

Albumin Creatinine Ratio (ACR) versus Protein Creatinine Ratio (PCR) for Nephrology Referral criteria in Primary Care

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Introduction:

- Proteinuria is important diagnostic test and a bad prognostic marker for Chronic Kidney Diseases (CKD) with or without diabetes mellitus¹ and cardiovascular diseases.
- Total proteinuria consists of albuminuria from glomeruli, filtered immunoglobulins as well as tubular proteins like Tamm Harsfall protein. Detection and quantification of urinary albumin is vital for diagnosis and management of most renal disorders.
- Urinary total protein is <150mg/day. Normal Albumin excretion is <20mg/day. Macroalbuminuria is defined as albumin excretion of 300mg/day or ACR of 30 mg/mmol or more. Screening for microalbuminuria in form of ACR is normal practice in diabetic clinics for a while. This has become very user friendly for the GPs.
- There is moderate to high correlation between spot urine protein creatinine ratio (PCR) and 24 hour urinary protein excretion²⁻⁷. Urinary albumin concentration correlates well with urinary total protein and also with 24 hour urinary protein over a very wide range of the level of proteinuria⁸⁻⁹⁻¹⁰⁻¹¹.
- Spot urinary PCR predicts actual 24 urine protein excretion with reasonable accuracy in patients with lower levels of protein excretion but is unreliable for higher levels of proteinuria¹⁻⁶⁻¹². At an early state of renal involvement in many chronic disorders, UAE (Urinary Albumin Excretion) increases by several folds compared to total protein which could remain normal¹³.
- Urinary total protein measurements have possible analytical inaccuracies¹⁴ while urinary albumin measurement is easy to standardise.
- Since 2006, eGFR is reported for each s.creatinine value reported from the lab in UK. Identification of significant proteinuria for nephrology referral (>1gm/day) is important in primary care with prevalence of CKD around 10%.
- 24 hour urine test for estimation of proteinuria is not practical in primary care setting to identify CKD. The test should be simple, comparable and reproducible in a similar way as in patients with microalbuminuria like diabetes. It should maintain uniformity of diagnostic testing for proteinuria for CKD patients.
- Because of technical reasons higher urinary Albumin requires further dilutions with increase in the cost with each dilution to report ACR value.

Objective:

- Aim of our study was to review our current guideline of ACR > 60 mg/mmol and to compare with PCR > 100mg/mmol for nephrology referral of patients with proteinuria>1gm/day.
- To establish a value of ACR for nephrology referrals for proteinuria from primary care to avoid any misses of significant proteinuria.

Methods:

- Following DOH (Department of Health) initiative for identification of CKD, we decided to measure and report ACR value for each request of urinary protein measurement to maintain consistency with microalbuminuria and to create less confusion amongst the primary health care professionals.

- After about 6 months of having practiced ACR reporting, we decided to review our cut off value of ACR > 60 mg/mmol for referral for proteinuria from primary care.
- 100 consecutive 24 hour urinary specimens from adult nephrology outpatient and inpatient departments with available relevant data were reviewed.
- Urinary ACR, PCR and 24 hour urinary protein values were compared and a cut off value of ACR was identified for 24 hour urinary protein level of greater than 1 gm per day to avoid any misses of significant proteinuria.
- Comparable graphs were produced and sensitivity, specificity, positive predictive p-values, Negative predictive p-values were compared.
- Cost of the tests were also reviewed.

Results:

- 39 out of 100 urinary specimens had a 24 hour urinary protein value of >1gm/day.
- Chart 1 shows linear correlation between ACR and PCR which is more obvious at lower values. Chart 2 shows only 2 values fall much far from ACR cut off value of 45mg/mmol.
- PCR>100 mg/mmol:** Nine out of 39 (23.6%) with >1 gm/day proteinuria had PCR<100 mg/mmol and 4 out of 61 (6.5%) with proteinuria less than 1 gm/day had PCR>100 mg/mmol. Sensitivity, specificity, positive predictive value and negative predictive value were 77%, 93%, 88%, 86% respectively (table 1)
- ACR>60:** Eleven out of 39 (28.2%) with >1gm/day proteinuria had ACR<60 mg/mmol and none out of 61 with proteinuria less than 1 gm/day had ACR> 60 mg/mmol. Sensitivity, Specificity, positive predictive value and negative predictive values were 71%, 100%, 100%, 84% respectively. (Table 1)
- ACR>45:** Four out of 39(10.2%) with >1gm/day proteinuria had ACR<45 mg/mmol. 2 of these had PCR>100mg/mmol. None out of 61 with proteinuria less than 1 gm/day had ACR>45 mg/mmol. Sensitivity, specificity, positive and negative predictive values were 90%, 100%, 100%, 94% respectively (Table 1).

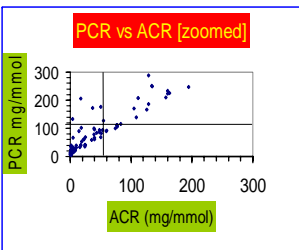


Chart 1. Values of PCR and ACR for 24 hour urinary specimens

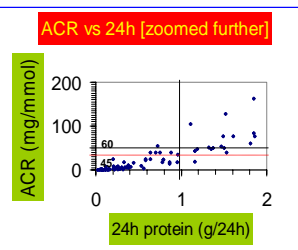


Chart 2 ACR values (60mg/mmol and 45 mg/mmol) compared with 24 hr urinary protein levels

	Sensitivity %	Specificity %	Positive predictive value	Negative predictive value
PCR>100	77	93	88	86
ACR>60	71	100	100	8784
ACR>45	90	100	100	94

Table 1. Sensitivity, Specificity, positive predictive value, Negative predictive values for all 39 specimens with proteinuria >1 gm/day

	Sensitivity %	Specificity %	Positive predictive value	Negative predictive value
PCR>100	81	93	83	88
ACR>60	75	100	100	87
ACR>45	95	100	100	96

Table 2. Sensitivity, Specificity, positive predictive value, Negative predictive values for 37/39specimens with proteinuria >1 gm/day (excluding 2 specimens with both PCR and ACR negative)

- Only 2 out of 100 (2%) specimens analyzed did not fit referral criteria for both PCR and ACR. With exclusion of these two specimens, from 37/39 specimens of >1 gm/day proteinuria, calculated comparative sensitivity, specificity, positive and negative predictive values were (Table 2): For ACR>45mg/mmol - 95%, 100%, 100%, 96%, For PCR>100mg/mmol - 81%, 93%, 83%, 88% respectively

Conclusion:

- ACR has better specificity and positive predictive value compared to PCR>100mg/mmol
- ACR > 60mg/mmol is poor in identifying significant (>1 gm/day) proteinuria from primary care.
- Cut off value of ACR over 45mg/mmol has higher statistical value compared to ACR>60mg/mmol and PCR>100mg/mmol.
- ACR >45mg/mmol is acceptable value for referral for significant proteinuria.
- Reporting of a specific value of ACR>45mg/mmol is not necessary for monitoring and managing progression of proteinuria as 24 hour urine measurements are still required to quantify proteinuria in these cases after referral to secondary care.

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