The amount of proteins excreted in the urine by normal adults (<150 mg/24 hours) is the result of collection of proteins from serum or renal origin and their degradation products. Under normal physiological conditions the most prevalent of the urine proteins excreted (up to 70 mg per day) is produced in the kidney, urine proteins from serum origin only accounting for up to 22 mg per day. Glomerular filtration barriers indeed markedly limit the filtration of normal to high-molecular weight serum proteins, and the proximal tubule efficiently reabsors low-molecular weight serum proteins (<40 kDa) filtered by the glomeruli. Therefore, an albumin excretion above 20 mg/L (microalbuminuria), increases the albumin to total protein ratio,1 and is considered a diagnostic marker for chronic kidney disease (CKD) even in the presence of normal glomerular filtration rate.2 Microalbuminuria is now also part of the strategy for cardiovascular risk assessment and immunometric systems specific for albuminuria are gradually replacing multiparametric conventional dipstick (MCD) in epidemiological studies.3 However, the increased albumin excretion may also let the total urine protein concentration reach the first turning point of the MCD.4 The semi-quantitative assessment with MCD indeed marks trace results in response to a protein concentration of as little as 150 mg/L and a distinct color change of the 1+ level at around 300 mg/L. The possibility to rule out urinary tract infections (UTI) with MCD was also reported.5 The present study was thus performed to investigate the sensibility and specificity of MCD to estimate microalbuminuria and UTI in epidemiological studies.

Urine specimens arriving at the Central Laboratory of Careggi Hospital, Florence, Italy from February through May 2009 for total protein assay (n=280; 59% males; mean age 57 years, range 16-78), urinary albumin evaluations (n=454; 57% males; mean age 53, range 13-79) or suspected UTI (n=179; 43% males; mean age 46, range 14-68) were used. In patients with suspected UTI, urine was collected by the midstream clean-catch technique after preliminary exclusion of the subjects who had either taken antibiotics in the past 72 hours or symptomatic vaginal discharge (standardized instructions). All samples were processed within 2-4 hours after arrival. Test strip urinalysis was carried out using Aution sticks 10EA (Menarini Diagnostic, Florence, Italy) according to the manufacturer's instructions. Data were expressed as ordinal scale (“normal,” “negative,” “positive”; nominal concentrations). Total protein was measured with Pyrogallol red complex procedure (Advia 2400 analyser; Siemens Healthcare Diagnostic, Tarrytown, NJ, USA). Albumin in urine was measured with the immuno-nephelometric method (Immage 800, Beckman-Coulter, Brea, CA, USA). Urine culture was performed with an automated system (Robobact System, DIESSE Diagnostica Senese S.p.A., Siena, Italy). Independent predictors of UTI were investigated using 10^4 and 10^5 colony forming units (CFU)/mL as criteria for positivity of culture. Statistical analysis was performed using the Statistical Package for Social Sciences version 17.0 (SPSS Inc., Chicago, IL, USA). A p-value <0.05 was considered significant. Kappa for nominal data was used to assess concordance between raters. Different assay methods were compared with Chi^2 test for discrete readings, or linear regression analysis, and Pearson’s correlation coefficients for continuous variables. Diagnostic accuracy was assessed by Receiver Operating Characteristic (ROC) curves. Predictors of UTI were investigated with stepwise logistic regression using MCD parameters (relative density, pH, nitrite, leukocyte esterase, hemoglobin, or protein) as independent variables.

The relationship between total protein and albumin urinary concentrations was preliminary assayed in 80 urine samples with normal protein electrophoresis values. Notwithstanding the close correlation between total protein and albumin urinary concentration (y = 0.643 x -37.11; r = 0.9572; p=0.009), a non-uniform relationship was confirmed with slope change at around 150 mg/L total protein and 20 mg/L albumin concentrations (Figure 1). The impact of rating in ranking of proteinuria readings was then assessed in the first 84 samples. Fifty out of the 84 dipsticks (59.5%) were allocated in the same group by the 3 operators, 32 (38.1%) received a different allocation by one of the operators. Only 2 strips (2.4%) received a different allocation by the 3 readers. Kappa for nominal data revealed a significant concordance of raters (p=0.009).

Accuracy of the stick to discriminate positive and negative responses for proteinuria and the uniformity of correct/incorrect results compared with reference methods along the measurement range (0-12,000 mg/L) are reported in Table 1. A Chi^2 test for correct/incorrect readings for total protein showed good discriminating capacity (p=0.001). Furthermore, Chi^2 tests on the over/correct/under readings for the 6 protein ranges showed homogeneity of response (p=0.001 for all). In particular, 157 out of 280 specimens (56%) had urinary

Disclosure. This study was supported by a research grant from the “Ministero dell’Università e della Ricerca, Direzione Generale per le strategie e lo sviluppo dell’inte

rnazionalizzazione della ricerca scientifica e tecnologica” and “Ministero degli Affari Esteri” within the frame of the Executive Programme of Scientific and Technological Cooperation between Italy and Yemen for the years 2006-2009 (Grant #269/P/0116202 ).
From the Department of Laboratory (Rapi, Bartolini), Careggi Hospital, the Department of Critical Care Medicine (Cambi, Bannooosh, Baldreschi, Massetti, Modesti), University of Florence, the Institute for Oncologic Study and Prevention (Puliti), Florence, the Don Carlo Gnocchi Foundation (Modesti), Centro Santa Maria degli Ulivi, Pozzolatico, Italy, and the Department of Cardiology (Bannooosh), University of Science and Technology, Sana’a, Yemen. Address correspondence and reprints request to: Prof. Pietro A. Modesti, Department of Critical Care Medicine and Don Carlo Gnocchi Foundation, University of Florence, Viale Morgagni 85, 50134 Florence, Italy. Tel/Fax: +39 (55) 7949376. E-mail: pamodesti@unifi.it

References


