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CADTH RAPID RESPONSE REPORT: SUMMARY OF ABSTRACTS

Creatinine and Urea Point of Care Testing for Patients with Suspected Renal Failure: Clinical Utility, Cost-Effectiveness and Guidelines

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Authors: Shannon Hill, Suzanne McCormack

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Research Questions

1. What is the clinical utility of creatinine and urea point of care testing for patients with suspected renal failure?
2. What is the cost-effectiveness of creatinine and urea point of care testing for patients with suspected renal failure?
3. What are the evidence-based guidelines regarding the use of creatinine and urea point of care testing in non-emergency department settings?

Key Findings

Four non-randomized studies were identified regarding the clinical utility of creatinine and urea point of care testing with suspected renal failure or impairment. One evidence-based guideline was identified regarding the use of creatinine and urea point of care testing in non-emergency department settings. No economic evaluations were identified regarding the cost-effectiveness of creatinine and urea point of care testing for patients with suspected renal failure.

Methods

A limited literature search was conducted by an information specialist on key resources including Medline, Embase, the Cochrane Library, the University of York Centre for Reviews and Dissemination (CRD) databases, the websites of Canadian and major international health technology agencies, as well as a focused internet search. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were creatinine and point-of-care (PoC) testing. Search filters were applied to limit retrieval to guidelines for Q3 only. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2015 and March 27, 2020. Internet links were provided, where available.

Selection Criteria

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Patients with suspected renal failure or impaired function
Intervention	Urea and creatinine point of care (PoC) testing (e.g., iSTAT device)
Comparator	Q1-2: Central laboratory testing or no lab testing
Outcomes	Q1: Clinical utility (e.g., reduce hospital stay, hospital admission, morbidity, mortality) Q2: Cost-effectiveness (e.g., cost per health benefit) Q3: Recommendations regarding the appropriate use of PoC creatinine and urea for ongoing renal function monitoring
Study Designs	Health technology assessments, systematic reviews, randomized controlled trials, economic evaluations, non-randomized studies, evidence-based guidelines

Results

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports and systematic reviews are presented first. These are followed by randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines.

Four non-randomized studies[1-4] were identified regarding the clinical utility of creatinine and urea point of care testing with suspected renal failure or impairment. One evidence-based guideline[5] was identified regarding the use of creatinine and urea point of care testing in non-emergency department settings. No health technology assessments, systematic reviews, randomized controlled trails or economic evaluations were identified in the literature.

Additional references of potential interest are provided in the appendix.

Overall Summary of Findings

Four non-randomized studies[1-4] were identified regarding the clinical utility of creatinine and urea point of care (PoC) testing with suspected renal failure or impairment. The authors of the first non-randomized study[1] assessed the utility of creatinine PoC blood gas analysis compared to laboratory assay for patients admitted to the intensive care unit. The authors found that creatinine PoC blood gas testing identified more acute kidney injury patients and provided earlier detection of acute kidney injury compared to laboratory assay measurements.[2] The authors of the second non-randomized study[2] evaluated the implementation of creatinine assay PoC testing on a blood gas analyzer for screening pre-existing renal impairment compared to central laboratory blood testing. The authors found that creatinine assay PoC testing reduced patient waiting times and concluded that the implementation of creatinine assay PoC testing may allow for more rapid clinical decisions.[2] The third non-randomized study[3] compared three PoC testing devices with a reference laboratory standard. Clinical utility outcomes were not specified within the identified abstract, however, the authors concluded that PoC technology may be feasible to screening patients at risk of acute kidney injury.[3] The fourth non-randomized study[4] evaluated the clinical impact of the Stat Sensor PoC Whole Creatinine Analyzer compared to laboratory measurements for mean turnaround time. The authors reported a faster turnaround time for the PoC measurements compared to laboratory measurements and the authors concluded

that the PoC measurements showed similar creatinine values with laboratory measurements but provided faster results.[4]

One evidence-based guideline[5] by the National Institute for Health and Care Excellence was identified regarding the appropriate use of PoC testing to assess kidney function. This guideline recommends the use of PoC creatinine devices for assessing kidney function, however, they do not recommend certain PoC devices to be used to assess kidney function in order to guide decisions for intravenous contrast use during outpatient computer tomography scans in adults.[5]

References Summarized

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

No literature identified.

Randomized Controlled Trials

No literature identified.

Non-Randomized Studies

1. Takaori K, Uchino S, Takinami M. Impact of point-of-care creatinine monitoring on early detection of acute kidney injury in critical illness. *J Nephrol*. 2019 Dec;32(6):927-935. PubMed: PM31512198

2. Bargnoux AS, Beaufils O, Oguike M, et al. Point-of-care creatinine testing in patients receiving contrast-enhanced computed tomography scan. *Clin Chim Acta*. 2018 Mar;478:111-113. PubMed: PM29269201

3. Snaith B, Harris MA, Shinkins B, Jordaan M, Messenger M, Lewington A. Point-of-care creatinine testing for kidney function measurement prior to contrast-enhanced diagnostic imaging: evaluation of the performance of three systems for clinical utility. *Clin Chem Lab Med*. 2018 07 26;56(8):1269-1276. PubMed: PM29672267

4. Carden AJ, Salcedo ES, Tran NK, et al. Prospective observational study of point-of-care creatinine in trauma. *Trauma Surg Acute Care Open*. 2016;1(1):e000014. PubMed: PM29766058

Economic Evaluations

No literature identified.

Guidelines and Recommendations

5. National Institute for Health and Care Excellence. Point-of-care creatinine devices to assess kidney function before CT imaging with intravenous contrast. (*NICE diagnostics guidance DG37*); 2019. https://www.nice.org.uk/guidance/dg37
See: 1. Recommendations: 1.1 and 1.3, page 4.

Appendix — Further Information

Previous CADTH Reports

6. i-STAT Point of Care Blood Testing System: Clinical and Cost-Effectiveness, and Diagnostic Accuracy. (*CADTH Health Technology Inquiry Service*). Ottawa (ON): CADTH; 2009. https://cadth.ca/i-stat-point-care-blood-testing-system-clinical-and-cost-effectiveness-and-diagnostic-accuracy

Non-Randomized Studies

Alternative or No Specified Comparator

7. Heringa M, Floor-Schreudering A, De Smet P, Bouvy ML. Clinical Decision Support and Optional Point of Care Testing of Renal Function for Safe Use of Antibiotics in Elderly Patients: A Retrospective Study in Community Pharmacy Practice. *Drugs Aging*. 2017 11;34(11):851-858.
PubMed: PM29119468

8. van Lint CL, van der Boog PJ, Romijn FP, et al. Application of a point of care creatinine device for trend monitoring in kidney transplant patients: fit for purpose? *Clin Chem Lab Med*. 2015 Sep 01;53(10):1547-1556.
PubMed: PM25719331

Alternative Outcome

9. Kimura S, Iwasaki T, Shimizu K, et al. Evaluation of a point-of-care serum creatinine measurement device and the impact on diagnosis of acute kidney injury in pediatric cardiac patients: A retrospective, single center study. *Health Sci Rep*. 2020 Mar;3(1):e143.
PubMed: PM32166189

10. Vaara ST, Glassford N, Eastwood GM, Canet E, Martensson J, Bellomo R. Point-of-care creatinine measurements to predict acute kidney injury. *Acta Anaesthesiol Scand*. 2020 Feb 14;14:14.
PubMed: PM32057092

11. Snaith B, Harris MA, Shinkins B, et al. Point of care creatinine testing in diagnostic imaging: A feasibility study within the outpatient computed tomography setting. *Eur J Radiol*. 2019 Mar;112:82-87.
PubMed: PM30777224

12. van der Heijden C, Roosens L, Cluckers H, Van Craenenbroeck AH, Peeters B. Analytical and clinical performance of three hand-held point-of-care creatinine analyzers for renal function measurements prior to contrast-enhanced imaging. *Clin Chim Acta*. 2019 Oct;497:13-19.
PubMed: PM31271741

13. Griffin BR, Butler-Dawson J, Dally M, et al. Unadjusted point of care creatinine results overestimate acute kidney injury incidence during field testing in Guatemala. *PLoS ONE*. 2018;13(9):e0204614.
PubMed: PM30261074

14. Spaeth BA, Shephard AK, Shephard MDS, Mathew TH. Assessment of a point-of-care device for measuring creatinine in a community screening program for chronic kidney disease. Medical Research Archives; (3). 2015. https://journals.ke-i.org/index.php/mra/article/view/132

Review Articles

15. Tricoli A, Neri G. Miniaturized Bio-and Chemical-Sensors for Point-of-Care Monitoring of Chronic Kidney Diseases. *Sensors (Basel)*. 2018 Mar 22;18(4):22. PubMed: PM29565315

Additional Information

16. Gbinigie O, Price CP, Heneghan C, Van den Bruel A, Pluddemann A. Creatinine point-of-care testing for detection and monitoring of chronic kidney disease: primary care diagnostic technology update. *Br J Gen Pract*. 2015 Nov;65(640):608-609. PubMed: PM26500316