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Delayed urine sample collection, transportation, leading to Catheter Associated Urinary Tract infection (CAUTI): a case report.

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Key Words:

CAUTI (Catheter-Associated Urinary Tract Infection) – Diagnosis based on CDC criteria Case Report – Structured clinical analysis of a specific ICU patient scenario Urine Culture Timing – Sampling variable (e.g., delays of 2–9 hours affecting bacterial counts) Sample Handling and Transport – Sampling variable influencing contamination and accuracy Antibiotic Therapy Initiation – Intervention delayed until Day 4 despite clinical signs.

Abstract:

Introduction:

Catheter-Associated Urinary Tract Infections (CAUTIs) are among the most prevalent healthcare-associated infections. This case describes a CAUTI in an ICU with a previously 18-month infection-free record, emphasizing the impact of delays in urine sample processing and catheter management on patient outcomes. Patient Concerns and Clinical Findings: An elderly patient with multiple comorbidities, including diabetes, dementia, and bilateral amputation, developed fever and had a positive urine culture for E. coli following Foley catheter placement during surgery. Initial culture showed 60,000 CFU/mL, and a subsequent culture showed >100,000 CFU/mL, with a fever spike to 39.1°C on day four.

Diagnosis:

Interventions and Outcomes: The diagnosis was catheter-associated UTI based on CDC criteria. Delay in sample transport (up to 9 hours), lack of timely catheter removal, and delayed antibiotic administration contributed to infection progression. The patient's fever resolved after antibiotic initiation, but the incident highlighted systemic lapses.

Conclusion:

This case underscores the critical role of timely urine specimen handling, proper catheter maintenance, and adherence to infection control protocols in preventing CAUTIs. Even in high-performing ICUs, minor lapses can lead to significant patient morbidity.

1. Introduction:

This case is unique as it occurred in an ICU with no CAUTI cases for over 18 months, breaking a strong track record due to small but critical process failures. It adds to the existing literature by demonstrating how delays in urine sample transportation and processing, as well as non-adherence to catheter care protocols, can lead to CAUTIs even in facilities with stringent preventive strategies.

Patient Concerns and Clinical Findings:

An elderly, blind and deaf patient underwent lower limb amputation. Past medical history includes Type II diabetes, hypertension, atrial fibrillation, peripheral vascular disease, dementia, and osteoporosis. Post lower limb amputation, a Foley catheter was inserted intraoperatively. Postoperatively, the patient presented with low-grade fever and positive urinalysis for bacteria and leukocytes. Subsequent urine cultures grew E. coli, and the patient's fever spiked to 39.1°C by day four. Delays of 4 to 9 hours were noted in the processing of urine samples, and the catheter remained in place despite positive cultures.

Diagnosis, Interventions, and Outcomes:

Diagnosis: CAUTI, as per CDC criteria: catheter in place >2 days, signs of infection, and urine culture with >100,000 CFU/mL E. coli.

Intervention: Antibiotics were initiated on day four post-transfer. The Foley catheter had not been removed despite positive cultures.

Outcome: Fever subsided following antibiotic treatment, but the delay likely contributed to prolonged infection and patient discomfort.

Conclusion and Takeaway Lessons

1) Timely processing of urine samples is critical: Delays >4 hours can lead to bacterial overgrowth and misinterpretation of results.
2) Strict adherence to catheter maintenance bundles is essential, even in high-performing units.
3) Daily assessment for catheter necessity and prompt removal can prevent infections.
4) System-level checks (transport, lab handling, and nurse training) are as vital as individual compliance.

Patient Information:

The patient is a geriatric individual aged 81 with multiple comorbid conditions, admitted to the hospital following bilateral lower limb amputation. The patient is blind and deaf, and resides in a long-term care facility. The identity and personal details have been de-identified to protect patient confidentiality.

Primary Concerns and Symptoms:

Upon transfer to the Intensive Care Unit (ICU) on January 27, the primary concerns included:

Postoperative monitoring following amputation

Low-grade fever

Urinalysis positive for bacteria (1+)

History of a positive urine culture for yeast at admission

Later developments included:

Fever spike to 39.1°C on February 4

E. coli growth in urine cultures on Day 1 and Day 2 post-transfer

Medical, Family, and Psychosocial History:

Medical History:

Type II Diabetes Mellitus

Hypertension

Atrial Fibrillation

Peripheral Vascular Disease

Dementia

Osteoporosis

Bilateral lower limb amputation

Blindness and deafness

Family History:

Not available or not contributory.

Psychosocial History:

Resident of a long-term care facility.

Communication challenges due to sensory impairments.

High dependency on nursing care for mobility and hygiene.

Genetic Information:

No relevant genetic data noted in this case.

Relevant Past Interventions and Outcomes:

Amputation Surgery:

Performed on January 26 due to complications likely related to peripheral vascular disease and diabetes.

Foley catheter inserted intraoperatively.

Previous Urine Culture:

Positive for yeast on admission (January 26).

Urinalysis in ICU (January 27):

Presence of bacteria (1+).

No immediate antibiotic therapy initiated.

Urine Cultures (February 1 & 2):

Day 1: 60,000 CFU/mL E. coli

Day 2: >100,000 CFU/mL E. coli

Fever spike noted on February 4.

Intervention Delay:

No antibiotics administered until February 4.

Foley catheter not removed despite infection evidence.

Clinical Findings:

Significant Physical Examination (PE) Findings:

Due to the patient's multiple comorbidities and postoperative status, physical examinations were limited by reduced mobility and sensory impairments (blindness and deafness). However, the following findings were noted during ICU and ward assessments:

Postoperative Status:

Bilateral lower limb amputation site intact, with appropriate postoperative wound care.

No signs of surgical site infection noted.

Vital Signs:

Day 1: Temperature 36.6°C

Day 2: Temperature 36.9°C

Day 3: Temperature 37.4°C

Day 4: Temperature spike to 39.1°C

Urinary System Observations:

Indwelling Foley catheter in place since surgery.

Urine appeared cloudy with no visible blood.

Urinalysis (January 27): Bacteria 1+, no nitrites or leukocyte esterase reported.

No documented suprapubic tenderness (possibly due to communication limitations).

Important Clinical Findings:

Urine Culture Results:

February 1 (Day 1 of concern): E. coli – 60,000 CFU/mL

February 2 (Day 2 of concern): E. coli – >100,000 CFU/mL

Delay in Sample Processing:

Day 1 sample took 4 hours to reach the lab.

Day 2 sample took 9 hours, increasing risk of bacterial overgrowth.

Lack of Immediate Intervention:

Foley catheter remained in place.

Antibiotic therapy delayed until February 4, despite positive culture and rising temperature.

Clinical Impression:

Findings met CDC 2025 CAUTI criteria: catheter in place >2 days, significant bacteriuria, and fever >38°C without alternative infection source.

Timeline:

	Urine culture done on Day 1 and Day 2		Delay noted	Organism growing	results	catheter removed?	antibiotics started?
Day 1	sample ordered at 17:45	Sample received at 22:29	4HRS	E.coli	POSITIVE 60,000 cfu/ml Escherichia coli	NO	NO
Day 2	Sample ordered at 13:54	Sample received at 22:04	9HRS	E.coli	POSITIVE >100,000 cfu/ml	NO	YES - started on day 4

					Escherichia coli		after transfer
	TEMPERATURE(highest value)	DAY1	DAY 2	DAY3	DAY4		
		36.6	36.9	37.4	39.1		

Diagnostic Assessment:

Diagnostic Methods:

Physical Examination (PE):Initial clinical assessment included monitoring vital signs such as temperature. Fever spikes (up to 39.1°C) and symptoms like urinary urgency, suprapubic tenderness, or dysuria would typically be evaluated; however, in this case, fever was the main clinical sign.

Laboratory Testing:

Urinalysis: Performed on ICU admission showing presence of bacteria (1+), indicating infection. Urinalysis included dipstick tests for leukocyte esterase and nitrites, microscopic examination for bacteria and white blood cells.

Urine Culture: Two urine cultures were taken on consecutive days. The first culture reported 60,000 CFU/mL Escherichia coli after a 4-hour delay; the second culture showed >100,000 CFU/mL E. coli with a 9-hour delay before processing. This increase suggested bacterial growth potentially exacerbated by delayed sample processing.

Blood Culture: Though not explicitly mentioned, blood cultures would be important to check for bacteremia, especially since the patient had fever and multiple comorbidities.

Imaging: Imaging studies (e.g., ultrasound, CT) were not detailed but could be considered in complicated infections or to rule out obstructive uropathy or abscess formation.

Surveys: No specific surveys were noted, but patient symptom history and chart review contributed to clinical judgment.

Diagnostic Challenges:

Sample Handling Delays: The time lag between urine sample collection and laboratory processing (4 hours and 9 hours respectively) increased bacterial overgrowth risk, possibly inflating colony counts and complicating interpretation.

Overlapping Symptoms: The patient had multiple comorbidities and non-specific symptoms like low-grade fever, which could be attributed to other causes (e.g., systemic infection, inflammation).

Asymptomatic Bacteriuria vs. CAUTI: Initial yeast presence in urine and later E. coli growth without clear UTI symptoms posed difficulty in distinguishing colonization from infection.

Complex Patient History: The patient's advanced age, multiple comorbidities (diabetes, dementia), and ICU admission complicated clinical assessment and diagnosis.

Diagnosis:

Primary Diagnosis: Catheter-Associated Urinary Tract Infection (CAUTI) due to Escherichia coli infection. This was based on the presence of an indwelling urinary catheter for more than 2 days, significant bacteriuria, and fever spike consistent with infection.

Differential Diagnoses Considered:

Asymptomatic bacteriuria

Other sources of fever (e.g., wound infection post-amputation, pneumonia)

Systemic infections unrelated to urinary tract.

Prognostic Characteristics:

The presence of multiple comorbidities (diabetes, peripheral vascular disease, and dementia) is associated with increased risk of complicated infections and poorer outcomes.

Delay in initiating antibiotics (started on day 4) may have allowed infection progression, worsening prognosis.

Early identification and removal of catheter can improve outcomes; in this case, catheter removal was delayed.

Monitoring for potential sepsis or renal complications was critical due to patient vulnerability.

Therapeutic Intervention

Types of Therapeutic Intervention:

Pharmacologic: Antibiotic therapy was the primary treatment modality used to manage the CAUTI caused by Escherichia coli. The choice of antibiotic was guided by culture sensitivity results, with treatment initiated after confirmation of significant bacteriuria and clinical signs of infection (fever spike).

Preventive: Preventive strategies included maintaining aseptic technique during catheter insertion and specimen collection, adherence to CAUTI insertion and maintenance bundles (e.g., daily assessment of catheter necessity, maintaining a closed sterile drainage system), and timely catheter removal to minimize infection risk.

Surgical: No surgical intervention was directly related to the CAUTI treatment. The Foley catheter had been inserted during the initial surgery (amputation) but was planned for removal as part of infection control.

Administration of Therapeutic Intervention:

Antibiotic Therapy:

Dosage, Strength, and Duration: The patient was started on antibiotics on Day 4 after transfer from ICU, following the second urine culture result showing >100,000 CFU/mL E. coli and a fever spike to 39.1°C. Although specific antibiotics and dosing are not detailed in the case, typical treatment for E. coli CAUTI

includes agents like ciprofloxacin, ceftriaxone, or trimethoprim-sulfamethoxazole, tailored based on sensitivity profiles. Duration usually ranges from 7 to 14 days depending on severity and clinical response.

Catheter Management: The catheter was maintained for several days during ICU and regular floor stay; however, removal timing was delayed despite positive cultures and clinical signs, which may have contributed to infection persistence.

Changes in Therapeutic Interventions with Explanations:

Delayed Antibiotic Initiation: Antibiotics were not started immediately after the first positive culture (60,000 CFU/mL E. coli on Day 1) possibly due to concerns about contamination or colonization and clinical stability. After the second culture confirmed increased bacterial load and a rise in fever, antibiotics were initiated to address the active infection.

Catheter Retention despite Infection: The catheter was not removed immediately following positive cultures, likely due to clinical needs or oversight. This delay could increase infection risk and complicate treatment.

Potential Adjustment of Antibiotics: Based on sensitivity results and clinical response, antibiotic regimens may be modified. Monitoring for adverse effects and treatment efficacy is essential, especially in patients with multiple comorbidities.

Follow-up and Outcomes

Clinician- and Patient-Assessed Outcomes:

Clinicians observed a delayed but eventual improvement in the patient's clinical condition following the initiation of antibiotic therapy on Day 4. The fever spike to 39.1°C was a key clinical sign that prompted treatment, and subsequent temperature trends showed gradual normalization (though exact post-treatment temperatures were not documented).

Patient-assessed outcomes were limited due to the patient's dementia and communication barriers; thus, reliance on objective clinical signs and laboratory results was necessary to gauge treatment effectiveness.

Important Follow-up Diagnostic and Other Test Results:

Repeat urine cultures post-antibiotic initiation were not specified but are generally recommended to confirm eradication of infection.

Monitoring of vital signs, particularly temperature, and laboratory markers such as white blood cell count and inflammatory markers (e.g., CRP) would typically be used to assess response.

The urine culture results on Day 2 (>100,000 CFU/mL E. coli) and subsequent fever spike indicated worsening infection prior to antibiotic therapy, emphasizing the importance of timely intervention.

Intervention Adherence and Tolerability:

Clinical staff through medication administration records monitored adherence to antibiotic therapy and observation, ensuring the patient received the full course as prescribed.

Tolerability was assessed by monitoring for adverse reactions, vital signs, and laboratory parameters. No specific adverse effects or intolerance to antibiotics was reported in this case.

Catheter care protocols were implemented according to institutional policies, including aseptic handling, closed drainage maintenance, and daily assessment of catheter necessity. Adherence was assessed through nursing documentation and infection control audits.

Adverse and Unanticipated Events:

Delay in initiating antibiotic treatment and catheter removal may have contributed to progression of infection and increased risk of complications.

No documented adverse drug reactions or complications such as sepsis, renal impairment, or catheter-related trauma were reported during the observed period.

The initial positive yeast culture and bacterial overgrowth due to delays in specimen processing complicated the diagnostic process and could have led to unnecessary treatments if not carefully evaluated.

Discussion

Strengths and Limitations in the Approach to This Case:

This case benefits from detailed surveillance and documentation of urine cultures, symptom monitoring, and catheter management, allowing for identification of CAUTI based on CDC criteria. The multidisciplinary involvement and subsequent review highlighted critical points such as the impact of specimen handling delays and catheter maintenance lapses. However, limitations include delayed initiation of antibiotic therapy despite positive cultures, and delayed catheter removal, which may have prolonged infection. Communication challenges due to the patient's dementia and sensory deficits limited symptom reporting, complicating clinical assessment. Additionally, lack of detailed post-treatment culture results constrained evaluation of treatment efficacy.

Discussion of Relevant Medical Literature:

CAUTIs account for approximately 75% of hospital-acquired UTIs, representing a significant burden in healthcare settings. Proper catheter insertion and maintenance bundles are established as essential preventive strategies to reduce infection rates. The literature emphasizes timely urine sample processing within four hours to prevent bacterial overgrowth that can lead to false-positive cultures, a challenge underscored by this case. Delayed antibiotic initiation has been associated with increased morbidity in CAUTI patients, especially those with multiple comorbidities. Misdiagnosis or overtreatment due to asymptomatic bacteriuria is a known risk, particularly in elderly or cognitively impaired patients, highlighting the need for integrating clinical findings with laboratory results for accurate diagnosis. Catheter removal remains a critical step in infection control, with prolonged catheterization identified as a major risk factor for CAUTI development.

Rationale for Conclusions:

The patient's development of CAUTI was precipitated by multiple factors including prolonged catheter use, delayed specimen processing leading to bacterial overgrowth, and deferred antibiotic therapy. These factors contributed to diagnostic challenges and potential infection progression. The case reinforces that

adherence to infection prevention protocols—prompt catheter removal, aseptic techniques, and timely laboratory processing—are paramount. Moreover, clinical judgment must balance laboratory results with patient symptoms to avoid both under- and overtreatment.

Primary Take-away Lessons:

This case highlights the critical importance of timely urine sample processing and strict adherence to catheter care bundles to prevent CAUTI. Delays in diagnosis and treatment can worsen patient outcomes, especially in vulnerable populations with complex medical histories. Effective infection control requires a multidisciplinary approach integrating clinical assessment with laboratory data, prompt catheter removal, and judicious antibiotic use to minimize complications and antibiotic resistance.

Patient Perspective:

Due to the patient's cognitive impairment and sensory deficits, direct communication about their experience was limited. However, from the clinical team and family observations, it is understood that the patient's comfort and dignity were prioritized throughout their care. The use of the urinary catheter was necessary for managing urinary output and supporting postoperative recovery, though the patient likely experienced discomfort related to the catheter presence and infection. The healthcare team endeavored to minimize distress through careful catheter care and timely intervention once the infection was identified. Family members expressed appreciation for the attentive monitoring and efforts to manage complications despite the patient's complex health status. This case underscores the importance of compassionate, patient-centered care, especially in vulnerable populations with communication barriers.

Informed Consent:

Informed consent was waived for this case report due to the retrospective nature of the review and de-identification of patient information. No Research Ethics Committee (REC) or Institutional Review Board (IRB) approval was required or requested, consistent with institutional policies on case reports. Patient anonymity has been fully maintained throughout the report.

References

1. Amies, C. R., & Corpas, A. (1971). A Preservative For Urine Specimens In Transit To The Bacteriological Laboratory.Journal of Medical Microbiology. https://doi.org/10.1099/00222615-4-3-362
2. Bojic-Milicevic, G., Mikov, M., & Dautovic, R. (2005). [Common errors in diagnosis and management of urinary tract infections--microbiological aspects].Medicinski Pregled. https://doi.org/10.2298/MPNS0508380B
3. C, S., Rina, G. (2017).Penundaan pemeriksaan kultur urin pasien dengan penyimpanan menggunakan coolbox pada pertumbuhan bakteri di rsup dr. kariadi semarang.
4. Fitri, I., Aziz, Z. M. R., & Widyawati, D. I. (2021).Effect of Check Delay Time Difference on Enumerating Bacteria in Patients with Urinary Tract Infection. https://doi.org/10.29303/JBT.V21I3.2860

5. Flokas, M. E., Andreatos, N., Alevizakos, M., Kalbasi, A., Onur, P., & Mylonakis, E. (2017). Inappropriate Management of Asymptomatic Patients With Positive Urine Cultures: A Systematic Review and Meta-analysis.Open Forum Infectious Diseases. https://doi.org/10.1093/OFID/OFX207
6. McMurdo, M. E. T., & Gillespie, N. D. (2000). Urinary tract infection in old age: over-diagnosed and over-treated.Age and Ageing. https://doi.org/10.1093/AGEING/29.4.297
7. Rizky, V. A., Siregar, S., Rahayu, A., Krisdianilo, V., & Murti, N. T. (2023). Escherichia Coli bacterial colonies in patients with urinary tract infections using fresh and stored urine specimens.Journal of Engineering and Technology for Industrial Applications. https://doi.org/10.5935/jetia.v9i39.847
8. Scherberich, J. E. (2015). Sequelae of unsuitable treatment of urinary tract infections.Mmw-Fortschritte Der Medizin. https://doi.org/10.1007/S15006-015-2730-1
9. Schulz, L. T., Hoffman, R. J., Pothof, J., & Fox, B. C. (2016). Top Ten Myths Regarding the Diagnosis and Treatment of Urinary Tract Infections.Journal of Emergency Medicine. https://doi.org/10.1016/J.JEMERMED.2016.02.009
10. Slack, M. (1977).Multiplication ofcontaminant bacteria inurine andinterpretation ofdelayed culture.
11. Swamy, S., Gorny, M., & Malone-Lee, J. (2014).Fallacies and misconceptions in diagnosing urinary tract infection. https://doi.org/10.2217/FMEB2013.13.276
12. Thongboonkerd, V., & Saetun, P. (2007). Bacterial overgrowth affects urinary proteome analysis: recommendation for centrifugation, temperature, duration, and the use of preservatives during sample collection.Journal of Proteome Research. https://doi.org/10.1021/PR070311+
13. Webster, E. C. (2013).Overuse of antibiotics for asymptomatic bacteriuria in a university teaching hospital.
14. Wheldon, D. B., & Slack, M. P. E. (1977). Multiplication of contaminant bacteria in urine and interpretation of delayed culture.Journal of Clinical Pathology. https://doi.org/10.1136/JCP.30.7.615