

CKD, complications & management

CPD Presentation

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Definition

CKD is defined as abnormalities of kidney structure or function, present for more than 3 months

Criteria for CKD (either of the following present for >3 months)

Markers of kidney damage

Increased albuminuria

Urine sediment abnormalities

Electrolyte and other abnormalities due to tubular disorders

Structural abnormalities detected by histology

Structural abnormalities detected by imaging

Kidney transplantation

Decreased GFR

GFR <60ml/min/1.73m²

Epidemiology

- Chronic kidney disease (CKD) is a public health problem worldwide with a global prevalence of 11% to 13%.
- In South Africa, prevalence is 14.3 %, in Kenya 4.0 % and 8.0 % in Sudan.
- Rural and urban dwellers have also similar CKD prevalence rates

CKD/ Risk factors

- ◉ DM 48%
- ◉ HTA 19.7 %
- ◉ Glomerulonephritis 8.3%

Clasificación

Stage	Criteria
1	GFR \geq 90 plus evidence of kidney damage
2	GFR 60–89 plus evidence of kidney damage
3	GFR 30–59
4	GFR 15–29
5	GFR $<$ 15

Classification

● For albumin excretion:

- A1=normal to mildly increased (AER <30 mg/d or ACR <30 mg albumin/g creatinine)
- A2=moderately increased (AER 30–300 mg/d or ACR 30–300 mg/g)
- A3=severely increased (AER >300 mg/d or ACR >300 mg/g)

Complications

Tabla 3. Prevalence of common complications of chronic kidney disease according to the glomerular filtration grades^a

Complication	Glomerular filtration rate (ml/min/1.73m ²)				
	≥ 90	60-89	45-59	30-44	< 30
HBP ^b	18.3	41.0	71.8	78.3	82.1
Anaemia ^c	4.0	4.7	12.3	22.7	51.5
Hyperparathyroidism ^d	5.5	9.4	23.0	44.0	72.5
Hyperphosphataemia ^e	7.2	7.4	9.2	9.3	23.0
Deficiency of 25(OH) Vit D ^f	14.1	9.1	10.7		27.2
Acidosis ^g	11.2	8.4	9.4	18.1	31.5
Hypoalbuminaemia ^h	1.0	1.3	2.8	9.0	7.5

- Adequate blood pressure (BP) control is the basis for cardiovascular, renal and overall prevention in CKD patients.
- BP mgt optimization, may need more than 2 drugs
- Target < 140/90

Table 4. Key aspects of high blood pressure management in chronic kidney disease

Adequate control of BP forms the basis of cardiovascular and renal prevention in CKD patients

Objectives

Target	Comments
BP <140/90mmHg	- In non-diabetics and in diabetics with an albumin/creatinine ratio <30mg/g; GR: 1, recommended; evidence B
BP <130/80mmHg	- In non-diabetics and in diabetics with an albumin/creatinine ratio \geq 30mg/g; GR: 2, suggested; evidence D
Individualise	- Caution in older patients or those with many cardiovascular comorbidities; GR: not graded - Caution in patients with orthostatic hypotension; GR: not graded

Intervention	Comments
Weight reduction (GR 1D)	<ul style="list-style-type: none"> - Effective measure for overall prevention - Different interventions, non-surgical or surgical, that lead to the reduction of systolic BP between 9 and 23mmHg - It may be effective in reducing albuminuria - Particularly effective in CKD grades 1 and 2 - Caution in stage 5 due to risk of malnutrition
Reduced salt intake (GR 1C)	<ul style="list-style-type: none"> - Recommend between 4 and 6g of salt per day - Moderate effectiveness, reduction in systolic BP of 4-5mmHg - Particularly indicated in cases of salt and water retention
Physical exercise	<ul style="list-style-type: none"> - There are no specific studies in CKD patients - In the hypertensive or cardiovascular risk population, it is effective in overall prevention - Recommend 3-5 weekly sessions of 30-60 minutes of aerobic exercise - Reduction in systolic blood pressure of 6mmHg
Other	<ul style="list-style-type: none"> - A restriction in alcohol consumption is effective in the hypertensive population in general - Quitting smoking is a key measure in overall prevention - In CKD patients, potassium, magnesium or fatty acid supplements are not recommended

Pharmacological treatment of choice

Drugs	Comments
General consideration	<ul style="list-style-type: none">- In most patients, it is necessary to use more than one antihypertensive drug to control BP
ACE inhibitors or ARBs	<ul style="list-style-type: none">- In non-diabetic and diabetic patients with an albumin/creatinine ratio of 30-300mg/g; GR: 2, suggested; evidence D- In non-diabetic and diabetic patients with an albumin/creatinine ratio of >300mg/g (or equivalent proteinuria >500mg/24 hours); GR: 1, recommended; evidence B
All drugs	<ul style="list-style-type: none">- In non-diabetic and diabetic patients with an albumin/creatinine ratio of <30mg/g

Anemia

- ◉ Lack of EPO
- ◉ Iron Deficiency
- ◉ Inflammation
- ◉ Accumulation of uremic toxins

Anemia

- Anemia is twice as prevalent in people with CKD (15.4%) as in the general population (7.6%).
- The prevalence of anemia increases with stage of CKD, from 8.4% at stage 1 to 53.4% at stage 5.

Anemia

EPO

Iron

CVD complication

- LV systolic and diastolic dysfunction
- MI
- CHF
- Stroke
- Afib
- PAD

CVD complications

- ◉ In the US, the prevalence of CVD in CKD patients reaches 63%,
- ◉ In contrast with only 5.8% in people without CKD, and this prevalence is directly correlated with the severity of CKD

CVD complications

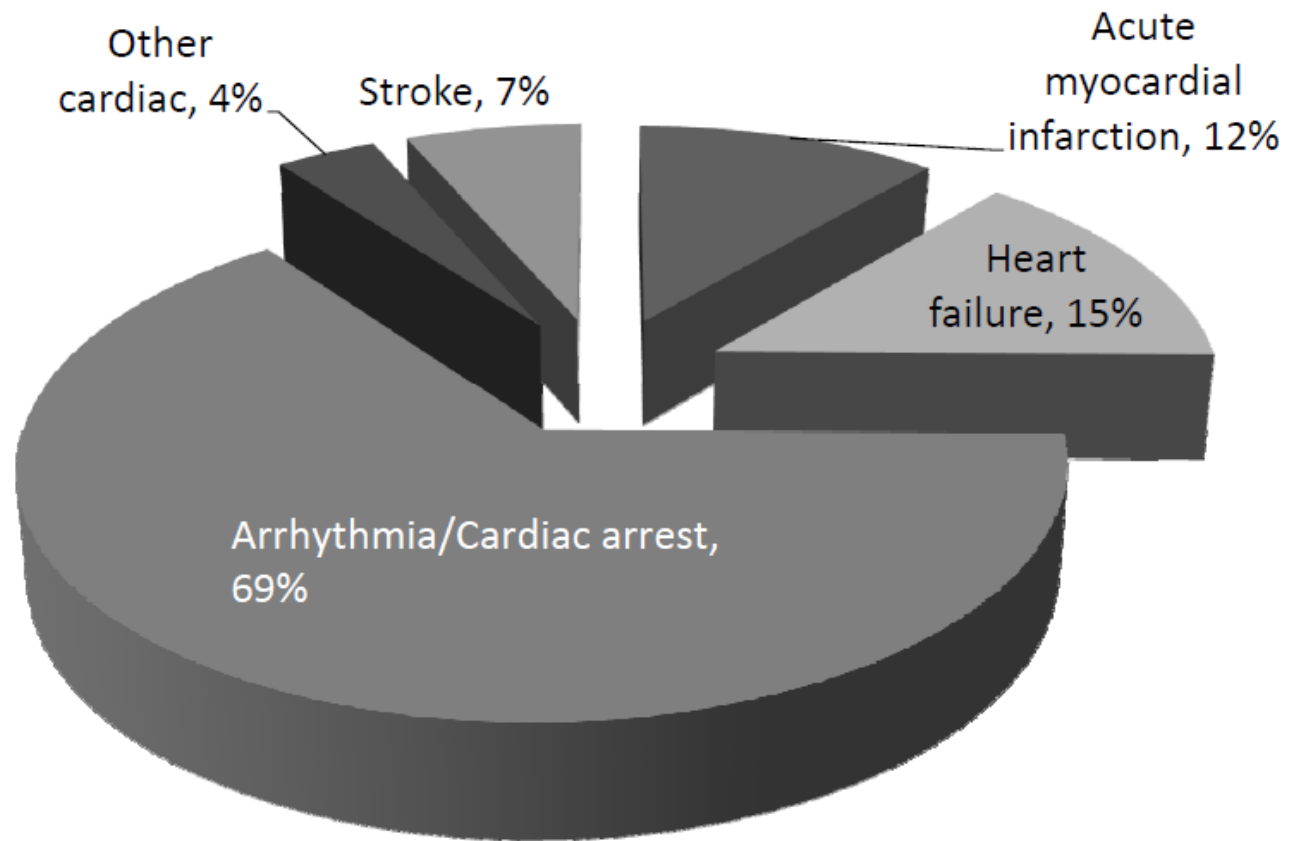
- In dialysis dependent end-stage renal disease (ESRD) patients, the risk of cardiovascular (CV) mortality is 10-fold to 20-fold higher than in age- and gender-matched control subjects without CKD .
- Traditional risk factors :
 - advanced age
 - hypertension
 - diabetes, and
 - Dyslipidemia

CVD complications

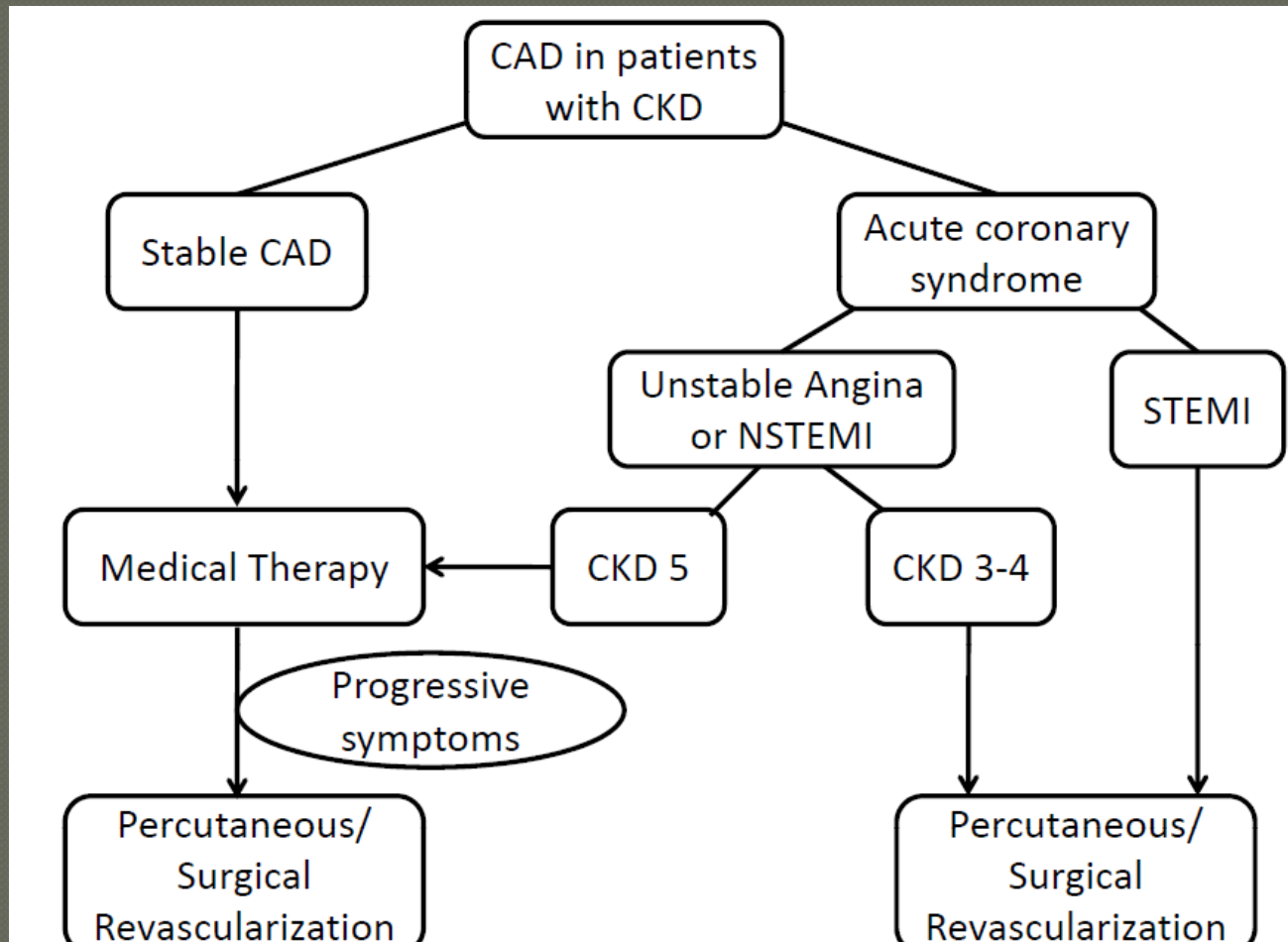
○ Nontraditional risk factors:

- anemia,
- volume overload
- mineral metabolism abnormalities
- proteinuria
- malnutrition
- oxidative stress
- inflammation

CVD



). Major causes of cardiovascular death in dialysis patients.



CVD

- Abstaining from smoking
- Exercise
- Weight control
- Lipid profile control

- ◉ Optimal control of diabetes and BP
- ◉ Anaemia correction,
- ◉ Phosphorus-calcium metabolism control
- ◉ Platelet anti-aggregation in secondary prevention

Lifestyle modification

- Control of obesity
- A reduction in salt intake to between 4 and 6g per day
- High dietary protein intake in CKD patients results in an accumulation of uraemic toxins, but insufficient intake may lead to malnutrition.
- Reduce protein intake to 0.8g/kg/day in adults with an estimated GFR <30ml/ min/1.73m²

Bone damage

- Progressive CKD with loss of functioning kidney mass results in a suspension of the last step in the hydroxylation of vitamin D₂ (25OHvitD) to active vitamin D₃ (1,25(OH)₂vitD) by renal α-1-hydroxylase.
- The deficiency of vitamin D₃ leads to decreased retention of calcium by the renal tubules and a reduction of calcium absorption from the gastrointestinal tract.

Bone damage

- The subsequent hypocalcemia induces secondary hyperparathyroidism with the release of parathyroid hormone (PTH) which results in a quantifiable increase of active osteoclasts in bone with release of skeletal calcium
- The up-regulation of bone metabolism elaborates fibroblast growth factor 23 (FGF23) whose major functions are to induce the catabolism of vitamin D2 and inhibit renal tubular phosphate reabsorption .
- The net effects are a lowering of blood calcium, elevation of phosphate concentrations and progressive bone loss.

Bone damage

- In principle, management is aimed at the restoration of kidney functions through dialysis or renal transplantation and the re-establishment of normal blood calcium concentrations with among others vitamin D supplementation.
- Secondary hyperparathyroidism can be addressed through the control of calcium intake, dialyze calcium content and the use of calcimimetic drugs which mimic the action of calcium, thereby reducing parathyroid activity .

Bone damage

- If managed successfully, blood calcium concentrations return to normal, secondary hyperparathyroidism is corrected and PTH over-production suspended.
- Osteoclasts become de-activated, bone catabolism ceases and the risk for cardiovascular calcifications is averted.

Bone disease

- Mineral and bone metabolism disorders may begin at initial CKD grades and increase as the disease progresses
- These changes are grouped under the heading of mineral and bone metabolism disorders and include:
 - related renal osteodystrophy and
 - extraskeletal (vascular) calcifications.

Bone disease

- Renal osteodystrophy includes :
 - osteitis fibrosa cystica
 - osteomalacia
 - adynamic bone disease.

Secondary Hyperthyroidism, T3

- Phosphate binders
- Calcium supplement
- Vitamin D

Acidosis

- The prevalence and severity of acidosis increases as CKD deteriorates
- Treatment with oral bicarbonate supplements in patients with bicarbonate concentrations $<22\text{mEq/l}$ is suggested, if it is not contraindicated

Refer to Nephrologist

Table 7. Criteria for referral to the nephrologist

- Acute deterioration of kidney function
- GFR $<30\text{ml}/\text{min}/1.73\text{m}^2$
- Significant and sustained albuminuria (albumin/creatinine ratio $\geq 300\text{mg}/\text{g}$; equivalent to protein/creatinine ratio $\geq 500\text{mg}/\text{g}$ or proteinuria $\geq 500\text{mg}/24\text{h}$)
- CKD progression (sustained decrease in the GFR $>5\text{ml}/\text{min}/1.73\text{m}^2$ per year or due to a change of category [from G1 to G2, from G2 to G3a, from G3a to G3b, from G3b to G4 or from G4 to G5], whenever the latter is accompanied by a GFR loss of $\geq 5\text{ml}/\text{min}/1.73\text{m}^2$)^a
- Microhaematuria not explained by other causes, sediment with >20 red blood cells/field, especially in the case of red blood cell casts
- Resistant HBP (not controlled with a combination of three antihypertensive drugs, including a diuretic)
- Persistent serum potassium abnormalities
- Recurrent nephrolithiasis
- Hereditary kidney disease

Dialysis

- Access:
 - Acute catheter
 - Chronic Catheter
 - Fistula
 - Vascular graft
- Peritoneal vs Hemodialysis
- Dry weight in ESRD patients is currently determined in most dialysis centers on a clinical basis, and it is commonly defined as the lowest body weight a patient can tolerate without developing intra- or interdialytic hypotension or other symptoms of dehydration

Kidney transplant

- In March 1976, the first renal transplantation in Egypt was carried out at the Department of Urology, University of Mansoura
- Contrindications to kidney receiving:
 - Sensitization with positive lymphocytotoxic cross match and donor specific antibodies
 - Recent malignancy
 - Addiction
 - Psychiatric disorders,
 - Type I diabetes mellitus
 - Significant extrarenal organs failure (pulmonary, hepatic, and cardiac)

Kidney transplantation

○ Absolute contraindications for donation include:

- Active infections
- Diabetes
- Even minimal renal function impairment
- Arterial hypertension
- Serological positivity for HBV or HCV

Post transplant management

- Steroids
- Immunosuppressive drugs
- Induction and maintenance phase
- Rejection more likely to happen during the first 3 months

Prevention

- Prevent obesity
- Screen and prevent diabetes in an at-risk population
- Glycemic control once diabetes develops
- Blood pressure (BP) control once hypertension develops

Prevention

- Screen for diabetic chronic kidney disease (CKD)
- Use of renin-angiotensin-aldosterone system (RAAS) inhibition/blockade in those with diabetic CKD
- Control of other cardiovascular (CV) risk factors such as management of low-density lipoprotein cholesterol (LDL-C)

Monitoring

- Recommendations for frequency of monitoring for CKD progression depend on the severity of disease.
- Patients at the lower end of the severity classification (G1A1, G1A2, G2A1, G2A2, G3aA1) need only be monitored once yearly.
- As severity progresses, monitoring frequency should increase to :
 - twice yearly (G1A3, G2A3, G3aA2, G3bA1),
 - thrice yearly (G3aA3, G3bA2, G3bA3, G4A1, G4A2), or
 - at least quarterly (G4A3, G5A1, G5A2, G5A3).
- Increasing severity of CKD should lead to increased monitoring.

Monitoring

- Progression of CKD is defined as a change in GFR category and a 25% decrease in GFR.
- This practical definition should decrease the risk of small fluctuations in GFR leading to intensified therapy due to the crossing of an arbitrary cutpoint.

Conclusion

- AS far as CKD, complications and management are concerned, prevention is better than cure
- Whether be primary , secondary or tertiary prevention

Recommendation

- Early identification of CKD paired with appropriate management and earlier referral to specialty kidney services results in economic and clinical benefits.
- The majority of CKD patients have albuminuria prior to a decrease in glomerular filtration rate.
- Regular laboratory tests for albuminuria in the high-risk group, especially for hypertensive or diabetes mellitus patients, should contribute to early detection of CKD.

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