

تفريغ علم وظائف الأعضاء المرضي



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Renal Pathophysiology (part 2)

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لجان الرفعات

هو عبارة عن بروتين في urine ويقسم إلى قسمين النوع البروتين المرّ يظهر في urine :

Proteinuria

- Presence of abnormal concentration of proteins in the urine.

*proteinuria makes urine froth easily!

1. Low molecular weight proteins:

* normally low MW proteins are filtered at glomeruli but are absorbed by tubular cells.

من الطبيعي رصير الرها فلترة عن طريق Bowman capsule لانها Low M.w

ولكن فعند لو صار الها فلترة له انهم تطلع لبي نسبة اقل من 150mg/day في urine

* Less than 150 mg/day should appear in the urine.

* the appearance of more than 150mg of low MW proteins in the urine 24 hours means failure of reabsorption by tubular cells and indicates **tubular cell damage**.

* Proteinuria of low MW proteins more than 2g/day indicates **significant glomerular disease**.

اذا ظهرت عندي البنية اكثر من 2g/day يعني المشكلة معتي بي

tubular يعني انو عندي كمان مشكلة في نفس الكسول (capsule)

وتدعي significant glomerular disease

اذا تطلع البروتين من هاهي البنية في 24h يعني النوع نسبة عندي ما همار الو good reabsorb ليه عندهم تكسر في

tubular cell

Proteinuria

2. Albuminuria → major protein found in plasma.

* Normally albumin is not filtered at glomeruli. → لا توجد البلازما في مشد من الطبيعي
ليخرج الى خلاصة

* Presence of albumin in the urine is a positive sign of **glomerular disease.**

- Albuminuria is seen in the early stages of the glomerular disease of diabetes mellitus **diabetic nephropathy**. ايضاً يعتبر داء من الامراض التي يتظاهر عندها
بمرض

* Minor leakage of albumin into glomerular filtrate may occur temporarily after **vigorous exercise, fever and heart disease.** ويمكن يكون نتيجة
1) التمارين الصعبة
2) الحرارة ← بالر يكون مكنها
3) امراض القلب

ببدر يظهر
urine
يعني عندي امراض
glomerular

Orthostatic proteinuria:

- **Proteinuria** occurs only during the day.
- **First-morning urine sample contains no protein.**
- Is usually benign in the absence of renal disease.

ما يظهر عندو بروتين اول فادامي
بسا اثناء اليوم

و بيجيك هاذ اليوم من شرط يكونه فين عكن يكونه هيد
ولكن اذا صار عندو عرض او infection او inflammation او abnormality
فا يكون اثني هيد ابدًا او ما يكونه normal cause

NEPHROTIC SYNDROME

(نزلها مباشرة مع
 proteinuria
 وعند أحيات كبيرة جداً
 خالية تكون تقريباً
 3.5 grams/day

- Is due to the loss of large quantities of protein in the urine.

- The signs and symptoms start to appear when proteinuria is about 3.5 grams/day.

تعتبر كمية كبيرة كـ 3.5

- Characteristics of nephrotic syndrome:

1. Serum albumin is less than 3 grams/100 ml.

2. Signs of fluid retention or edema. تجمع سوائل

3. Proteinuria of more than 3.5 g/24 hours.

عند سبب

البروتين الي خارج الجسم excretion

- Causes of nephrotic syndrome: edema or retention

The diseases causing nephrotic syndrome always affect the glomeruli.

Glomerular nephritis وهو مرض في الكلى

1. Glomerulonephritis.

2. Systemic diseases:

واحد عند مرضى مثل يكون في kidney

"diabetic nephropathy, amyloidosis"

يمكن أن تكون أي كلمة بـ itis infection or inflammation

عبارة عن بروتين يتم تصفيته

بـ systemic circulation

مشكلة في kidney إذا استتبها بارتفاع عالية، تظهر بـ proteinuria يكون عند nephrotic syndrome وهو مرض عند

Clinical features of nephrotic syndrome

Fluid accumulation
بتكون نسبة albumin
للموجودة بالدم قليلة
تترتفع نسبة Na⁺ retention

1. Edema انتفاخ / تجمع سوائل

- * Is due to hypoalbuminemia and Na⁺ retention.
- * Starts in lower limbs and extends to genitalia and lower abdomen (in severe cases).

بحالات معينة قسماً دائماً .

Ascites occur early in children.

In the morning the edema is seen in the upper limbs and face.

في الصباح يكون عندهم انتفاخ بالوجه او بالجذع العلوي من الجسم

انتفاخ باحقدام وعين للمعدة
اذا اصاب بالصدر Ascites يكون

2. Hypercoagulability هونا يكون عند تشككة ب Clot Factor ب coagulation →

- * tendency for clot formation, is due to loss of anticoagulants.
- * It may lead to venous thrombosis and emboli formation.

نسبة Clot Factor بتكون عالية و بزيادة عندهم thrombosis or emboli

لأنو anticoagulation مبرالها excretion ب urine و ما بيسر عند normally anticoagulation

3. Infection

- * is due to hypogammaglobulinemia

لا تو بفسار و ال anti body الي بتشتغل هذه الميكروبات في بردتياك
ف بيسر لها excretion in urine و مثال علها gamma globulin بتشتغل مع immune system

لا يهاطون ب urine بتكون نسبتها

4. Hypercholesterolemia

- * leads to arterial occlusion hyperlipidemia + هذا عند نسبة عالية
- * (enzymes involved in cholesterol metabolism are lost in urine).

لح واحد عندو نسبة الكولسترول عالية + هذا عند نسبة عالية hyperlipidemia
لأنو ينتقل عن طريق apo protein اذا مبرالها excretion عاليه لدرتياك و البروتينات المسطولة عن النقل نقل بزيادة نسبة الكولسترول

بأندم قليلة

Glomerulonephritis (GN)

- ^{التحباب} Inflammation of glomeruli. ^{يحدث نتيجة وجود بكتيريا} → streptococcal
- It is mostly immunologically mediated which is due to:
 1. Deposition of anti-glomerular basement membrane antibodies.

^{بكتيريا} Streptococcal infection.

*The antibody-antigen complexes are ^{ترسب} deposited in the glomeruli.

These complexes are ^{تدكون} formed from the reaction of the antibodies against glomerular antigens or with antigens deposited in the glomeruli.

^{المفاعلات}

①

الاجسام
المضادة

glomerular antigens

②

antigens ترسب ب glomeruli

Glomerulonephritis (GN)

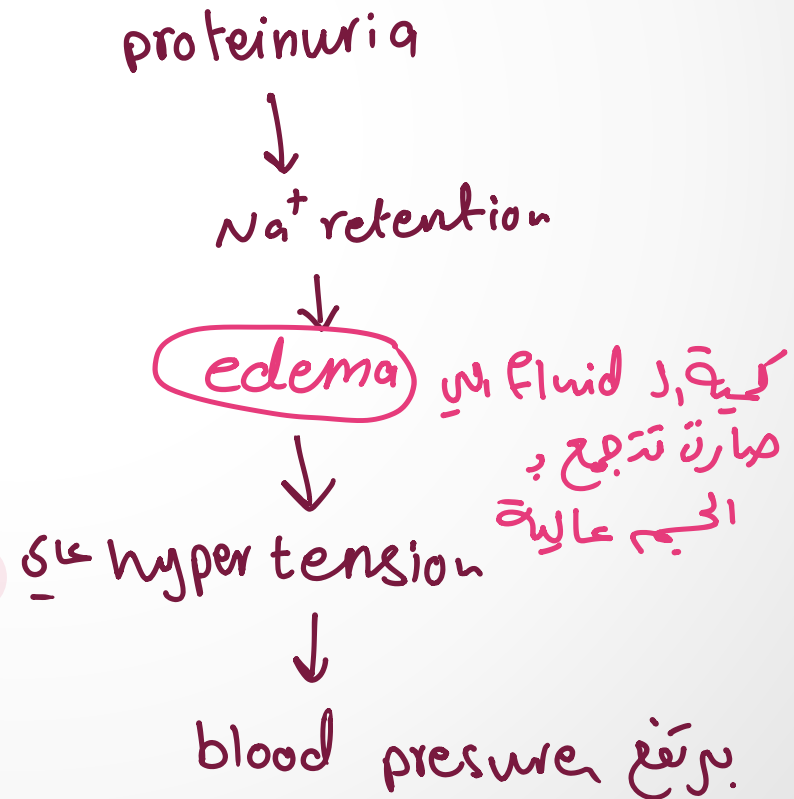
- It might be acute or chronic.
- Might lead to kidney failure.

ويمكن يؤدي إلى فشل كلوي لانه الكلية ربيع غير قادرة على القيام بوظائفها.

Signs and symptoms:

- Na⁺ retention.
- Edema.
- Hypertension.
- Proteinuria.
- Hematuria.
- Reduced urine output.

تقل



Acute tubular necrosis (ATN)

موت الخلايا الموجودة
tubule

* Necrosis of cells of kidney tubules.

* It is the most common cause of acute renal failure.

• **Tubular cell death is caused by:** يكون موت الخلايا بسبب

a. Reduce renal blood flow such as in shock.

b. Toxins such as: نتيجة استخدام الادوية
الساكنة

- Gentamycin, vancomycin

- Cytotoxic drugs (cyclosporin, cisplatin)

← أهمية الدم التي
تترواح للتأثير
بتكون قليلة
مثل shock

Acute tubular necrosis (ATN)

شرح الآلية:

- Reduce blood flow to tubular cells leads to less O₂ delivery to tubular cells especially to cells of the ascending loop of Henle (they are very active metabolically) → death of the cells → accumulation of cells into the lumen of the tubules leading to occlusion.

Clinical manifestations:

- Dehydration.
- Swelling and fluid retention.
- Reduced renal output.

acute
chronic

فشل الكلية **Renal failure**

- Failure of the kidney to perform its function.
- It might be due to renal disease or systemic disease.
- Can be acute or chronic.

عند شرط يكون نتيجة وجود
مشكلة ب kidney يكون
تكون مشكلة او مرض
systemic

Acute renal failure

سُمِّيَتْها acute
للنو فجأة الكلية بطلت
قدرة تحمل وظيفتها
خلال آخر 48 ساعة

- Sudden entire or almost entire loss of kidney function within 48 hours

بتعمل تشخيص عن طريق Creatinine أو

glomerule *
Filteration

High plasma creatinine concentration and decreased urine output.

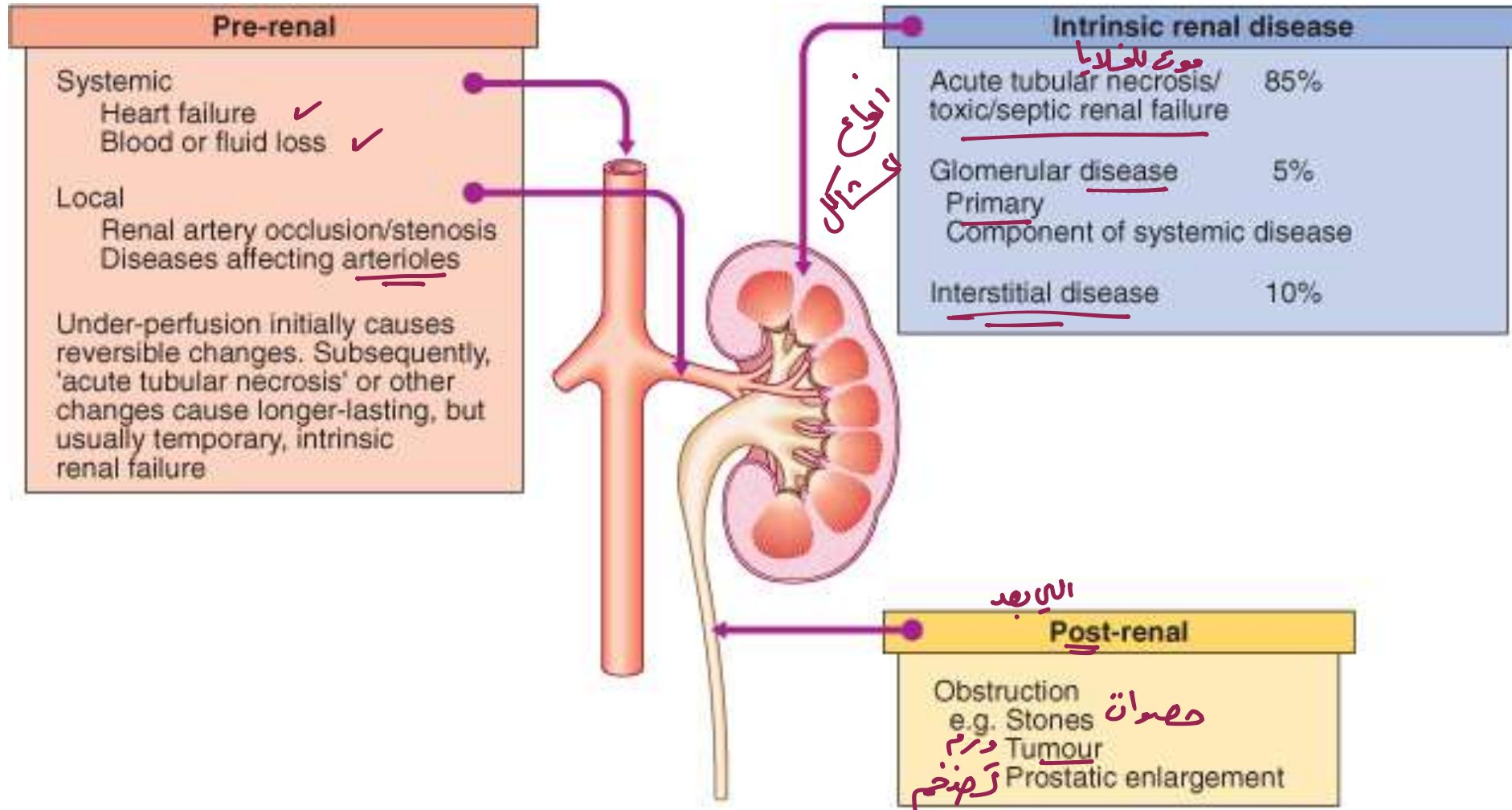
It is usually reversible if recognized early and treated properly.

نعمل عن

انزلا زخم تكون
نستو لبيعة
ما يكون هارلو
reabsorption
يعني لازم يكون البيعة
البيعة التي يستخرج من muscle

اذا عتت معالجة بجله
و بندهي ولكن اذا لم تتم
معالجته بدحول Chronic

Acute renal failure: Causes



Clinical features of ARF:

- The signs and symptoms are a combination of underlying conditions that caused the renal failure and those of renal failure itself.

1. Abnormalities of urine volume: التشخيص حسب :

*Oliguria

***Anuria** → is rare and indicates acute urinary tract obstruction or vascular occlusion.

***Sometimes urine volume is normal or increased (seen in 20% of patients).** This is due to low GFR and poor tubular absorption and does not mean normal kidney excretory function.

(polyuria)

لأنه في بومان capsule غير قادرة ان تعمل good filtration للمواد بالكمية لاصح و
يمكن ان يصير لنا secretion عالي للمياه و كمية الكلى عالية ب kidney و مارح يصير لنا

Filtration
للمياه

Clinical features of established ARF

لا نومها رلها
good excretion
ف يضل
البلازما

2. Blood chemistry abnormalities:

* High plasma urea and creatinine concentrations.

→ blood test.

* Hyperkalemia must be corrected because of its effect on heart function (causes ventricular arrhythmia).

الفوسفات كالي + البوتاسيوم عالي.

* Hypocalcemia: is due to decreased the active form of vitamin D

الكالسيوم قليلة

* Acid-base disturbances → metabolic acidosis.

اضطرابات

→ سبة H^+ يزيد

* Respiratory rate is increased (due to metabolic acidosis)

* Pulmonary edema may develop (due to retention of fluid or inappropriate administration of excess fluid).

* Anemia (due to blood loss and less erythropoietin production).

تصبح RBC قليل

* Bleeding tendency

* Immunity depression and infection.

التهاه/عدوى

Chronic renal failure

- Loss of nephrons and decline of renal function.
مُفقدت تقلل وظائف الكلى chronic
لبشكل أكبر من acute

• **Determined by a persistent decrease in GFR for more than 3 months.**

- Causes: إذا زاد الانخفاض لمدة ٣ أشهر ولم تتم معالجته

- Diabetes.

- Hypertension.

- Systemic lupus erythematosus. → بهير الجهاز المناعي

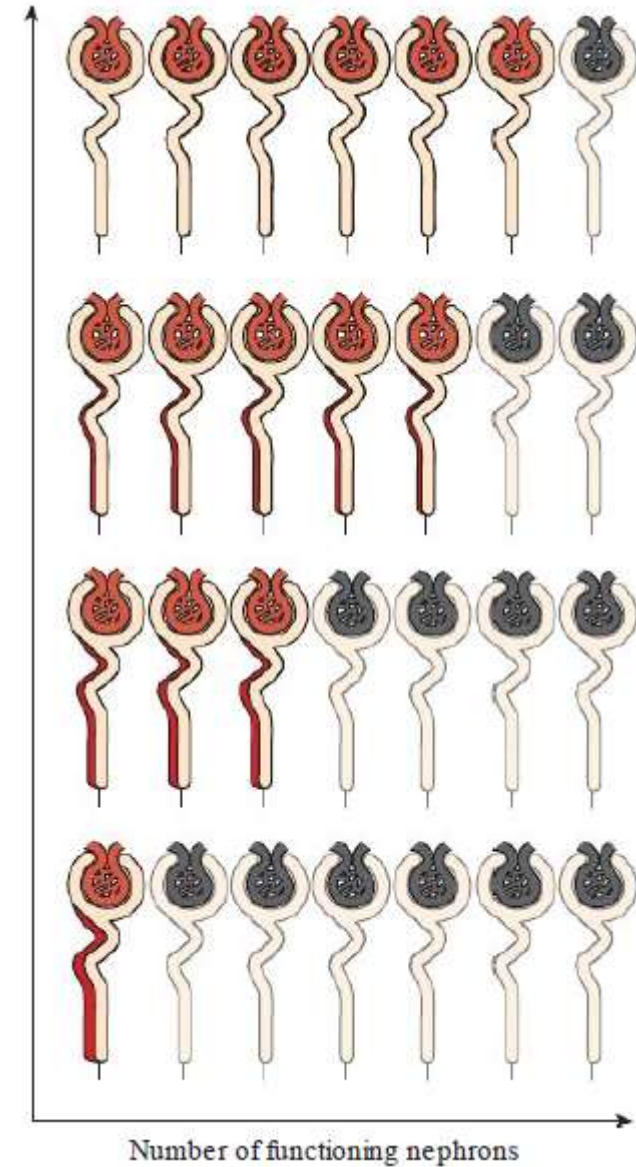
- Polycystic kidney disease.

لناسر الي عندهم أليامر
Kidney ع

بيبي

لهاجم لفسو

FIGURE 26-3. Relation of renal function and nephron mass. Each kidney contains about 1 million tiny nephrons. A proportional relation exists between the number of nephrons affected by a disease process and the resulting glomerular filtration rate.



لنبتوف اذا عانا بروين بـ urine
او لBlood بـ urine
او creatinine

Diagnostic measures of CKD

- GFR is considered the best measure for overall kidney function.
- GFR varies based on age, sex and body size.
- Normal is between 120-130 ml/min/1.73 m²
- GFR is measured based on serum creatinine levels taking on consideration the above variations.
- **Proteinuria is an adjuvant tool for measuring nephrons injury and repair.**

جدول صحیح

TABLE 2 6 - 1 Stages of Chronic Kidney Disease

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

لیزم عملی
عسل لکری
اورزاعہ

GFR, glomerular filtration rate.

Adapted from National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: Evaluation, classification, and stratification. 2002. Available at: http://www.kidney.org/professionals/KDOQI/guidelines_ckd/toc.htm. Reprinted with permission from National Kidney Foundation, Inc.

Chronic kidney disease is defined as either kidney damage or GFR <60 mL/min/1.73 m² for ≥3 months. Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine tests or imaging studies.

دائرہ

Clinical manifestations

- In the early stages, CKD is largely asymptomatic.
يكونها صامتة فالمرضى فيها
- Azotaemia (elevated nitrogen-containing waste in the blood) is an early sign of CKD.
ارتفاع
- Uraemia: elevated urea in the blood which is characterized by:
 - Fatigue. التعب
 - Neuropathy. → ما يستغل من إنتاج الaction potential
 - Sleep disorders. مشاكل بالنوم
 - Encephalopathy. مشاكل بالBrain بمراكز معينة بالدماغ
 - Nausea and vomiting. غثيان وقيء
 - WBCs dysfunction. ضعف وظيفي
 - Pruritis.
حكة بالSkin

Anemia

This anemia may be caused by:

1. Decrease in ^{تقل}erythropoietin production.
2. Inhibition in erythropoiesis by the toxic effect of metabolic waste products on bone marrow.
3. An increase in blood loss due to increased capillary fragility and poor platelet's function.
4. Reduction in dietary intake and absorption of iron and other substances needed for erythropoiesis.
5. Shortening of RBC life span.

Bone abnormalities of CRF (renal osteodystrophy)

- bone abnormality**
These abnormalities are a mixture of: كمية المعادن بتقل او هبعب يتكون ر bone بشكل كويس
- * Osteomalacia (failure of bone mineralization). صتاسفة لعظام
 - * Osteoporosis (reduction in bone mass). تقللة العظم بتقل
- *In CRF there is less 1,25-dihydroxycholecalciferol (the active form of vitamin D) decreasing absorption of ca^{+2} from intestine → hypocalcemia, this causes:
- A. Reduction in bone calcification. تقليل العظام بتقل الكالسيوم
 - B. Hyperparathyroidism → increased bone resorption. ارتفاع ب parathyroid hormone
- * Excretion of phosphate is decreased in CRF leading to hyperphosphatemia which stimulates the parathyroid glands. نقص عندهم كفة ب excretion

Chronic Renal Failure

مشاكل بـ endocrine

Endocrine disorders of CRF

Hyperprolactinaemia → causes a decrease in libido and sexual function in males and female.

Hyperparathyroidism → is due to hypocalcemia and hyperphosphatemia.

Amenorrhea (means absence of menstrual cycle in females)

There is also relative insulin resistance in CRF.

الخلايا التي تفرز انسولين

↓ However, a decreased renal metabolism of insulin in CRF may reduce the daily requirements of insulin in diabetics.

وتقل حاجة

بدائل انسولين

انسولين وعيّن اليكوز تزيد نسبتهم

Chronic Renal Failure

Metabolic acidosis:

تبادل فوسفات
 H^+
 Ca^{2+}

- The increased H^+ leads to an exchange of H^+ instead of Ca^{2+} in the bone and this aggravates the metabolic disease of the bone of CRF.
- The respiration is strongly stimulated by metabolic acidosis. The increased respiratory activity is an attempt to reduce H^+ concentration by blowing off CO_2 . Plasma pH less than 6.8 leads to coma and death.

Heart diseases in CKD

LV dysfunction due to fluid overload and anaemia.

Hypertension which is due to sodium and water retention.

LV dysfunction coupled with hypertension can lead to heart failure.

يؤدي الى مشاكل او فشل
بالقلب



Replacement of renal function in renal

failure زرعہ اور عمل سکی

****When kidneys stop working temporarily or permanently, metabolic waste products accumulate in the blood.**

It is essential to get rid of these toxic substances which worsen the condition and affect other body systems. It is also important to replace the endocrine function of the failing kidneys.

****It is possible to replace the excretory function of the failed kidneys by hemodialysis or peritoneal dialysis.**

****Dialysis can not replace the endocrine and metabolic functions of the kidney. These functions could be resumed by a kidney transplant.**



Thank You

