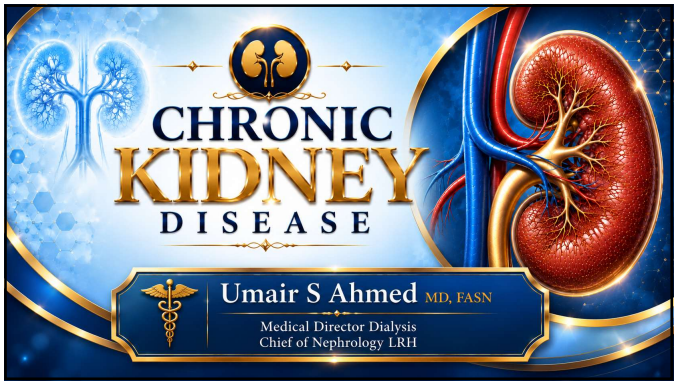
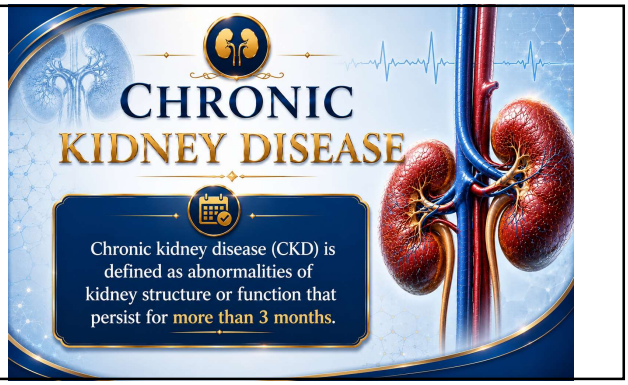

CHRONIC
KIDNEY
DISEASE
Umair S Ahmed MD, FASN
Medical Director Dialysis
Chief of Nephrology LRH

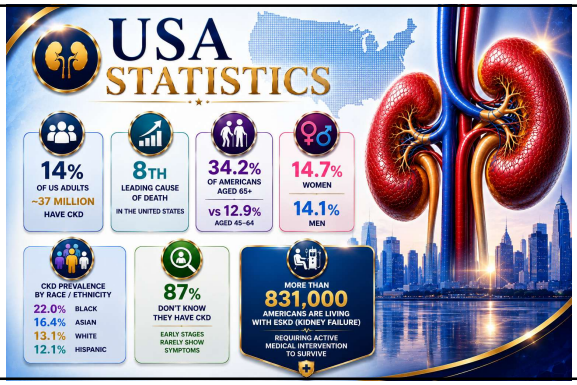
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CHRONIC
KIDNEY DISEASE
Chronic kidney disease (CKD) is defined as abnormalities of kidney structure or function that persist for more than 3 months.

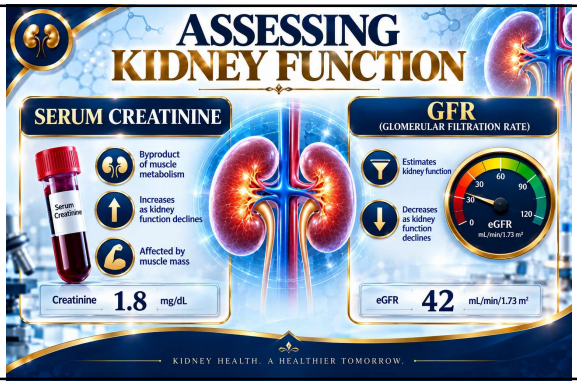
2


GLOBAL
STATISTICS
FOR 2023
788 MILLION
ADULTS (≥20 YEARS) HAD CKD IN 2023
UP FROM 378M IN 1990 AND 627M IN 2013
9TH
LEADING CAUSE OF DEATH GLOBALLY
PROJECTED TO BE THE 5TH LEADING CAUSE BY 2040
1.5 MILLION
DEATHS ANNUALLY
ONE DEATH EVERY 20 SECONDS
12%
OF ALL GLOBAL CARDIOVASCULAR DEATHS
4.6 MILLION
PEOPLE GLOBALLY
RELY ON DIALYSIS OR KIDNEY TRANSPLANT TO SURVIVE

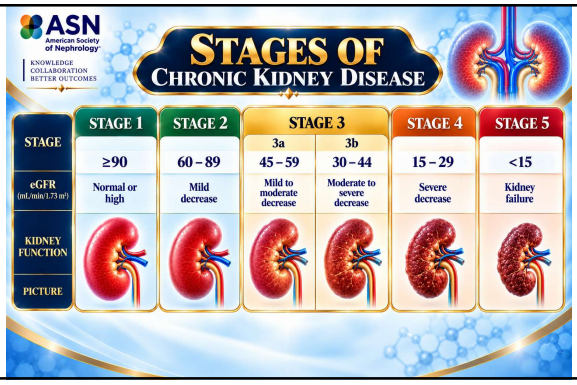
3


USA
STATISTICS
14%
OF US ADULTS
~37 MILLION
HAVE CKD
8TH
LEADING CAUSE
OF DEATH
IN THE UNITED STATES
34.2%
OF AMERICANS
AGED 65+
VS 12.9%
AGED 45–64
14.7%
WOMEN
14.1%
MEN
CKD PREVALENCE
BY RACE / ETHNICITY
22.0% BLACK
16.4% ASIAN
13.1% WHITE
12.1% HISPANIC
87%
DON'T KNOW
THEY HAVE CKD
EARLY STAGES
RARELY SHOW
SYMPTOMS
MORE THAN
831,000
AMERICANS ARE LIVING
WITH ESKD (KIDNEY FAILURE)
REQUIRING ACTIVE
MEDICAL INTERVENTION
TO SURVIVE

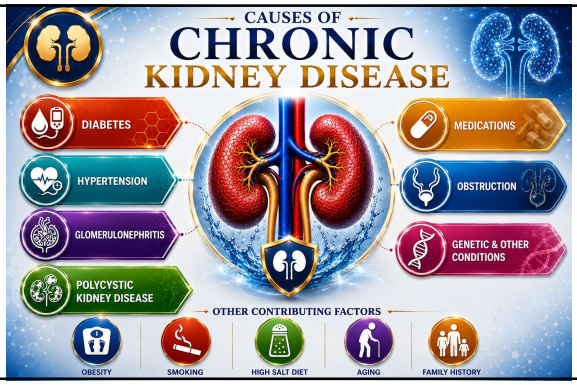
4


ASSESSING
KIDNEY FUNCTION
SERUM CREATININE
Byproduct of muscle metabolism
Increases as kidney function declines
Affected by muscle mass
Serum Creatinine
Creatinine 1.8 mg/dL
GFR
(GLOMERULAR FILTRATION RATE)
Estimates kidney function
Decreases as kidney function declines
0
30
60
90
120
eGFR
mL/min/1.73 m²
eGFR 42 mL/min/1.73 m²
KIDNEY HEALTH. A HEALTHIER TOMORROW.

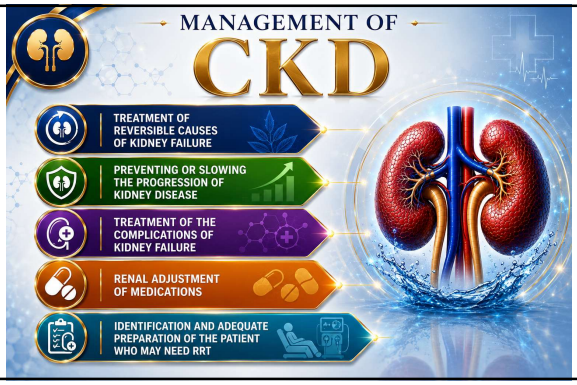
5


ASN
American Society of Nephrology
KNOWLEDGE
COLLABORATION
BETTER OUTCOMES
STAGES OF
CHRONIC KIDNEY DISEASE
STAGE
STAGE 1
STAGE 2
STAGE 3
3a
3b
STAGE 4
STAGE 5
eGFR (mL/min/1.73 m²)
≥90
60 – 89
45 – 59
30 – 44
15 – 29
<15
Normal or high
Mild decrease
Mild to moderate decrease
Moderate to severe decrease
Severe decrease
Kidney failure
KIDNEY FUNCTION
PICTURE

6


CAUSES OF
CHRONIC
KIDNEY DISEASE
DIABETES
HYPERTENSION
GLOMERULONEPHRITIS
POLYCYSTIC KIDNEY DISEASE
MEDICATIONS
OBSTRUCTION
GENETIC & OTHER CONDITIONS
OTHER CONTRIBUTING FACTORS
OBESITY
SMOKING
HIGH SALT DIET
AGING
FAMILY HISTORY

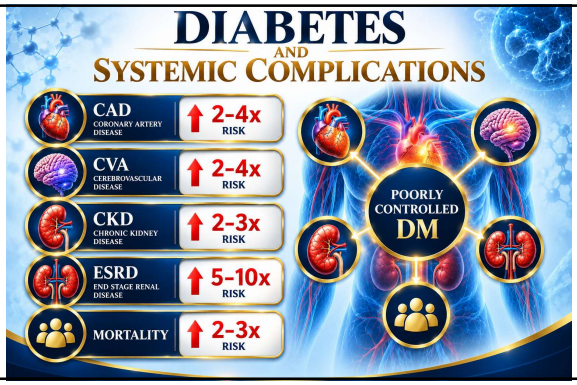
7


MANAGEMENT OF
CKD
TREATMENT OF REVERSIBLE CAUSES OF KIDNEY FAILURE
PREVENTING OR SLOWING THE PROGRESSION OF KIDNEY DISEASE
TREATMENT OF THE COMPLICATIONS OF KIDNEY FAILURE
RENAL ADJUSTMENT OF MEDICATIONS
IDENTIFICATION AND ADEQUATE PREPARATION OF THE PATIENT WHO MAY NEED RRT

8


ASN
American Society of Nephrology
DM is the leading cause of CKD

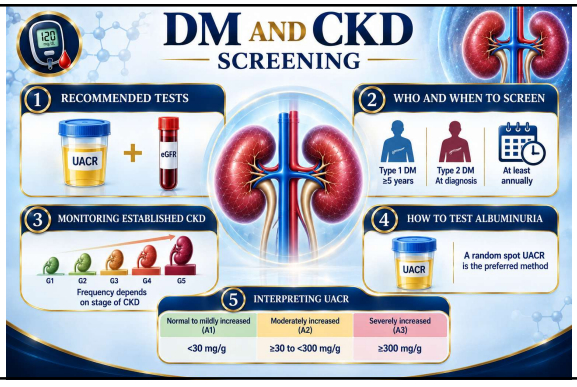
9


DIABETES
AND
SYSTEMIC COMPLICATIONS
CAD
CORONARY ARTERY DISEASE
2-4x
RISK
CVA
CEREBROVASCULAR DISEASE
2-4x
RISK
CKD
CHRONIC KIDNEY DISEASE
2-3x
RISK
ESRD
END STAGE RENAL DISEASE
5-10x
RISK
MORTALITY
2-3x
RISK
POORLY CONTROLLED
DM

10


DIABETES
MELLITUS
105
mg/dL
GOOD GLYCEMIC CONTROL
GOOD BP CONTROL.
LIFESTYLE MODIFICATION
GOAL DIRECTED MEDICAL THERAPY

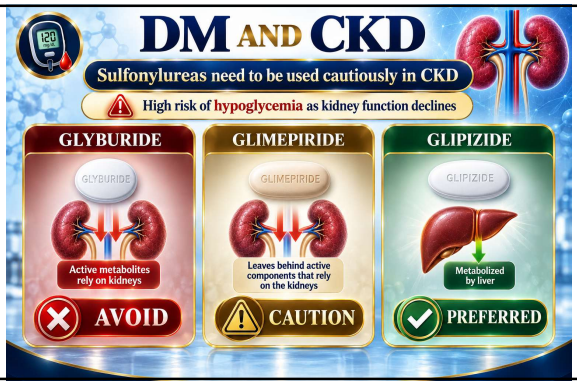
11


DM AND CKD
SCREENING
1 RECOMMENDED TESTS
UACR
+
eGFR
2 WHO AND WHEN TO SCREEN
Type 1 DM
≥5 years
Type 2 DM
At diagnosis
At least
annually
3 MONITORING ESTABLISHED CKD
G1
G2
G3
G4
G5
Frequency depends
on stage of CKD
4 HOW TO TEST ALBUMINURIA
UACR
A random spot UACR
is the preferred method
5 INTERPRETING UACR
Normal to mildly increased (A1)
Moderately increased (A2)
Severely increased (A3)
<30 mg/g
≥30 to <300 mg/g
≥300 mg/g

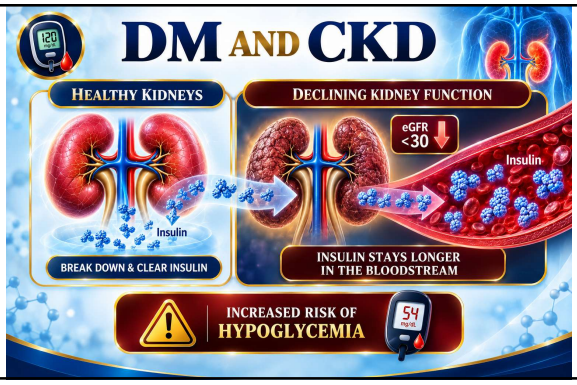
12


DM AND CKD
KDIGO 2022 RECOMMENDATIONS
1
SGLT2 INHIBITORS
Start if eGFR ≥30 mL/min/1.73 m²
Continue as tolerated
Kidney & CV protection
PATIENT CENTERED CARE
INDIVIDUALIZE
MONITOR
REASSESS
2
GLP-1 RECEPTOR AGONISTS
Preferred add-on if needed
CV benefit & glycemic control
3
METFORMIN
Use if eGFR ≥30 mL/min/1.73 m²
Reduce dose if eGFR 30-44
Stop if eGFR <30
Monitor kidney function

13


DM AND CKD
Sulfonylureas need to be used cautiously in CKD
High risk of hypoglycemia as kidney function declines
GLYBURIDE
GLYBURIDE
Active metabolites rely on kidneys
AVOID
GLIMEPIRIDE
GLIMEPIRIDE
Leaves behind active components that rely on the kidneys
CAUTION
GLIPIZIDE
GLIPIZIDE
Metabolized by liver
PREFERRED

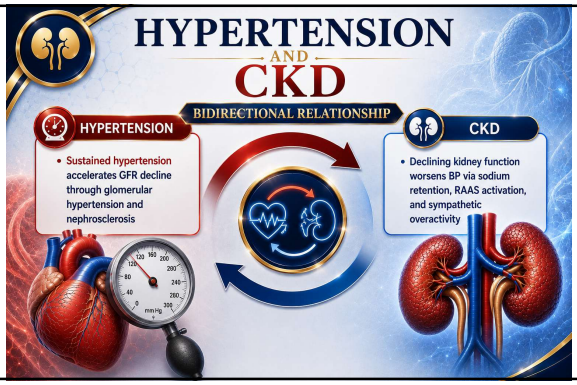
14


DM AND CKD
HEALTHY KIDNEYS
Insulin
BREAK DOWN & CLEAR INSULIN
DECLINING KIDNEY FUNCTION
eGFR <30
Insulin
INSULIN STAYS LONGER IN THE BLOODSTREAM
INCREASED RISK OF HYPOGLYCEMIA
54

15


ASN
American Society of Nephrology
HTN is the second leading cause of CKD

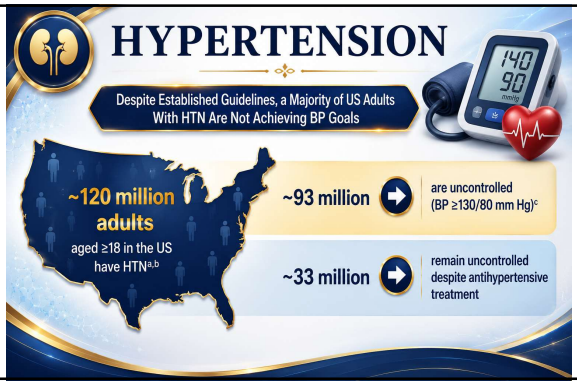
16


HYPERTENSION
AND
CKD
BIDIRECTIONAL RELATIONSHIP
HYPERTENSION
• Sustained hypertension accelerates GFR decline through glomerular hypertension and nephrosclerosis
CKD
• Declining kidney function worsens BP via sodium retention, RAAS activation, and sympathetic overactivity

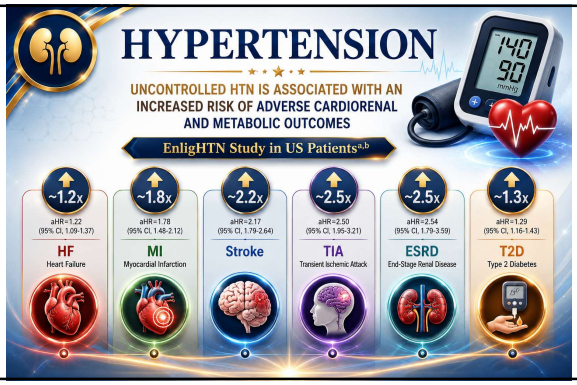
17


HYPERTENSION
DIFFERENT TARGET GOALS
KDIGO
2021
SYSTOLIC
<120 mm Hg
WHEN TOLERATED
2025
AHA/ACC
TREATMENT GOAL
SBP <130 mm Hg
ADA
2026
<130/80 mm Hg
IF SAFELY ATTAINED,
WITH <120 mm Hg ENCOURAGED.
ESH
EUROPEAN SOCIETY OF HYPERTENSION
PRIMARY TARGET
<140/90 mm Hg
WITH <130/80 IF TOLERATED.

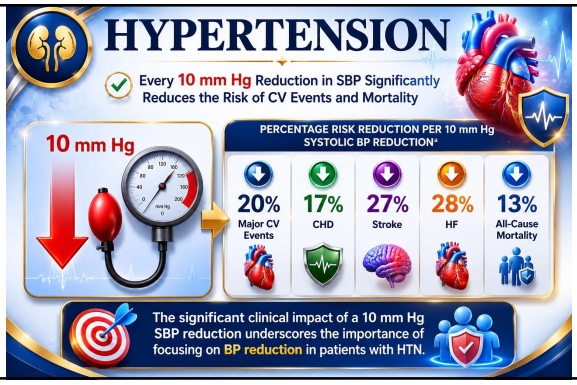
18


HYPERTENSION
Despite Established Guidelines, a Majority of US Adults With HTN Are Not Achieving BP Goals
~120 million adults
aged ≥18 in the US have HTN[a,b]
~93 million
are uncontrolled (BP ≥130/80 mm Hg)[c]
~33 million
remain uncontrolled despite antihypertensive treatment

19


HYPERTENSION
UNCONTROLLED HTN IS ASSOCIATED WITH AN INCREASED RISK OF ADVERSE CARDIORENAL AND METABOLIC OUTCOMES
EnligHTN Study in US Patients[a,b]
~1.2x
aHR=1.22 (95% CI, 1.09-1.37)
HF
Heart Failure
~1.8x
aHR=1.78 (95% CI, 1.48-2.12)
MI
Myocardial Infarction
~2.2x
aHR=2.17 (95% CI, 1.79-2.64)
Stroke
~2.5x
aHR=2.50 (95% CI, 1.95-3.21)
TIA
Transient Ischemic Attack
~2.5x
aHR=2.54 (95% CI, 1.79-3.59)
ESRD
End-Stage Renal Disease
~1.3x
aHR=1.29 (95% CI, 1.16-1.43)
T2D
Type 2 Diabetes

20


HYPERTENSION
Every 10 mm Hg Reduction in SBP Significantly Reduces the Risk of CV Events and Mortality
10 mm Hg
PERCENTAGE RISK REDUCTION PER 10 mm Hg SYSTOLIC BP REDUCTION[a]
20%
Major CV Events
17%
CHD
27%
Stroke
28%
HF
13%
All-Cause Mortality
The significant clinical impact of a 10 mm Hg SBP reduction underscores the importance of focusing on BP reduction in patients with HTN.

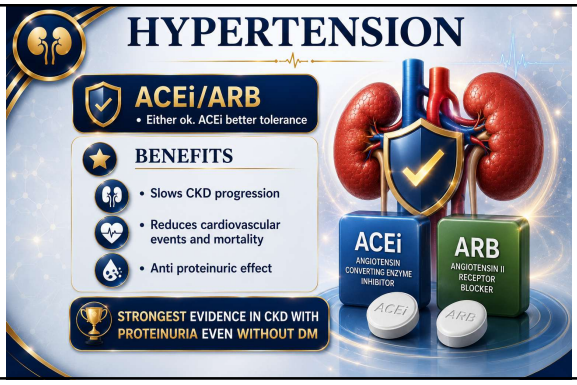
21


HYPERTENSION
NEED ACCURATE BP MONITOR
ACCURATE READINGS
BETTER DECISIONS
BETTER OUTCOMES
158 SYS
93 DIA
72 PULSE
START STOP
CLINICALLY ACCURATE
VALIDATED
CHECK THE VALIDATED LIST
https://www.validatebp.org

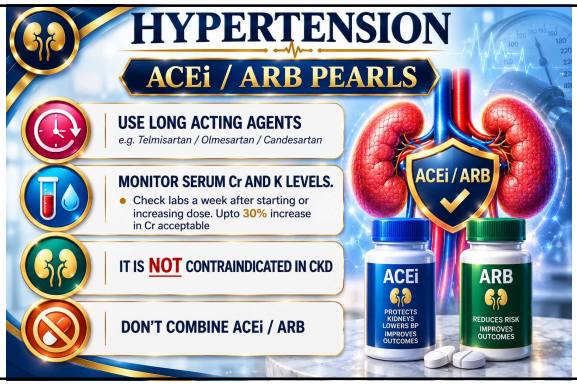
22


HYPERTENSION
FIRST LINE ANTI HYPERTENSIVES
ACEi / ARB
Block RAAS
Lower BP
Protect kidneys and heart
THIAZIDES
THIAZIDE
Promote sodium and water excretion
Proven BP reduction and cardiovascular benefit
DIHYDROPYRIDINE CCB
Relax blood vessels
Reduce peripheral resistance
Effective BP control
FIRST LINE MEDICATIONS HAVE BETTER OUTCOMES AND SAFETY PROFILE

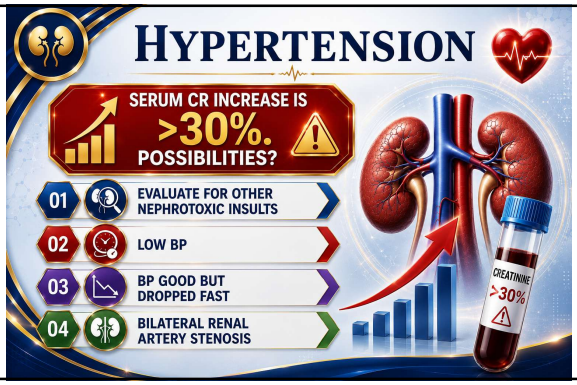
23


HYPERTENSION
ACEi/ARB
Either ok. ACEi better tolerance
BENEFITS
Slows CKD progression
Reduces cardiovascular events and mortality
Anti proteinuric effect
STRONGEST EVIDENCE IN CKD WITH PROTEINURIA EVEN WITHOUT DM
ACEi
ANGIOTENSIN CONVERTING ENZYME INHIBITOR
ARB
ANGIOTENSIN II RECEPTOR BLOCKER

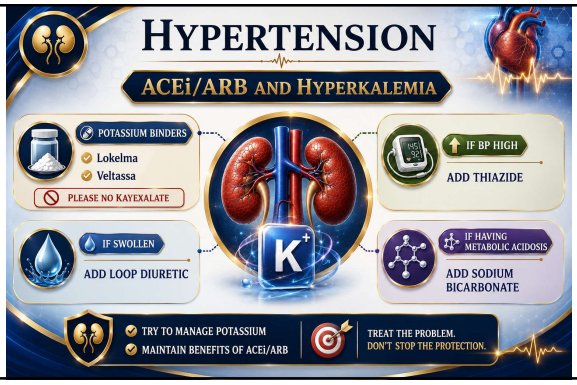
24


HYPERTENSION
ACEi / ARB PEARLS
USE LONG ACTING AGENTS
e.g. Telmisartan / Olmesartan / Candesartan
MONITOR SERUM Cr AND K LEVELS.
Check labs a week after starting or increasing dose. Upto 30% increase in Cr acceptable
IT IS NOT CONTRAINDICATED IN CKD
DON'T COMBINE ACEi / ARB
ACEi / ARB
ACEi
PROTECTS KIDNEYS
LOWERS BP
IMPROVES OUTCOMES
ARB
REDUCES RISK
IMPROVES OUTCOMES

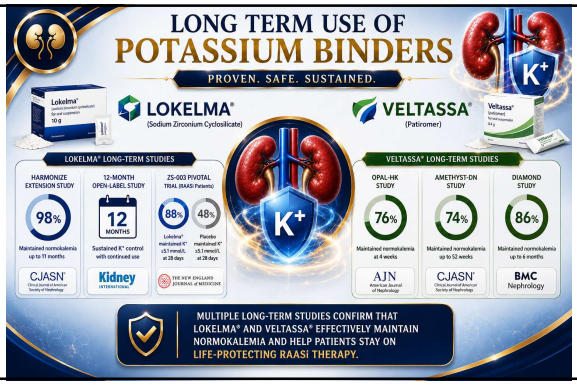
25


HYPERTENSION
SERUM CR INCREASE IS >30%. POSSIBILITIES?
01 EVALUATE FOR OTHER NEPHROTOXIC INSULTS
02 LOW BP
03 BP GOOD BUT DROPPED FAST
04 BILATERAL RENAL ARTERY STENOSIS
CREATININE >30%

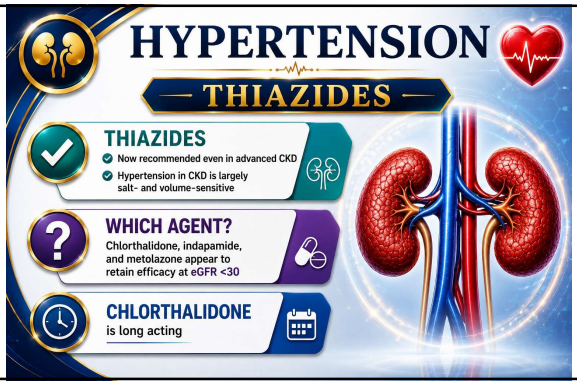
26


HYPERTENSION
ACEi/ARB AND HYPERKALEMIA
POTASSIUM BINDERS
Lokelma
Veltassa
PLEASE NO KAYEXALATE
IF BP HIGH
ADD THIAZIDE
IF SWOLLEN
ADD LOOP DIURETIC
IF HAVING METABOLIC ACIDOSIS
ADD SODIUM BICARBONATE
K+
TRY TO MANAGE POTASSIUM
MAINTAIN BENEFITS OF ACEi/ARB
TREAT THE PROBLEM. DON'T STOP THE PROTECTION.

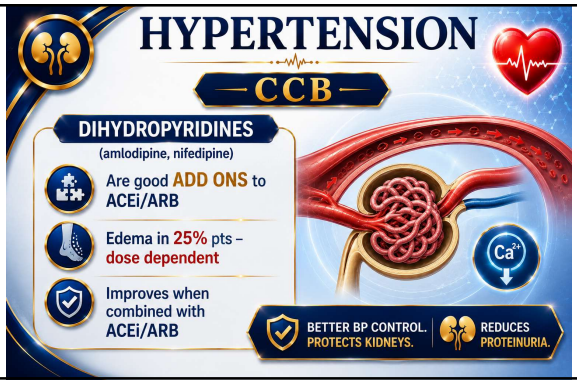
27


LONG TERM USE OF
POTASSIUM BINDERS
PROVEN. SAFE. SUSTAINED.
LOKELMA®
(Sodium Zirconium Cyclosilicate)
VELTASSA®
(Patiromer)
LOKELMA® LONG-TERM STUDIES
HARMONIZE EXTENSION STUDY
98%
Maintained normokalemia up to 11 months
12-MONTH OPEN-LABEL STUDY
12
MONTHS
Sustained K+ control with continued use
ZS-003 PIVOTAL TRIAL (RAASi Patients)
88%
48%
VELTASSA® LONG-TERM STUDIES
OPAL-HK STUDY
76%
Maintained normokalemia at 4 weeks
AMETHYST-DN STUDY
74%
Maintained normokalemia up to 52 weeks
DIAMOND STUDY
86%
Maintained normokalemia up to 6 months
MULTIPLE LONG-TERM STUDIES CONFIRM THAT LOKELMA® AND VELTASSA® EFFECTIVELY MAINTAIN NORMOKALEMIA AND HELP PATIENTS STAY ON LIFE-PROTECTING RAASi THERAPY.

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HYPERTENSION
THIAZIDES
THIAZIDES
Now recommended even in advanced CKD
Hypertension in CKD is largely salt- and volume-sensitive
WHICH AGENT?
Chlorthalidone, indapamide, and metolazone appear to retain efficacy at eGFR <30
CHLORTHALIDONE
is long acting

29


HYPERTENSION
CCB
DIHYDROPYRIDINES
(amlodipine, nifedipine)
Are good ADD ONS to ACEi/ARB
Edema in 25% pts – dose dependent
Improves when combined with ACEi/ARB
BETTER BP CONTROL. PROTECTS KIDNEYS.
REDUCES PROTEINURIA.

30


HYPERTENSION
CONSIDER COMBINATION PILLS
NEED TWO ANTIHYPERTENSIVES IF BP >20/10 ABOVE GOAL
TAKES A FEW WEEKS TO SEE FULL ANTIHYPERTENSIVE EFFECT
HALF THE MAX DOSE HAS ALREADY PROVIDED 2/3RD OF THE MAX EFFECT
138
88

31


RESISTANT HYPERTENSION
DEFINITION
BP above goal despite being on three antihypertensives including a diuretic — at reasonable doses
EVALUATE FOR COMPLIANCE
EVALUATE FOR SECONDARY HYPERTENSION
SYS 158
DIA 93
PULSE 72
START STOP
Lower BP Longer Lives

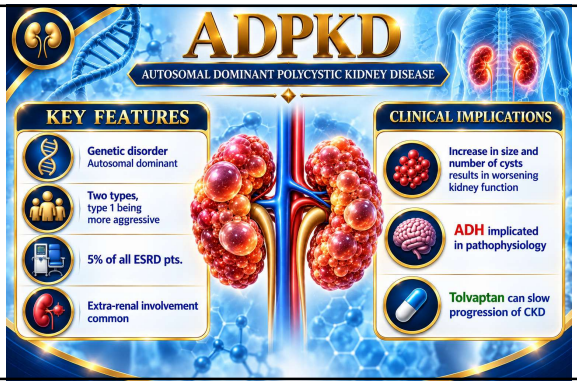
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RESISTANT HYPERTENSION
SCREEN FOR SECONDARY CAUSES
Primary aldosteronism
OSA
CKD
Renovascular disease
Pheochromocytoma
SYS 158
DIA 92
PULSE 78
START STOP

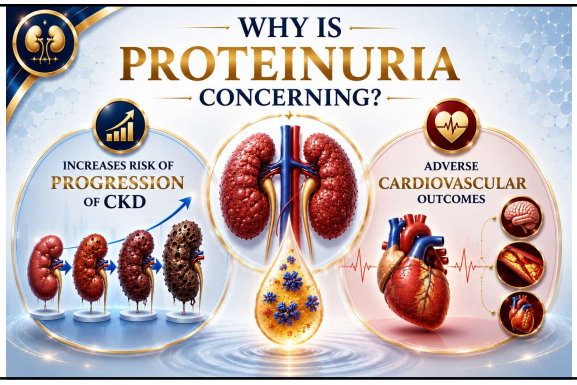
33


CKD AND GN
1
GN IS A LEADING PRIMARY CAUSE OF CKD AND ESKD
Third most common cause of kidney failure worldwide
3
2
IgA NEPHROPATHY IS THE MOST COMMON GN IN THE WORLD
IgA
3
CKD AND HEMATURIA COULD BE A CONCERNING COMBINATION
EARLIER RECOGNITION. BETTER OUTCOMES.

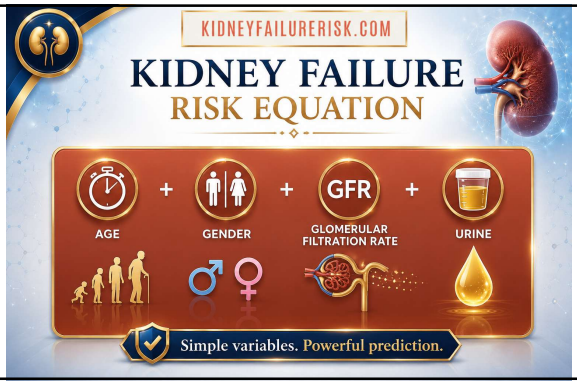
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ADPKD
AUTOSOMAL DOMINANT POLYCYSTIC KIDNEY DISEASE
KEY FEATURES
Genetic disorder
Autosomal dominant
Two types, type 1 being more aggressive
5% of all ESRD pts.
Extra-renal involvement common
CLINICAL IMPLICATIONS
Increase in size and number of cysts results in worsening kidney function
ADH implicated in pathophysiology
Tolvaptan can slow progression of CKD

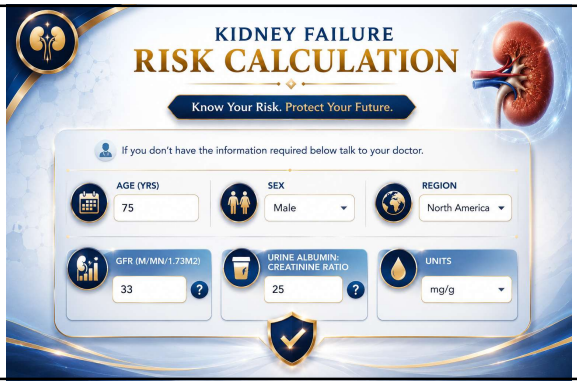
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WHY IS
PROTEINURIA
CONCERNING?
INCREASES RISK OF PROGRESSION OF CKD
ADVERSE CARDIOVASCULAR OUTCOMES

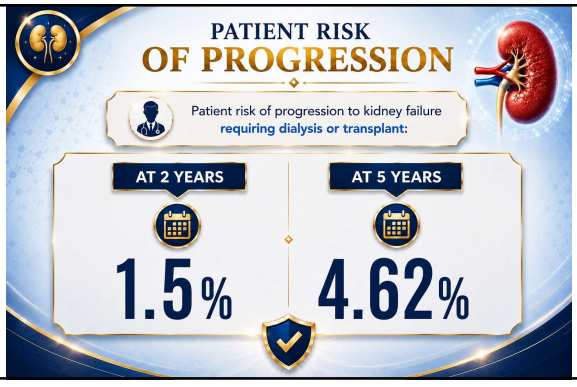
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KIDNEYFAILURERISK.COM
KIDNEY FAILURE
RISK EQUATION
AGE
GENDER
GFR
GLOMERULAR FILTRATION RATE
URINE
Simple variables. Powerful prediction.

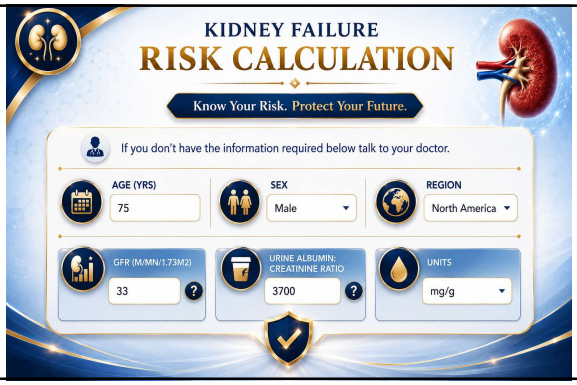
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KIDNEY FAILURE
RISK CALCULATION
Know Your Risk. Protect Your Future.
If you don't have the information required below talk to your doctor.
AGE (YRS)
75
SEX
Male
REGION
North America
GFR (M/MN/1.73M2)
33
URINE ALBUMIN: CREATININE RATIO
25
UNITS
mg/g

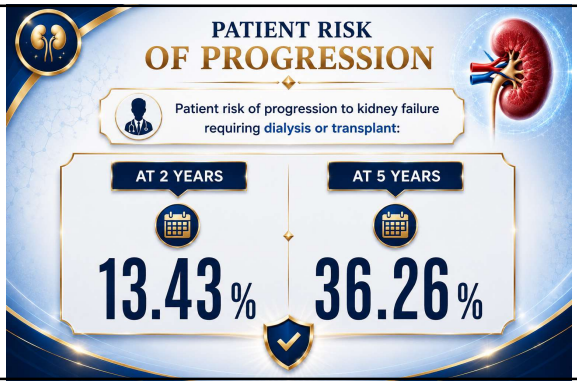
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PATIENT RISK
OF PROGRESSION
Patient risk of progression to kidney failure
requiring dialysis or transplant:
AT 2 YEARS
AT 5 YEARS
1.5%
4.62%

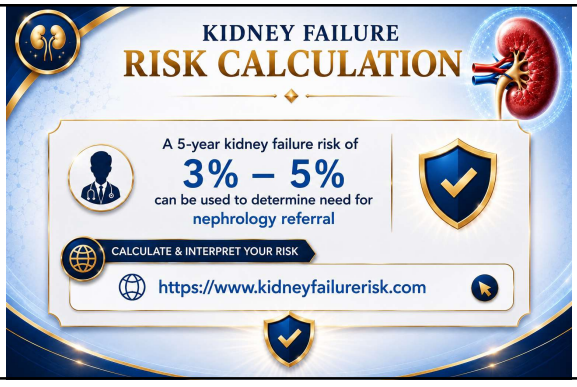
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KIDNEY FAILURE
RISK CALCULATION
Know Your Risk. Protect Your Future.
If you don't have the information required below talk to your doctor.
AGE (YRS)
75
SEX
Male
REGION
North America
GFR (M/MN/1.73M2)
33
URINE ALBUMIN: CREATININE RATIO
3700
UNITS
mg/g

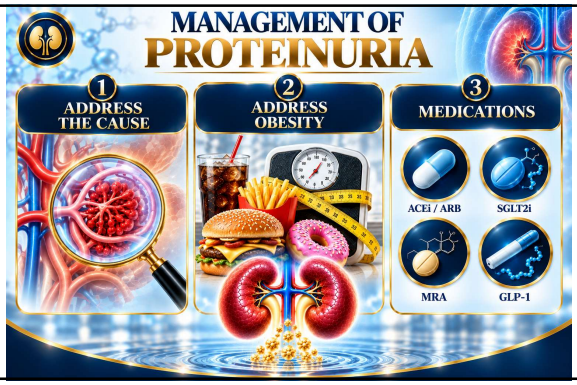
40


PATIENT RISK
OF PROGRESSION
Patient risk of progression to kidney failure requiring dialysis or transplant:
AT 2 YEARS
13.43%
AT 5 YEARS
36.26%

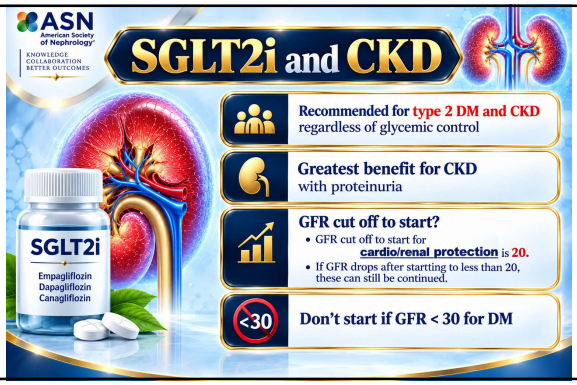
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KIDNEY FAILURE
RISK CALCULATION
A 5-year kidney failure risk of
3% – 5%
can be used to determine need for
nephrology referral
CALCULATE & INTERPRET YOUR RISK
https://www.kidneyfailurerisk.com

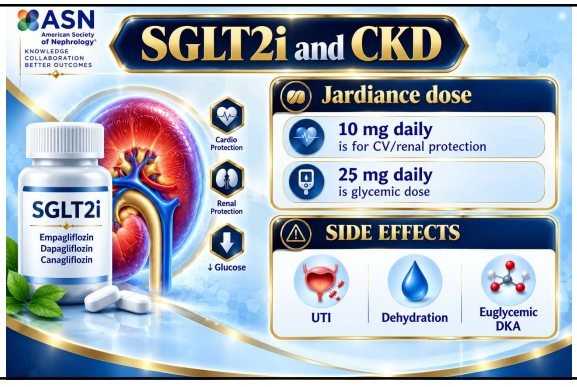
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MANAGEMENT OF
PROTEINURIA
1
ADDRESS THE CAUSE
2
ADDRESS OBESITY
3
MEDICATIONS
ACEi / ARB
SGLT2i
MRA
GLP-1

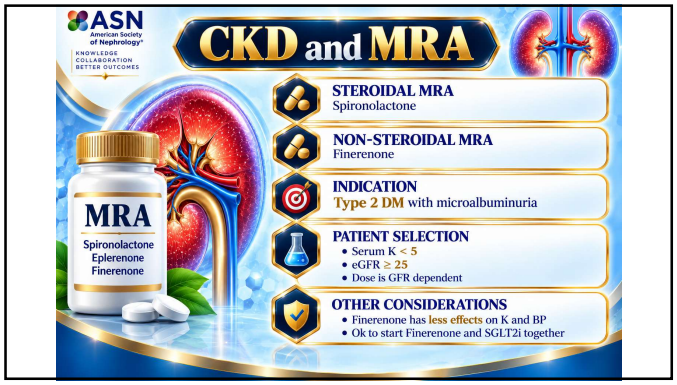
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ASN
American Society of Nephrology
KNOWLEDGE COLLABORATION BETTER OUTCOMES
SGLT2i and CKD
Recommended for type 2 DM and CKD regardless of glycemic control
Greatest benefit for CKD with proteinuria
GFR cut off to start?
• GFR cut off to start for cardio/renal protection is 20.
• If GFR drops after startting to less than 20, these can still be continued.
<30
Don't start if GFR < 30 for DM
SGLT2i
Empagliflozin
Dapagliflozin
Canagliflozin

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ASN
American Society of Nephrology
KNOWLEDGE COLLABORATION BETTER OUTCOMES
SGLT2i and CKD
Jardiance dose
10 mg daily
is for CV/renal protection
25 mg daily
is glycemic dose
SIDE EFFECTS
UTI
Dehydration
Euglycemic DKA
Cardio Protection
Renal Protection
↓ Glucose
SGLT2i
Empagliflozin
Dapagliflozin
Canagliflozin

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ASN
American Society of Nephrology
KNOWLEDGE COLLABORATION BETTER OUTCOMES
CKD and MRA
MRA
Spironolactone
Eplerenone
Finerenone
STEROIDAL MRA
Spironolactone
NON-STEROIDAL MRA
Finerenone
INDICATION
Type 2 DM with microalbuminuria
PATIENT SELECTION
• Serum K < 5
• eGFR ≥ 25
• Dose is GFR dependent
OTHER CONSIDERATIONS
• Finerenone has less effects on K and BP
• Ok to start Finerenone and SGLT2i together

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ASN
American Society of Nephrology
KNOWLEDGE COLLABORATION BETTER OUTCOMES
CKD and Finerenone
Finerenone
Non-steroidal Mineralocorticoid Receptor Antagonist (MRA)
10
20
STARTING DOSE IN CKD
Determined by baseline eGFR
eGFR 25 to <60
10 mg once daily
eGFR ≥60
20 mg once daily
Target dose: 20 mg once daily
DO NOT INITIATE
Do not initiate if serum potassium is >5.0 mmol/L
CONTINUATION AT LOW eGFR
Can be continued below 25 mL/min/1.73 m² if potassium is acceptable and it is otherwise tolerated.
MONITORING
4 WEEKS
After 4 weeks (1 month), recheck potassium and eGFR.
DOSE UPTITRATION
If K+ ≤ 4.8 mmol/L and eGFR stable,
Upititrate from 10 mg to 20 mg once daily

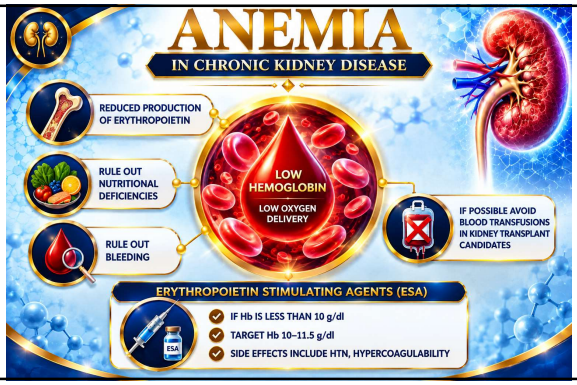
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LIFESTYLE CHANGES
IN CKD
SODIUM RESTRICTIONS
DIET RICH IN FRUITS AND VEGETABLES
EXERCISE
AHA recommends 150 mins moderate intensity exercise a week
WEIGHT LOSS
SMOKING CESSATION

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WHAT ARE THE
COMPLICATIONS OF CKD ?
ANEMIA
CARDIOVASCULAR DISEASE
MINERAL AND BONE DISORDER
HYPERTENSION
ELECTROLYTE ABNORMALITIES & ACIDOSIS
VOLUME OVERLOAD
MALNUTRITION & MUSCLE WASTING
INCREASED RISK OF INFECTIONS
COGNITIVE IMPAIRMENT

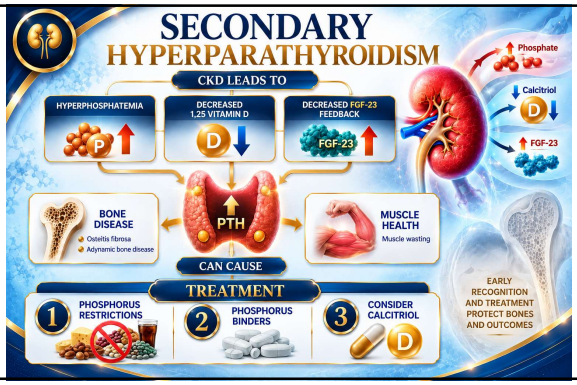
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ANEMIA
IN CHRONIC KIDNEY DISEASE
REDUCED PRODUCTION OF ERYTHROPOIETIN
RULE OUT NUTRITIONAL DEFICIENCIES
RULE OUT BLEEDING
LOW HEMOGLOBIN
LOW OXYGEN DELIVERY
IF POSSIBLE AVOID BLOOD TRANSFUSIONS IN KIDNEY TRANSPLANT CANDIDATES
ERYTHROPOIETIN STIMULATING AGENTS (ESA)
IF Hb IS LESS THAN 10 g/dl
TARGET Hb 10–11.5 g/dl
SIDE EFFECTS INCLUDE HTN, HYPERCOAGULABILITY

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METABOLIC ACIDOSIS
POTENTIAL CONSEQUENCES
BONE DEMINERALIZATION
MUSCLE WASTING & WEAKNESS
FASTER CKD PROGRESSION
ADVERSE CV OUTCOMES
↓ HCO3⁻
BICARBONATE LOW
↑ ACID (H⁺)
↓ BASE (HCO3⁻)
TREATMENT
1
START SODIUM BICARBONATE SUPPLEMENTS
if serum bicarbonate is < 18
NaHCO3
2
INCREASE CONSUMPTION OF FRUITS AND VEGETABLES

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SECONDARY
HYPERPARATHYROIDISM
CKD LEADS TO
HYPERPHOSPHATEMIA
DECREASED 1,25 VITAMIN D
DECREASED FGF-23 FEEDBACK
Phosphate
Calcitriol
FGF-23
BONE DISEASE
Osteitis fibrosa
Adynamic bone disease
PTH
MUSCLE HEALTH
Muscle wasting
CAN CAUSE
TREATMENT
1 PHOSPHORUS RESTRICTIONS
2 PHOSPHORUS BINDERS
3 CONSIDER CALCITRIOL
EARLY RECOGNITION AND TREATMENT PROTECT BONES AND OUTCOMES

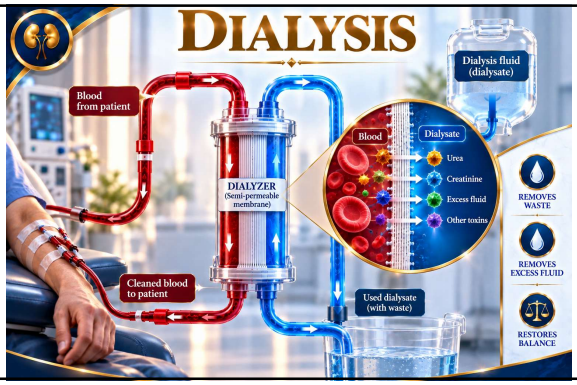
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VOLUME OVERLOAD
CLINICAL MANIFESTATIONS
Pulmonary congestion
Elevated filling pressures
Peripheral edema
Ascites
Worsening kidney function
MANAGEMENT
SODIUM RESTRICTION
LOOP DIURETIC THERAPY
ACHIEVE NEGATIVE FLUID BALANCE
MONITOR RESPONSE

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RENAL REPLACEMENT THERAPY
DIFFERENT PATHS. SAME GOAL. A BETTER TOMORROW.
Care Beyond Kidneys
COMFORT SUPPORT DIGNITY
DIALYSIS
KIDNEY TRANSPLANT
PALLIATIVE CARE
REMAINS AN OPTION

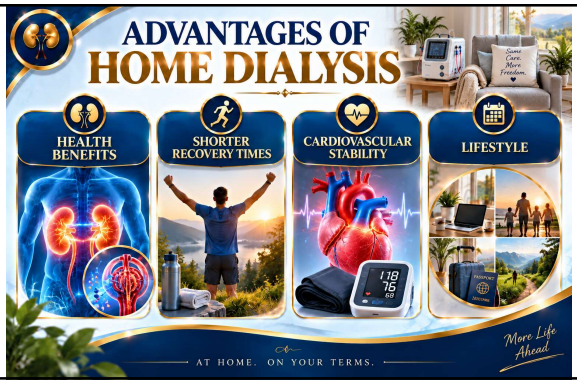
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DIALYSIS
Blood from patient
Dialysis fluid (dialysate)
DIALYZER
(Semi-permeable membrane)
Blood
Dialysate
Urea
Creatinine
Excess fluid
Other toxins
REMOVES WASTE
REMOVES EXCESS FLUID
RESTORES BALANCE
Cleaned blood to patient
Used dialysate (with waste)

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DIFFERENT TYPES OF
DIALYSIS
HEMODIALYSIS (HD)
AT A DIALYSIS CENTER
Dialyzer (filter)
PERITONEAL DIALYSIS (PD)
AT HOME
Dialysis solution (dialysate)
Peritoneal membrane
HOME HEMODIALYSIS (HHD)
AT HOME

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ADVANTAGES OF
HOME DIALYSIS
HEALTH BENEFITS
SHORTER RECOVERY TIMES
CARDIOVASCULAR STABILITY
LIFESTYLE
AT HOME. ON YOUR TERMS.
More Life Ahead

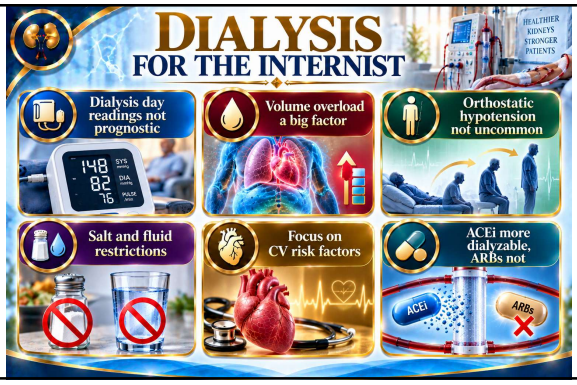
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HOW DO YOU SELECT A
HOME DIALYSIS PATIENT?
MEDICALLY STABLE
PHYSICALLY CAPABLE
COGNITIVE ABILITY
SUITABLE HOME ENVIRONMENT
GOOD SUPPORT SYSTEM

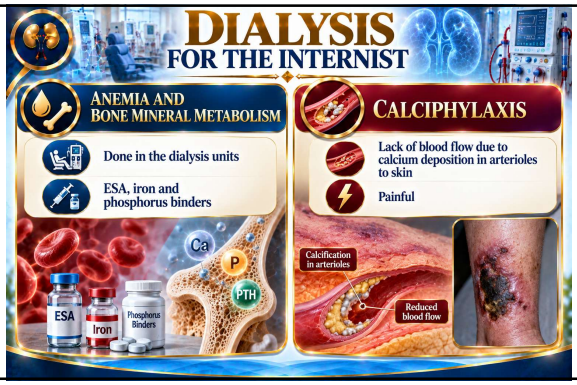
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DIALYSIS AND SURVIVAL
FIVE-YEAR SURVIVAL RATE
Survival Rate (%)
41.2%
98.2%
92%
63–65%
DIALYSIS (ESRD)
PROSTATE CANCER
BREAST CANCER
COLON CANCER

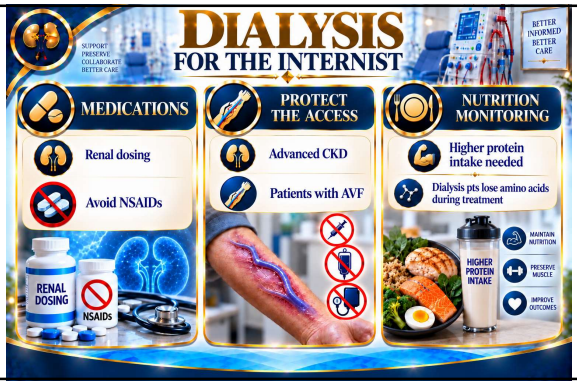
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DIALYSIS
FOR THE INTERNIST
Dialysis day readings not prognostic
Volume overload a big factor
Orthostatic hypotension not uncommon
Salt and fluid restrictions
Focus on CV risk factors
ACEi more dialyzable, ARBs not
ACEi
ARBs

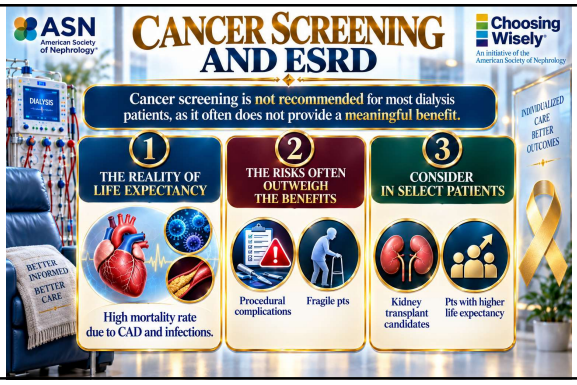
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DIALYSIS
FOR THE INTERNIST
ANEMIA AND BONE MINERAL METABOLISM
Done in the dialysis units
ESA, iron and phosphorus binders
ESA
Iron
Phosphorus Binders
Ca
P
PTH
CALCIPHYLAXIS
Lack of blood flow due to calcium deposition in arterioles to skin
Painful
Calcification in arterioles
Reduced blood flow

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DIALYSIS
FOR THE INTERNIST
MEDICATIONS
Renal dosing
Avoid NSAIDs
RENAL DOSING
NSAIDs
PROTECT THE ACCESS
Advanced CKD
Patients with AVF
NUTRITION MONITORING
Higher protein intake needed
Dialysis pts lose amino acids during treatment
HIGHER PROTEIN INTAKE
MAINTAIN NUTRITION
PRESERVE MUSCLE
IMPROVE OUTCOMES

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ASN
American Society of Nephrology
CANCER SCREENING AND ESRD
Choosing Wisely
An initiative of the American Society of Nephrology
Cancer screening is not recommended for most dialysis patients, as it often does not provide a meaningful benefit.
1
THE REALITY OF LIFE EXPECTANCY
High mortality rate due to CAD and infections.
2
THE RISKS OFTEN OUTWEIGH THE BENEFITS
Procedural complications
Fragile pts
3
CONSIDER IN SELECT PATIENTS
Kidney transplant candidates
Pts with higher life expectancy
INDIVIDUALIZED CARE BETTER OUTCOMES

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ASN
American Society of Nephrology
USE OF STATINS
IN DIALYSIS PATIENTS
DIALYSIS FOR THE INTERNIST
THE EVIDENCE
In dialysis patients, statins do not reduce major cardiovascular events or mortality.
AURORA
A Study to Evaluate the Use of Rosuvastatin in Subjects on Regular Hemodialysis
4D STUDY
Die Deutsche Diabetes Dialyse Studie
DO NOT INITIATE
STATIN
MAY CONTINUE
INDIVIDUALIZE CARE

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DIALYSIS FOR THE INTERNIST
MEDICATIONS TO AVOID
KIDNEYS MATTER
GABAPENTIN
OPIOIDS
NSAIDS
PHOSPHATE ENEMA
BACLOFEN
SUCRALFATE
INDIVIDUALIZE CARE

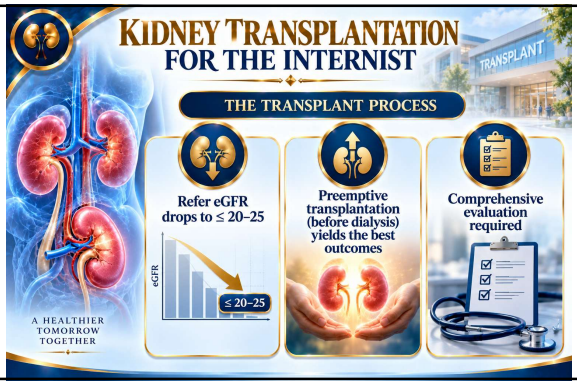
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WHAT DO YOU NEED TO KNOW ABOUT
KIDNEY TRANSPLANTATION?
TRANSPLANT

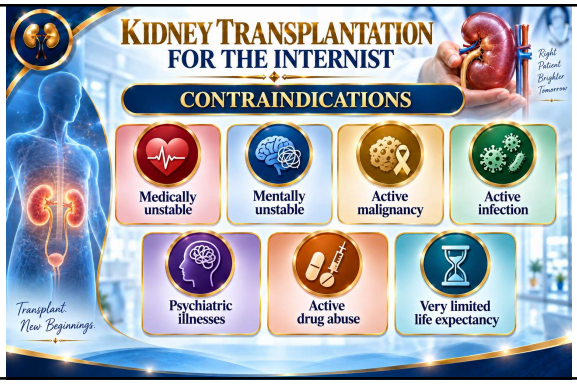
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FIVE YEAR
PATIENT SURVIVAL
DIALYSIS
LIVING DONOR TRANSPLANT
DECEASED DONOR TRANSPLANT
HUMAN ORGAN
FOR TRANSPLANT
40%
>90%
79%

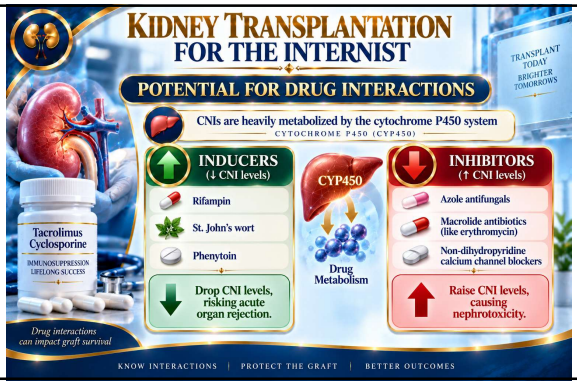
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KIDNEY TRANSPLANTATION
FOR THE INTERNIST
TRANSPLANT
THE TRANSPLANT PROCESS
Refer eGFR drops to ≤ 20–25
eGFR
≤ 20–25
Preemptive transplantation (before dialysis) yields the best outcomes
Comprehensive evaluation required
A HEALTHIER TOMORROW TOGETHER

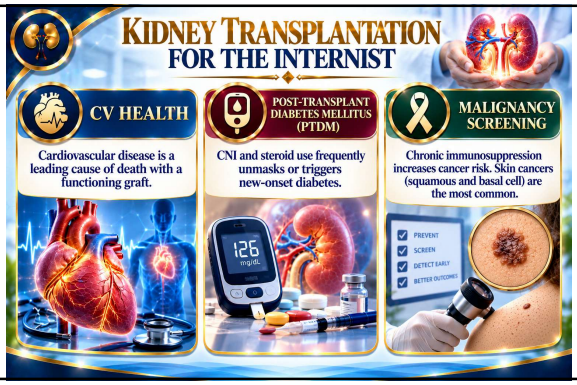
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KIDNEY TRANSPLANTATION
FOR THE INTERNIST
CONTRAINDICATIONS
Medically unstable
Mentally unstable
Active malignancy
Active infection
Psychiatric illnesses
Active drug abuse
Very limited life expectancy
Transplant. New Beginnings.

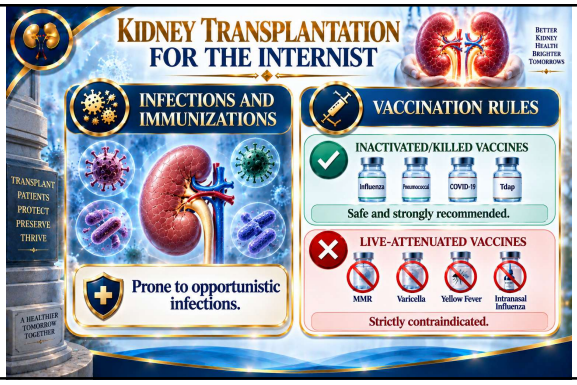
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KIDNEY TRANSPLANTATION
FOR THE INTERNIST
POTENTIAL FOR DRUG INTERACTIONS
CNIs are heavily metabolized by the cytochrome P450 system
CYTOCHROME P450 (CYP450)
INDUCERS
(↓ CNI levels)
Rifampin
St. John's wort
Phenytoin
Drop CNI levels, risking acute organ rejection.
CYP450
Drug Metabolism
INHIBITORS
(↑ CNI levels)
Azole antifungals
Macrolide antibiotics (like erythromycin)
Non-dihydropyridine calcium channel blockers
Raise CNI levels, causing nephrotoxicity.
Tacrolimus
Cyclosporine
IMMUNOSUPPRESSION
LIFELONG SUCCESS
Drug interactions can impact graft survival
KNOW INTERACTIONS | PROTECT THE GRAFT | BETTER OUTCOMES
TRANSPLANT TODAY
BRIGHTER TOMORROWS

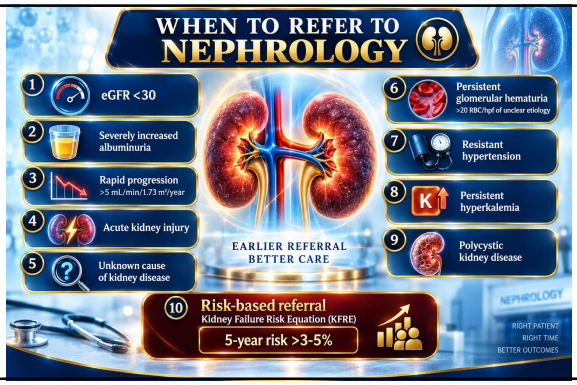
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KIDNEY TRANSPLANTATION
FOR THE INTERNIST
CV HEALTH
Cardiovascular disease is a leading cause of death with a functioning graft.
POST-TRANSPLANT DIABETES MELLITUS (PTDM)
CNI and steroid use frequently unmasks or triggers new-onset diabetes.
126
mg/dL
MALIGNANCY SCREENING
Chronic immunosuppression increases cancer risk. Skin cancers (squamous and basal cell) are the most common.
PREVENT
SCREEN
DETECT EARLY
BETTER OUTCOMES

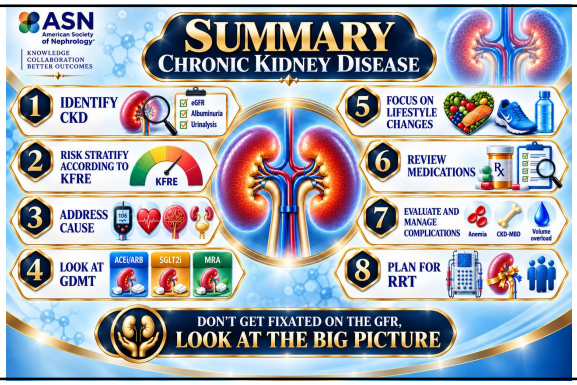
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KIDNEY TRANSPLANTATION
FOR THE INTERNIST
BETTER KIDNEY HEALTH BRIGHTER TOMORROWS
INFECTIONS AND IMMUNIZATIONS
Prone to opportunistic infections.
VACCINATION RULES
INACTIVATED/KILLED VACCINES
Influenza
Pneumococcal
COVID-19
Tdap
Safe and strongly recommended.
LIVE-ATTENUATED VACCINES
MMR
Varicella
Yellow Fever
Intranasal Influenza
Strictly contraindicated.
TRANSPLANT PATIENTS PROTECT PRESERVE THRIVE
A HEALTHIER TOMORROW TOGETHER

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WHEN TO REFER TO
NEPHROLOGY
1 eGFR <30
2 Severely increased albuminuria
3 Rapid progression >5 mL/min/1.73 m²/year
4 Acute kidney injury
5 Unknown cause of kidney disease
6 Persistent glomerular hematuria >20 RBC/hpf of unclear etiology
7 Resistant hypertension
8 Persistent hyperkalemia
9 Polycystic kidney disease
EARLIER REFERRAL
BETTER CARE
10 Risk-based referral
Kidney Failure Risk Equation (KFRE)
5-year risk >3-5%
NEPHROLOGY
RIGHT PATIENT
RIGHT TIME
BETTER OUTCOMES

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ASN
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KNOWLEDGE COLLABORATION BETTER OUTCOMES
SUMMARY
CHRONIC KIDNEY DISEASE
1 IDENTIFY CKD
eGFR
Albuminuria
Urinalysis
2 RISK STRATIFY ACCORDING TO KFRE
KFRE
3 ADDRESS CAUSE
4 LOOK AT GDMT
ACEi/ARB
SGLT2i
MRA
5 FOCUS ON LIFESTYLE CHANGES
6 REVIEW MEDICATIONS
7 EVALUATE AND MANAGE COMPLICATIONS
Anemia
CKD-MBD
Volume overload
8 PLAN FOR RRT
DON'T GET FIXATED ON THE GFR,
LOOK AT THE BIG PICTURE

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