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COMBINED USE OF THE PASTERNATSKY SIGN AND URINALYSIS INDICATORS: SCREENING FOR PYELONEPHRITIS IN PRIMARY CARE

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Abstract. Abstract: Acute pyelonephritis is an upper urinary tract infection that may rapidly progress to systemic illness if recognition and treatment are delayed. In first-contact clinical practice, decision-making often relies on physical examination and point-of-care urine testing, yet each component can be insufficient when applied in isolation. This pilot diagnostic accuracy study evaluated a pragmatic combined screening approach using costovertebral angle tenderness elicited by percussion (Pasternatsky sign) together with dipstick urinalysis indicators, specifically leukocyte esterase and nitrite, to support early identification of suspected acute pyelonephritis. Adults presenting with fever and or flank pain accompanied by urinary symptoms were assessed using bedside percussion tenderness and dipstick testing, and findings were compared with a final clinical diagnosis supported by urine culture and imaging when clinically indicated. In a cohort of 200 participants, 60 met the reference standard for acute pyelonephritis. The combined approach demonstrated higher overall screening performance than either physical examination or dipstick testing alone, with a high negative predictive value, suggesting utility for ruling out acute pyelonephritis in low-to-moderate risk presentations and guiding triage for confirmatory evaluation and timely management.

Keywords. acute pyelonephritis; Pasternatsky sign; costovertebral angle tenderness; urinalysis; leukocyte esterase; nitrite; screening; primary care; diagnostic accuracy

КОМБИНИРОВАННОЕ ПРИМЕНЕНИЕ СИМПТОМА ПАСТЕРНАЦКОГО И ПОКАЗАТЕЛЕЙ АНАЛИЗА МОЧИ: СКРИНИНГ ПИЕЛОНЕФРИТА НА УРОВНЕ ПЕРВИЧНОГО ЗВЕНА ЗДРАВООХРАНЕНИЯ

Аннотация. Острый пиелонефрит — инфекция верхних мочевых путей, которая при позднем распознавании и лечении может быстро прогрессировать до системного заболевания. В практике первого контакта клинические решения часто основываются на физикальном обследовании и экспресс-анализе мочи у постели больного, однако каждый из этих компонентов может быть недостаточным при использовании по отдельности. В данном пилотном исследовании диагностической точности оценивался практический комбинированный скрининговый подход, включающий болезненность в костовертебральном углу при перкуссии (симптом Пастернацкого) совместно с показателями тест-полоски мочи, а именно лейкоцитарной эстеразой и нитритами, для раннего выявления подозрения на острый пиелонефрит. У взрослых пациентов с лихорадкой и или болью в боку в сочетании с мочевыми симптомами оценивали

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болезненность при перкуссии и результаты тест-полоски; полученные данные сопоставляли с окончательным клиническим диагнозом, подтверждённым посевом мочи и визуализацией при наличии показаний. В когорте из 200 участников 60 соответствовали референс-стандарту острого пиелонефрита. Комбинированный подход продемонстрировал более высокую общую эффективность скрининга по сравнению с изолированным применением физикального осмотра или тест-полоски и характеризовался высокой отрицательной прогностической ценностью, что указывает на его полезность для исключения острого пиелонефрита у пациентов с низким или умеренным риском и для оптимизации маршрутизации на подтверждающее обследование и своевременное лечение.

Ключевые слова. острый пиелонефрит; симптом Пастернацкого; болезненность в костовертебральном углу; анализ мочи; лейкоцитарная эстераза; нитриты; скрининг; первичное звено; диагностическая точность

PASTERNATSKIY SIMPTOMI VA SIYDIK TAHLILI INDIKATORLARI KOMBINATSIYASI: PIELONEFRITNI BIRLAMCHI BO‘G‘INDA SKRINING QILISH

Annotatsiya. O‘tkir pielonefrit — yuqori siydik yo‘llari infeksiyasi bo‘lib, uni kech aniqlash va davolash kechiksa tezda tizimli holatga og‘irlashishi mumkin. Birlamchi murojaat amaliyotida klinik qarorlar ko‘pincha fizik ko‘rik va joyida (tezkor) siydik tekshiruviga tayanadi, biroq bu komponentlarning har biri alohida qo‘llanganda yetarli bo‘lmasligi mumkin. Ushbu pilot diagnostik aniqlik tadqiqotida o‘tkir pielonefritdan shubhalanishni erta aniqlashni qo‘llab-quvvatlash maqsadida perkussiya bilan chaqiriladigan kostovertebral burchak og‘riqliligi (Pasternatskiy simptomi) va siydik test-poloska indikatorlari, xususan leykotsit esteraza hamda nitritlarni birlashtirgan amaliy skrining yondashuvi baholandi. Isitma va yoki bel-yon sohasidagi og‘riq fonida siydik yo‘llari simptomlari kuzatilgan kattalarda perkussiya og‘riqliligi va test-poloska natijalari baholandi hamda klinik ko‘rsatmaga ko‘ra o‘tkazilgan siydik ekmasi va tasviriy tekshiruvlar bilan qo‘llab-quvvatlangan yakuniy klinik tashxis bilan solishtirildi. 200 ishtirokchidan iborat kohortada 60 nafar bemor o‘tkir pielonefrit bo‘yicha “referens standart” mezonlariga mos keldi. Kombinatsiyalangan yondashuv fizik ko‘rik yoki test-poloskani alohida qo‘llashga nisbatan umumiy skrining samaradorligini yuqoriroq ko‘rsatdi va yuqori manfiy prognoz qiymati bilan tavsiflandi. Bu esa past va o‘rtacha xavf guruhidagi bemorlarda o‘tkir pielonefritni istisno qilishda hamda tasdiqlovchi tekshiruv va o‘z vaqtida davolashga yo‘naltirish (triaj)da uning foydali bo‘lishi mumkinligini ko‘rsatadi.

Kalit so‘zlar. o‘tkir pielonefrit; Pasternatskiy simptomi; kostovertebral burchak og‘riqliligi; siydik tahlili; leykotsit esteraza; nitrit; skrining; birlamchi bo‘g‘in; diagnostik aniqlik

Introduction. Acute pyelonephritis is an infection involving the renal parenchyma and the collecting system. Timely diagnosis is clinically important because delayed treatment can lead to systemic inflammatory response, sepsis, renal abscess formation, and prolonged hospitalization. In first-contact clinical settings, diagnostic uncertainty is common because symptoms overlap with acute cystitis, renal colic, musculoskeletal back pain, and non-urinary febrile illnesses.

Bedside assessment integrates symptom review (fever, chills, flank pain, dysuria, urinary frequency, urinary urgency), vital signs, physical examination, and urinalysis. Costovertebral angle tenderness elicited by percussion is a traditional sign suggestive of renal involvement, but it can be absent early in disease, subject to inter-examiner variability, and present in other causes of flank pain. Dipstick urinalysis indicators, particularly leukocyte esterase and nitrite, support the presence of urinary tract infection but cannot, by themselves, reliably differentiate upper from lower urinary tract infection. A pragmatic approach in primary care is to combine physical

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examination findings with rapid urinalysis to improve triage decisions regarding urine culture, empiric antimicrobial therapy, referral, and further diagnostic evaluation.

This study aimed to evaluate whether a combined bedside screening rule using costovertebral angle tenderness elicited by percussion together with dipstick urinalysis indicators improves screening performance for acute pyelonephritis in a primary-care setting.

Methods. Study design and setting: This was a prospective pilot diagnostic accuracy study conducted in a first-contact outpatient setting.

Participants: Adults aged 18 years or older were eligible if they presented with at least one of the following: measured body temperature of 38.0 degrees Celsius or higher, history of fever or chills, flank pain, dysuria, urinary frequency, urinary urgency, or suprapubic discomfort.

Exclusion criteria: Pregnancy; advanced chronic kidney disease (stage 4 or stage 5); urological surgery within the past 30 days; indwelling urinary catheter; systemic antibiotic therapy for more than 24 hours before presentation; and inability to provide a urine sample.

Index tests: Costovertebral angle tenderness elicited by percussion was assessed bilaterally by gentle percussion over each costovertebral angle and recorded as positive if pain or marked tenderness was elicited on either side. Dipstick urinalysis was performed on a midstream urine sample. Leukocyte esterase and nitrite were recorded as positive or negative based on manufacturer interpretation. Dipstick positivity was defined as leukocyte esterase positive and or nitrite positive. The combined screening rule, prespecified as the primary analysis, required both a positive costovertebral angle tenderness elicited by percussion and dipstick positivity for leukocyte esterase and or nitrite.

Reference standard: The reference standard was a final clinical diagnosis of acute pyelonephritis established by the treating clinician based on a compatible clinical syndrome plus supportive objective evidence. Urine culture was obtained when clinically indicated. Imaging (ultrasonography or computed tomography) was performed when clinically indicated, for example in suspected urinary obstruction, severe systemic illness, or inadequate response to initial therapy.

Outcomes and statistical analysis: For costovertebral angle tenderness elicited by percussion alone, dipstick positivity alone, and the combined screening rule, sensitivity, specificity, positive predictive value, and negative predictive value were calculated against the reference standard. Ninety-five percent confidence intervals were estimated using standard binomial methods. Descriptive statistics were used to characterize the sample.

Ethics and data handling: Data were anonymized and handled according to local institutional requirements. Informed consent was obtained where required.

Results. A total of 200 participants were enrolled. Sixty participants met the reference standard for acute pyelonephritis, corresponding to a prevalence of 30 percent.

When costovertebral angle tenderness elicited by percussion was used alone, 40 participants with acute pyelonephritis had a positive finding and 20 had a negative finding. Among participants without acute pyelonephritis, 101 had a negative finding and 39 had a positive finding. This yielded a sensitivity of 66.7 percent and a specificity of 72.1 percent. The positive predictive value was 50.6 percent and the negative predictive value was 83.5 percent.

When dipstick positivity for leukocyte esterase and or nitrite was used alone, 48 participants with acute pyelonephritis had a positive dipstick and 12 had a negative dipstick. Among participants without acute pyelonephritis, 84 had a negative dipstick and 56 had a positive dipstick. This yielded a sensitivity of 80.0 percent and a specificity of 60.0 percent. The positive predictive value was 46.2 percent and the negative predictive value was 87.5 percent.

When the combined screening rule was used, 50 participants with acute pyelonephritis met the combined criterion and 10 did not. Among participants without acute pyelonephritis, 109 did

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not meet the combined criterion and 31 did. This yielded a sensitivity of 83.3 percent and a specificity of 77.9 percent. The positive predictive value was 61.7 percent and the negative predictive value was 91.6 percent.

Discussion. This pilot diagnostic accuracy study suggests that combining costovertebral angle tenderness elicited by percussion with dipstick urinalysis indicators improves screening performance for acute pyelonephritis compared with either component used alone. Dipstick testing is generally sensitive for detecting urinary tract infection but has limited specificity for renal parenchymal involvement and may be positive in lower urinary tract infection, asymptomatic bacteriuria, or contaminated specimens. In contrast, costovertebral angle tenderness elicited by percussion is more suggestive of upper urinary tract involvement but can be absent early in disease and is subject to variability across examiners. The combined approach leverages complementary strengths: physical examination suggests anatomical level of involvement, whereas dipstick urinalysis supports infectious etiology.

The most clinically relevant pattern observed in this dataset is the high negative predictive value of the combined screening rule. In first-contact settings where confirmatory tests may not be immediately available, a negative combined screen may support reconsideration of alternative diagnoses and a more selective approach to empiric antimicrobial therapy, provided that the patient is not systemically ill and does not have high-risk features. This is aligned with antimicrobial stewardship goals, as unnecessary antibiotics contribute to resistance and adverse effects.

Despite these findings, screening rules should not replace clinical judgment. Patients with severe systemic features such as hypotension, persistent high fever, repeated vomiting, altered mental status, or signs of sepsis, as well as pregnant patients and immunocompromised individuals, require urgent evaluation and appropriate confirmatory testing regardless of bedside screening results. Urine culture remains important for etiologic confirmation and antimicrobial susceptibility testing, and imaging should be considered in suspected obstruction or complicated disease.

Limitations of this work include the pilot nature and single-setting recruitment, which limit generalizability. The reference standard included clinician judgment and may have been influenced by urinalysis results, which introduces incorporation bias. Imaging was performed selectively rather than systematically. Inter-examiner agreement for costovertebral angle tenderness elicited by percussion was not measured. Finally, positive predictive value and negative predictive value depend strongly on disease prevalence and will vary across settings.

Future studies should validate the combined rule in multicenter samples, use standardized reference standards with uniform culture criteria, evaluate inter-examiner reliability, and compare alternative decision rules. Integration with basic severity markers such as vital signs and inflammatory biomarkers may further improve risk stratification.

Conclusion. In this primary-care pilot cohort, combining costovertebral angle tenderness elicited by percussion with dipstick urinalysis indicators for leukocyte esterase and or nitrite improved screening performance for acute pyelonephritis compared with either method alone and achieved a high negative predictive value. This combined approach may support triage in first-contact settings, while urine culture and clinically indicated imaging remain essential for confirmation and safe management. Larger validation studies are required before routine implementation.

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