

# Medical Management of Patients Undergoing Dentoalveolar Surgery



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## KEYWORDS

- Medical management • Dentoalveolar surgery • Anticoagulation
- Medication-related osteonecrosis

## KEY POINTS

- Presurgical evaluation should include risk stratification for prevention of potential problems.
- There are new guidelines regarding management of patients taking oral anticoagulants.
- There is a recent update regarding management of patients with medication-related osteonecrosis of the jaw (MRONJ).

## INTRODUCTION

The oral and maxillofacial surgeon (OMS) should have an understanding of common medical comorbidities. This understanding allows for risk stratification and thus prevention of potential problems. Remaining current with updated literature regarding diseases, diagnosis, treatment strategies, and pharmacology ultimately improves patient care. This article provides an update on some of the most common medical diseases for the patient undergoing dentoalveolar surgery.

## PRESURGICAL EVALUATION

Preoperative evaluation begins with a complete history and physical examination. First, the patient completes a screening questionnaire, which includes medical and surgical histories, allergies, and a list of current medications. The patient is then classified according to the American Society of Anesthesiologists (ASA) Physical Status Classification System (**Table 1**). The ASA classification system provides an overall impression of a surgical patient who is to undergo a procedure under

anesthesia. The patient's risk of having a complication is then stratified according to the Surgical Classification System (**Table 2**).

## CARDIOVASCULAR

When meeting a patient, the OMS should begin with a cardiac-focused physical examination. This examination consists of obtaining blood pressure in both arms, assessing for carotid/jugular pulsations/bruits/murmurs, examining the abdomen for distension and hepatosplenomegaly, and assessing the extremities for peripheral edema. One or more of these findings may alert the surgeon that decompensated cardiac disease is present. Next, the surgeon should consider clinical predictors of increased perioperative cardiovascular risk. The American Heart Association and American College of Cardiology determined that a patient who has specific cardiac clinical risks should be further evaluated by a cardiologist for additional cardiac risk stratification (**Table 3**). Next, the OMS should evaluate the patient's functional status using activities of daily living and

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**Table 1**  
American Society of Anesthesiologists patient classification

| ASA PS | Preoperative Health Status                                | Comments and Examples   |
|--------|---|---|
| 1      | Normal healthy patient                                    | No organic, physiologic, or psychiatric disturbance; healthy with good exercise tolerance   |
| 2      | Mild systemic disease                                     | No functional limitations; has a well-controlled disease of 1 body system<br>Examples: controlled hypertension without systemic effects, cigarette smoking without COPD, mild obesity, pregnancy  |
| 3      | Severe systemic disease                                   | Some functional limitation; has a controlled disease of more than 1 body system or 1 major system with no immediate danger of death<br>Examples: controlled CHF, stable angina, poorly controlled hypertension, morbid obesity, chronic renal failure |
| 4      | Severe systemic disease that is a constant threat to life | Has at least 1 severe disease that is poorly controlled or at end stage; possible risk of death<br>Examples: unstable angina, symptomatic COPD, symptomatic CHF, hepatorenal failure  |
| 5      | Moribund, not expected to survive without the operation   | Not expected to survive more than 24 h without surgery; imminent risk of death<br>Examples: multiorgan failure, sepsis syndrome with hemodynamic instability, poorly controlled coagulopathy  |
| 6      | Declared brain dead, organ donor                          | —   |

Note: if a surgical procedure is performed emergently, "E" is added to the previously defined ASA classification.

Abbreviations: CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease.

Adapted from ASA Physical Status Classification System. American Society of Anesthesiologists. Available at: <https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system>; with permission.

**Table 2**  
Surgical classification system

|            |   |
|------------|---|
| Category 1 | Minimal risk to patients independent of anesthesia<br>Minimally invasive procedures with little or no blood loss<br>Operation done in an office setting |
| Category 2 | Minimal to moderately invasive procedures<br>Blood loss < 500 mL<br>Mild risk to patients independent of anesthesia                                     |
| Category 3 | Moderately to significantly invasive procedure<br>Blood loss 500–1000 mL<br>Moderate risk to patients independent of anesthesia                         |
| Category 4 | Highly invasive procedure<br>Blood loss > 1500 mL<br>Major risk to patients independent of anesthesia   |

From Fattahi I. Perioperative laboratory and diagnostic testing—what is needed and when? *Oral Maxillofac Surg Clin North Am* 2006;18(1):3, v; with permission.

metabolic equivalents (METs). One MET is the oxygen consumption of a 70-kg, 40-year-old at rest. A patient who is able to perform activities of greater than 4 METs without symptoms is considered to have a good functional capacity (Table 4).<sup>1</sup> Finally, the Goldman criteria relies on multivariate analysis and assigns points to certain physical characteristics, helping to assess a patient's cardiac risk (Table 5). The points are then tallied and correlated with the cardiac risk.<sup>2</sup> Patients range from having 0 points and thus a 0.9% risk of serious cardiac event or death to greater than 26 points and a 63.6% risk of serious cardiac event or death.<sup>2</sup>

### Hypertension

Hypertension is defined as blood pressure higher than 140/90 mm Hg measured on 2 different occasions over a 1- to 2-week span. The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) classified patients according to blood pressure (Table 6).<sup>3</sup> Accordingly, when a patient's systolic blood pressure is greater than 140 or



**Table 3**  
Clinical predictors of increased perioperative cardiovascular risk

|              |   |
|--------------|---|
| Major        | Unstable coronary syndromes<br>Acute or recent MI<br>Unstable or severe angina<br>Decompensated heart failure<br>Significant dysrhythmias<br>High-grade atrioventricular block<br>Symptomatic ventricular dysrhythmias<br>Supraventricular dysrhythmias with uncontrolled ventricular rate<br>Severe valvular disease |
| Intermediate | Mild angina pectoris<br>Previous MI based on history or Q waves on ECG<br>Compensated or previous heart failure<br>Diabetes mellitus<br>Renal insufficiency   |
| Minor        | Advanced age (>70 y)<br>Abnormal result of ECG<br>Rhythm other than sinus<br>Low functional capacity<br>History of stroke<br>Uncontrolled systemic hypertension   |

Abbreviations: ECG, electrocardiogram; MI, myocardial infarction.

Data from Fleischer LA, Beckman JA, Brown LA, et al. American College of Cardiology/American Heart Association (ACC/AHA) 2007 Guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 2007;116:418-99.

diastolic blood pressure is greater than 90, pharmacologic treatment should be initiated.<sup>4</sup> Recently, the JNC released updates that described no change in classification, but rather

stated "specific targeted" systolic and diastolic blood pressures and drugs based on gender, race, cardiac history, and other ongoing medical comorbidities.<sup>4</sup> Perioperatively, patients who have severe hypertension (>210/110 mm Hg) have an exaggerated hypotensive response to anesthesia and labile responses. Therefore, elective office surgery should be deferred if systolic blood pressure is greater than 180 and diastolic blood pressure is greater than 110 when other systemic comorbidities are present and if systolic blood pressure is greater than 210 and diastolic blood pressure is greater than 120 if no other comorbidities are present.<sup>3</sup>

#### Pacemaker/Defibrillator

Symptomatic bradycardia is treated with an implantable pacemaker.<sup>5</sup> A demand pacemaker discharges with missed beat or when heart rate is below a predetermined bradycardia threshold. A pacemaker can be single or dual chamber or biventricular where each ventricle is wired separately.<sup>6</sup> Recurrent ventricular tachycardia or ventricular fibrillation is treated with an implantable cardioverter-defibrillator (ICD). ICD is programmed to treat different dysrhythmias by defibrillating, cardioverting, or pacing. ICD provides a shock within 15 seconds of sensing a dysrhythmia.<sup>7</sup> When a patient has ICD and electrocautery will be used during an operation, the surgeon must communicate preoperatively with cardiology so that it is suspended intraoperatively and reprogrammed postoperatively. Alternatively, a magnet can be placed externally over the pacemaker to convert it to asynchronous mode.<sup>8</sup>

#### Coronary Artery Disease

Coronary artery disease (CAD) or atherosclerotic disease is defined as chronic inflammation of arterial endothelium by low-density lipoprotein, and lipid macrophage accumulation causes

**Table 4**  
METs based on activities of daily living

| Excellent (>7 METs)                         | Moderate (4-7 METs)                    | Poor (<4 METs)                            |
|---|--|---|
| Recreational sports (swimming, tennis, etc) | Cycling                                | Vacuuming                                 |
| Jogging (10-min mile)                       | Walking 4 mph                          | Walking 2 mph                             |
| Household work (lifting furniture)          | Light household work (dusting, dishes) | Personal care (dressing, eating, bathing) |

Data from Fleischer LA, Beckman JA, Brown LA, et al. American College of Cardiology/American Heart Association (ACC/AHA) 2007 Guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation* 2007;116:418-99.



**Table 5**  
Goldman criteria for cardiac index

| Criteria  | Points |
|---|--------|
| <b>History</b>  |        |
| Age >70 y   | 5      |
| Myocardial infarction <6 mo                             | 10     |
| <b>Physical examination</b>                             |        |
| S3 gallop   | 11     |
| Jugular venous distention                               | 11     |
| Aortic valve stenosis                                   | 3      |
| <b>Electrocardiogram</b>                                |        |
| Rhythm other than sinus or premature atrial contraction | 7      |
| >5 premature ventricular contractions per minute        | 7      |
| <b>General status</b>                                   |        |
| Po <sub>2</sub> <60 or Pco <sub>2</sub> >50             | 3      |
| K levels <3 mEq/L or HCO <sub>3</sub> levels <20 mEq/L  | 3      |
| SUN >50 or creatinine >3 mg/dL                          | 3      |
| Abnormal AST or chronic liver disease                   | 3      |
| Bedridden   | 3      |
| <b>Operation</b>  |        |
| Intraperitoneal, intrathoracic, aortic                  | 3      |
| Emergency   | 4      |

Abbreviations: AST, aspartate aminotransferase; SUN, serum urea nitrogen.

From Goldman L, Caldera DL, Nussbaum SR, et al. Multifactorial index of cardiac risk in noncardiac surgical procedures. *N Engl J Med* 1977;297:26.

atheromas and calcification of tunica media, which leads to a narrowed artery with acute to chronic endothelial inflammation with an atheroma rupture or vasospasm. Risk factors for

CAD are male gender, increasing age, dyslipidemia, hypertension, diabetes, obesity, sedentary lifestyle, and family history.<sup>9</sup> Treatment consists of lifestyle modifications, pharmacologic therapy, and coronary revascularization.

Atrial fibrillation occurs when there is no coordinated electrical atrial conduction. The atrioventricular node sporadically reacts with no cardiac contraction, which reduces ventricular filling and cardiac output and places the patient at an increased risk for thromboembolic events. New atrial fibrillation is treated by electrical or pharmacologic cardioversion to obtain rate control. Patients are often placed on long-term anticoagulants such as Coumadin. The goal of Coumadin therapy is to maintain a balance between preventing clots and causing excessive bleeding. However, Coumadin has many drug interactions and a narrow therapeutic window and requires frequent monitoring. International normalized ratio (INR) provides information to prescribing physicians to ensure that Coumadin is producing the desired effect; it helps to ensure that the person's clotting time is at a therapeutic level without causing excessive bleeding or bruising.

**Table 6**  
JNC classification

| Category            | SBP   | DBP   |
|---------------------|---|---|
| Normal              | <120  | >80   |
| Prehypertension     | 120–139   | 80–89   |
| Stage I             | 140–159   | 90–99   |
| Stage II            | 160–180   | 100–110   |
| Urgent/<br>emergent | >180<br>With signs/<br>symptoms<br>of end-<br>organ<br>damage | >110<br>Examples: rales,<br>papilledema,<br>headache,<br>chest pain |

Abbreviations: DBP, diastolic blood pressure; SBP, systolic blood pressure.

Adapted from James PA, Oparil S, Carter BL, et al. 2014 Evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA* 2013;311(5):507–20.



## ANTICOAGULATION

Newer oral anticoagulants were developed as alternatives to warfarin in the treatment of arterial and venous thromboembolism and in stroke prevention in patients with nonvalvular atrial fibrillation. These anticoagulants include dabigatran (Pradaxa), a direct thrombin inhibitor, as well as rivaroxaban (Xarelto) and apixaban (Eliquis), factor Xa inhibitors. These drugs do not require monitoring, and therefore patient compliance is essential. However, in emergency situations such as life-threatening bleeding or nonelective major surgery, they cannot be reversed because there are no antidotes currently available. Phase 1 and 2 research studies are ongoing.<sup>10</sup> For dabigatran, a specific antidote has been tested in a rat model of anticoagulation and a study in healthy male volunteers has been recently reported. For rivaroxaban, prothrombin complex concentrates (PCCs) have been found to completely reverse the prolongation of the prothrombin time induced by this new oral anticoagulant. For apixaban, recombinant factor VII was found in an experimental study using human blood to be superior to activated PCC and PCC.

The decision to discontinue anticoagulants should be based on the risk of surgical bleeding and discussion with the treating physician. For a simple procedure such as a single tooth extraction, there is typically no need to change these medications.<sup>11</sup> Local hemostatic measures suffice to control possible bleeding problems resulting from minor dental treatment. If multiple extractions are scheduled, after consultation with the prescribing physician, ideally, a patient should stop taking this medication 5 to 7 days before the scheduled procedure. If use of anticoagulants cannot be stopped because of the risk of thromboembolism, the patient's INR should be carefully monitored during the week before operation and obtained on the morning of the procedure. The desired range is 2 to 3, which often corresponds with the therapeutic range. There is no need to discontinue aspirin.<sup>12</sup> During surgical procedures involving high bleeding risk (multiple extractions, operations lasting >45 minutes, head and neck cancer surgery), the recommendation is to suspend the medication 2 to 3 days before the operation and consider bridging or switching to subcutaneous heparin or Lovenox.<sup>13</sup> Medication should be reintroduced after 24 hours, provided good hemostasis has been achieved.<sup>14</sup> The current idea for patients taking rivaroxaban (Xarelto), and apixaban (Eliquis) is to discontinue these medications, in the case of high surgical bleeding risk, 2 to 3 days before the procedure. Patients taking

dabigatran (Pradaxa), with renal insufficiency and creatinine clearance between 30 and 50 mL/min, should discontinue the medication 2 to 4 days before the procedure.<sup>15</sup> Because of the rapid onset of action of these newer anticoagulant medications, bridging is reserved for patients with a high risk for thromboembolism and the inability to take oral medications for 2 or 3 days postprocedure.

## ENDOCARDITIS PROPHYLAXIS

Valvular heart disease is a significant risk factor for perioperative complications. Valves can have stenosis or regurgitation. Mitral and aortic valve disorders are more common.<sup>16</sup> Conditions which require prophylaxis for endocarditis to include prosthetic heart valves, history of infective endocarditis, unrepaired cyanotic congenital heart disease, and repaired congenital heart defect with prosthetic material or device during the first 6 months following the procedure.<sup>17</sup> The antibiotic regimen remains the same and is given in Table 7.

## MEDICATION-RELATED OSTEONECROSIS OF THE JAW

Management of patients with or at risk for MRONJ was discussed in the American Association of Oral and Maxillofacial Surgeons (AAOMS) position papers in 2007<sup>18</sup> and 2009.<sup>19</sup> Since then, the knowledge base and experience in addressing MRONJ has expanded, necessitating modifications and refinements to the previous guidelines.<sup>20</sup> A patient is considered to have MRONJ if all of the following criteria are met: current or previous treatment with antiresorptive or antiangiogenic agents, exposed bone or bone that can be probed through an intraoral or extraoral fistula in the maxillofacial region that has persisted for longer than 8 weeks, and no history of radiation therapy to the jaws or obvious metastatic disease to the jaws.<sup>20</sup> This new term was adopted to accommodate the growing number of osteonecrosis cases involving the maxilla and mandible associated with antiresorptive and antiangiogenic therapies. There are multiple hypotheses concerning the potential mechanisms leading to MRONJ, including altered bone remodeling, oversuppression of bone resorption, angiogenesis inhibition, constant microtrauma, suppression of innate or acquired immunity, vitamin D deficiency, soft tissue toxicity, inflammation, and/or infection.<sup>20</sup> Intravenous administration of medication increases the risk for MRONJ. The prevalence of osteonecrosis of the jaw increases over time. The risk of MRONJ



**Table 7**  
Antibiotic prophylaxis for prevention of endocarditis

|                               | Medication   | Adults          | Children          |
|-------------------------------|--------------|-----------------|-------------------|
| Oral                          | Amoxicillin  | 2 g             | 50 mg/kg          |
| Allergic to penicillin        | Clindamycin  | 600 mg          | 20 mg/kg          |
|                               | Azithromycin | 500 mg          | 15 mg/kg          |
| Unable to take oral medicines | Ampicillin   | 2 g IM or IV    | 50 mg/kg IM or IV |
| Allergic to penicillin        | Ceftriaxone  | 1 g IM or IV    | 50 mg/kg IM or IV |
|                               | Clindamycin  | 600 mg IM or IV | 20 mg/kg IM or IV |

Abbreviations: IM, intramuscularly; IV, intravenously.

Adapted from Wilson W, Taubert KA, Gewtitz M, et al. Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *Circulation* 2007;116:1736-54.

in patients exposed to oral bisphosphonates (BPs) after tooth extraction is 0.5%.<sup>21</sup> The risk of MRONJ in patients exposed to intravenous BPs ranges from 1.6% to 14.8%.<sup>20</sup> The risk of developing MRONJ in patients who have been exposed to antiresorptive medications for dentoalveolar operations such as dental implant placement or

endodontic or periodontal procedures is unknown.<sup>20</sup> Therefore, according to the special committee appointed by AAOMS, the risk of MRONJ after the above-mentioned procedures is comparable to the risk associated with tooth extraction.<sup>20</sup> Staging and treatment strategies are given in **Table 8**.

**Table 8**  
Staging and treatment strategies for patients with MRONJ

| Stage   | Description   | Treatment Strategies   |
|---------|---|--|
| At risk | No apparent necrotic bone in a patient who was treated with oral or intravenous BP  | No treatment<br>Patient education  |
| Stage 0 | No clinical evidence of necrotic bone but nonspecific clinical findings, radiographic changes, and/or symptoms  | Systemic management (pain medication, antibiotics)   |
| Stage 1 | Exposed and necrotic bone or fistulas that probe to bone in patients who are asymptomatic and have no evidence of infection   | Antibacterial mouth rinse, clinical follow-up on quarterly basis, patient education, review of indications for continued BP therapy                        |
| Stage 2 | Exposed and necrotic bone or fistulas that probe to bone associated with infection as evidenced by pain and erythema in the region of exposed bone with or without purulent drainage  | Symptomatic treatment with oral antibiotics, antibacterial mouth rinse, pain control, debridement to relieve soft tissue irritation, and infection control |
| Stage 3 | Exposed and necrotic bone or a fistula that probe to bone in patients with pain, infection, and 1 or more of the following: <ul style="list-style-type: none"> <li>• Exposed and necrotic bone extending beyond the region of alveolar bone resulting in pathologic fracture</li> <li>• Extraoral fistula</li> <li>• Oroantral or oronasal communication</li> <li>• Osteolysis extending to inferior border of mandible or sinus floor</li> </ul> | Antibacterial mouth rinse, oral antibiotics, pain control, debridement or resection for longer-term palliation of infection and pain                       |

Adapted from Ruggiero SL, Dodson TB, Fantasia J, et al. American Association of Oral and Maxillofacial Surgeons position paper on medication-related osteonecrosis of the jaw-2014 update. *J Oral Maxillofac Surg* 2014;72(10):1938-56; with permission.



## SUMMARY

Patients who undergo oral and maxillofacial surgery are often relatively healthy, and complications related to medical conditions are not common. However, medical conditions may be present in any patient and may lead to increased morbidity and mortality unless these conditions are uncovered in those without such a history and recognized in those with a history of disease. A thorough medical and social history will elicit medical comorbidities when known. A thorough physical examination will often confirm the presence of systemic disease or identify it in those without a prior history.

Obtaining a thorough history and physical examination requires a systematic approach to a patient interview, consisting of: chief complaint, history of the chief complaint; a medical history with review of all systems, allergies, and medications, a social history, a family history, surgical history, and assessment of functional status. The sensitivity of a thorough history to identify a previously unrecognized medical condition should not be underestimated. The physical examination should also be standardized to include all relevant systems. The history and physical examination will then enable the surgeon to request additional investigations and medical referrals that allow risk stratification.

The risk assessment for each patient undergoing surgery requires an understanding of the surgical stress and the patient's medical condition. Major oral and maxillofacial surgery is considered to be intermediate in surgical operative risk. Oral and maxillofacial procedures performed in an ambulatory setting would be considered low risk.

Preoperative patient assessment is best completed by the surgeon who has a vested interest in the patient's well-being. When medical conditions and comorbidities are recognized preoperatively, appropriate workup or referral is easily organized. The involvement of other medical and surgical subspecialties should be readily sought when indicated. The ultimate goal of the preoperative evaluation is to identify medical concerns and provide the perioperative treatment algorithms that minimize patient morbidity.

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