, preferably, a computed tomography (CT) scan of the abdomen and pelvis are the recommended imaging modalities.

In the pediatric population, various sampling methods are available to diagnose UTIs, with suprapubic aspiration or catheterization offering a lower risk of contamination and providing more reliable results. When using a plastic bag for urine collection, several steps must be followed to rule out UTI, including dipstick evaluation and microscopic analysis. The presence of leukocyte esterase and nitrite on a dipstick, as well as the possibility of pyuria and bacteriuria, should be excluded to prevent misdiagnosis of a UTI. For toilet-trained children and individuals, a clean, voided midstream urine sample is typically sufficient for diagnosis [18]. Patients with negative urine cultures but persistent symptoms should be further evaluated for other causes, such as atypical organisms, interstitial cystitis, endometriosis, atrophic

vaginitis, trauma, urethral pathology, neoplasms, diverticula, strictures, medication side effects, or vaginitis [19][20][21]. Cystoscopy is rarely performed solely for the diagnosis of recurrent UTIs, as it may inadvertently lead to an ascending lower UTI [22][23]. While routine cystoscopy is typically not recommended, it can be useful in postoperative cases to exclude ureteral injuries, evaluate incomplete bladder emptying, or identify potential bladder calculi. The choice of irrigation fluid during cystoscopy has been studied, with a Cleveland health system study noting a significantly higher rate of UTIs in patients who underwent cystoscopy with 10% dextrose and water irrigation compared to those receiving normal saline [24]. All cystoscopies were conducted to exclude intraoperative ureteral injuries during complex urogynecological procedures.

Treatment / Management:

Management of Acute Uncomplicated Urinary Tract Infections (UTIs)

Acute uncomplicated urinary tract infections are predominantly managed in the outpatient setting. Women presenting with characteristic symptoms of acute cystitis may be prescribed antibiotic therapy via telehealth consultations [25]. In instances of treatment failure or for patients at high risk, urine culture is recommended to tailor the antibiotic regimen appropriately. Hospitalization may be warranted depending on the clinical scenario, particularly for those with persistent fever, severe pain, an inability to take oral medications, or poor adherence to prescribed regimens [A1]. The management of simple cystitis is generally straightforward. It is critical to obtain urine cultures prior to initiating therapy. For patients who have received treatment for cystitis within the past three months, urine culture and susceptibility testing are essential to guide antibiotic selection, given the increased risk of antibiotic resistance. Patients with complicated cystitis or pyelonephritis should also have urine cultures before starting empiric antibiotics.

The first-line empiric antibiotic treatments for simple cystitis include:

- **Nitrofurantoin** 100 mg orally twice daily for 5 to 7 days. This antibiotic should be avoided in suspected cases of pyelonephritis due to poor tissue penetration, as well as in patients with creatinine clearance less than 30 mL/min.
- **Trimethoprim-sulfamethoxazole** 160/800 mg orally twice daily for 3 days. This option should be avoided if the local resistance rate exceeds 20%.
- **Fosfomycin** as a single oral dose of 3 grams.
- **Pivmecillinam** (not available in the United States, but commonly used in Europe), which is considered the agent of choice for urinary tract infections (UTIs) in Nordic countries. This agent should be avoided if pyelonephritis is suspected due to inadequate tissue penetration [26].

Oral β-lactams are considered the next best options when the aforementioned treatments cannot be prescribed. The recommended β-lactams include amoxicillin-clavulanate 500 mg twice daily, cefdinir 300 mg twice daily, cefdroxil 500 mg twice daily, and cefpodoxime 100 mg twice daily, each for 5 to 7 days. Ampicillin or amoxicillin should be avoided due to high resistance rates [27][28]. If β-lactams are contraindicated, fluoroquinolones such as levofloxacin 250 to 500 mg daily, ciprofloxacin 250 to 500 mg twice daily, or norfloxacin 400 mg twice daily for 3 days may be used as alternatives. However, fluoroquinolones are contraindicated in pregnancy and should be avoided when possible to minimize the development of quinolone resistance. For inpatient management, especially for patients at risk of multi-drug resistant (MDR) pathogen infection, carbapenems such as imipenem 500 mg IV every 6 hours, meropenem 1 g IV every 8 hours, or doripenem 500 mg IV every 8 hours are used. For patients without risk factors for MDR pathogens, ceftriaxone 1 gram IV daily or piperacillin-tazobactam 3.375 grams IV every 6 hours are appropriate alternatives. Fluoroquinolones, both oral and intravenous, such as ciprofloxacin and levofloxacin, are also viable options. In critically ill patients, carbapenems (as previously mentioned) and vancomycin are typically prescribed. Aminoglycosides may also be selectively used, depending on urine culture and sensitivity results, and local antibiotic susceptibility patterns.

Symptoms should show significant improvement within 48 hours of initiating antibiotic therapy. If no improvement is noted within the first 48 hours, a repeat urine culture is advised, along with urologic imaging to rule out complications such as an obstructing urinary stone, hydronephrosis, urinary retention, renal abscess, or pyelonephritis. Clinicians generally do not perform post-treatment urinalysis or urine culture for patients who are asymptomatic after therapy. However, repeat urine cultures should be obtained for patients with persistent symptoms following antimicrobial treatment. In patients with renal failure, preferred agents for UTIs include carbapenems, cephalosporins, doxycycline, fosfomycin, penicillins, and quinolones. Intravesical instillation of an antibiotic solution, such as gentamicin, may also be considered in patients with severe renal impairment. For patients with end-stage renal failure, quinolones like ciprofloxacin and levofloxacin are the first-line agents, with cefdinir or cefpodoxime serving as backup options [29][30]. For prophylaxis, the preferred antimicrobials are trimethoprim alone and fosfomycin [31].

Treatment for Recurrent UTIs

Recommended interventions for recurrent urinary tract infections (UTIs) encompass optimizing personal hygiene practices, avoiding spermicides, ensuring proper wiping techniques, enhancing fluid intake and hydration, and the potential use of vaginal estrogens where indicated. While the impact of lifestyle modifications on reducing recurrent UTIs remains inconclusive, advising patients to adopt improved hygiene practices carries no adverse effects and may offer some benefit [13][32]. The use of probiotics for UTI prevention is still under scrutiny, as existing clinical trials have not yielded definitive conclusions regarding their efficacy [33][34][35][36][37][38][39] (A1). In cases where conservative approaches fail to prevent recurrent UTIs, various non-antibiotic prophylactic treatments are commonly considered. Cranberry products, often recommended as first-line prophylactic agents, have uncertain efficacy. Cranberries are believed to exert their effects by providing proanthocyanidins, which inhibit bacterial adherence to the urothelium. However, the effectiveness of commercially available cranberry products, which contain limited amounts of proanthocyanidins, remains contentious. The American Urological Association Guidelines acknowledge the use of cranberry products but caution patients about their uncertain effectiveness, suggesting that alternative measures may be necessary. D-mannose, another potential prophylactic treatment, is hypothesized to reduce bacterial adherence to the urothelial mucosa through binding to bacterial surface ligands. However, randomized trials have failed to provide compelling evidence for its clinical benefit. The product is relatively expensive, and the optimal dosing remains unclear, with 500 mg twice daily commonly recommended.

Methenamine, when used in conjunction with vitamin C, acidifies the urine, and if the urinary pH remains below 5.5, methenamine is converted to formaldehyde in the bladder. A systematic review has shown methenamine to be an effective and well-tolerated prophylactic agent, offering an alternative to systemic antibiotics and their associated side effects. In a multi-institutional randomized trial, methenamine demonstrated comparable efficacy to trimethoprim in preventing UTI recurrences over a one-year period. Despite some studies failing to demonstrate long-term benefits, the majority indicate its efficacy, warranting further investigation, particularly in light of the increasing prevalence of antibiotic resistance. However, methenamine is contraindicated in patients with a glomerular filtration rate (GFR) of less than 10 mL/min. Vaginal estrogen cream has been found to reduce recurrent UTIs in postmenopausal women and should be considered as part of the prophylactic approach when appropriate. Behavioral and lifestyle modifications have shown promise in preventing recurrent UTIs. In a study involving 47 patients, a combination of probiotics, D-mannose, and cranberry products led to a 76% reduction in UTI recurrence rates and a more than 90% reduction in antibiotic use over six months. This combination of non-antibiotic therapies appears to be effective, potentially avoiding antibiotic-related side effects and reducing the risk of bacterial resistance. However, additional research with larger sample sizes and a broader array of components is required to confirm these findings and optimize the treatment protocol.

Vaccines for recurrent UTI prevention are still under development, but some candidates show promise. The oral vaccine MV140, which contains heat-inactivated strains of *Escherichia coli*, *Klebsiella pneumoniae*, *Enterococcus faecalis*, and *Proteus vulgaris*, has demonstrated good efficacy in preventing recurrent UTIs in clinical studies with minimal adverse effects. A long-term study on MV140 has shown

sustained efficacy for up to nine years post-administration. While not yet approved for use in the United States or Canada, MV140 is available in several countries, including Australia, Chile, Mexico, the Netherlands, and others. Antibiotic prophylaxis remains an effective strategy for controlling recurrent UTIs but is typically considered only after non-antibiotic measures have failed. Prophylactic antibiotic use is advised when other interventions are ineffective, or when rapid recurrence is evident. This approach is intended to limit bacterial resistance, mitigate antibiotic-related side effects, and reduce overall costs. However, the use of antibiotics for patients with permanent catheters or nephrostomies is discouraged, as it often leads to the rapid emergence of highly resistant organisms. Post-coital prophylaxis may be appropriate for women whose cystitis episodes are associated with sexual activity. Self-directed therapy, wherein patients begin a short course of antibiotics at the first sign of a UTI, may be considered for patients who are well-informed about UTI symptoms and are capable of reliably following treatment instructions. This approach has been shown to be as effective as continuous low-dose prophylaxis with fewer gastrointestinal side effects. In cases where self-directed therapy fails, continuous prophylactic treatment may be necessary.

Long-term low-dose antibiotic prophylaxis remains the gold standard for preventing recurrent UTIs, especially in cases that do not respond to conservative measures. This regimen requires a high level of patient adherence, as it typically spans at least six months and carries a risk of promoting antibiotic resistance. Prophylaxis should be employed in the most persistent cases, where other interventions have been ineffective or cannot be utilized effectively. Surveillance urine testing and cultures in asymptomatic patients are generally not recommended, as they do not benefit high-risk individuals, such as those in nursing homes or with diabetes. Asymptomatic bacteriuria should not be treated unless symptoms are present, with the exception of pregnant women or patients about to undergo urinary tract surgery [47][48][49][50][51] (A1). In the event that a patient with a recurrent UTI develops an acute UTI, a urine culture should be obtained, and an alternative antibiotic regimen should be prescribed. The treatment duration typically does not exceed one week. If urine cultures reveal resistance to all available oral agents, parenteral antibiotics may be necessary, with fosfomycin being a viable option. In such cases, an infectious disease consultation is recommended. The treatment duration should generally be no longer than one week [52][53][54][55][56].

Long-term, Low-Dose Antibiotic Prophylaxis

Continuous long-term prophylactic antibiotic therapy generally involves the use of lower dosages compared to the treatment of acute cystitis. This approach is referred to as the long-term, low-dose therapy protocol. The selection of the appropriate antibiotic is based on the patient's culture and sensitivity results. A preliminary evaluation of the effectiveness of prophylaxis is recommended at 3 months, with a typical treatment duration of 6 to 12 months if the therapy proves effective. Unfortunately, many patients may relapse into their previous patterns of infection once prophylaxis is discontinued [57][58]. In some cases, experts may advise extending the duration of prophylaxis for 2 years or longer in select patients. Nitrofurantoin, sulfamethoxazole-trimethoprim (SMX-TMP), and trimethoprim are considered preferred agents in these scenarios. Quinolones are generally avoided for prophylaxis due to their association with the development of bacterial resistance. When quinolones are deemed necessary, norfloxacin is preferred due to its limited tissue penetration beyond the urinary tract, which helps maintain appropriate urinary levels. However, this antibiotic is reserved for situations where other first-line agents are not suitable [59] (A1). While some patients have been prescribed continued low-dose prophylaxis for years, this practice has yet to undergo scientific validation. Long-term use of low-dose antibiotics may lead to various adverse effects, such as gastrointestinal, hepatic, and pulmonary complications. Beta-lactam antibiotics, while occasionally prescribed, can significantly alter gastrointestinal flora, carry a risk of pseudomembranous colitis (Clostridia), induce bacterial resistance, and encourage yeast overgrowth.

Data on the use of fosfomycin for UTI prophylaxis is limited, though it may be suitable in certain cases [60]. Prophylactic regimens are not fixed; antibiotic agents can be modified to help sustain efficacy. In patients with chronic, permanent urinary catheters, a short course of 1 to 3 days of antibiotic prophylaxis has been shown to reduce the incidence of symptomatic UTIs. This strategy may benefit severely

immunocompromised patients or those who experience persistent infections following catheter changes. However, routine use of prophylaxis is discouraged due to the anticipated increase in antibiotic use and the potential exacerbation of bacterial resistance patterns [61] (A1). Several disadvantages of antibiotic prophylaxis are noted, including added costs, inconvenience, allergies, and the risk of drug-drug interactions. Additionally, continuous prophylaxis may increase the likelihood of yeast superinfections and Clostridia overgrowth in the gastrointestinal tract. The prolonged use of antibiotics also fosters the emergence of more resistant urinary pathogens [62]. While long-term, low-dose antibiotic prophylaxis is effective, it requires high patient compliance and poses the risk of resistance. Moreover, patients often experience a relapse when prophylaxis is discontinued, and there is no available evidence to support the continuation of prophylaxis beyond one year [A1].

Preferred Antibiotic Agents for Recurrent UTI Prophylaxis

The following antibiotic agents are considered the preferred options for recurrent UTI prophylaxis:

- Nitrofurantoin at a dosage of 50 to 100 mg, administered at bedtime (HS) daily.
- Sulfamethoxazole-trimethoprim at 40/200 mg, administered at bedtime (HS) daily.
- Trimethoprim at 100 mg, administered at bedtime (HS) daily.

Second-line Agents Less Preferred for Prophylaxis

Second-line agents, which are less preferred for UTI prophylaxis, include:

- Cephalexin at 125 mg or 250 mg, administered at bedtime (HS) daily.
- Cefaclor at 250 mg, administered at bedtime (HS) daily.
- Fosfomycin at 3 gm, administered every 10 days.
- Norfloxacin at 400 mg, administered at bedtime (HS) daily.

UTI Prophylaxis in Renal Failure

For patients with significant renal failure (GFR <30 mL/min), nitrofurantoin, methenamine, or sulfa medications cannot be used for prophylaxis. In such cases, the preferred agents for UTI prophylaxis include:

- Trimethoprim at 100 mg, administered at bedtime (HS) daily.
- Fosfomycin at 3 gm, administered every 10 days.
- Quinolones, administered at a reduced dosage (less preferred) [63].

AUA Guidelines for Recurrent UTIs

The American Urological Association (AUA) Guidelines for recurrent UTIs are evidence-based recommendations formulated by an interprofessional expert committee. These guidelines, published in 2019, were developed after an extensive review of the latest peer-reviewed medical literature. The AUA Guidelines currently recommend only two non-antibiotic-based therapies for recurrent UTIs: cranberry prophylaxis and vaginal estrogen [3].

Differential Diagnosis

When considering the differential diagnosis of urinary tract infections (UTIs), several conditions should be ruled out, including atrophic vaginitis, characterized by thinning, drying, and inflammation of the vaginal tissues, often leading to urinary symptoms due to estrogen loss. Another condition to consider is overactive bladder, marked by increased frequency and urgency without evidence of infection. Painful bladder syndrome, a diagnosis of exclusion, involves symptoms of dysuria, frequency, and urgency, but with no evidence of infection. Pelvic inflammatory disease should also be considered, presenting with lower abdominal or pelvic pain, fever, cervical discharge, and cervical motion tenderness. Prostatitis can be distinguished by pain during ejaculation and tenderness of the prostate during digital rectal examination.

Urethritis, often seen in sexually active women, is identified by pyuria in urinalysis without bacterial infection. Urolithiasis, particularly bladder or distal ureteral calculi, may cause similar symptoms, and nephrolithiasis could potentially serve as an infected focus. Vaginitis presents with vaginal discharge, odor, pruritus, and dyspareunia, but without the frequency or urgency typically seen in UTIs.

Prognosis

Recurrent urinary tract infections typically do not lead to long-term complications, and patients often recover completely. The mortality rate associated with acute uncomplicated cystitis in women is extremely low. However, in terms of morbidity, each episode of UTI is associated with a loss of approximately 1.2 days of class or work attendance. Prognosis tends to be most favorable in younger patients without pre-existing comorbidities. In contrast, factors that may contribute to a worse prognosis include advanced age, recent urinary instrumentation, recent hospitalization or antibiotic therapy, pre-existing diabetes mellitus, sickle cell anemia, or chronic renal disease [64]. UTIs occurring in the presence of anatomical abnormalities, such as renal calculi, obstruction, hydronephrosis, colovesical fistula, neurogenic bladder, renal failure, or bladder exstrophy, are associated with a poorer prognosis.

Complications

Several risk factors are associated with an increased likelihood of complications in urinary tract infections, including urinary tract obstruction, recent urinary tract instrumentation, older age, and diabetes mellitus—particularly in relation to conditions like emphysematous pyelonephritis and papillary necrosis. Acute pyelonephritis may progress to more severe complications, such as renal abscesses, perinephric abscesses, papillary necrosis, or emphysematous pyelonephritis. In these cases, the absence of symptom improvement after 48 hours of appropriate antibiotic therapy necessitates further evaluation with urological imaging. Complicated UTIs may also present with bacteremia, sepsis, multi-organ system failure, or acute renal failure.

Deterrence and Patient Education

While the proven benefits of preventive measures for recurrent UTIs remain modest, several strategies are recommended for patients to reduce the likelihood of further infections. Increased fluid intake of at least 2 liters per day is advised, with one study demonstrating that higher water intake reduced the incidence of cystitis episodes [65]. For postmenopausal women experiencing vulvovaginal atrophy (genitourinary syndrome of menopause), topical vaginal estrogen is recommended to reduce future UTI risk, provided there are no contraindications. Behavioral modifications, such as wiping from front to back, using clean liquid soap, avoiding reusable sponges and luffas during bathing, and voiding shortly after sexual intercourse, are also beneficial [66]. The evidence on cranberry juice's role in preventing recurrent UTIs remains inconclusive [67].

Antibiotic prophylaxis should be considered only after other preventive measures have been exhausted and for women with a confirmed diagnosis of recurrent cystitis. In some cases, the potential adverse effects of antibiotic prophylaxis, such as drug toxicity, resistance development, microbiome alteration, and Clostridioides difficile infections, may outweigh the benefits. For women whose cystitis episodes are associated with sexual activity, postcoital antibiotics may be recommended to minimize adverse effects without compromising the drug's efficacy or encouraging antibiotic resistance [74]. Continuous prophylaxis may be considered in other cases, with the choice of medications being largely similar. The need for antibiotic prophylaxis should be reassessed after six months.

Summary of Personal Hygiene Recommendations

Recurrent urinary tract infections in many women can be attributed to suboptimal personal hygiene. While controlled studies have not conclusively demonstrated the efficacy of lifestyle modifications in reducing recurrent UTIs, patients should be educated on proper hygiene practices. This information is sometimes more effectively delivered by a female clinician, particularly when discussing sensitive hygiene topics with female patients [13][32].

Several conservative hygiene recommendations include washing hands prior to urination or showering to avoid transferring germs to the vaginal area. Patients should wipe from front to back to minimize the risk of moving harmful bacteria from the rectum towards the urinary tract. Only one wipe should be used per urination to prevent the introduction of additional bacteria into the urethra, with sterile baby wipes being a cleaner option compared to toilet paper. Bathing should be avoided, as bathwater can introduce bacteria to the urethra. If bathing is necessary, patients should refrain from using bubble baths or additives, as these can irritate the vaginal mucosa. Additionally, reusable sponges and luffas should be avoided, as they can retain bacteria despite attempts to clean them. Gentle liquid soaps should be used for washing, with bar soaps avoided due to their exposure to bacteria. A soft washcloth should be used to apply soap, and it should be kept clean and sterile. The urethral area should be cleaned first during a shower, following a single front-to-back wipe, to ensure no contamination from other areas. Douches and other personal hygiene products should be used only if recommended by a clinician, as many commercial products can irritate the delicate mucosa of the vaginal and urethral areas.

During menstruation, tampons are preferred over sanitary napkins as they provide better hygiene and reduce bacterial growth. It is recommended that patients empty their bladders every 4 hours during the day, even if they do not feel the urge to urinate, to prevent bacterial buildup. Tight clothing, such as pantyhose or tight slacks, should also be avoided, as these can trap bacteria near the urethra. Adequate hydration is essential, with increased water intake helping to maintain urine clarity. Vitamin C supplementation, as well as drinking cranberry juice, may help in preventing recurrent UTIs. Patients should avoid irritants such as caffeine, alcohol, and certain spices, as these can exacerbate bladder irritation. Physical activities like prolonged bicycling or horseback riding, which may increase the risk of bladder infections, should be limited. After sexual activity, patients should be instructed to void and drink additional water, and in some cases, postcoital antibiotics may be recommended. Vaginal estrogen creams may also be prescribed to postmenopausal women to improve resistance to bladder infections. Finally, patients should adhere to prescribed antibiotic regimens for prophylaxis, following clinician instructions to prevent recurrent infections. In cases where patients still develop UTIs despite following these recommendations, they should seek medical advice promptly. Clinicians will often request a urine specimen and may conduct further tests, including kidney x-rays or cystoscopy, to assess the underlying cause.

Nursing Interventions:

In managing a patient with recurrent urinary tract infections (UTIs), nursing interventions focus on both prevention and treatment to ensure patient comfort, reduce the recurrence of infections, and promote overall health. Key nursing interventions include:

1. **Patient Education**: Nurses should provide clear, comprehensive education on personal hygiene practices, such as wiping from front to back to prevent bacterial contamination of the urethra. Patients should be instructed to avoid using harsh soaps, douches, or feminine hygiene products that can irritate the urinary tract. The importance of adequate hydration (at least 2 liters of water daily) to flush out bacteria and prevent dehydration should also be emphasized [64].
2. **Encouraging Regular Voiding**: Nurses should encourage patients to urinate regularly, ideally every 3 to 4 hours, even if they do not feel the urge. This helps in flushing out any potential pathogens and preventing their accumulation in the urinary tract.
3. **Postcoital Care**: In patients with UTIs related to sexual activity, nurses should advise postcoital urination to minimize the risk of infection. Some patients may also benefit from postcoital antibiotic prophylaxis, as prescribed by the healthcare provider.
4. **Medications**: Nurses should ensure adherence to prescribed antibiotics and provide information on completing the full course to avoid antibiotic resistance. They should monitor for side effects, especially gastrointestinal disturbances, and provide guidance on managing them.
5. **Monitoring for Complications**: Nurses should assess for signs of more severe infection, such as fever, flank pain, or worsening symptoms, and promptly report changes to the healthcare team.

Additionally, if a patient presents with risk factors for complicated UTIs, nurses should advocate for appropriate diagnostic testing, such as urine cultures or imaging studies, to ensure timely and effective treatment.

Role of Radiologist in this Condition:

The role of the radiologist in diagnosing urinary tract infections (UTIs) is crucial for identifying underlying structural abnormalities, complications, and the extent of infection. While UTIs are primarily diagnosed through clinical evaluation and urine analysis, radiological imaging plays an essential role in cases where the infection is recurrent, complicated, or does not respond to standard treatment. Radiologists assist in identifying anatomical abnormalities that may predispose patients to recurrent or complicated UTIs. For instance, imaging studies such as ultrasound, computed tomography (CT) scans, or magnetic resonance imaging (MRI) can reveal structural issues like renal stones, bladder abnormalities, or obstructions that might impair urine flow, leading to infections. In cases of pyelonephritis or abscess formation, CT scans with contrast can offer detailed views of the kidneys, allowing for the identification of renal abscesses or perinephric fluid collections, which may require further intervention. Furthermore, radiologists are integral in evaluating patients with complicated UTIs, especially those with risk factors such as diabetes or recent urinary instrumentation. Imaging studies help detect conditions like hydronephrosis, which can result from urinary tract obstructions, or vesicoureteral reflux, where urine flows backward into the kidneys, increasing the risk of infection. In some cases, radiological findings may necessitate surgical intervention or other therapeutic approaches to manage these complications effectively. In addition to diagnostic imaging, radiologists collaborate with clinicians to interpret results, ensuring that appropriate interventions are initiated based on the findings. This multidisciplinary approach ensures accurate diagnosis, timely treatment, and optimal patient outcomes in the management of UTIs.

Benefits of Medical Records in UTI:

Medical records play a critical role in the management of urinary tract infections (UTIs) by providing comprehensive and accurate documentation of a patient's health history, diagnostic findings, treatment progress, and response to interventions. The benefits of medical records in the diagnosis, treatment, and prevention of UTIs are manifold. Firstly, medical records enable clinicians to track and analyze a patient's history of UTIs, including frequency, severity, and recurrence patterns. This longitudinal data helps healthcare providers to identify patients at high risk for recurrent infections, such as those with anatomical abnormalities, comorbidities like diabetes, or a history of urinary tract instrumentation. By documenting previous treatment regimens and outcomes, clinicians can make informed decisions about adjusting therapies or introducing preventive strategies, such as prophylactic antibiotics or lifestyle modifications. Secondly, medical records facilitate the accurate diagnosis of UTIs through the documentation of clinical signs, symptoms, and laboratory findings, including urine culture results and sensitivity testing. This ensures that healthcare providers can prescribe the most effective antibiotics based on the specific pathogen identified, reducing the risk of resistance and improving treatment efficacy. Additionally, medical records contribute to patient safety by ensuring continuity of care. They allow healthcare providers to review previous treatment courses, allergies, and contraindications, minimizing the risk of drug interactions or adverse reactions. In cases of complicated UTIs or when patients require referral to specialists, medical records provide essential information that enhances communication between multidisciplinary teams, promoting coordinated and comprehensive care. Overall, the accurate and timely documentation within medical records is vital for ensuring the proper diagnosis, management, and prevention of UTIs, ultimately improving patient outcomes.

Conclusion:

Recurrent urinary tract infections (UTIs) present a significant challenge in both clinical practice and public health. The diagnosis of UTIs has traditionally relied on detecting high levels of bacteria in urine, typically more than 100,000 CFU/mL. However, emerging research has questioned the adequacy of this high CFU threshold, particularly in recurrent infections. Studies suggest that lowering this threshold to 100 CFUs of Escherichia coli in the presence of specific symptoms may provide a more accurate and clinically

relevant diagnostic tool. This adjustment allows for quicker identification and treatment, preventing further recurrence and associated complications. In the management of recurrent UTIs, the collaborative roles of healthcare professionals are pivotal. Nurses are crucial in monitoring patient symptoms, ensuring adherence to preventive measures, and providing education on proper hygiene practices. Radiologists play a critical role in identifying anatomical abnormalities that may predispose individuals to recurrent infections, such as bladder diverticula or cystoceles. Clinical pathologists are essential for analyzing urine samples to accurately identify pathogens, ensuring appropriate antibiotic treatment and preventing resistance. In addition, the integration of medical records in case management is indispensable, as it allows for the tracking of patient histories, infection recurrence patterns, and effective treatment plans. The presence of recurrent UTIs in women, particularly those with predisposing factors like sexual activity or anatomical abnormalities, highlights the need for personalized care strategies. Factors such as hygiene practices, anatomical malformations, and inadequate initial treatment contribute significantly to the recurrence of UTIs. By refining diagnostic criteria, adopting a more collaborative approach in case management, and utilizing medical records efficiently, healthcare teams can reduce the frequency of recurrent UTIs and improve patient outcomes. Additionally, ongoing research into the microbial mechanisms of recurrent UTIs and the role of the urinary microbiome could provide valuable insights into better prevention and treatment strategies. Overall, a multifaceted approach that incorporates updated diagnostic practices, effective interdisciplinary teamwork, and optimal use of medical records can greatly enhance the management of recurrent UTIs, ultimately improving the quality of care and reducing the associated healthcare costs.

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التهابات المسالك البولية المتكررة: الأدوار المساهمة في إدارة الحالة من التمريض، أطباء الأشعة، أطباء الأمراض السريرية، والسجلات الطبية

الملخص:

الخلفية :تتميز التهابات المسالك البولية المتكررة (UTIs) بحدوث نوبات متكررة من التهاب المثانة البكتيري الحاد، وهي شائعة بشكل خاص بين النساء بسبب العوامل التشريحية. العبء المالي التهابات المسالك البولية المتكررة كبير، حيث تنفق الولايات المتحدة مليارات الدولارات سنويًا على العلاج. تقليديًا، يعتمد تشخيص التهابات المسالك البولية على عتبة عالية من وحدات تكوين المستعمرات (CFU) في عينات البول، لكن الأدلة الناشئة تشير إلى أن العتبة الأدنى قد توفر دقة تشخيص أفضل .

الهدف :تستعرض هذه الدراسة أدوار التمريض، وأطباء الأشعة، وأطباء الأمراض السريرية، والسجلات الطبية في إدارة التهابات المسالك البولية المتكررة، مع التركيز على التشخيص والعلاج والوقاية.

الطرق :تضمنت الدراسة مراجعة شاملة للمعايير التشخيصية الحالية، بما في ذلك تأثير تقليل عتبة CFU لتشخيص التهابات المسالك البولية المتكررة. كما تم فحص مساهمات مختلف المتخصصين في الرعاية الصحية في إدارة هذه العدوى، خصوصًا فيما يتعلق بالنتائج السريرية وتحسين استراتيجيات العلاج.

النتائج :تشير النتائج إلى أن تعديل العتبة التشخيصية للتهابات المسالك البولية المتكررة يمكن أن يحسن الكشف المبكر ونتائج العلاج. تعتبر أدوار المتخصصين في الرعاية الصحية مثل الممرضات وأطباء الأشعة وأطباء الأمراض السريرية أساسية في إدارة التهابات المسالك البولية المتكررة. يساعد الممرضون في مراقبة أعراض المرضى وامتثالهم للتدابير الوقائية، بينما يساعد أطباء الأشعة في تشخيص المشاكل التشريحية الأساسية، ويقوم أطباء الأمراض السريرية بتقييم زراعة البول لتحديد المسببات بدقة.

الخلاصة :يمكن أن يؤدي تحسين المعايير التشخيصية للتهابات المسالك البولية المتكررة، خصوصًا من خلال تقليل عتبةCFU ، إلى إدارة أكثر كفاءة وتقليل معدلات التكرار. تعتبر الجهود التعاونية بين فرق التمريض والأشعة والأمراض السريرية حاسمة في تقديم رعاية شاملة. يمكن أن يسهم الاستخدام الفعال للسجلات الطبية في تحسين التشخيص والعلاج، مما يؤدي إلى نتائج أفضل للمرضى وتقليل تكاليف الرعاية الصحية.

الكلمات المفتاحية :التهابات المسالك البولية المتكررة، التشخيص، عتبةCFU ، التمريض، الأشعة، الأمراض السريرية، السجلات الطبية، العلاج، الوقاية.