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Dental management in renal failure: Patients on dialysis

SUPERVISED BY:

Assistant Professor Dr. Khitam Jassim

PREPARED BY:

Mohammed Raad Khurbat

Ayat Hassan Rahm

Karar Ali Niema

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SUPERVISOR CERTIFICATIN

I certify that the preparation of this project entitled Graduation Document prepared by

Ayat Hassan Raham

Mohammed Raad Khurbat

Karrar Ali Niema

was made under my supervision at dentistry college/maysan University in partial fulfillment of the Requirements for the Degree of Bachelor of dentistry.

Signature Supervisor Name: Assistant Professor Dr. Khitam Jassim

Date: / /2024

Abstract

Chronic renal failure is an important health care problem throughout the world, with an incidence of 337, 90, 107 and 95 new cases per million inhabitants/year in the United States, Australia, New Zealand and the United Kingdom, respectively.

These figures moreover invariably tend to increase. During the progression of renal damage, clinical manifestations are noted in practically all body organs and systems, and 90% of all affected patients experience oral symptoms. The existing management options range from simple measures based on changes in diet and life style, to different forms of dialysis (hemodialysis and peritoneal dialysis), and also kidney transplantation. Given the multiple oral manifestations of chronic renal failure, and the different repercussions of its treatment upon the oral cavity, these patients require special considerations and precautions in the face of dental treatment.

Consultation with the nephrologist is essential before any dental treatment is carried out, in order to determine the condition of the patient, define the best moment for dental treatment, introduce the necessary pharmacological adjustments, or to establish other important aspects for preventing complications in the dental clinic. The present study reviews the characteristics of the disease, the existing therapeutic options, and the considerations of relevance for the dental professional.

Key words: Chronic renal failure, glomerular filtration rate, dialysis, renal transplant, immunosuppressive therapy, renal osteodystrophy, oral lesions, gingival hyperplasia, dental management.

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1:Introduction

Each human kidney is composed of about one million anatomical and functional units called nephrons. In turn, each nephron is composed of a glomerule and tubule. The glomerule consists of an interconnected network of capillaries contained within a cup-like sac known as Bowman's capsule, which continues with the proximal convoluted tubule.

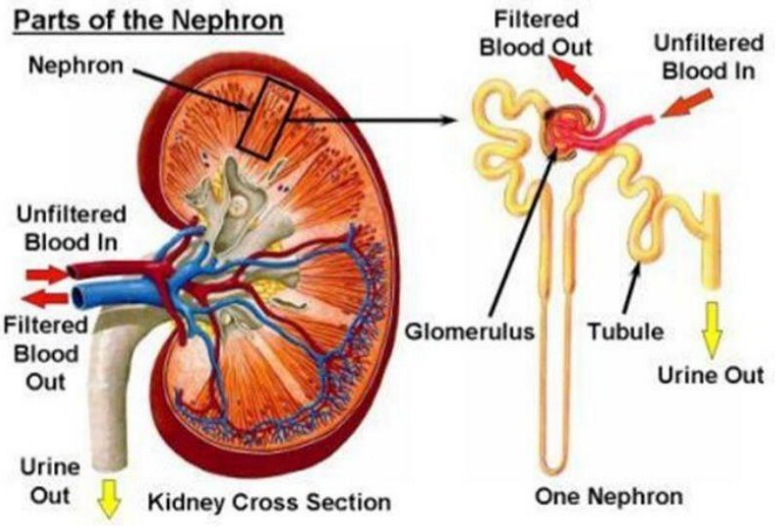
The latter in turn gives rise to different sequential segments: the loop of Henle, the distal convoluted tubule, and the collector ducts. The final segment collects the urine from a number of distal convoluted tubules and drains it directly into the renal papilla (34).

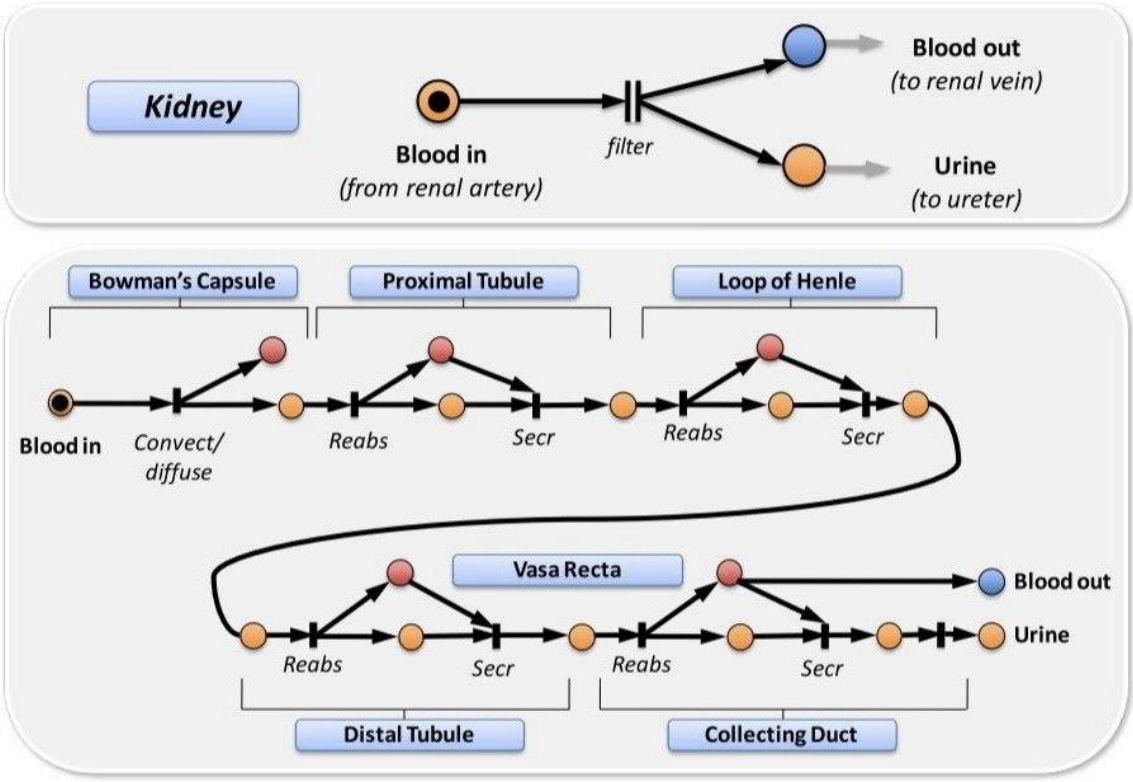
The kidneys have a number of important functions:

(a) Excretion of metabolic waste products.

(b) Electrolyte regulation through the control of sodium, potassium and water excretion, and acid-base homeostasis.

(c) Endocrine regulatory functions: eicosanoids (prostaglandins, throm boxanes, leukotrienes, prostacyclins, etc.), erythropoietin (EPO), the renin-angiotensin system, and vitamin D me tabolism (23). In particular, the renin-angiotensin system comprises one of the mechanisms involved in the control of blood pressure (BP): when the latter decreases, the kidney releases renin, which in turn triggers an enzymatic cascade that produces abundant blood angiotensin II – a hormone that increases global peripheral vascular resis tance and thus increases BP (77).





A functional model of waste removal in the kidney

2:Classification of renal failure

When a nephron is destroyed it is unable to regenerate, and the kidneys compensate the loss through hypertrophy of the remaining nephrons, so that normal kidney function can be maintained until approximately half of all the existing nephrons have been destroyed. Once this point has been reached, symptoms of renal functional impairment begin to appear:-

a) Acute renal failure (ARF) : is characterized by a sudden and important reduction in glomerular filtration rate (GFR) lasting for hours or days. The underlying causes are classified as pre-renal, intrinsically renal or post-renal (Table 1). In general, renal function is restored once the underlying cause has been resolved (100,98), and it is not common for the dental professional to treat a patient with ARF.

Table 1. Causes of renal failure.

Acute renal failure

Pre-renal
Gastrointestinal losses
Excessive perspiration
Bleeding Burns with fluid sequestration
Renal losses
Cardiovascular failure
Liver failure
Intrinsic renal causes
Acute tubular necrosis (vasomotor nephropathy)
Severe cortical necrosis
Severe acute glomerulonephritis
Vasculitis
Malignant hypertension
Accelerated scleroderma
Allergic interstitial nephritis
Post-renal
Bilateral ureteral obstruction or ureteral obstruction in patients with a single kidney
Bladder obstruction
Bladder rupture
Urethral obstruction

Chronic renal failure

Chronic immune glomerulopathy

Hypertensive nephrosclerosis
Chronic tubulointerstitial diseases
Metabolic diseases (e.g., diabetes mellitus)
Congenital and hereditary renal processes (e.g., renal polycystic disease)

b) Chronic renal failure

Chronic kidney diseases are results of progressive deterioration of kidney nephrons and dysfunction of glo-merular filtration. As a result, the kidney function is impaired followed by high loss of fluids from the body due to the increased excretion of urine (polyuria) .The most common causes are diabetes mellitus, glomerulonephritis, and chronic hypertension. In older individuals, the most commonly diagnosed causes of CRF are renovascular disease and diabetes mellitus, although other causes include polycystic kidney disease and pyelonephritis

Besides, in patients who have not been treated properly, the concomitant effects are also polydipsia, tremor and hematuria. In a more severe form of the disease we can see edemas in the face, particularly on lids as a result of fluid retention and the impaired balance of electrolytes With chronic renal deficiency we should pay attention to the following:

The immune system of patients is grossly weakened, and consequently, there is greater tendency to infection. Candidiasis and ulcers are common in the oral cavity. Soft tissues in the oral cavity are pale due to anemia. As a result, excretion of saliva is reduced, food retention in the mouth is increased and halitosis is an ultimate outcome. In extreme cases stomatitis uremica may develop. In fact, uremia is invariably followed by stomatitis. This stomatits is characterized by thickening and redness of the bucal mucus and the presence of pseudo-membranes that cover oral mucus, gingiva, soft palate and pharynx. We can rarely encounter surface and deep ulcerations smaller than 1 cm in radius without a specific localization . The bottom of these ulcerations does not bleed easily. The histological lesions indicate inflammatory process accompanied by necrosis. A similar form of stomatitis can appear with nephritis without azotemia. Vincent's microorganisms are commonly the cause of secondary infection of uremic stomatitis.

Absorption of medications administered per OS is reduced due to reduced absorption capacity of the gastrointestinal tract.

Forms of B and C hepatitis are frequent, and as a resuit, there is a tendency to bleeding.

Anemia is a result of the reduced erythropoietin production. As yet, the standard for assessing the value of hematokryte in patients with renal dysfunction who have to undergo the operation has not been ascertained. A study has shown an increase in intraoperative complications for hematokryte values of 20-26%. The acceptable value of hematokryte is 36 % which can be achieved by administering erythro-poietin for several weeks prior to the operative procedure. Fresh blood transfusion should be avoided whenever possible, primarily because it reduces the chances of a successful transplantation in case of need. In other words, every transfusion is the introduction of new antigens into the body, and the latter can, in turn, react by producing anti-bodies . Tendency to bleeding is increased because of platelets dysfunction. Consequently, APTT and INR have to be monitored very carefully

There is also a tendency to hypertension and hypotension. Pre-operative and intra-operative tension is quite common in patients with chronic renal disease. This is attributed to fear, increased kateholamine secretion and hypertension caused by renal dysfunction .

In patients with more severe renal disease there changes appear on paradontium. Thus, in patients with uremic dystrophy a loss of lamina dura and trabecular build of jaw bones occurs

Secondary hyperparatireoidism is also very common. It is a result of phosphate retention and their influence on hyper production of paratireoid hormone resulting in the increased loss of calcium in bones. In children with more severe chronic disease retardation in teeth development and jaw malformation may occur, but also changes in the tooth structure and porcelain abnormalities, precocious loss of teeth etc .

Acid- base disorders. Acidosis in patients with chronic renal disease may reduce the effectiveness of local anesthetics .

Hyperalcemia. General anaestitic is to be avoided in patients with chronic renal disease whose potassium level is over 5.5 mmol/1. Otherwise, there is an increased risk of aritmia .

Signs	Symptoms
Pallor due to anemia	Pruritus
Increased photosensitive pigmentation	Lethargy
Brown discoloration of the nails	Anorexia, nausea, vomiting, diarrhea
Scratch marks due to pruritus	Poor concentration
Signs of fluid overload	'Restless' legs
Hypertension	Leg cramps
Pericardial frictional rub, pericardial effusion	Ankle edema
Flow murmurs	Dyspnea
Bruising due to platelet abnormality	Insomnia
Confusion, coma, fits (severe uremia)	Loss of libido
Renal osteodystrophy (see Table 6)	Feeling cold

3:EPIDEMIOLOGY

Data on the epidemiology of CRF are available in many countries, although different sampling techniques are used in each country, and units in some regions (e.g., the UK) are not obliged to report patient figures.

The reported incidence of CRF is 337, 90, 107 and 95 per million population (pmp) in the USA, Australia, New Zealand, and the UK, respectively. The incidence increases with age, and males are more commonly affected than females. Incidence also varies with ethnicity. For example, in the USA, Caucasians and Black Americans have higher incidences than Asians and Native Americans. However, in the UK, the incidence of CRF is higher in Asians and Afro-Caribbeans than in Caucasians (12).

The death rate is 178, 189, 217, and 209 per 1000 patient years (pyr) in the USA, Australia, New Zealand, and the UK, respectively (Table 1). These figures suggest that the USA has a lower death rate than the UK, but the USA data do not include deaths in the first 90 days following the onset of chronic renal failure. However, the UK death rate at 1 year and 90 days (188/1000 pyr) is comparable with that in the USA. There are only slight differences in the death rates between genders. Ethnicity also affects death rate: In the USA, it is lowest in Asians (130/1000 pyr) and highest in Caucasians (193/1000 pyr).

Survival rates vary with ethnic origin and the underlying cause of renal failure. In the USA, for example, the five-year survival rate for Caucasians is lower than that for Black Americans (34.7% compared with 46.8%). The prognosis for individuals with diabetes mellitus and/or hypertension is worse than that for individuals with glomerulonephritis (30.9% and 36.5%, compared with 59.9%). A comparison of these figures with the five-year survival rate (62%) for all cancers in the USA highlights the poor prognosis for individuals with chronic renal failure (109) The most common cause of death is cardiac failure, followed by infection and malignancy Diabetes mellitus and hypertension greatly increase this risk (90)

4:Laboratory tests of renal function

1-Assessment of renal function

The assessment of renal compromise requires a number of laboratory investigations in conjunction with a thorough clinical evaluation. Deviation from ‘normal’ levels of many blood and urinary constituents can reflect renal insult or systemic disorder.

2-Glomerular filtration rate

This is the rate at which substances are filtered from the blood of the glomeruli into the Bowman's capsules of the nephrons. It is an overall index of renal function. It is calculated by the clearance of specific substances. Endogenous substances should have a constant plasma concentration. Any substance freely filtered by the glomerulus and not subsequently secreted, reabsorbed or metabolized by the distal parts of the renal system has a clearance equivalent to the GFR

3-Creatinine clearance

Creatinine is the most commonly used endogenous marker for renal function. It is a product of muscle metabolism that is freely filtered at the glomerulus and secreted in small amounts in the proximal tubule. This results in a small overestimation of GFR, the impact of which is attenuated by the plasma creatinine assay, which generally also leads to an overestimation of the actual concentration of creatinine. The measurement of the clearance of creatinine normally involves a 24-hour collection

4-Serum cystatin C

This alkaline non-glycosylated protein is produced at a constant rate by almost all nucleated cells. It is freely filtered at the glomerulus and is not reabsorbed in the proximal tubule. It is however, metabolized to some degree in the renal tubules thus limiting the utility of urinary measurement. As GFR declines serum levels of cystatin C rise. This rise can precede a rise in serum creatinine levels by 1–2 days2 and can be a useful marker of early AKI. Although initially it was thought that

5-Free water clearance

Although rarely calculated, this allows quantification of urinary excretion of water and electrolytes by theoretically separating urine into two components: one consisting of isosmotic urine containing all solutes and the other containing only free water. Clearance of

this free water is responsible for altering plasma osmolality and, in particular, the plasma sodium concentration. Clearance of free water can indicate the ability of the kidneys to conserve water by the production of concentrated

6-Other serum biochemistry in glomerular filtration rate reduction

Serum electrolyte levels are non-specific markers of renal dysfunction and offer little in the way of quantitative analysis. Acute reduction in GFR is often accompanied by an elevation of serum potassium, urate and phosphate (as well as urea and creatinine) and a reduction in serum bicarbonate and calcium levels. Additionally, metabolic acidosis with an elevated anion gap is characteristic.

7-Tests for tubular dysfunction

Proximal tubular: failure causes acidosis accompanied by a fall in serum potassium, phosphate, urate and bicarbonate levels, reflecting a failure of reabsorption. Usually, urea and creatinine levels are normal. Acidification of the urine by oral ammonium chloride is occasionally carried out to indicate the presence of renal tubular acidosis. This measures the ability of the kidney to produce acidic urine (pH <5.3) in response to the ammonium chloride. This compound is metabolized hepatically to

8-Urinalysis

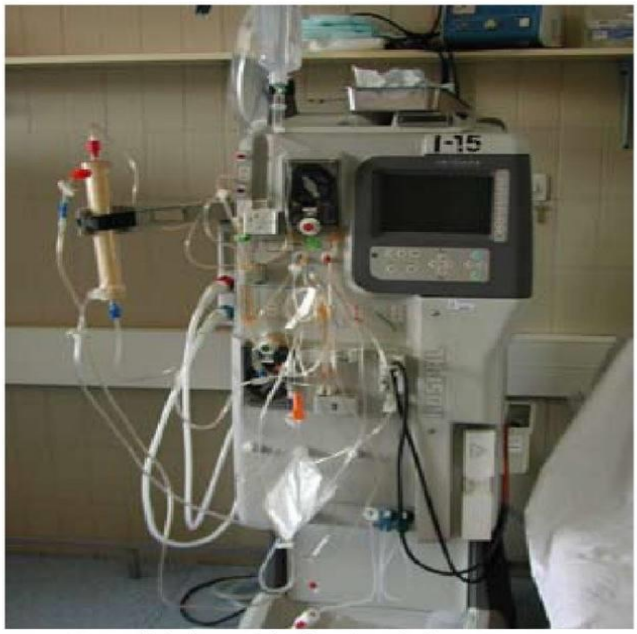
The physicochemical properties of urine as well as the presence and concentration of substances can be used as non-specific markers of renal disease but are also assessors of renal function. Urine dipstick testing allows bedside cost-effective analysis and screening for many common conditions. Indices examined on dipstick testing include pH, specific gravity, protein, glucose, ketones, nitrite, blood, bilirubin, urobilinogen and leucocytes. The urine specific gravity reflects the concentration(88,59,58)

5:TREATMENT OF CHRONIC RENAL FAILURE

The treatment of CRF includes dietary changes, correction of systemic complications, and dialysis or renal graft receipt.

Dietary and fluid restrictions may be required to accommodate the reduced excretory capacity of the kidneys.

Acidosis and increased levels of potassium can be treated by reducing dietary intake of potassium-rich foods, such as bananas, and sodium restriction can aid the control of hypertension. It is sometimes necessary to reduce protein consumption to minimize nitrogenous waste produets. Despite this treatment, most patients progress to end-stage renal failure (ESRF), requiring dialysis or transplantation.



Hemodialysis machine in a hospital center.

6:Dialysis

Dialysis is an artificial mechanism that clears blood of nitrogen waste and other toxic products of metabolism. Two modalities are currently used: peritoneal dialysis (PD) and hemodialysis (HD).

In PD, access to the body is gained through a catheter placed in the abdominal wall and inserted in the peritoneum. The dialysate (sterile electrolyte solution) is introduced through the catheter, and the peritoneal membrane filters the blood waste products via an osmotic mechanism.

In HD, blood filtration is carried out by a machine (dialyzer) equipped with a semipermeable membrane allowing passage of the excess fluids and waste products. Most patients are subjected to dialysis three days a week. To this effect, an artificial permanent vascular access is placed in the form of a catheter or surgically performed arteriovenous fistula. During HD, the patients receive anticoagulation, generally in the form of heparin, to facilitate blood cycling through the dialyzer, and for ensuring permeability of the vascular access. Renal transplantation is the treatment of choice in patients with irreversible renal failure.

Immediately before transplantation, and after the surgical operation, immunosuppressive therapy must be provided to avoid acute rejection . This generally comprises combined treatment in the form of corticosteroids, calcineurin inhibitors (cyclosporine, tacrolimus), and lymphocyte proliferation inhibitors (azathioprine, mycophenolate mofetil). All transplant patients, with the exception of those receiving an organ from an identical twin, require life-long immunosuppressive therapy. c) Prevention of infections. Infections are one of the most important causes of morbidity and mortality in CRF. Vaccination is therefore potentially very useful in patients of this kind, though such treatment is underused, since no clear guidelines have been established, and vaccination response with the normal doses and regimens may be limited.

Prognosis The life expectancy of patients on dialysis remains somber (approximately one-third that of the general population). The prognosis of individuals with diabetes mellitus and/or hypertension is poorer than that of patients with glomerulonephritis. The most common causes of death among patients with ESRF are cardiovascular problems (about 50% of global mortality), followed by infections and malignization .

7:Renal Transplantation

Renal allografts may be cadaveric or from living donors, either related or non-related (although those from living relatives give rise to the best prognosis). Cadaveric organs are allocated on the basis of HLA tissue-typing, ABO compatibility, and the age and size of the donor and recipient.

In the UK, during 2001, 1743 (29.6 per million population) kidney transplant operations were perfomed These consisted of 1385 cadaveric and 358 living donor renal transplants. The majority (263) of the living donors were relatives. The one-year success rate is presently 86% for cadaveric- and 95% for living-donor-transplanted kidneys, The principal cause of allograft failure is rejection, although adverse drug side-effects may also be a contributing factor, Immunosuppressant therapy is required to minimize the risk of allograft rejection. Commonly used agents are prednisolone, azathioprine, cyclosporin, and, more recently, tacrolimus, Cyclosporin has been associated with potentially serious side-effects, including nephro-toxicity, hepatotoxicity, neurotoxicity, hypertrichosis, and diabetes mellitus Tacrolimus has adverse side-effects similar to those of cyclosporin, such as nephrotoxicity and neurotoxicity; however, diabetes is a more frequent complication and occurs in up to 37% of patients receiving tacrolimus Hypertension and cytomegalovirus infection are less common with tacrolimus than with cyclosporin therapy, In addition to immunosuppressants, recipients of renal allografts require an array of medications, some of which can give rise to oral side-effects(87,112,103,37,118,33,76,65,119,64)

8:Manifestations of chronic renal failure and related therapies

(a) Gingival Enlargement

Gingival enlargement secondary to drug therapy is the most-reported oral manifestation of renal disease. It can be induced by cyclosporin and/or calcium channel blockers. It principally affects the labial interdental papillae, although it can become extensive, involving the gingival margins and lingual and palatal surfaces (102)

(1) Cyclosporin-induced Gingival Enlargement

The prevalence of gingival enlargement in individuals taking cyclosporin is unclear, and reportedly has a wide range-from 6 to 85% (95)

It can be evident within 3 mos of the initiation of cyclosporin therapy(91) Children and adolescents may be more prone to this drug-induced gingival enlargement than adults. Il oral hygiene is poor, older individuals are also prone to gingival enlargement(92).

Improvement in oral hygiene and professional cleaning results in a reduction in cyclosporin-associated gingival enlargement(105). However, this may be due to reduction in plaque-related inflammation rather than any drug-associated gingival enlargement(93). There are conflicting reports on the association between gingival enlargement and cyclosporin dose(79), but the extent of the gingival enlargement does not seem to be related to the function of the allograft(104).

Regular clinical monitoring of cyclosporin-related gingival enlargement is essential, since squamous cell carcinoma(110) and Kaposi's sarcoma have been reported within such gingival lesions(85)

(2) Calcium Channel-blocker-induced Gingival Enlargement

Calcium channel blockers are prescribed to renal allograft recipients to reduce hypertension and cyclosporin-induced nephrotoxicity(66). There are many reports of nifedipine, amlodipine(96), diltiazem(15), verapamil(16), oxidipine, felodipine, and nitrendipine(36) causing this gingival enlargement. The reported prevalence of nifedipine-induced gingival enlargement is variable and occurs in 10-83% of treated patients(94). There are no data on the frequency of gingival enlargement with the other calcium channel blockers.

The presence of dental plaque may predispose to nifedipine-induced gingival enlargement(73)

, but is not essential to its development(67). The dose or duration of treatment is not related to the prevalence of gingival enlargement(6). Some studies have reported a reduction in gingival enlargement following a change to an alternative calcium channel blocker(50), but these drugs can still cause some gingival enlargement.(114)

(3) Combined Cyclosporin and Calcium Channel-blocker Therapy

There may be an increased incidence (106) and severity (41)of gingival enlargement when cyclosporin and nifedipine are prescribed together. In contrast, the combination ofe verapamil with cyclosporin does not seem to increase the frequency or severity of drug-induced gingival enlargement significantly. (12)

(4)Tacrolimus

Tacrolimus has been reported both to cause (1) and to lessen (4) gingival enlargement, although, in a recent study of children with renal allografts, while 41% of those receiving cyclosporin had gingival enlargement, the majority of those receiving tacrolimus did not have this problem(97).Cyclosporin-associated gingival enlargement may reduce or resolve when cyclosporin is replaced by tacrolimus. (26)

(5) Other Gingival Changes

The gingivae in individuals with CRF can be pale due to anemia(57), with possible loss of the demarcation of the mucogingival junction(10), and when there is platelet dysfunction, the gingivae may bleed easily. (75)

(b) Oral Hygiene and Periodontal Disease

The oral hygiene of individuals receiving hemodialysis can be poor. For example, only 15% of 45 individuals receiving hemodialysis from 4 centers in Virginia, USA, had a good standard of oral hygiene(71). Deposits of calculus may be increased (57)There is no good evidence of an increased risk of periodontitis(9), although premature tooth loss has been reported(55). Localized suppurative osteomyelitis, secondary to periodontitis, was observed in one individual receiving hemodialysis(107).

(c) (xerostomia)

Symptoms of xerostomia can arise in many individuals receiving hemodialysis(61). Possible causes include restricted fluid intake, side-effects of drug therapy, and/or mouth-breathing. Long-term xerostomia may predispose to caries and gingival inflammation and can give rise

to difficulties with speech, denture retention, mastication, dysphagia, sore mouth, and loss of taste(80).It also predisposes to caries and infections such as candidosis and acute suppurative sialadenitis (81)

(d)Oral Malodor/Bad Taste

Uremic patients may have an ammonia-like oral odor(27,28), which also occurs in about one-third of individuals receiving hemodialysis ,Chronic renal failure can give rise to altered taste sensation, and some patients complain of an unpleasant and/or metallic taste, or a sensation of an enlarged tongue (54)

(e) mucosal Lesions

A wide range of oral mucosal lesions, particularly white patches and/or ulceration, has been described in individuals receiving dialysis and allografts. In particular, lichen-planus-like disease (sometimes termed lichenoid disease) can arise, sometimes, but not always, as a consequence of the associated drug therapy (e.g., diuretics, beta-blockers)(13). Similarly, oral hairy leukoplakia can occur secondary to drug-related immunosuppression(32), although clinically and histopathologically similar lesions lacking Epstein-Barr virus (EBV) have been observed with uremia(63).

Of note, this latter lesion may resolve with correction of the uremia.Uremic stomatitis may manifest as white, red, or grey arcas of the oral mucosa. The erythemopultaceous form consists of grey pseudomembrane overlying painful erythema patches, while an ulcerative form is red with a 'pultaceous covering(52).

There are no good histological descriptions of uremic stomatitis; thus, it is difficult to define the cause of this unusual oral mucosal change. It has been suggested, but never definitively demonstrated, that uremic stomatitis may be due to chemically based trauma from elevated levels of nitrogenous compounds (48) In some instances, the mucosal surface may become erythematous or ulcerate(42). Oral mucosal macules and nodules have also been described in 14% of individuals receiving hemodialysis(51).

(f) Oral Malignancy

The risk of oral squamous cell carcinoma in patients receiving hemodialysis is generally similar to that of otherwise healthy individuals in the general population (71)although there have been reports suggesting that therapy following renal transplantation predisposes to epithelial dysplasia and carcinoma of the lip(86). Perhaps unsurprisingly, Kaposi's sarcoma (KS) can occur in the mouths of immunosuppressed renal transplant recipients (30).

There have been reports of squamous cell carcinoma(111) and KS (75)arising within areas of cyclosporin-induced gingival enlargement. Any increased risk of oral malignancy in CRE probably reflects the effects of iatrogenic immunosuppression, which increases liability to virally associated tumors, such as Kaposi's sarcoma or non-Hodgkin's lymphoma. The inconsistent association between oral epithelial dysplasia and oral squamous cell carcinoma is in accord with the low risk of such disease in individuals with other, more significant, immunosuppressed states-for example, HIV disease.

(g)Oral Infections

(1) Candidosis

Angular cheilitis has been described in up to 4% o hemodialysis and renal allograft recipients(84)

. Other oral candidal lesions -such as pseudomembranous (1.9%), erythematous (3.8%), and chronic atrophic candidosis (3.8%)-have been reported in allograft recipients (43). These figures may underestimate the increased susceptibility of immunosuppressed allograft recipients to fungal infection, since systemic anti-fungal agents are commonly prescribed prophylactically (83).

(2) Viral Infection

Prior to the availability of appropriate anti-viral drugs(e.g., acyclovir, gancyclovir, and valacyclovir), about 50% of renal allograft recipients, who were seropositive for herpes simplex, experienced recurrent, severe, and prolonged HSV infections(47). However, in recent years, the use of effective anti-herpetic regimes has significantly reduced the frequency of such infection(46). Long-standing post-allograft immunosuppression may predispose subjects to human herpesvirus & (HHV-8) and associated Kaposi's sarcoma (49)

(h) Dental Anomalies.

Delayed eruption of permanent teeth has been reported in children with CRF(82). Enamel hypoplasia of the primary and permanent teeth(116), with or without brown discoloration(8), can also occur.Narrowing or calcification of the pulp chamber of teeth of adults with chronic renal disease can occur(39). The exact cause of this dental change is not known.

Renal allograft recipients have significantly more narrowing of the pulp chamber than those receiving hemodialysis(70).

There is no consistent association between corticosteroid therapy and narrowing of the pulp chamber(31).Increased (56)and decreased rates of dental caries(117)

have been observed in groups of patients with CRF. However, there is no evidence of a significantly increased risk of caries in patients with CRF. Although patients may have xerostomia, there would seem to be no increased risk of cervical caries, as might be expected(81).

Non-carious tooth tissue loss is more prevalent in individuals with CRF than in the general population(53). This may be due to nausea(68), esophagcal regurgitation, or induced vomiting in bulimia nervosa (if a patient finds the restricted diet unpleasant) (62)

(1) Bone Lesions

A wide range of bony anomalies can arise in chronic renal disease. These reflect a variety of defects of calcium metabolism, including: loss of hydroxylation of 1-hydroxycholecaleiferol to active vitamin D (1,25-dihydroxycholecalciferol); decreased hydrogen ion excretion (and resultant acidosis); hyperphosphatemia; hypocalcemia and resultant secondary hyperparathyroidism; and finally, interference in phosphate biochemistry by dialysis(74).Secondary hyperparathyroidism affects up to 92% of patients receiving hemodialysis(69) Hyperparathyroidism may present as a maxillary brown tumor(11), enlargement of the skeletal bases(89), or tooth mobility(98).

9:Dental management of renal failure patients

Patients with renal failure require special considerations in relation to dental treatment, not only because of the conditions inherent to the disease and its multiple oral manifestations, but also because of the side effects and characteristics of the treatments they receive(35).

1-Consultation with the nephrologist provides information on the state of the disease, the type of treatment, the best timing of dental management, or the medical complications that may arise (105). Any modification of the usual medication used by the patients or of other aspects of their treatment must first be consulted with the nephrologist (35).

2.- Close cooperation between medical and dental professionals is desirable in order to improve the oral and general health of the patient, based on the creation of a dental care program in the context of a multidiscipline approach to the disease (5).

3.- Prior to any invasive dental treatment, a complete blood count is to be obtained, together with coagulation tests, in view of the possible hematological alterations (35).

4.- It is essential to eliminate any infection in the oral cavity as soon as possible (24), with the consideration of antibiotic prophylaxis when bleeding and/or a risk of septicemia is expected (extractions, periodontal treatments, endodontics and periapical surgery, the placement of orthodontic braces, tartrectomy when bleeding is expected, implant surgery, and the reimplantation of avulsioned teeth) (113,108,60).

5.- Blood pressure is to be monitored before and during treatment, with the administration of sedation to lessen anxiety (24).

6.- The metabolism and elimination of certain drugs are altered in situations of renal failure. In such cases dose adjustment or modification of the dosing frequency is needed (Table 3). The prescription of aminoglycoside antibiotics and tetracyclines is to be avoided, because of their nephrotoxicity (35,24,82).

Penicillins, clindamycin and cephalosporins can be administered at the usual doses, and are the antibiotics of choice – though the dosing interval should be prolonged (24,82,38). As regards analgesics, paracetamol is the non-narcotic analgesic of choice in application to episodic pain. Aspirin possesses antiplatelet activity, and as such should be avoided in uremic patients (40,3,78). As regards the rest of nonsteroidal antiinflammatory drugs (indomethacin, ibuprofen, naproxen and sodium diclofenac), dose reduction or even avoidance is indicated in the more advanced stages of renal failure (35,24,82), since they

inhibit prostaglandins and generate a hypertensive effect (35,82). Benzodiazepines can be prescribed without the need of dose adjustments, though excessive sedation may occur (35,24,40). The narcotic analgesics (codeine, morphine, fentanyl) are metabolized by the liver, and so usually do not require dose adjustment (35,24,44).antibiotics and tetracyclines is to be avoided, because of their nephrotoxicity (35,24,82).

10:Dialyzed patients

Patients on peritoneal dialysis require no special measures as regards dental treatment, beyond those already commented above. We therefore will center our attention on hemodialysis.

Due to the already mentioned reasons, dialyzed patients are at an increased risk of bleeding. It is advisable to provide dental treatment on non-dialysis days, to ensure the absence of circulating heparin, which has a half-life of about four hours (82,45). In any case, prior to invasive procedures, it is important to request a complete blood count and coagulation tests (24), and to ensure that local hemostatic measures are available: mechanical compression, sutures (24,45), topical thrombin, microfibrilar collagen and oxidized regenerated cellulose. Desmopressin has been proposed for the control of severe bleeding in patients with renal failure, and conjugated estrogens can be used to achieve longer term hemostasia (40). Tranexamic acid in the form of a rinse (24,19) or administered via the oral route at a dose of 10-15 mg/kg body weight a day distributed in 2-3 doses, may also prove useful (61). - Although there is some controversy in the literature regarding the need for antibiotic coverage to prevent bacterial endocarditis in dialyzed patients (24,113,108), endocarditis is effectively a potential complication in such patients. The recommended antibiotic regimen is 2 g of amoxicillin via the oral route one hour before the dental procedure. In the case of patients with allergy to penicillin, clindamycin is the drug of choice (600 mg via the oral route, one hour before the intervention). - Dialyzed patients are subjected to numerous transfusions and blood exchanges, and this implies an increased risk of infection in the form of HIV, HBV, HCV and tuberculosis. Periodic monitoring is required, with the adoption of measures to avoid both personal contagion on the part of the dental professional and cross-contamination in the dental clinic - Hemodialysis can affect the serum concentrations of different drugs used by CRF patients(17), when such substances are administered before the dialysis session. Supplementary dosing after dialysis therefore may be needed Transplant patients - It is important to conduct dental evaluation prior to renal transplantation, in order to eliminate the existing infectious foci. Teeth offering an uncertain prognosis are to be removed. - The potential for oral infections after transplantation is very high, since these patients receive immunosuppressive therapy(14,72). Prophylactic antibiotic treatment is therefore indicated before invasive dental procedures are carried out - Prolonged corticosteroid therapy may make it necessary to administer a supplementary dose in situations of stress, such as when visiting the dentist, in order to avoid an adrenal crisis The

most recent guides recommend a dose of 25 mg of hydrocortisone via the intravenous route, before the intervention - In the first 6 months after transplantation, patients should avoid any elective dental treatment.(20,21,22)

Table 3. Dose adjustment of drugs used in dental practice, in patients with renal failure.

Drug substance	Elimination [1]	Adjustment method [2]	Adjustment in renal failure according to glomerular filtration rate (GFR)(ml/min)		
			> 50	10-50	< 10
ANTIMICROBIALS					
Amoxicillin	R (H)	I	8	8-12	12-18
Erythromycin	H	D	100	100	50-75
Clindamycin	H	D	100	100	100
Metronidazole	H (R)	D	100	100	50
Doxycycline	H (R)	D	100	100	100
Ampicillin	R (H)	I	6	6-9	9-12
Tetracycline	R (H)	I	6-8	12-24	Avoid
Aciclovir	R	I	8	12-24	48
Ketoconazole	H	D	100	100	100
ANALGESICS / ANTIINFLAMMATORY					
Aspirin	H (R)	I	4	4-6	Avoid
Paracetamol	H (R)	I	4	6-8	8-12
Ibuprofen	H (R)	I	100	100	Avoid
Diclofenac	H	D	100	100	Avoid
Naproxen	H	D	100	100	Avoid
SEDATIVES					
Codeine	H (R)	D	100	100	100
Diazepam	H	D	100	100	100
Alprazolam	H (R)	D	100	100	100
ANESTHETICS					
Lidocaine	H	D	100	100	100
Mepivacaine	H	D	100	100	100
OTHERS					
Prednisone	H	D	100	100	100

11:CONCLUSIONS

Patients with kidney diseases are an extremely delicate group of patients.

They have tendency to infection and therefore, prophylactic antibiotics treatment is a must prior to surgical interventions.

They are also prone to bleeding and therefore surgical interventions should be undertaken in the days when the patient does not use dialysis.

We should always bear in mind that patients with kidney transplants are prescribed immunosuppres-sant therapy.

Dental treatment of such patients implies close cooperation between the dentist and the nephrologist

12:Dentist recommendations for kidney failure patients receiving dialysis treatment

include:

1. See a doctor regularly: Patients should follow up on their general and dental health condition regularly with their dentist and health care team.

2. Avoid infection: Infection in the mouth should be avoided by practicing good oral hygiene and rinsing with salt water or antibacterial solutions.

3. Taking care of gingivitis: Kidney failure may increase the risk of gingivitis, so you should maintain gum cleanliness and visit the dentist to treat any potential problems.

4. Evaluation of medications: Some medications used to treat kidney failure may affect oral health, so the patient should discuss any potential side effects with the doctor.

5. Improving nutrition: Good nutrition contributes to oral health, so patients should be careful to follow a healthy and balanced diet.

6. Consider oral problems: Patients should report any oral problems such as pain, bleeding, or swelling to the dentist immediately to provide appropriate treatment.

7. Taking care of oral dryness: Oral dryness can be a common problem in patients with kidney failure, so you should drink plenty of water and avoid alcoholic and soft drinks.

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