SCREENING and INITIAL MANAGEMENT of DIABETIC MICROALBUMINURIA and NEPHROPATHY

Begin screening 12 years of age and over with no overt renal disease:
Do annual random urinalysis for protein*

Negative

- **Send random urine collection for albumin/creatinine ratio (A/C)**
- **If A/C <30, repeat UA in 1 year**

A/C ≥ 30
2 out of 3 times in 3-6 months

Microalbuminuria established

Begin therapy

Optimize blood glucose control
A1C<7 %

Optimize BP control (goal < 130/80)
Start ACEI or ARB*****

Positive

Quantitate proteinuria

Abnormal results

Overt nephropathy established

Assess for chronic kidney disease (estimate GFR)

If creatinine is ≥1.5 mg/dl for women
or
1.8 mg/dl for men,
or
GFR <60; refer to nephrologist

*The following conditions may cause a false positive result for proteinuria or microalbuminuria:

- exercise within 24 hours
- infection
- fever
- congestive heart failure
- marked hyperglycemia
- marked hypertension

If any of these conditions are present, repeat the urinalysis for protein or microalbumin after the condition has resolved; then proceed with the algorithm according to the results of the repeat test.

**Angiotensin converting enzyme inhibitor

***Angiotensin II receptor blocker

RECOMMENDATIONS FOR GLYCEMIC CONTROL

Biochemical Index	Normal	Goal
Fasting/preprandial plasma glucose	<100 mg/dl	70-130 mg/dl
Peak postprandial plasma glucose	<140mg/dl	<180 mg/dl
A1C	<6%	<7%

These glycemic goals are for nonpregnant adults. Goals should be tailored to individual patients. Such actions may include enhanced diabetes self-management education, co-management with a diabetes team, referral to an endocrinologist, change in pharmacological therapy, initiation or increased self-glucose monitoring, or more frequent contact with the patient. A1C is referenced to a nondiabetes range of 4.0-6.0% (mean 5.0%, SD±0.5%). Postprandial glucose measurements should be made 1-2 hours after the beginning of the meal. More stringent goals (<6.0%) may be considered.

Diabetes Care 34 (Suppl. 1):S3, January 2011

Adapted from the American Diabetes Association Clinical Practice Recommendations, 2011.

EXPLANATORY NOTES
SCREENING and INITIAL MANAGEMENT of DIABETIC MICROALBUMINURIA and NEPHROPATHY

1. This algorithm should be used in conjunction with the "Basic Guidelines for Diabetes Care" developed by the Diabetes Coalition of California in collaboration with the California Diabetes Program of the California Department of Public Health.

2. Microalbuminuria is the earliest clinical evidence of incipient nephropathy. It is associated with progression to overt nephropathy and increased risk of retinopathy and cardiovascular morbidity and mortality. There are 3 methodologies available to screen for microalbumin in the urine. These are a spot sample for measuring albumin/creatinine (A/C) ratio, a 24-hour urine measurement, or a timed overnight measurement. The spot urine collection is the simplest and preferred methodology (see table below). Microalbuminuria is defined as urinary A/C ratio of ≥30 µg albumin /mg creatinine (which is equivalent to ≥30 mg albumin /g creatinine) in 2 out of 3 collections. When obtaining the A/C ratio, it is important to remember that patients with very low body mass may have an abnormally high ratio whereas in patients with high body mass, the ratio may underestimate the presence of microalbuminuria. In these specific patients a timed urine collection may be more appropriate.

3. Screening for proteinuria should begin as soon as possible after the diagnosis of type 2 diabetes. Screening for proteinuria in type 1 diabetes should begin with puberty once the duration of diabetes is more than five years. If proteinuria is present on routine dipstick, quantification will help in the development of a treatment plan (24-hour urinary protein or random A/C ratio). Other reasons to quantitate proteinuria are to follow effects of treatment and to be alert to other possible causes of proteinuria with possible different prognosis or different treatment.

Definitions of abnormalities in albumin excretion

Category	Spot collection (A/C ratio) (µg/mg creatinine)
Normal	<30
Microalbuminuria	30-299
Macro (clinical)-albuminuria	≥300

Adapted from *Diabetes Care, 34(Suppl. 1):January 2011*

   - A false positive urinary protein test or A/C ratio may occur with the following circumstances: exercise in previous 24 hours, infection or fever, congestive heart failure, marked hypertension or marked hyperglycemia. These conditions should be resolved and the test repeated.
   - If the dipstick is negative for proteinuria, microalbuminuria should be checked. A microalbumin dipstick or tablet may be used on the same random sample of urine. If this is positive (>20 µg/mg), a random A/C ratio should be done. If A/C ratio ≥30 µg/mg, it should be repeated on 2 collections over the next 3-6 months because of the day-to-day variability of albumin excretion; 2 out of 3 should be positive before microalbuminuria is diagnosed. (Many laboratories will routinely do an A/C ratio if a random microalbumin is ordered. If dipstick or tablet for microalbumin is not available at the site of service, a random specimen should be sent to the laboratory for an A/C ratio. Check with the laboratory to see how this should be ordered.)

4. Staging of Chronic Kidney Disease (CKD)
   - The dialysis population now exceeds 547,000 patients and it is estimated that nearly 23 million Americans have some form of CKD. Diabetes is the cause of CKD in a high percentage of these patients. In response to the growing population of patients with CKD, the National Kidney Foundation defined five stages of CKD and published clinical guidelines for staging and management. The stage of kidney disease can be assigned to the patient based on calculated glomerular filtration rate. This calculation only necessitates a serum creatinine and patient age and gender.
   - The calculated Glomerular Filtration Rate (GFR) is the best means to follow kidney function and most large laboratories are now reporting GFR estimates as part of the report of a serum creatinine. A simple GFR calculator, the Stages of Chronic Kidney Disease, and the guidelines of care can easily be found at the National Kidney Foundation or National Kidney Disease Education Program website (http://www.kidney.org/professionals/KDOQI/gfr.cfm or www.nkdep.nih.gov/professionals/gfr_calculators/index.htm for adult pdf version).

Stages of Chronic Kidney Disease (CKD)

Stage	Description	GFR (mL/min/1.73m^2)
1	Kidney damage with normal or ↑GFR	≥90
2	Kidney damage with mild ↓GFR	60-89
3	Moderate ↓GFR	30-59
4	Severe ↓GFR	15-29
5	Kidney failure	<15 (or dialysis)

Adapted from *Am J Kidney Dis. 39(2 Suppl 1):S1-S66, 2002*.

   - Several recent well-designed studies have shown that careful control of the blood glucose and blood pressure can reduce the progression to overt nephropathy, retinopathy, and cardiovascular morbidity and mortality. The use of an angiotensin converting enzyme (ACE) inhibitor also has been demonstrated to reduce progression to overt nephropathy, cardiovascular morbidity and mortality and, perhaps, retinopathy. More recently, use of angiotensin II receptor blockers (ARB) has been shown to reduce the progression to more severe nephropathy. Regular monitoring of glomerular filtration rate and potassium creatinine is recommended to determine the beneficial effect of treatment.
   - Timely referral to a nephrologist is indicated once a patient reaches Stage 3 allowing for appropriate education regarding the options for renal replacement therapy (peritoneal dialysis, hemodialysis, and/or transplantation).
   - Kidney damage is defined as any one of the followings- albuminuria, proteinuria, persistent hematuria (excluding urological conditions), radiological abnormalities (e.g. scarring or polycystic kidneys) , pathological abnormalities (e.g. abnormal renal biopsy)

