

Outpatient Management of Chronic Kidney Disease for the Internist

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Agenda

- I. Goal of CKD Management
- II. Definition & Staging of CKD
- III. Epidemiology
- IV. Slowing Progression of CKD
- V. Safety Features
- VI. Complications of CKD
- VII. Referral & Co-Management with Nephrology

Goal of CKD Management

- ▶ Prevent or Slow Progression
- ▶ Minimize Complications
- ▶ Improve Quality of Life
- ▶ Lower cost burden on health care system

Primary Care Physicians – First Line of Defense Against Chronic Kidney Disease (CKD)

- ▶ Early Detection is essential
- ▶ Early management can improve outcomes
- ▶ Approximately 14.8% of adults in the U.S. meet the definition of CKD
- ▶ PCPs are essential in the management of this population

Definition of Chronic Kidney Disease

- ▶ Duration of ≥ 3 months
- ▶ Glomerular Filtration Rate (GFR) < 60 ml/min/1.73 m²
- ▶ Kidney damage defined as structural abnormalities or functional abnormalities other than decreased GFR
 - ▶ Pathologic abnormalities
 - ▶ Kidney transplantation
 - ▶ Albuminuria
 - ▶ Urinary sediment abnormalities
 - ▶ Imaging abnormalities

Classification of Chronic Kidney Disease Staging

- ▶ Causes
 - ▶ Presence or absence of systemic disease
 - ▶ Location in the kidney of pathologic or anatomic findings
- ▶ Glomerular Filtration Rate
 - ▶ Based on CKD Epi Equation
- ▶ Albuminuria

CGA Staging

Cause

Assign cause of CKD based on presence or absence of systemic disease and the location within the kidney of observed or presumed pathologic-anatomic findings

	Examples of systemic diseases or conditions affecting the kidney	Examples of primary kidney diseases (absence of systemic diseases affecting the kidney)
Glomerular disease	Diabetes, systemic autoimmune diseases, systemic infections, drugs, neoplasia (including amyloidosis)	Diffuse, focal or crescentic proliferative glomerulonephritis; focal and segmental glomerulosclerosis; membranous nephropathy; minimal change disease
Tubulointerstitial disease	Systemic infections, autoimmune, sarcoidosis, drugs, urate, environmental toxins (lead, aristolochic acid), neoplasia (myeloma)	Urinary-tract infections, stones, obstruction
Vascular disease	Atherosclerosis, hypertension, ischemia, cholesterol emboli, systemic vasculitis, thrombotic microangiopathy, systemic sclerosis	ANCA-associated renal limited vasculitis; fibromuscular dysplasia
Cystic and congenital disease	Polycystic kidney disease, Alport's syndrome, Fabry's disease	Renal dysplasia, medullary cystic disease, podocytopathies

Abbreviations: ANCA, antineutrophil cytoplasmic antibody; CKD, chronic kidney disease, GN, glomerulonephritis
Genetic diseases are not considered separately because some diseases in each category are now recognized as having genetic determinants.

*Note that there are many different ways in which to classify CKD. This method of separating systemic diseases and primary kidney diseases is only one, proposed by the KDIGO Work Group, to aid in conceptual approach.



CGA Staging

GFR

Assign GFR categories

GFR category	GFR (ml/min/1.73 m ²)	Terms
G1	≥90	Normal or high
G2	60-89	Mildly decreased*
G3a	45-59	Mildly to moderately decreased
G3b	30-44	Moderately to severely decreased
G4	15-29	Severely decreased
G5	<15	Kidney failure

Abbreviations: CKD, chronic kidney disease; GFR, glomerular filtration rate.

*Relative to young adult level

In the absence of evidence of kidney damage, neither GFR category G1 nor G2 fulfill the criteria for CKD.

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CGA Staging

Albuminuria

Assign albuminuria[†] categories

Category	AER	ACR (Approximate equivalent)		Terms
		(mg/24h)	(mg/mmol)	
A1	<30	<3	<30	Normal to mildly increased
A2	30-300	3-30	30-300	Moderately increased*
A3	>300	>30	>300	Severely increased**

Abbreviations: AER, albumin excretion rate; ACR, albumin-to-creatinine ratio; CKD, chronic kidney disease

*Relative to young adult level.

**Including nephrotic syndrome (albumin excretion usually >2200 mg/24 hours [ACR >2220 mg/g; >220 mg/mmol])

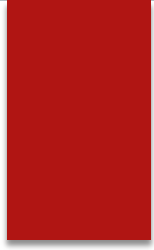
[†]Note that where albuminuria measurement is not available, urine reagent strip results can be substituted



Importance of Staging

- ▶ Guide management of CKD
- ▶ Identify those at highest risk for complications
- ▶ Guides when to intensify monitoring of patients
- ▶ Guides when to refer to Nephrologist
- ▶ Guides content of patient education

Epidemiology



Percentage of NHANES Participants in KDIGO Risk Categories (2011-2014)

				Albuminuria categories			
				A1	A2	A3	
				Normal to mildly increased	Moderately increased	Severely increased	
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol	
GFR categories (ml/min/1.73 m ²)	G1	Normal to high	≥ 90	54.7	4.3	0.4	4.7%
	G2	Mildly decreased	60-89	30.4	2.6	0.3	2.9%
	G3a	Mildly to moderately decreased	45-59	3.9	0.9	0.2	5.0%
	G3b	Moderately to severely decreased	30-44	1.0	0.5	0.2	1.7%
	G4	Severely decreased	15-29	0.1	0.1	0.2	.4%
	G5	Kidney failure	< 15	<0.001	0.001	0.01	.01%
				5.0%	8.5%	1.3%	

14.8% of US Population Meets Definition of CKD

Summary of Relative Risks from Categorical Meta-Analysis

(reagent strip included [-, ±, +, ≥++])

Kidney Failure (ESRD)

	ACR <10	ACR 10-29	ACR 30-299	ACR ≥300
eGFR > 105	Ref	Ref	7.8	18
eGFR 90-105	Ref	Ref	11	20
eGFR 75-90	Ref	Ref	3.8	48
eGFR 60-75	Ref	Ref	7.4	67
eGFR 45-60	5.2	22	40	147
eGFR 30-45	56	74	294	763
eGFR 15-30	433	1044	1056	2286

All-Cause Mortality

	ACR <10	ACR 10-29	ACR 30-299	ACR ≥300
eGFR > 105	1.1	1.5	2.2	5.0
eGFR 90-105	Ref	1.4	1.5	3.1
eGFR 75-90	1.0	1.3	1.7	2.3
eGFR 60-75	1.0	1.4	1.8	2.7
eGFR 45-60	1.3	1.7	2.2	3.6
eGFR 30-45	1.9	2.3	3.3	4.9
eGFR 15-30	5.3	3.6	4.7	6.6

Acute Kidney Injury (AKI)

	ACR <10	ACR 10-29	ACR 30-299	ACR ≥300
eGFR > 105	Ref	Ref	2.7	8.4
eGFR 90-105	Ref	Ref	2.4	5.8
eGFR 75-90	Ref	Ref	2.5	4.1
eGFR 60-75	Ref	Ref	3.3	6.4
eGFR 45-60	2.2	4.9	6.4	5.9
eGFR 30-45	7.3	10	12	20
eGFR 15-30	17	17	21	29

Cardiovascular Mortality

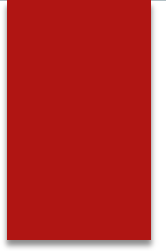
	ACR <10	ACR 10-29	ACR 30-299	ACR ≥300
eGFR > 105	0.9	1.3	2.3	2.1
eGFR 90-105	Ref	1.5	1.7	3.7
eGFR 75-90	1.0	1.3	1.6	3.7
eGFR 60-75	1.1	1.4	2.0	4.1
eGFR 45-60	1.5	2.2	2.8	4.3
eGFR 30-45	2.2	2.7	3.4	5.2
eGFR 15-30	14	7.9	4.8	8.1

Progressive CKD

	ACR <10	ACR 10-29	ACR 30-299	ACR ≥300
eGFR > 105	Ref	Ref	0.4	3.0
eGFR 90-105	Ref	Ref	0.9	3.3
eGFR 75-90	Ref	Ref	1.9	5.0
eGFR 60-75	Ref	Ref	3.2	8.1
eGFR 45-60	3.1	4.0	9.4	57
eGFR 30-45	3.0	19	15	22
eGFR 15-30	4.0	12	21	7.7



Slowing Progression



Interventions to Delay Progression in CKD

- I. Hypertension Management
- II. Albuminuria should use ACEI or ARB
- III. Diabetes – target A1C 7%
- IV. Correct Metabolic Acidosis

Hypertension Management

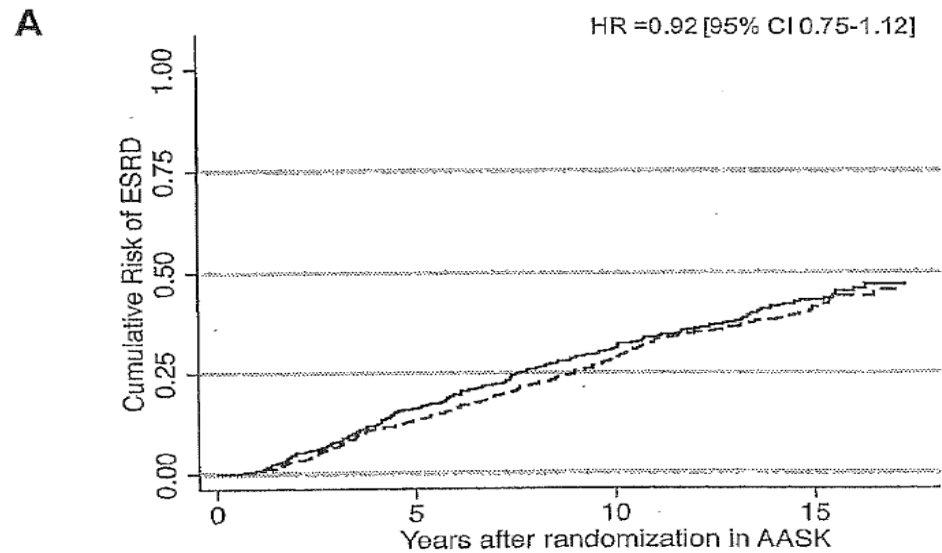
- ▶ Blood Pressure (BP) Goal $<140/90$
- ▶ Consider BP Goal $<130/80$ if spot UACR > 300 mg/g
 - ▶ Use ACEI or ARB if spot UACR > 30 mg/g
 - ▶ Do not use ACEI and ARB together (Risk Acute Kidney Injury (AKI) & Hyperkalemia)
 - ▶ Diuretics usually required
 - ▶ Thiazide – stage G1-G3b
 - ▶ Loop diuretic - stage G4-G5
 - ▶ Dietary sodium restriction $< 2\text{g/day}$

Hypertension Management cont'd

- ▶ Complications of ACEI or ARBs
 - ▶ A. Hyperkalemia
 - ▶ Low K diet
 - ▶ Diuretics
 - ▶ Potassium binding resins (i.e., Veltassa, Patiromer)
 - ▶ Correct metabolic acidosis if present
 - ▶ Discontinue RAAS blockers

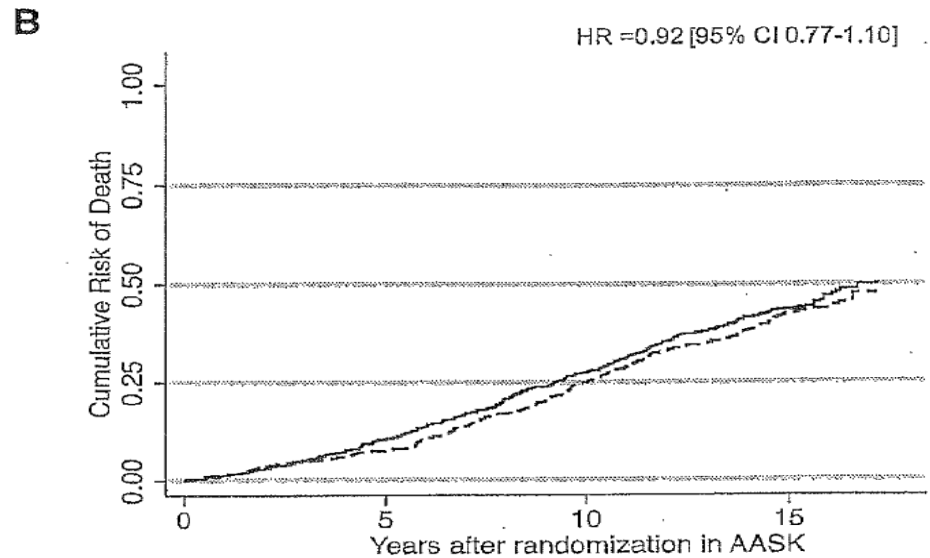
Hypertension Management – cont'd

- ▶ B. Acute Kidney Injury
 - ▶ Stable increase in creatinine up to 25% within 2 months of starting ACEI or ARB can be considered normal and not need to discontinue RAAS blockers
 - ▶ Increase in creatinine over 25%
 - ▶ Discontinue RAAS blockers
 - ▶ Evaluate for renal artery stenosis or overdiuresis



Number at risk				
Usual BP	545	419	298	152
Strict BP	522	420	302	146

— Usual BP - - - Strict BP



Number at risk				
Usual BP	545	489	395	220
Strict BP	522	482	392	207

— Usual BP - - - Strict BP

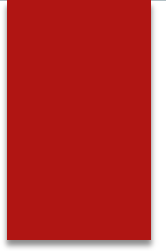
Glycemic Control

- ▶ Target HgbA1C < 7%
 - ▶ Higher target for patients at high risk of hypoglycemia or a limited life expectancy
- ▶ Benefits
 - ▶ Reduction of cardiovascular risk
 - ▶ Renal Protection
 - ▶ Decreased progression of albuminuria
 - ▶ Preservation of renal function

Metabolic Acidosis

- ▶ Some evidence to suggest correction slows progression of CKD
- ▶ Treat is serum bicarbonate level if less than 22 mmol/L
 - ▶ Sodium bicarbonate - 650 mg tid
 - ▶ Sodium citrate – 30 cc daily

Safety Features



Patient Safety in CKD

eGFR < 60

- ▶ Dose drugs for level of eGFR if they are predominantly excreted by the kidney
- ▶ Decrease risk of AKI from volume depletion
- ▶ Prevent contrast-induced AKI
 - ▶ Avoid contrast if possible or use minimal volume of low osmolality contrast
 - ▶ Consider isotonic saline infusion before, during and after procedure
 - ▶ Withhold Metformin, RAAS blockers, and diuretics

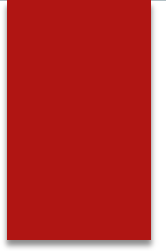
Patient Safety in CKD

- ▶ Stage G3a (eGFR 45-59)
 - ▶ Avoid prolonged use of NSAIDs
 - ▶ Can continue Metformin
- ▶ Stage G3b (eGFR 30-44)
 - ▶ Avoid use NSAIDs
 - ▶ Reduce dose of Metformin by 50% and monitor patient closely

Patient Safety in CKD – cont'd

- ▶ Stage G4-G5 (eGFR < 30)
 - ▶ Avoid NSAIDs
 - ▶ Avoid Bisphosphonates
 - ▶ Avoid Metformin
 - ▶ Avoid PICC lines
 - ▶ Protect veins for future dialysis access
 - ▶ Monitor for increased risk of bleeding with Warfarin

Complications



Complications of CKD

- ▶ Anemia
- ▶ Metabolic Acidosis
- ▶ Metabolic and Bone Disease
- ▶ Cardiovascular Disease

Anemia

- ▶ Identification is Essential
 - ▶ Stage G3a – check Hgb at least annually
- ▶ Normocytic, Normochromic
- ▶ Be sure not iron deficient before using Erythrocyte Stimulating Agents (ESAs)
 - ▶ Replete with oral iron or use IV iron if no response to oral
- ▶ Indication for ESA
 - ▶ Avoid Transfusion
 - ▶ Frequently used for Hgb <9
 - ▶ No goal hemoglobin

Metabolic Acidosis

- ▶ Adverse Consequences
 - ▶ Progression of CKD
 - ▶ Increased bone resorption
 - ▶ Increased protein catabolism
 - ▶ Decreased albumin synthesis
- ▶ Treatment
 - ▶ Sodium bicarbonate
 - ▶ Sodium citrate

Bone and Mineral Disorders

- ▶ Usually see Stage G3b, G4, & G5
- ▶ Abnormalities
 - ▶ Hyperphosphatemia
 - ▶ Hypocalcemia
 - ▶ Decreased Vitamin D
 - ▶ Increase Parathyroid Hormone
- ▶ Goals for PTH vary with Stage of CKD
 - ▶ G3 35-70
 - ▶ G4 70-110
 - ▶ G5 150-300
- ▶ Co-Manage with Nephrology

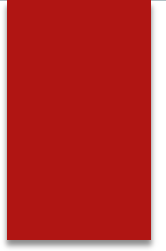
Cardiovascular Disease

- ▶ CKD is an independent risk factor for cardiovascular disease and death
- ▶ Strategies to employ:
 - ▶ Statins
 - ▶ Low dose aspirin if bleeding risk is acceptable
 - ▶ Weight reduction
 - ▶ Exercise
 - ▶ Stop smoking

Co-Management of CKD Population with PCPs and Nephrologists

- ▶ PCPs essential in early detection
 - ▶ Screen high risk patients – Diabetics & Hypertension
 - ▶ Number of patients with early stages is too great to be cared for by nephrology
 - ▶ Better patient outcomes when issues addressed to slow progression, complications of CKD, & also safety issues
 - ▶ Need team approach

Referral & Co- Management with Nephrology



Classification of CKD Based on GFR and Albuminuria Categories: "Heat Map"

CKD is classified based on:

- **Cause (C)**
- **GFR (G)**
- **Albuminuria (A)**

				Albuminuria categories		
				Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-299 mg/g 3-29 mg/mmol	≥300 mg/g ≥30 mg/mmol
GFR categories (ml/min/1.73 m ²) Description and range	G1	Normal or high	≥90	1 if CKD	Monitor 1	Refer* 2
	G2	Mildly decreased	60-90	1 if CKD	Monitor 1	Refer* 2
	G3a	Mildly to moderately decreased	45-59	Monitor 1	Monitor 2	Refer 3
	G3b	Moderately to severely decreased	30-44	Monitor 2	Monitor 3	Refer 3
	G3	Severely decreased	15-29	Refer* 3	Refer* 3	Refer 4+
	G5	Kidney failure	<15	Refer 4+	Refer 4+	Refer 4+

Colors: Represents the risk for progression, morbidity and mortality by color from best to worst. Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red, very high risk.

Numbers: Represent a recommendation for the number of times per year the patient should be monitored.

Refer: Indicates that nephrology referral and services are recommended.

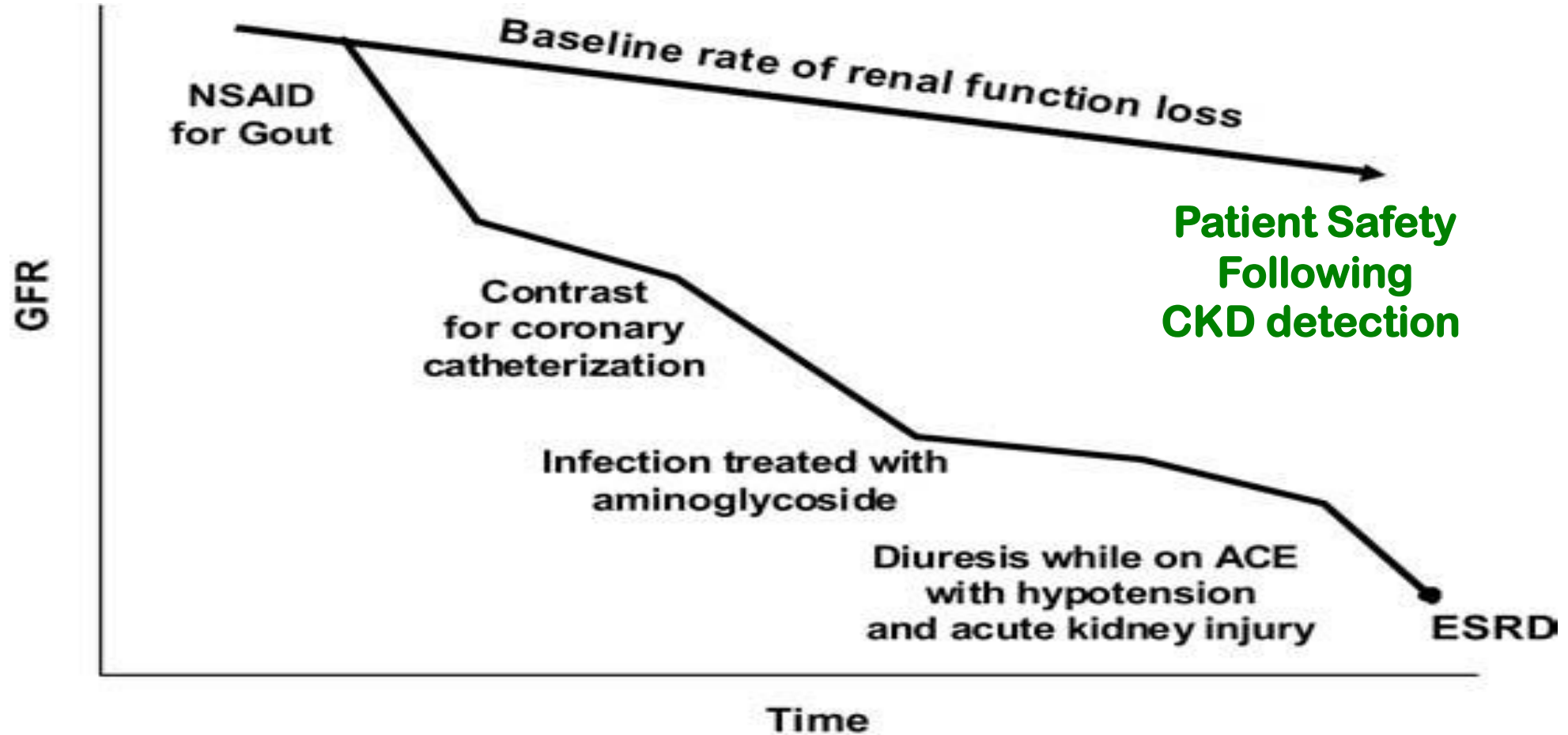
*Referring clinicians may wish to discuss with their nephrology service depending on local arrangements regarding monitoring or referral.



Co-Management of CKD

PCP (G 1- G3b A1/A2)	Co-Management (G3bA3-G5)	Nephrologist (G 4-5)
Early Detection , staging & identification of CKD complications	Hypertension	Diagnosis & Management of AKI
Comorbid conditions (CAD, PAD, COPD, DM, Obesity-OSA, Arthritis)	Hypervolemia	Diagnosis of unexplained CKD
Vaccination (Flu, Pneumococcal, Hep B)	Medication usage & dosing	Identification & treatment of CKD complications (hyperkalemia, metabolic acidosis, anemia, SHPT,)
Health Screening (appropriate for age and comorbidities)	Patient safety-risk benefit of IV contrast (Iodinated & Gadolinium)	Diagnosis & Management of electrolyte , acid-base disorders
Guideline based nephrology referral	AKI follow up	Glomerulonephritis including renal biopsy if indicated
	“Save the veins” & avoid PICC lines	Refractory Hypertension
	Hyperlipidemia	CKD Education
	Cardiovascular-Primary & Secondary Prevention	Preparation for Renal Replacement: Modality Selection Access Placement Initiation RRT Transplant referral Conservative Management CKD 5 w/o dialysis
	End of Life Planning including decisions to start/terminate dialysis & palliative care	Nutritional CKD counseling
		Renal Transplant follow up

Impact of primary care CKD detection with a patient safety approach



Summary

- ▶ CKD is a very prevalent problem
- ▶ CKD is associated with much morbidity
- ▶ Early detection & treatments is key
- ▶ Primary Care Providers are essential for this process to be successful



The End

Additional References

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