

Urine biomarkers for Acute Kidney Stress in Major Elective Surgical Patients – a feasibility study.

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Behaviour change towards preventing hospital-acquired acute kidney injury rather than implementing renal replacement therapy bundles once the event has occurred is becoming evident in various clinical settings. Biomarkers that provide information about the state of the nephrons prior to acute kidney injury (AKI) being evident (cf. conventional creatinine methods) have been well documented. The composite biomarker [TIMP2]x[IGFBP7] can indicate renal stress within the nephrons prior to detection of functional change.

The test marketed as NephroCheck[®], Biomérieux is the first FDA-approved test for AKI.

Our study assessed the feasibility of introducing urinary measurements into the patient pathway for major elective, non-cardiac surgery and gathered patient-based examples of potential benefits of a non-invasive biochemical assessment of renal function. We have used Tissue Inhibitor Metalloproteinase 2 (TIMP2) and Insulin-Like Growth Factor Binding Protein 7 (IGFBP7) as indicators of acute kidney stress.

Fifteen adult patients were identified using our pre-operative risk assessment tool. This scoring system is capable of identifying patients at risk of developing AKI following elective major surgery (in-house verification). Patients with a high score were identified and given the opportunity to consent to participation on the day of surgery. [TIMP2]x[IGFBP7] requires 100 µL of urine sample for analysis. A positive result was given by using a cut off of > 0.3. Samples were collected from catheters already in place for routine patient management at 4 and 12 hours post-operatively. Care pathways and management of renal function according to existing protocols remained in place and unchanged. The study was ethically approved by the NHS Research Ethics Committee (IRAS 239519).

15 patients were classified as high risk of developing AKI with the pre-operative AKI risk score (mean score = 28.5 ± 14.6 %). The mean age = 74 years and mean BMI = 28.6. There was no significant difference in pre-op and post-op creatinine measurements. Negative results ([TIMP2] x [IGFBP7] = < 0.3) were seen in 4/15 patients at 12 hours post-operatively, indicating low risk of AKI within the next 12 h. None of these patients went on to develop AKI in the following 7 days after surgery. Furthermore, 3 of these 4 patients also had negative Nephrocheck[®] results at 4 hours post-op. Positive Nephrocheck[®] results were seen in 11/15 patients at 12 hours post-operatively. Six of these patients had a positive Nephrocheck[®] score at 4 hours. Three patients with positive Nephrocheck[®] at 12 hours developed AKI within 48 hours following surgery, before standard creatinine measurements indicated AKI. These cases were investigated further to identify possible causes of AKI and implications of having an 'early warning' of AKI were assessed.

We have shown in this feasibility study that it is possible to incorporate timely collection of urine samples for [TIMP2]x[IGFBP7] biomarker assessment at 4 and 12 hours post-operatively. In this small trial the negative predictive value was 100 % with a positive predictive value of 27 %. Larger studies are required to prove the usefulness of Nephrocheck in risk assessment of AKI in high risk post-operative surgical patients.