Systemic Diseases and Their Treatments in the Elderly: Impact on Oral Health

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Abstract

The lifespan of the US population is increasing, with the elderly desiring successful aging. This goal is jeopardized as multiple systemic conditions and their treatments become more prevalent with age, causing impaired systemic and oral health and influencing an older person's quality of life. To obtain successful aging, a compression of morbidity must be obtained through prevention and management of disease. This paper describes the most common systemic diseases causing morbidity and mortality in persons aged 65+ years: diseases of the heart, malignant neoplasms, cerebrovascular diseases, chronic obstructive pulmonary disease, pneumonia, influenza, diabetes mellitus, trauma, Alzheimer's disease, renal diseases, septicemia, and liver diseases. Disease prevalence and the impact of medications and other therapeutic measures used to treat these conditions are discussed. Oral sequelae are reviewed with guidelines for early detection of these deleterious consequences, considerations for oral treatment, and patient management. An understanding of the impact of systemic diseases and treatment on oral health is imperative for dental practitioners to appropriately treat and manage older patients with these conditions. With a focus on early detection and prevention, oral health care providers can improve the quality of life of this population and aid in the attainment of successful aging. [J Public Health Dent 2000;60(4):289-96]

Key Words: oral health, elderly, successful aging, disease, treatment, dental care.

A comprehensive understanding of the influence of aging on oral health and function requires an assessment of the impact of systemic conditions on the oral-facial region (1). Recently, clinicians and researchers have begun to demonstrate that oral diseases are not necessarily the consequence of aging in a healthy person. Rather, multiple systemic conditions and impairments as well as their treatments become more prevalent with aging, impair oral health, and consequently the quality of life of an older person. The purpose of this paper is to provide an overview of the consequences of common systemic diseases associated with morbidity and mortality in the elderly and their treatments (medications, radiation, chemotherapy) on the health and function of the oral-facial region. A thorough description of these conditions that impact on oral health and the provision of dental therapies in an aging population is beyond the scope of this paper. Therefore, the most common causes of death and their treatment in adults aged 65+ years in the United States will be discussed, as well as their impact on oral health and the provision of dental treatment. These will include diseases of the heart, malignant neoplasms, cerebrovascular diseases, chronic obstructive pulmonary disease, pneumonia, diabetes mellitus, trauma, Alzheimer's disease, renal diseases, septicemia, liver diseases, and the medications used to treat these diseases. The goal of this paper is to sensitize clinicians, researchers, educators, and administrators to the oral impact of systemic conditions and their treatments. It is hoped this knowledge will permit the preservation and maintenance of oral health-related quality of life in older adults.

Diseases of the Heart

Diseases of the heart are the most common cause of mortality in the elderly (Table 1) and the third most common chronic condition in adults aged 65+ years (Table 2). These diseases account for 50 percent of all deaths of persons over the age of 85 (2). Although death rates have declined, diseases of the heart have remained the number one cause of death for the past five decades (3). The majority are attributed to ischemic heart disease, myocardial infarction, and hypertension. Many recent studies investigating the association between heart disease and dental/periodontal diseases have suggested a connection (4,5); however, this purported relationship

TABLE 1
Ten Leading Causes of Mortality in Adults Age 65+ Years (20)

Rank	Cause of Death	Rate/ 100,000
1	Heart diseases	1,808
2	Malignant neoplasms	1,131
3	Cerebrovascular diseases	415
4	COPD*	270
5	Pneumonia, influenza	221
6	Diabetes mellitus	137
7	Accidents, adverse effects	91
8	Alzheimer's disease	62
9	Renal diseases	62
10	Septicemia	51

*Chronic obstructive pulmonary disease.

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requires further scientific validation.

Some cardiovascular conditions and their subsequent treatment have oral-facial signs and symptoms, and therefore have oral treatment considerations (Table 3). Anginal pain can present as referred pain to the neck, clavicle, and mandible, and can be localized to the mandible and teeth. A comprehensive differential diagnosis must consider dental-alveolar origin (caries, periodontal disease), temporomandibular joint disease, referred musculoskeletal pain, central or peripheral nervous system pain, and myocardial infarction. In addition, the treatment of cardiovascular diseases with drugs also has deleterious oral consequences. For example, antihypertensive medications can cause salivary dysfunction (diuretics, calcium channel blockers, beta blockers), gingival enlargement (calcium channel blockers), lichenoid mucosal reactions (thiazide diuretics), and disturbances in taste (Table 4). Higher salt detection thresholds have also been observed in persons with hypertension (6). Consultation with the patient's physician is recommended to determine if alteration of the drug regimen is appropriate (7).

Dental treatment must be designed to address the oral complications of persons who have undergone cardiac transplantation and postoperative immunosuppressive pharmacological regimens. Immunosuppressive therapy increases the prevalence of oral opportunistic infections, such as reactivation of herpes simplex virus and overgrowth of *Candida albicans*. Cyclosporine, a frequently used antirejection drug, has been reported to cause gingival enlargement in as many as 13–85 percent of patients (8).

The use of local anesthetics with epinephrine can be a concern in the treatment of cardiac patients because of the effect of increased heart rate, stroke volume, and cardiac output. However, at low doses, epinephrine has been found to have few of these sys-

TABLE 2
Ten Leading Chronic Conditions in Adults Aged 65+ Years (25)

Rank	Chronic Conditions	Rate/ 1,000
1	Arthritis	502
2	Hypertension	364
3	Heart disease	324
4	Chronic sinusitis	151
5	Diabetes mellitus	101
6	Allergic rhinitis	80
7	Varicosities	75
8	Hernia	64
9	Hemorrhoids	62
10	Chronic bronchitis	61

TABLE 3
Oral Treatment Considerations Due to Systemic Conditions

Systemic Condition	Cause	Oral Considerations	Treatment Considerations
Coagulation disorders	Anticoagulation therapy Chemotherapy Liver cirrhosis Renal disease	Increased bleeding risk	Alter anticoagulation therapy Limit dental-alveolar surgery Use topical anticoagulation methods
Immunosuppression	Alcoholic cirrhosis Chemotherapy Diabetes Medications Organ transplant therapy Renal disease	Microbial infections	Appropriate antimicrobial medications
Joint replacements	Accidents Osteoarthritis Rheumatoid arthritis	Increased risk for late prosthetic joint infections	Antibiotic prophylaxis
Radiation sequelae	Head and neck radiation	Salivary hypofunction Mucositis Osteoradionecrosis Increased caries risk Dysphagia Dysgeusia Difficulty with mastication Microbial infections Impaired denture retention	Regular fluoride use Salivary substitutes and stimulants Aggressive oral hygiene and recall Pain management
Steroid therapy	Autoimmune diseases Organ transplant therapy	Microbial infections Increased risk for adrenal insufficiency	Appropriate antimicrobial medications Steroid supplementation for dental procedures
Valvular damage/heart murmur	Acquired heart defects Congenital heart defects Valvular transplants	Increased risk for developing subacute bacterial endocarditis	Antibiotic prophylaxis

TABLE 4
Overview of Oral Sequelae of Medication Intake for Systemic Diseases *[cont. next page]*

Drug Category	Drug	Oral Problem
Analgesics	Aspirin	Hemorrhage, erythema multiforme
	NSAIDs	Hemorrhage
	Barbiturates, codeine	Erythema multiforme
Anesthetics (local)	Benzocaine, Procaine HCl, Lidocaine	Taste disorders
Antiarrhythmics	Procainamide	Lupus-like reaction
	Quinidine	Lichenoid mucosal reaction
Antiarthritic, antipyretic, antiinflammatory	Allopurinol, Auronofin, Colchicine, Dexamethasone, Hydrocortisone, Levamisole, D-Penicillamine, Phenylbutazone, Salicylates, 5-Thiopyridoxine	Taste disorders
	Gold Salts	Taste disorders, lichenoid reaction, oral pigmentation, vesicululcerative stomatitis
Antibiotics	All	Oral candidiasis
	Erythromycin	Hypersensitivity reaction, vesiculoulcerative stomatitis
	Penicillin	Hypersensitivity reaction, erythema multiforme, vesiculoulcerative stomatitis
	Chloramphenicol, Ciprofloxacin Clindamycin, Dapsone, Isoniazid, Sulfa antibiotics,	Erythema multiforme Melanosis
	Tetracyclines	Brown pigmentation of teeth and tongue
	Minocycline	
	Chlorhexidine	
	Ampicillin, Cefamandole, Ethambutol HCl, Griseofulvin, Lincomycin, Metronidazole, Niridazole, Sulfasalazine, Tetracyclines	Taste disorders
Anticoagulants	All	Hemorrhage
Anticonvulsants	Carbamazepine	Erythema multiforme, taste disorders
	Phenytoin	Erythema multiforme, gingival enlargement, taste disorders
Antidiarrhea	Bismuth	Dark pigmentation of tongue
Antihistamines	All	Salivary dysfunction
	Chlorpheniramine maleate	Taste disorders
Antihypertensives	All	Salivary dysfunction
	Calcium channel blockers	Gingival enlargement
	ACE inhibitors	Vesiculoulcerative stomatitis, pemphigus vulgaris
	Chloramphenicol	Vesiculoulcerative stomatitis
	Hydralazine	Lupus-like reaction, erythema multiforme
	Methyldopa	Lupus-like reaction and lichenoid mucosal reaction
	Thiazide diuretics	Lichenoid mucosal reaction
	Minoxidil, Verapamil	Erythema multiforme
	Acetazolamide, Amiloride, Captopril, Diazoxide, Diltiazem, Enalapril, Ethacrynic acid, Nifedipine	Taste disorders
Antilipidemics	Cholestyramine, Clofibrate	Taste disorders
Antimicotics	Griseofulvin	Erythema multiforme, black pigmentation of tongue
	Amphotericin B	Taste disorders
Antineoplastics	All	Oral candidiasis, oral hemorrhage, recurrent oral viral infections, aphthous stomatitis, vesiculoulcerative stomatitis
Anti-Parkinsonian	All	Salivary dysfunction
	Levodopa	Taste disorders
Antireflux agents	All	Salivary dysfunction
	Cimetidine	Erythema multiforme
Antithyroids	Carbimazole, Methimazole, Methylthiouracil, Propylthiourcil, Thiouracil	Taste disorders
Antioxidants	Octyl gallate	Allergic ulcerations
Anxiolytics	Benzodiazepines	Salivary dysfunction
Chelating agents	Penicillamine	Ulcers and pemphigus vulgaris

temic effects, and in stable cardiovascular patients can be used safely (9). For patients with a questionable cardiac history, 0.04 mg of epinephrine should be the maximum dose given (approximately two 1.8 cc carpules of local anesthetic with 1:100,000 epinephrine) while unstable cardiac patients should receive epinephrine only

TABLE 4
Overview of Oral Sequelae of Medication Intake for Systemic Diseases *[cont.]*

Drug Category	Drug	Oral Problem
Corticosteroids, immunosuppressants, antiproliferatives	All	Oral candidiasis, recurrent oral viral infections, vesiculoulcerative stomatitis
	Azathioprine, Bleomycin, Carmustine, Doxorubirin, 5-Fluorouracil, Methotrexate, Vincristine Sulfate	Taste disorders
	Cyclosporine	Gingival enlargement
Hypoglycemics	Sulfonylurea agents	Erythema multiforme
	Glipizide, Phenformin and derivatives	Taste disorders
Muscle Relaxants	All	Salivary dysfunction
	Baclofen, Chlorzoxazone	Taste disorders
Others	Etidronate, Germine Monoacetate, Idoxuridine, Iron Sorbitex, Vitamin D	Taste disorders
Psychotherapeutics	All	Salivary dysfunction
	Glutethimide, Meprobamate	Erythema multiforme
	Phenothiazines	Oral pigmentation, tardive dyskinesia
	Lithium Carbonate	Erythema multiforme, taste disorders
	Trifluoperazine HCl	Taste disorders
Sympathomimetics	Amphetamines, Amrinone	Taste disorders
Vasodilators	Bamifyline HCl, Dipyridamole, Nitroglycerin Patch, Oxyfedrine	Taste disorders

for emergency dental treatment. Although the dental office environment and dental treatment can increase heart rates and blood pressures, treatment can be safely rendered to patients with ischemic heart disease with adequate anxiety and pain control (10).

Antibiotic prophylaxis is recommended for persons with cardiac valvular abnormalities at risk for developing subacute bacterial endocarditis. Recent modification of the antibiotic recommendations simplified and clarified the regimen to reduce overuse of antibiotics, potential adverse effects, and drug resistance (11). Current investigations have found scant data to support an association between dental treatment and the development of subacute bacterial endocarditis, and therefore judicial use of antibiotics and further research in this area are warranted (12).

Malignant Neoplasms

The second most common cause of death in the US elderly is malignant neoplasms. While the cancers most frequently found in the elderly (genitourinary, gastrointestinal, lung) do not directly affect the oral cavity, their treatment with radiation, surgery, and chemotherapy may indirectly or directly affect oral health and function. Chemotherapy causes reversible mucositis, stomatitis, salivary hypofunction, dysgeusia, diminished appetite, and increased susceptibility to oral microbial infections (13). Approximately 1 percent of all neoplasms found in the oral and pharyngeal region originate below the clavicles and metastasize to the head and neck (14).

Cancers of the oral cavity and pharynx, which represent 5 percent of all neoplasms in the United States, have a direct and frequently permanent deleterious effect on oral health and function. In 1998 there were 30,300 new cases of oral cavity and pharyngeal cancers diagnosed, and 8,000 reported deaths attributable to these neoplasms in the United States (15). Although men experienced a much greater likelihood of developing oral-pharyngeal cancer in the past, the male:female ratio is now 2:1. The prevalence and mortality of oral cancers increase with age, and the major preventable risk factors are tobacco use and excessive alcohol consumption.

Treatment for oral-pharyngeal neoplasms includes surgery, radiation therapy, and chemotherapy, depending upon the tumor stage and extent of regional spread (16). Extensive removal of the cancerous growth and affected lymph nodes can result in significant facial disfiguration, dysphagia, altered speech and mastication, trismus, facial and oral paresthesia, salivary gland dysfunction, and diminished neck and shoulder mobility. Head and neck radiation is frequently used postsurgery for the treatment of residual and microscopic disease; however, it also has significant side effects. These sequelae include mucositis, stomatitis, oral microbial infections (reactivation of herpes simplex and varicella zoster viruses, *Candida albicans* infections), dysphagia, permanent salivary gland dysfunction, smell and taste dysfunction, and increased risk of developing osteoradionecrosis (16). Chemotherapy can produce serious yet temporary stomatitis, oral microbial infections, gingival and oral mucosal hemorrhage, salivary dysfunction, and smell and taste dysfunction. Due to the significant morbidity and mortality of antineoplastic therapies, these patients require frequent and long-term follow-up by dental professionals.

Cerebrovascular Diseases

Nearly 6 percent of older adults have been diagnosed with cerebrovascular diseases, the third most common cause of death in the elderly. The motor, sensory, and cognitive alterations that accompany these diseases have deleterious effects on oral health and function. A cerebral vascular accident (CVA or stroke) can cause permanent oral sensory and motor deficits, resulting in poor tongue function and lip seal, difficulty eating and drinking, impaired use of dentures, and visuospatial problems with adverse social and psychological consequences (17). Nutritional deficiencies and dimin-

ished quality of life can result from impaired food and fluid intake.

The location of the cerebral vascular accident will determine the oral-facial deficits. Left cerebral cortex lesions cause right-sided paralysis and difficulty with auditory memory, speech, language, and the oral phase of swallowing. Right cortex lesions cause left-sided paralysis with subsequent neglect of affected sites, pharyngeal dysfunction with potential for aspiration, and difficulty with memory and performing certain tasks (such as toothbrushing). Oral-facial motor and sensory impairments can lead to improper dental and denture hygiene, ultimately leading to dental and periodontal diseases and oral microbial infections that can become exacerbated by the lack of sensory detection by the patient. Some patients experience problems with communication, judgment, and memory, which inhibit accurate solicitation of the patient's pertinent medical history, chief complaint, and compliance with home care instructions.

Anticoagulation therapy is the standard preventive treatment following a stroke, and will produce hemorrhage, petechiae, ecchymoses, and purpura of all oral mucosal tissues. Dental treatment can be performed safely if the prothrombin time is within twice the normal range or if the INR is less than 3 (18). If excessive dental-alveolar surgery is planned, coordination of care with medical colleagues is necessary to modify the anticoagulant regimen and reduce the risk of peri- or postoperative hemorrhage.

Chronic Obstructive Pulmonary Disease

Chronic obstructive pulmonary disease (COPD: bronchitis, asthma, and emphysema) represents the fourth most common cause of death among older persons. The prevalence, incidence, and mortality of these diseases increase with age. Smoking, a preventable behavior, is the risk factor responsible for the majority of the deaths caused by COPD. Little is known regarding the direct effects of COPD on oral health; however, it is well established that a common treatment modality of COPD (corticosteroids) has many oral consequences (19). Chronic use of corticosteroids suppresses the hypothalamic-pituitary-adrenal axis that can result in acute adrenal insufficiency during stress. Therefore, steroid replacement therapy is necessary for extensive dental and surgical procedures (19). Many patients use steroid inhalers that should be brought to all dental appointments for use if necessary to ensure protection of a patent airway. Chronic use of systemic and inhaled corticosteroids also predisposes patients to oral fungal infections. Finally, nitrous oxide use is contraindicated in persons with COPD.

Pneumonia and Influenza

The prevalence of the fifth leading cause of death in the elderly, pneumonia and influenza, increases dramatically with age. From 65–74 years to 85+ years, the frequency increases twenty-fold (20). Aspiration pneumonia is caused by the aspiration of gastric and/or oropharyngeal secretions by persons with compromised host defense mechanisms. Oropharyngeal swallowing dysfunction—a consequence of neuromuscular and cerebrovascular diseases, debilitation, salivary hypofunction, and medications—is a frequent risk factor for aspiration pneumonia (21). Colonization of the oropharynx with Gram-negative bacilli predisposes to bacillary pneumonia (22). A major source of anaerobe infection is the gingival crevice; incidence increases with poor oral hygiene and periodontal disease. It is therefore recommended that patients at risk should receive routine dental examinations and treatment, and may benefit from an antimicrobial rinse (23). Broad-spectrum antibiotics are the standard treatment regimen for pneumonia. Extended antibiotic use increases the risk of developing oral fungal infections and antibiotic resistance.

Diabetes Mellitus

Nine percent of adults over the age of 65 years have diabetes mellitus, the sixth leading cause of death in this population. Over the past two decades, the prevalence of diabetes has increased 30–40 percent, depending upon ethnicity, sex, age, and diagnostic criteria (24). In addition, diabetes is a risk factor for developing glaucoma, the sixth most prevalent type of chronic impairment among the elderly (25,26).

Presence or absence of diabetes and the degree of glucose metabolic control significantly influence the level and severity of diabetes-related oral diseases. Well-controlled diabetics have fewer oral health problems than poorly controlled diabetics (27,28). Some clinical studies suggest that controlled diabetics have the same incidence of oral disease as the general population (29). The most common oral disease seen in diabetics and in greater prevalence than nondiabetics is periodontal disease (27,30). Many studies have shown that poor glycemic control precedes the incidence and progression of periodontitis. Recent investigations also have elicited an association between severe periodontitis and an increased risk of poor glycemic control (27,30).

Several mechanisms have been proposed to explain the increased susceptibility of diabetics to periodontal diseases, including alterations in host response, subgingival microflora, collagen metabolism, vascularity, gingival crevicular fluid, and heredity patterns (27). Multiple pathophysiological mechanisms (compromised neutrophil function: decreased phagocytosis and leukotaxis) also have been implicated in the increased alveolar bone loss found in diabetics (27,29), and increased tendency for more active carious lesions and missing teeth (28).

Diabetes predisposes an individual to sensory and peripheral neuropathies, which may produce chemosensory deficits such as impaired taste function and decreased smell sensitivity (31). This sensory dysfunction can inhibit the ability to maintain a proper diet leading to poor glycemic regulation. Diabetics also have reported increased complaints of glossodynia and/or stomatopyrosis, as well as increased complaints of dry mouth (xerostomia). There is no consensus demonstrating a relationship between glycemic control and salivary gland dysfunction (32). However, the xerostomic complaints may be due to diabetes-associated thirst, and not objective evidence of salivary hypofunction.

Accidents and Adverse Effects

Traumatic injuries, the seventh most common cause of mortality in the elderly, are becoming a greater cause of death as more older adults participate in active lifestyles. Approximately 30 percent of all elderly report an annual occurrence of traumatic in-

jury (33); thus, maxillofacial trauma is becoming more frequent. Unfortunately, this older cohort is more susceptible to the adverse effects of accidents and is at greater risk for injury-associated morbidity due to osteoporosis, diminished sensory and motor function, and impaired communication (26).

There are critical systemic and psychosocial considerations in the management of trauma in the elderly (34). Perioperative care of older adults is different and more complex due to age-associated immunologic changes of decreased wound repair and healing, and impaired ability to resist infection. Therefore, wound management should incorporate prophylactic antibiotic use when the potential for infection is increased, longer maintenance of sutures, and excision of ragged wound edges to reduce vascularity (34). The postoperative complication of delirium is more commonly seen in the elderly secondary to medication intake, particularly in individuals with impaired renal and hepatic function. Finally, postoperative care often requires the assistance of a caregiver to provide daily hygiene and nutrition maintenance.

Alzheimer's Disease

Although cognitive decline is not a normal part of aging, the likelihood of developing dementia and Alzheimer's disease, the eighth leading cause of mortality in the elderly, increases with age. There are multiple etiologies of dementia in the elderly—reversible (e.g., depression, medications) and irreversible (e.g., Alzheimer's disease, Parkinson's disease, multi-infarct dementia). Alzheimer's disease is the most common, with the number of affected adults expected to double or triple in the next 25 years (35). Cognitive changes can be characterized as a decline in memory, learning ability, comprehension, attention, judgment, and orientation. Depression is often present in early stages of dementia.

Recent studies have reported that unmedicated persons with Alzheimer's disease have decreased salivary flow and diminished oral health (36). Due to the loss of cognitive function and ability to maintain personal hygiene, persons with Alzheimer's are more susceptible to oral health problems and deterioration of oral health and function as the disease progresses (37). Although many of the cognitive-enhancing medications do not have oral effects, many Alzheimer's patients are prescribed antidepressants that can cause salivary dysfunction. Caregivers are essential for aiding in daily oral hygiene and maintaining oral health. Frequent dental recall for oral examination, cleaning, and treatment are critical to develop early strategies for prevention of deleterious sequelae (38). As learning new tasks can be difficult, adaptation to dentures can be a challenge for these persons. And in later stages of the disease, prosthetic use and toothbrushing skills may be forgotten. New situations and people, e.g., in a dental office, can be frightening and cause disorientation.

In the later stages of the disease, Alzheimer's patients may lose eating skills, develop swallowing dysfunction, and exhibit a loss of appetite. Olfactory senses have been found to be diminished in persons with Alzheimer's disease (39). Maintenance of adequate nutrition is important in this population. As communication is impaired in later stages of the disease, proper assessment of eating problems is essential to rule out oral pain and discomfort.

Renal Diseases

The death rate from renal diseases has decreased due to improved diagnosis and management, yet diseases of the renal system are the ninth most common cause of mortality among persons over the age of 65 years in the United States. Renal function diminishes progressively with greater age; however, most healthy older adults are able to maintain body fluid and solute homeostasis (40). Older persons are more susceptible to undetected dehydration due to a diminished capacity to conserve water through the kidneys, and a lower sensation of thirst (41). Age-related renal changes also result in decreased elimination and excretion of many prescription and nonprescription medications commonly taken by older adults. Cautious drug prescription in the elderly is important because many of these drugs, such as antibiotics (penicillin, cephalexin, tetracycline) and analgesics (acetaminophen, aspirin), are excreted by the kidneys. All of these potential clinical problems are exacerbated in the patient with renal failure.

Renal insufficiency or renal failure ultimately require peritoneal or hemodialysis. These patients are susceptible to impaired wound healing, recurrent oral mucosal infections, dental caries, gingivitis, and periodontitis (42), particularly those taking corticosteroids. Uremic stomatitis is a condition unique to dialysis patients that typically presents as an erythemic thickening of the buccal mucosa with a pseudomembranous covering, ulcerative lesions, gingival and mucosal hemorrhage, and ecchymoses (43). Bony changes commonly seen include loss of lamina dura, demineralized bone, localized radiolucent jaw lesions (central giant cell granulomas), and widened trabeculations (43). Smell and taste changes have been observed in patients with renal failure, and there is some evidence that chemosensory function improves following dialysis and renal transplantation (44). Because heparin is administered during dialysis to prevent blood coagulation, dental procedures should be performed on alternate days of dialysis and precautions taken to avoid excessive hemorrhage.

Renal transplantation is a treatment option for patients with severe renal failure. Following transplantation, patients are placed on long-term immunosuppressants that have multiple oral sequelae (e.g., cyclosporine-induced gingival hyperplasia, steroid-induced oral fungal infections). Renal transplant recipients have been reported to have a greater prevalence of oral lesions such as candidiasis, leukoplakia, dysplasia, and cancer of the lip (45,46). These patients require pretransplantation oral evaluations and treatment, and close follow-up after transplantation to help maintain oral health and function and to diminish the likelihood of developing oral infections causing systemic problems in an immunosuppressed person.

Septicemia

Septicemia or bacteremia, the tenth most common cause of death of persons over 65 years of age in the United States, occurs at higher rates in hospitalized elderly than younger patients. In older persons bacteremias often persist with absent or vague symptoms. Unlike a younger cohort, the elderly are less likely to present with the usual symptoms of chills, sweating, lymphadenopathy, and fever (47).

In older patients with vague symptoms, especially the medically compromised who are more susceptible to the development of sepsis, it is critical to perform a comprehensive evaluation to determine the underlying cause.

The most frequent sources of infection in the elderly are gastrointestinal, genitourinary, and respiratory (47). Oral infection and abscess can be a source of bacteremia. Persons with chronic urinary tract infections who have been treated with multiple broad-spectrum antibiotics are more likely to develop drug-resistant strains of bacteria. These persons are more susceptible to maxillofacial infections and therefore a medical consultation regarding therapy and appropriate culture and sensitivity results should be considered. For example, a diabetic patient with a decubitis ulcer and delayed wound healing is at high risk for developing a bacteremia. Therefore, poor glycemic control should be considered when performing oral health care [see section on diabetes above]. The higher mortality rate for the older population is attributed to a more impaired immune system, more frequent exposure to invasive devices, and the existence of chronic diseases that inhibit physiologic reserve and recovery (47).

Chronic Liver Diseases and Cirrhosis

Diseases of the liver account for the eleventh most common cause of death in the United States for all ages (20), yet few age-related liver changes are seen in healthy persons. The elderly are at increased risk for developing drug-induced liver toxicity due to altered pharmacokinetics in extrahepatic drug metabolism. Therefore, careful prescription of medications that are metabolized in the liver is important: antibiotics (ampicillin, erythromycin, tetracycline), analgesics (aspirin, acetaminophen, codeine, ibuprofen), sedatives (diazepam), and local anesthetics (lidocaine, mepivacaine, prilocaine, bupivacaine) (48). Furthermore, vitamin K clotting factors are synthesized inthe liver, so coagulation disorders are a concern for the elderly with liver dysfunction (18). These persons often present with prolonged prothrombin time and partial thromboplastin time, and are at risk for developing hemorrhage following oral surgical procedures. Mucosal petechiae and ecchymoses, as well as spontaneous gingival bleeding can also result from coagulation abnormalities (18).

Infections are the most common complication in the elderly with cirrhosis, resulting from alcohol-induced immunosuppression (49). Oral complications include impaired wound healing, and recurrent oral microbial infections. Progressive deterioration of the liver ultimately requires transplantation for survival. These persons are also at high risk for developing infections secondary to long-term immunosuppressive therapy to reduce organ rejection. Finally, persons with liver cirrhosis have been reported to have diminished smell and taste function that can inhibit nutritional intake (44). Painless parotid gland hypertrophy has been observed to cause reversible salivary gland dysfunction in alcoholic cirrhosis.

Conclusions

As the population ages and experiences increased longevity, the risk for the development of systemic disease increases. Frequently a cascade effect of morbidity results as a systemic condition and its treatment impairs other organ systems causing susceptibility to further problems. However, the desire of the older population is not only to live longer, but to live free of disease. This concept of "compression of morbidity" requires aggressive application of preventive health measures. Systemic disease and treatments can impair oral health, thereby adding burden and inhibiting successful aging. The role of the oral health care provider is essential in eliminating oral disease by addressing systemic disease. This paper can aid practitioners in understanding the oral implications of common systemic diseases and treatments as well as provide treatment considerations and patient management recommendations.

The "compression of morbidity" paradigm can also be applied to oral health. If oral health can be maintained across a person's lifespan, this will contribute to improved quality of life and successful aging. Importantly, there are other risks to oral health in addition to the diseases mentioned in this paper, such as sociobehavioral patterns, genetic predisposition, environmental influences, and other systemic impairments. An oral health care provider must consider that the cause of oral problems may be multifactorial, and he/she must address each issue. Good oral health can be maintained for many elderly who have not achieved successful systemic aging when these principles are applied. However, only when oral disease in the elderly has been prevented will the goal of complete successful aging be attained.

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