Perioperative Assessment of the Maxillofacial Surgery Patient

Problem-based Patient Management

Elie M. Ferneini
Jeffrey D. Bennett
Editors

Springer

Perioperative Assessment of the Maxillofacial Surgery Patient

Elie M. Ferneini
Jeffrey D. Bennett
Editors

Perioperative Assessment of the Maxillofacial Surgery Patient

Problem-based Patient Management

Springer

Editors
Elie M. Ferneini
University of Connecticut
Farmington, CT
USA

Jeffrey D. Bennett
Indianapolis, IN
USA

ISBN 978-3-319-58867-4 ISBN 978-3-319-58868-1 (eBook)
https://doi.org/10.1007/978-3-319-58868-1

Library of Congress Control Number: 2017964624

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

The preoperative management and assessment of the maxillofacial surgery patient has become more complex in recent years. The aging of our population, increased chronic disease, and increased medical treatments of illness make preoperative assessment critical to a successful surgical outcome. This book blends the art and science to enhance the clinical wisdom of the surgeon. Francis W. Peabody said in 1927 “the secret of the care of the patient is in caring for the patient.” Surgical technique must have an abundant amount of personal caring in the doctor-patient relationship, but it also must be based on the latest and best medical information. The text accomplishes its goals well.

The scope of the material covered in this text is wide but relevant. The advances in surgery such as navigation and importance of behavioral issues are covered for the first time in the same surgical text. Issues of drug interactions, medical management of the surgical patients, and complications are detailed in a readable and useful manner. The chapters emphasize interprofessional management in providing the best surgical treatment and the best outcome.

Boston, MA, USA R. Bruce Donoff

Contents

Contributors

Marconi Abreu, M.D. Division of Endocrinology, Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, TX, USA

Odette M. Aguirre, D.D.S., M.S., M.P.H. Department of Biomedical and Applied Sciences, Indiana University School of Dentistry, Indianapolis, IN, USA

Mahmood Ahmad, M.D. Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan

Rishal Ambaram, D.D.S. Division of Oral and Maxillofacial Surgery, School of Dental Medicine, University of Connecticut, Farmington, CT, USA

Joelle El Amm, M.D. Division of Hematology and Oncology, School of Medicine, Lebanese American University, Beirut, Lebanon

Sarah T. Araji, M.D. PGY3 Obstetrics and Gynecology, Saint Joseph's Regional Medical Center, Paterson, NJ, USA

Chakib M. Ayoub, M.D., M.B.A. Department of Anesthsiology, Duke University School of Medicine, Durham, NC, USA

Roger S. Badwal, D.M.D., M.D. Division of Oral and Maxillofacial Surgery, Danbury Hospital, Danbury, CT, USA

Mohammad Banki, M.D., D.M.D., F.A.C.S. Artistic Contours, Warwick, RI, USA

Department of Surgery, Warren Alpert Medical School of Brown University, Providence, RI, USA

Division of Oral and Maxillofacial Surgery, University of Connecticut, Farmington, CT, USA

Lydia Aoun Barakat, M.D. Section of Infectious Disease, Yale University School of Medicine, New Haven, CT, USA

Jeffrey D. Bennett, D.M.D. Indianapolis, IN, USA

Michael S. Block, D.M.D. Private Practice, Metairie, LA, USA

Gary F. Bouloux, M.D., D.D.S., M.D.Sc. Division of Oral and Maxillofacial Surgery, Department of Surgery, Emory University School of Medicine, Atlanta, GA, USA

Yulanka Castro-Dominguez, M.D. Division of Cardiology, Department of Internal Medicine, Yale University School of Medicine, New Haven, CT, USA

Victor A. Chang, M.D. Yale University School of Medicine, New Haven, CT, USA

Marc Ciampi, M.D., F.A.C.P., F.A.S.N. Quinnipiac University Netter School of Medicine, North Haven, CT, USA

Yale University School of Medicine, New Haven, CT, USA

Joseph E. Cillo Jr, D.M.D., M.P.H., Ph.D., F.A.C.S. Division of Oral and Maxillofacial Surgery, Drexel University College of Medicine, Allegheny General Hospital, Allegheny Health Network, Pittsburgh, PA, USA

Jeremy D. Clark, M.D. Oculofacial Plastic and Orbital Surgery, Indianapolis, IN, USA

Department of Ophthalmology and Visual Sciences, University of Louisville, Louisville, KY, USA

Bernard J. Costello, D.M.D., M.D., F.A.C.S. Faculty Affairs, University of Pittsburgh School of Dental Medicine, Pittsburgh, PA, USA

Department of Oral and Maxillofacial Surgery, University of Pittsburgh, Pittsburgh, PA, USA

Department of Otolaryngology, University of Pittsburgh, Pittsburgh, PA, USA

H. Alexander Crisp, D.M.D. Department of Oral and Maxillofacial Surgery, Medical University of South Carolina College of Dental Medicine, Charleston, SC, USA

Roselle E. Crombie, M.D. General Surgery, Hyperbaric Medicine, Surgical Critical Care, Bridgeport Hospital, Bridgeport, CT, USA

Jasjit Dillon, D.D.S., M.B.B.S., F.D.S.R.C.S. Department of Oral and Maxillofacial Surgery, Harborview Medical Center, University of Washington, Seattle, WA, USA

Deena Elkafrawi, B.A. St. George's University School of Medicine, True Blue, Grenada

Annibal Faddoul, M.D. Department of Anesthesiology, American University of Beirut Medical Center, Beirut, Lebanon

Pooia Fattahi, M.D. Department of Neurology and Internal Medicine, Yale University, New Haven, CT, USA

Brendan Faulkner, Esq. RisCassi & Davis P.C., Hartford, CT, USA

Elie M. Ferneini, M.D., D.M.D., M.H.S., F.A.C.S. Division of Oral and Maxillofacial Surgery, University of Connecticut, Farmington, CT, USA

Beau Visage Med Spa/Greater Waterbury OMS, Cheshire, CT, USA

Antoine Ferneini, M.D., F.A.C.S. Division of Vascular Surgery, Yale-New Haven Hospital/St. Raphael Campus, North Haven, CT, USA

Connecticut Vascular Center, PC, North Haven, CT, USA

Lawrence P. Garetto, Ph.D. Department of Oral Pathology, Medicine and Radiology, Indiana University School of Dentistry, Indianapolis, IN, USA

Charles Warren Fairbanks Center for Medical Ethics, IU Health Methodist Hospital, Indianapolis, IN, USA

Marwan Ghabril, M.D. Division of Gastroenterology and Hepatology, Indiana University School of Medicine, Indianapolis, IN, USA

G.E. Ghali, D.D.S., M.D., F.A.C.S. Louisiana State University Health Sciences Center-Shreveport, Shreveport, LA, USA

Hady Ghanem, M.D. Division of Hematology and Oncology, Lebanese American University, School of Medicine, Beirut, Lebanon

Andre Ghantous, M.D., F.A.C.C. Division of Cardiology, Department of Internal Medicine, Yale University School of Medicine, New Haven, CT, USA

William Gossett, M.S.H.C.M., B.S.N., R.N., N.R.P. Department of Emergency Medicine, Indiana University Health—Ball Memorial Hospital, Muncie, IN, USA

Avni Gupta, M.D. Department of Psychiatry & Behavioral Medicine, University of Illinois-Peoria, Peoria, IL, USA

Millennium Pain Center, Unity Point Health-Methodist Hospital, Peoria, IL, USA

Thomas M. Halaszynski, D.M.D., M.D., M.B.A. Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Hui Bae Harold Lee, M.D., F.A.C.S. Oculofacial Plastic and Orbital Surgery, Indianapolis, IN, USA

Jennifer Hartwell, M.D., F.A.C.S. Department of Surgery, IU Health/Methodist Hospital, Indianapolis, IN, USA

Jagdev S. Heir, M.D., D.M.D., F.A.C.S. Sacramento Surgical Arts, PC, Sacramento, CA, USA

Andrew Herlich, D.M.D., M.D., F.A.A.P. Department of Anesthesiology, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Thomas Hickey, M.D. Yale School of Medicine, New Haven, CT, USA

VA Connecticut Healthcare System, West Haven, CT, USA

Steven Hugenberg, M.D. Rheumatology Division, Department of Medicine, Indiana University School of Medicine, Indianapolis, IN, USA

James R. Hupp, D.M.D., M.D., J.D., M.B.A. Journal of Oral Maxillofacial Surgery, Fairfield Glade, TN, USA

Emeritus of Oral-Maxillofacial Surgery, School of Dental Medicine, East Carolina University, Greenville, NC, USA

Michael P. Johnson, D.M.D., F.A.C.S Oral and Maxillofacial Surgery, Yale New Haven Hospital, Yale University, New Haven, CT, USA

Douglas Johnson, D.M.D. Oral and Facial Surgical Center, St. Augustine, FL, USA

Jayesh Kamath, M.D., Ph.D. Psychiatry and Immunology, Mood and Anxiety Program, University of Connecticut Health Center, Farmington, CT, USA

Katherine Kedzierski, M.D. Department of Neurology, Yale University, New Haven, CT, USA

Waterbury Neurology, Waterbury, CT, USA

Patrick J. Kennedy, Esq. RisCassi & Davis P.C., Hartford, CT, USA

Hassan Khalid, M.D. Division of Endocrinology, Department of Internal Medicine, University of Texas Southwestern Medical Center, Dallas, TX, USA

Shakaib Khan, M.D. Department of Psychiatry, University of Connecticut Health Center, Farmington, CT, USA

Roderick Youngdo Kim University of Michigan Oral and Maxillofacial Surgery, Ann Arbor, MI, USA

Head and Neck Oncologic and Microvascular Reconstructive Surgery, John Peter Smith Hospital, Baylor Scott & White, Fort Worth, TX, USA

Jan R. Kornilow, M.D., F.A.C.E.P., F.A.A.E.M. Department of Emergency Medicine, Indiana University Health—Ball Memorial Hospital, Muncie, IN, USA

Kyle J. Kramer, D.D.S., M.S. Department of Oral Surgery and Hospital Dentistry, Indiana University School of Dentistry, Indianapolis, IN, USA

Deepak G. Krishnan, D.D.S., F.A.C.S. Oral Maxillofacial Surgery, University of Cincinnati, Cincinnati, OH, USA

Michael Kwakye, M.D. Yale New Haven Hospital, New Haven, CT, USA

Carolyn McDonald, C.R.N.A. Department of Anesthesiology, Richard L. Roudebush VA Medical Center, Indianapolis, IN, USA

Daniel McNally, M.D. Division of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine, University of Connecticut School of Medicine, Farmington, CT, USA

Julie McNeish, D.M.D., M.D. Division of Oral and Maxillofacial Surgery, School of Dental Medicine, University of Connecticut, Farmington, CT, USA

Jacques Emile Mokhbat, M.D. Division of Infectious Diseases, Department of Medicine, Lebanese American University School of Medicine, Beirut, Lebanon,

Christian A. Moore, D.M.D. Department of Oral and Maxillofacial Surgery, University of Pittsburgh, Pittsburgh, PA, USA

Kristine Mosier, D.M.D., Ph.D. Department of Radiology, Indiana University School of Medicine, Indianapolis, IN, USA

Elie Tony Nader, M.D. Division of Pulmonary and Critical Care Medicine, Norton Community Physicians Group, Norton, VA, USA

Michele Obeid, M.D. Division of Hematology and Oncology, Lebanese American University, School of Medicine, Beirut, Lebanon

James Omlie, D.D.S., M.D. Department of Oral and Maxillofacial Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA, USA

Adriana D. Oprea, M.D. Department of Anesthesiology, Yale School of Medicine, New Haven, CT, USA

Frank Paletta, M.D., D.M.D., F.A.C.S. MSL Facial and Oral Surgery, Warwick, RI, USA

Warren Alpert Medical School, Brown University, Providence, RI, USA

LisaMarie Di Pasquale, D.D.S., M.D. Division of Oral and Maxillofacial Surgery, School of Dental Medicine, University of Connecticut, Farmington, CT, USA

George Sunny Pazhayattil, M.D., F.A.C.P. Quinnipiac University Netter School of Medicine, North Haven, CT, USA

Yale University School of Medicine, New Haven, CT, USA

Dmitry Peysakhov, D.M.D. Bothell Oral, Maxillofacial and Implant Surgery, Bothell, WA, USA

Timothy H. Pohlman, M.D., F.A.C.S. Department of Surgery, Section of Acute Care Surgery, Indiana University Health—Methodist Hospital, Indianapolis, IN, USA

Issa Rezek, M.D. Department of Surgery, Yale University School of Medicine, New Haven, CT, USA

Laura Romito, D.D.S., M.S., M.B.A. Nicotine Dependence Program, Indiana University School of Dentistry, Indianapolis, IN, USA

Sashidhar Sagi, M.D. Division of Gastroenterology and Hepatology, Indiana University School of Medicine, Indianapolis, IN, USA

David S. Shapiro, M.D., F.A.C.S., F.C.C.M. Department of Surgery, Saint Francis Hospital & Medical Center, Hartfort, CT, USA

Julie Ann Smith, D.D.S., M.D., M.C.R., F.I.C.D. Willamette Dental Group, Portland, OR, USA

Department of Oral and Maxillofacial Surgery, Oregon Health and Science University, Portland, OR, USA

Amit Sood, D.M.D., M.D. Division of Oral and Maxillofacial Surgery, School of Dental Medicine, University of Connecticut, Farmington, CT, USA

Martin B. Steed, D.D.S., F.A.C.S. Department of Oral and Maxillofacial Surgery, Medical University of South Carolina College of Dental Medicine, Charleston, SC, USA

Sean M. Stokes, Esq. RisCassi & Davis P.C., Hartford, CT, USA

Elisabeth M. Swanson, Esq. RisCassi & Davis P.C., Hartford, CT, USA

Pavan Tankha, D.O. Department of Anesthesiology, Yale School of Medicine, New Haven, CT, USA

Pain Management Section, VA Connecticut Healthcare System, West Haven, CT, USA

Youssef Tfaili, M.D. Department of Anesthesiology, American University of Beirut Medical Center, Beirut, Lebanon

Akashdeep Villing, D.M.D. Department of Oral and Maxillofacial Surgery, University of Washington, Seattle, WA, USA

Brent Benson Ward, M.D., D.D.S. Department of Surgery, Section of Oral and Maxillofacial Surgery, University of Michigan, Ann Arbor, MI, USA

Jennifer E. Woerner, D.M.D., M.D., F.A.C.S. Louisiana State University Health Sciences Center-Shreveport, Shreveport, LA, USA

Virginia Workman, M.D. Division of Cardiology, Department of Internal Medicine, Yale University School of Medicine, New Haven, CT, USA

Georges Yared, M.D. Department of OB/GYN, Lebanese American University School of Medicine, Beirut, Lebanon

Masoud Yeganegi, M.D., M.A.Sc. Waterbury Neurology, Waterbury, CT, USA

Jagiellonian University Medical College, Kraków, Poland

Tian Ran Zhu, M.D. Warren Alpert Medical School, Brown University, Providence, RI, USA

Tony G. Zreik, M.D., M.B.A. Department of OB/GYN, Lebanese American University School of Medicine, Beirut, Lebanon

Part 1

General Concepts in Assessment and Management of the Surgical Patient

1 Patient Safety

Jeffrey D. Bennett

Abstract

Excellent patient care is dependent upon attention to patient safety. There are many elements of patient safety that the practitioner must attend to; first and foremost is obtaining a complete medical and medication history. The more medically compromised the patient, the more time will be required to develop a thorough understanding of the patient's medical status and its implication in risk assessment. Ensuring that the correct treatment is provided is absolute. In a busy office, errors can occur. Steps, such as "time-out," to verify name and identify information, procedure, specific medical conditions, and allergies, can minimize medical errors and optimize care. Patient care extends beyond the actual time in treatment, and appropriate planning is required for continuance of care once the patient leaves the office. Despite the best of intentions and care, adverse events occur and the office must be prepared to manage these situations appropriately. Patient safety is an evolving process, and operating under the philosophy of "we have always done it this way" is no longer adequate or appropriate. This chapter will address several of these issues and others that are critical to patient safety.

1.1 Introduction

The goal of each patient encounter is to provide optimal care. A fundamental principle in medicine is "primum non nocere," translated as "first, do no harm." Patient safety is the basis for good patient care. In this chapter we will address various aspects that impact patient safety: patient selection; medical history and physical examination; management of a patient's pre-, intra-, and postoperative medications; checklists/time-out; monitoring; discharge, transference, and continuity of care; inter-professional communication; and staff and office preparation and training.

J.D. Bennett, D.M.D.
Indianapolis, IN, USA
e-mail: jb2omfs@gmail.com

E.M. Ferneini, J.D. Bennett (eds.), *Perioperative Assessment of the Maxillofacial Surgery Patient*,
https://doi.org/10.1007/978-3-319-58868-1_1

1.2 The Basis for Patient Safety

Healthcare is potentially hazardous. A 2016 publication estimates that medical error is the third greatest cause of death in the United States [1]. Surgical care accounts for two-thirds of the in-hospital deaths [2]. Medical errors permeate through all aspects of patient care. These medical errors can be categorized as diagnostic errors, medication errors, anesthetic errors, surgical errors, instrument errors, and procedural errors (which may include infection control, discharge/continuity/transference of care, and communication errors).

A medical error may be *the act of neglecting or doing something wrong*, which is an "act of commission," or the *act of failing to do the correct thing* that may be secondary to a lack of knowledge or understanding, which is an "act of omission" [3].

Healthcare is complex. Care may involve that of a medically complex patient. The surgical procedure may be one that the practitioner performs routinely, but every patient is unique and the unexpected may present itself at any time. Alternatively, the procedure may be one that the surgeon rarely performs and thus presents its own challenges. While oral and maxillofacial surgeons have traditionally safely administered anesthesia to their surgical patients, such a practice is not mundane but requires a well-trained, attentive, and cohesive anesthetic team. With the changing environment of healthcare, there has been a growth in office-based ambulatory anesthesia and surgery among other specialties both in medicine and dentistry. Each of the above, the patient, the procedure, the anesthetic, and the postoperative care following a procedure, is potentially fraught with error and provides the opportunity for the occurrence of an adverse event. It is inherent for each practitioner, as well as their offices, to be observant and learn from other organizations (such as the aviation and/nuclear industry) where high-risk acts are performed and accomplished with excellent safety records on how to minimize risk.

Processes, such as medication reconciliation, medication preparation and medication dispensation, time-outs, checklists, routine and emergency care manuals, and simulated patient care, have all been shown to reduce adverse events. Patient safety is a dynamic and developing activity. Hospitals have implemented these and various systems to reduce patient risk. The challenge to the outpatient office is to implement a comparable plan, most likely without the assistance of a staff consisting of risk officers, quality control officers, and compliance officers.

1.3 Medical History

The care of every patient begins with a good history. A good medical history requires that the practitioner listen and observe the patient. It begins with listing the patient's medical ailments/illnesses, surgeries, medications, and allergies. Many offices may use a form with a checklist of medical conditions, which may be completed by the patient, staff member, or practitioner. A checklist form completed and signed by the patient endorses that this is their understanding of their medical history. However, for a patient with a low health literacy, confusion with the items may contribute to an inaccurate response; and for the patient who anticipates difficulty in receiving treatment, the form may be intentionally falsely completed.

It is clear, therefore, that the checklist form by itself is insufficient and inadequate in providing a complete medical history. The checklist, however, provides information to guide and tailor further questioning as the practitioner next completes a review of systems. The review of systems confirms the diagnosis, defines the severity of a known illness, and/or identifies signs and symptoms suggestive of a previously unrecognized or defined illness.

1.4 Medication Management

A list of a patient's medications provides further insight into the patient's medical ailments. A medication for which a medical illness was not listed may identify a need for further exploration into the medical history. Multiple medications or specific medications for a medical ailment may provide insight into the severity of that condition. Knowing the patient's medications is an essential element to providing optimal care.

Many patients take over-the-counter medications, herbal or dietary supplements, and/or prescription medications. Herbal or dietary supplements may go unreported, as many patients do not consider these to be medications; yet approximately 20% of the population may be taking such supplements [4]. This is further compounded by the inability of many patients to provide an accurate and complete list of their medications.

Medication reconciliation, which is the process of ensuring a complete and accurate list of medications that the patient is taking, is a critical safety matter.

The practitioner is responsible for continuance or discontinuance of medications during the perioperative period. The decision to continue or discontinue a medication cannot solely be deferred to a medical consultant, as they may not have a full comprehension of the planned treatment and the effect of continuance or discontinuance of the medication on patient treatment [5]. An example of this is the ability to maintain hemostatic-altering medications (e.g., warfarin, antiplatelet medications) for most dentoalveolar surgery through the perioperative period; yet if the practitioner inquires about management of these medications during the perioperative period, the consultant response will frequently suggest their discontinuance.

An adverse drug event (ADE) is an injury, which results secondary to medication use. Adverse drug events are one of the most common contributing factors to morbidity and mortality. The ADE may be anticipatable as a known side effect or toxic reaction, which may be potentially avoidable. This entails being fully knowledgeable with the medications and either using an alternative medication if such is available or employing appropriate monitoring to recognize an unwanted effect and minimizing the adverse consequences. Alternatively, the ADE may be unforeseeable as an idiosyncratic or allergic reaction. Adverse drug events are not all the result of medication error; but it is critical to implement safety steps that can minimize medication error that can contribute to adverse drug events.

Many patients take multiple medications with the prevalence higher as the patient ages. The potential for drug interactions increases with polypharmacy. Drug–drug interactions have been reported to be responsible for an adverse drug interaction or altered drug efficacy in approximately 25% of the patients in an outpatient population [6, 7]. In the patient who presents taking multiple medications, drug–drug interactions may already exist being on the threshold to manifest their effect. An example of this may be the alteration in the homeostatic balance (e.g., acid–base change) as a result of patient treatment, which affects available drug concentrations.

The delivery of anesthesia entails its unique challenges. Anesthesia-related medication errors for both general anesthesia and sedation were reported to occur at a rate of one for every 20 medication administrations with one-third of the occurrences resulting in patient harm [8]. There are multiple factors that may contribute to anesthesia-related medication errors. The medical community has experienced various drug shortages over the past several years necessitating practitioners to use drugs with which that they may be less familiar. Drug shortages have also resulted in the lack of availability of the regularly used drug concentration. The use of infusion pumps, which require the input of medication, medication concentration, bolus, and infusion rate, may contribute to an increased level of complexity and incidence of error. One study in which anesthesiologist's ability to calculate drug concentrations demonstrated that approximately 60% of the participants made significant miscalculations resulting in drug concentrations which ranged between 50 times too low and 50 times too high [9]. This may be evident when formulating drug mixtures, such as propofol–remifentanil, or diluting emergency medications such as phenylephrine to the correct concentration for intravenous administration.

The potential for error with preparation of emergency medications is compounded when the medication preparation is urgently required.

Medication errors and/or adverse drug events may be minimized by:

1. Familiarity and knowledge of medications
2. Labeling all syringes with drug name and concentration after it is drawn up into the syringe
3. Avoidance of maintaining the same drug at different concentrations
4. Verifying that the vial contains the correct drug concentration
5. Avoidance of look-alike vials
6. Avoidance of using soundalike drug names
7. Medications (e.g., phenylephrine) in ready-to-use concentrations
8. Storage of medications in a temperature-controlled environment
9. Limiting the use of a multidose vial to a single patient
10. The use of sterile technique when preparing all medications (as not swabbing with alcohol before opening a multidose vial was associated with an incidence of contamination up to 18%)
11. Connecting a medication infusion (e.g., propofol–remifentanil) to the most proximal intravenous port
12. Ensuring a patent continuous running intravenous line (which will prevent an inadvertent medication bolus when patency of an obstructed line is reestablished)
13. Appropriate (closed-loop) communication
14. Utilizing readily available manuals/aids to determine dosing for both adult and pediatric patients
15. Preventing distraction

The greater the number of perioperative medications administered during an anesthetic, the more likely for a medical error or an adverse drug event to occur. The relatively limited number of anesthetic medications administered during an office-based anesthetic is associated with a decreased incidence of medication errors and adverse drug events.

1.5 Patient Selection

Based on the medical history and physical examination of the patient, the practitioner can determine what is the appropriate anesthetic depth and where the surgery should be performed. The following criteria may dictate the anesthetic depth: ASA classification, patient age, comorbidities, and/or treatment location. The practitioner must be cognizant of anatomic and physiologic developmental stages in the pediatric patient as they impact anesthetic care.

1.6 Tracking Patient Information

The management of a diverse and complex patient population entails the use of diagnostic testing, such as laboratory tests, imaging, and/or anatomic pathology.

Failure to track these diagnostic tests may result in misdiagnosis or failure or delay to diagnose [10, 11]. The office must ensure that the patient understands the purpose for and is aware of scheduled tests. The office must subsequently follow through if the patient does not obtain such testing and either reschedule or appropriately document if the failure is secondary to noncompliance with care. The office must maintain a logbook to safeguard that it tracks all ordered tests such that all specimens are received, no abnormal results are missed, and all test results are communicated to the patient.

1.7 Checklists and Time-Outs

Healthcare is a complex process that has many steps and tasks that make risk inevitable. Several industries, such as aviation, nuclear energy, and construction, as described by Atul Gawande in his book *The Checklist Manifesto: How To Get Things Right*, have implemented processes to optimize both safety and outcome quality while minimizing risk that have only begun to be adopted within healthcare [12].

An ideal checklist is a simple standardized process. It is designed to anticipate errors, intercept them, and prevent harm from occurring. A checklist establishes protection by developing redundancy and multiple layers or steps that need to be cross-checked. At times it may force a task to be performed.

A time-out is a period of interdisciplinary discussion. It ensures communication between the team members, minimizes misunderstandings, and ensures that everybody comprehends the intended procedure.

The World Health Organization (WHO) checklist/time-out process for surgery consists of three stages: sign in, time-out, sign out [13, 14]. The process has to be simple and flexible to incorporate different approaches, such that it will be used by practitioners in various types of facilities (e.g., hospital and office), yet exacting to achieve its goal. A primary principle goal of the Joint Commission is to prevent wrong patient and wrong site surgery, which is achieved by having that the entire surgical and anesthetic teams along with the patient verify correct patient, correct procedure, correct site, and patient allergies [15]. This is not a problem that occurs solely with hospital-based surgery but is a problem in the oral and maxillofacial surgery office. As recently as 2007, wrong site surgery in oral and maxillofacial surgery accounted for 14% of the malpractice claims compared to only 2% of the claims in orthopedic surgery [16].

It facilitates that all team members are introduced and know each other as when the team is familiar with each other, it functions best. It directs those caring for the patient to discuss any anticipated critical events prior to surgery as well those involved with postoperative care to discuss recovery management. The checklist ensures critical events that optimize outcomes are completed and confirmed by the team such as antibiotic prophylaxis administration, appropriate imaging is displayed, instrument and material counts both at commencement and completion of surgery are correct, implantable biologics/devices are appropriately documented, and specimens are appropriately logged.

Anesthesia is a critical aspect of care both in the hospital and office. An anesthesia checklist confirms working instrumentation, readiness of routine and emergency medications, accessibility of emergency manuals and protocols, and system functionality.

Combined, a checklist and time-out optimize communication, team cohesiveness, and consistency of care. The introduction of a surgical checklist to patient care has resulted in a decrease in both death rate and complication rate [17]. What is achieved by the checklist and time-out goes beyond the basic concept as it results in a modification in behavior fostering a culture of safety [18]. Office-based ambulatory surgery is susceptible to the same risks that occur within the hospital. Is it not time to incorporate these concepts into the office?

1.8 Training, Guidelines, and Aids

There is significant truth to the old adage that "you are only as good as your staff." Good care is dependent on a well-organized and quality staff. Creating and maintaining a quality team entails several components: staff and team training, office guidelines, and cognitive aids.

Staff and team training consists of two components. The first aspect of staff training focuses on knowledge and skill acquisition. Each office based on the scope of surgery that is performed will require individualized and precise instruction to attain the expertise specific to that office; however, a common core among most oral and maxillofacial surgery practices is the provision of deep sedation and general anesthesia. Knowledge base must be acquired and maintained in airway management, interpretation of monitoring information and data (e.g., ECG rhythm recognition), anesthetic pharmacology and techniques, recovery and discharge assessment, and anesthetic and emergency preparation and management. The second component of staff training focuses on team functionality or *crew resource management*. Teamwork training focuses on leadership, decision-making, information management, knowledge sharing, staff member empowerment, role delegation, individual responsibility, (closed-loop) communication, collaboration, workload distribution, and situational awareness.

Task simulators provide the opportunity to acquire specific skills. Airway management is a critical aspect of anesthesia care, with adverse airway events being the highest contributor to anesthetic morbidity and mortality [19–21]. Simple airway mannequins have been shown to teach airway skills that transfer well to clinical care. These simulators allow the individual to develop skill with bag-valve-mask ventilation, oral and nasal airway placement, supraglottic airway placement, and endotracheal intubation. However, most airway instruction, which is provided in conjunction with BLS and ACLS courses, employs simple airway simulators, which unfortunately do not replicate the difficult and complex airway that may be encountered in a real emergency. The importance of the staff acquiring and maintaining airway management skill within the ambulatory office relates to the incidence in which it contributes to morbidity and the limited personnel available within the ambulatory facility who can respond to a situation.

In the hospital, the practitioner team leader sole responsibility is observing, assessing, interpreting, and directing the team, which frequently consists of nursing, respiratory, and pharmacy staff in addition to other practitioners. In the ambulatory office, the personnel is more limited with a typical solely practitioner office having in addition to the surgeon, an anesthetic assistant, a surgical assistant, and a front desk staff member. The difference in staff support is obvious and is further compounded if the staff is not adequately skilled to provide assistance to the surgeon such that the surgeon is also tasked with providing most aspects of care in addition to directing such care. While there is a lack of literature pertaining to the OMS model, the emergency and simulation literature would support staff training to optimize patient care. Practitioners must appreciate that emergency management entails a level of skill and team training above what is required for routine anesthetic delivery.

Team functionality is achieved with simulation-based training. Simulation-based training replicates the "real" event. It provides an environment in which the entire office team can repetitively immerse themselves into both routine and emergent situations. It provides the opportunity to analytically assess the operation and functionality of the individuals, team, resource allocation, and office environment without placing a patient at risk of an adverse outcome. Because knowledge and skill diminish with time, simulation-based training must be regularly scheduled as "one does best what one does often." Repetitive training reinforces knowledge and skills [22].

While all of the points listed above in regard to teamwork training are critical to a functional team, I would like to emphasize the significance and importance of staff empowerment and leveling the hierarchy of command, especially in the office environment. In most OMS offices, the incidence of emergent events is few, making the event rare for not only the staff but also the practitioner. With significant responsibility placed on the practitioner, the practitioner's focus may be misdirected. A knowledgeable staff that is empowered and understands their role and responsibility in "speaking up" may make a contribution that could critically impact the outcome of events.

"Best practice" is achieved through the establishment of a structured protocol, which may be documented in critical care pathways. Much of routine practice adheres to a specific care pathway which when used to direct care both optimizes patient outcome and minimizes adverse events. The availability of critical care pathways is even more important when confronting an emergent situation. The stress associated with an emergent situation may impair the team's ability to retrieve knowledge that is rarely used, even if the office routinely is involved in simulation exercises. Cognitive aids and manuals, which are readily available and possibly posted on the operatory wall, have the ability to provide relevant information and facilitate emergency intervention.

1.9 Discharge and Transference of Care

Continuity of patient care is critical to optimizing patient outcome. Factors contributing to a lack of continuity occur in areas of transition. Transition of care can occur when a patient is shifted from an area of acute monitoring, such as the operating room or ambulatory office operatory, to an area less supervised, such as the recovery area (especially in the ambulatory office), and finally discharged home. Transition of care may also occur secondary to the changing dynamics of medical/dental care in which several different practitioners may care for one patient. Transition of care may occur between the consultation and surgery, surgery and postoperative care, outpatient and inpatient, and/or day and night. Transition of care is a potential weakness in patient care because it provides the opportunity for miscommunication among healthcare professionals. Patient care is complex, and clinical disagreements among doctors regarding patient care in addition to miscommunication have both contributed to adverse outcomes [23, 24].

It is precisely for these reasons that the utmost diligence must be taken when transitioning a patient from one area to another area or from one practitioner to another practitioner. There are protocols that may optimize patient care. For example, continuance of respiratory monitoring (oxygen saturation and respiratory rate) and intravenous access up to discharge in the ambulatory environment after an anesthetic observes for respiratory depression which is the greatest contributor to adverse events in the sedated patient while maintaining intravenous access simplifies the ability to provide necessary intervention.

For the sedated patient, there are established criteria and parameters to guide patient assessment. A systematic approach with checklists is as advantageous for discharge as they are to prior to the surgical procedure. It is prudent that the practitioner empower their staff. The staff that has been monitoring the patient may have observed concerns that may require assessment by the practitioner prior to discharge. Ultimately, it is the practitioner's responsibility to make the final decision to discharge the patient.

1.9.1 Postoperative Analgesia

Surgery inflicts pain, and appropriate pain management is a vital component of continuity of care. Short-acting opioids are frequently administered intraoperatively. These medications smoothen the anesthetic and reduce the requirement for anesthetic agents. However, short-acting opioids, such as fentanyl, do not provide significant postoperative analgesia. The practitioner may consider the intraoperative use of long-acting local anesthetic nerve blocks, infiltration of liposomal local anesthetics, intravenous NSAIDS, and/or intravenous acetaminophen to provide initial postoperative analgesia.

Enteral postoperative medications will usually be indicated for the initial home recovery period. NSAIDs, acetaminophen, opioids, or combinations of the above may be prescribed. NSAIDs have been shown to provide comparable if not superior analgesia to the opioid/acetaminophen combination [25]. A recommended regimen for postoperative analgesia is to take a NSAID (if not contraindicated) preemptively which is initiated either just prior to, intraoperatively, or immediately after surgery at a regular interval for the first 48 h. This has been demonstrated to reduce the severity of surgical pain. An opioid/acetaminophen combination can be used to supplement the NSAID medication; however, the preemptive NSAID administration should reduce and potentially negate the need for the opioid requirement and the adverse effects associated with opioid administration. It is not inappropriate to prescribe opioids as opioids or opioid combinations may be indicated, but the medical profession must understand that there is an opioid epidemic for which overprescribing postoperative opioid analgesia is contributing to.

1.10 Equipment Safety

Equipment safety is critical to patient and staff safety. It pertains to radiation safety, anesthetic gas scavenging, sterilization efficacy, monitoring device accuracy, correctness of anesthetic gas plumbing, as well as "backup" power and lighting.

Assembly or dysfunction of any component of equipment critical to patient care can contribute to an adverse outcome. This may be illustrated by the following examples. A failure to monitor autoclave function can result in ineffective instrument sterilization with transmission of disease. An inaccuracy in anesthetic plumbing may result in the administration of the wrong anesthetic gas (e.g., a gas other than oxygen coming from the oxygen outlet). This has resulted in resuscitation of patients with anoxic gas mixtures. This can only be avoided by having an oxygen sensor within the oxygen line. Inadequate reserve power and lighting can leave the practitioner "blind" (without monitoring, without suction, without emergency equipment) and unable to provide proper care. Maintaining a checklist will force task completion to ensure a functional environment.

Regulations differ based on medical or dental licensure, whether you participate in the AAOMS office anesthesia evaluation (OAE) program or have an accredited or non-accredited office, and/or state regulations. As dental and medical professionals, it is important to ensure standards that will optimize patient and staff safety.

Conclusion

It is important that we learn from others and that we recognize our mistakes and do not repeat them. We must understand that just because we managed a situation and avoided a catastraphe does not indicate that the overall management (planned and emergent) for the patient was correct. We must understand that not all "near misses" may have been recognized and that we were simply lucky. This chapter simply introduces the reader to concepts that are being implemented in all accredited hospitals. Is it not appropriate that a facility in which surgery and anesthesia are provided adopts these same standards to optimize patient care and minimize adverse events?

References

1. Makary MA, Daniel M. Medical error—the third leading cause of death in the United States. BMJ. 2016;353:i2139.
2. de Vries EN, Ramrattan MA, SM S, et al. The incidence and nature of in-hospital adverse events: a systematic review. Qual Saf Health Care. 2008;17(3):216–23.
3. Wachter RM. The nature and frequency of medical errors and adverse events. In: Wachter RM, editor. Understanding patient safety. New York: McGraw-Hill; 2012. p. 3–9.
4. Qato DM, Wilder J, Schumm LP, et al. Changes in prescription and over-the-counter medication and dietary supplement use among older adults in the United States, 2005 vs 2011. JAMA Intern Med. 2016;176:473.
5. Gary CJ, Glick M. Medical clearance. An issue of professional autonomy, not a crutch. JADA. 2014;143:1180–1.
6. Tulner LR, Frankfort SV, Gijsen GJ, et al. Drug-drug interactions in a geriatric outpatient cohort: prevalence and relevance. Drugs Aging. 2008;25(4):343–55.
7. Gandhi TK, Weingart SN, Borus J, et al. Adverse drug events in ambulatory care. N Engl J Med. 2003;348:1556–64.
8. Nanji KC, Patel A, Shaikh S, et al. Evaluation of perioperative medication errors and adverse drug events. Anesthesiology. 2016;124:24–34.
9. Avidan A, Levin PD, Weissman C, et al. Anesthesiologists' ability in calculating weight-based concentrations for pediatric drug infusion: an observational study. J Clin Anesth. 2014;26:276–80.
10. Graber ML, Franklin N, Gordon R. Diagnostic error in internal medicine. Arch Intern Med. 2005;165:1493.
11. West DR, James KA, Fernald DH, et al. Laboratory medicine handoff gaps experienced by primary care practices: a report from the shared networks of collaborative ambulatory practices and partners (SNOCAP). J Am Board Fam Med. 2017;27:796.
12. Gawande A. The checklist manifesto: how to get things right. Basingstoke: Picador; 2009.
13. Haynes AB, Weiser TG, Berry WR, et al. Safe Surgery Saves Lives Study Group A surgical safety checklist to reduce morbidity and mortality in a global population. NEJM. 2009;360:491–9.
14. The WHO surgical safety checklist and implementation manual. Geneva: World Health Organization Press; 2016.
15. The Joint Commission Ambulatory Care Patient Safety Goals. http://www.jointcommission.org/assets/1/6/2016_NPSG_AHC_ER.pdf. Viewed on January 5, 2017.
16. Lee JS, Curley JD, Smith RA. Prevention of wrong site tooth extraction: clinical guidelines. Br J Oral Maxillofac Surg. 2009;65:1793–9.
17. ABM H, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. N Engl J Med. 2009;360:491–9.
18. Hill MR, Roberts MJ, Alderson ML, Gale TCE. Safety culture and the 5 steps to safer surgery: an intervention study. Br J Anaesth. 2015;114(6):958–62. https://doi.org/10.1093/bja/aev063. Epub 2015 Mar 16.

19. Metzner J, Posner KL, Domino KB. The risk and safety of anesthesia at remote locations: the US closed claims analysis. Curr Opin Anaesthesiol. 2009;22:502–8.
20. Bhananker SM, Posner KL, Cheney FW, et al. Injury and liability associated with monitored anesthesia care: a closed claims analysis. Anesthesiology. 2006;1045:228–34.
21. Cheney FW, Posner KL, Cheney FW. Trends in anesthesia-related death and brain damage: a closed claims analysis. Anesthesiology. 2006;105:1081–6.
22. Neily J, Mills PD, Young-Xu Y, et al. Association between implementation of a medical team training program and surgical mortality. JAMA. 2010;304:1693–700.
23. Greenberg C, Regenbogen S, Studder D, et al. Patterns of communication breakdowns resulting in injury to surgical patients. J Am Coll Surg. 2007;204:533–40.
24. Hilsden R, Molfat B, Knowles S, et al. Surgeon agreement at the time of handover, a prospective cohort study. World J Emerg Surg. 2016;11:11. https://doi.org/10.1186/s13017-016-0065-6.
25. Moore PA, WIffen PJ, Derry S, et al. Non-prescription (OTC) oral analgesics for acute pain: an overview of Cochrane reviews. Cochrane Database Syst Rev. 2015;11:CD010794.

2 Preoperative Assessment and Evaluation for Maxillofacial Surgery

Thomas M. Halaszynski

Abstract

Maxillofacial patient's surgical condition(s), medical problems, and additional healthcare comorbidities should be preoperatively identified and managed appropriately to minimize postoperative complications or reduce the likelihood of admission to a critical care setting for convalescence. Appropriate judgment and effective medical management of the maxillofacial surgery patient can be achieved by incorporating insightful actions ranging from routine preoperative assessment to extensive evaluation, therapeutic interventions, and subspecialty consultation when needed. Optimal perioperative management for the maxillofacial surgery patient reveals its greatest impact is by preparing patients for surgery and ensuring their safe and effective transition to home. Maxillofacial surgery patient preoperative care should focus on improving outcomes, implementing the discovery from innovative preoperative practice models, improving information technology, and contributing to the evolution of evidenced-based practice principles through physician leadership and redesign of pre- and perioperative processes.

2.1 Introduction

Appropriate judgment and effective medical management of the uncomplicated maxillofacial surgery patient through to and including those with significant and complex medical comorbidities can be achieved by incorporating insightful actions ranging from routine preoperative assessment to more extensive evaluation, therapeutic interventions, and subspecialty consultation. A multimodal team consisting of the maxillofacial surgeon, anesthesiologist, patient primary care provider(s), and/or medical specialty consultants often conducts the evaluation and assessment which may, in selected cases, include admission to a specialty care unit for preoperative optimization [1].

T.M. Halaszynski, D.M.D., M.D., M.B.A.
Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA
e-mail: thomas.halaszynski@yale.edu

E.M. Ferneini, J.D. Bennett (eds.), *Perioperative Assessment of the Maxillofacial Surgery Patient*,
https://doi.org/10.1007/978-3-319-58868-1_2

Optimizing preoperative preparation has a twofold benefit toward curtailing the need for extensive postoperative care and/or ICU admission. First, it is in the best interest of the patient, medical institution, and healthcare system providers to minimize the need for intensive postoperative care management and to maximize patient surgical outcome(s). As an analogy, it has been shown that high-risk elderly patients who undergo medical optimization prior to high-risk surgical interventions have decreased mortality rates [2–4]. Second, less costly healthcare resources are consumed by preoperatively addressing significant comorbid diseases in order to curtail adverse perioperative incidents without the need for postoperative admission to a more intensive care or critical care setting. In addition, the era of managed care and cost containment places increasingly more stringent guidelines as to what constitutes "appropriate" (i.e., reimbursable) utilization of hospital inpatient resources.

It is important for healthcare personnel involved in maxillofacial preoperative assessment and preparation to comprehend all the patient needs and then to coordinate perioperative care efforts, especially in those patients who are likely to require more extensive perioperative evaluation, management, and care. This remains necessary as in some situations, a patient's medical problems may extend beyond the expertise of a single practitioner. However, it still remains optimal to have one individual coordinate the several preoperative assessment and management modalities should they become necessary to perform. Prior to implementation of the managed care era, even healthy patients were being admitted to the hospital at least 1 day prior to their scheduled surgery date so that routine testing (and often times conducting excessive testing) could be performed and reviewed.

However, in the past few decades, the aforementioned preoperative preparation protocol models have been modified, and these once traditional processes have become increasingly difficult to arrange. Instead, it is the responsibility of the maxillofacial surgical practitioner to ensure adequate, and when necessary, more comprehensive preoperative patient preparation(s). Therefore, it is important for the oral surgeon to establish a working framework of perioperative management, including appropriate and comprehensive preoperative assessment(s) as needed, that will minimize preoperative inefficiencies and maximize patient surgical preparedness to yield more optimal maxillofacial surgery outcomes. The preoperative interview is also a great opportunity to discuss options for postoperative analgesia, including multimodal analgesia in order to minimize postoperative pain and morbidity.

2.2 Preadmission Testing Centers

Well-established preadmission testing (PAT) centers, structured to address the needs of performing thorough and coordinated preoperative assessment of surgical patients, have become common in medical centers throughout the United States. These centers perform anesthesia, surgical, and nursing assessments of surgical patients days prior to scheduled surgery. The centers are staffed with healthcare providers capable of performing all the necessary presurgery workups and competencies for patient optimization protocols in anticipation of elective surgical intervention(s). These centers can improve perioperative care of patients as well as augment the satisfaction of surgeons and patients alike.

The PAT center has typically been staffed and coordinated by an anesthesiologist capable of performing and supervising activities related to the preoperative assessment and management of the maxillofacial surgical patient. These responsibilities include the preoperative anesthesia history and physical (H&P) examination, the requisite general H&P, attainment and review of laboratory data, decisions as to the need for further consultation, and patient instructions regarding which medications should be discontinued, continued, or initiated prior to surgery.

The time and resources invested in scheduling maxillofacial patients for a PAT visit can result in significant direct and indirect savings related to several other aspects of a patient's perioperative care [5, 6]. For example, healthcare dollars can be saved by elimination of unnecessary or excessive "routine" laboratory testing [5–9]. Evidence has shown that another important and impactful aspect of scheduling a preoperative PAT visit is improved perioperative efficiency along with decreases in last-minute delays (i.e., obtaining old medical/surgical records, requirements for additional medical testing, or need for further specialty consultation), reduced surgical cancelations, and a decrease in length of hospital stay [10]/[11]/[12]. Additional indirect influences and positive impact from effective preoperative preparation are related to the postoperative well-being of those patients with complicated medical comorbidities.

2.3 Preoperative Assessment

Components of the maxillofacial preoperative history and physical examination along with an anesthesiology preoperative assessment can overlap as they both include a review of systems and physical examination, history of present illness, review of allergies and adverse reactions, listing of medications, prior surgeries, and family history review for evidence of any genetic or inherited healthcare issues/complications. Additionally, the preoperative portion of an anesthesiology assessment/interview will examine a patient's history for any specific anesthesia-related issues or problems (i.e., adverse medication reactions, difficult airway, need for postoperative mechanical ventilation, unanticipated ICU admission, poorly controlled pain, persistent nausea, and/or vomiting) as well as any evidence for a family history of anesthesia-related issues (e.g., pseudocholinesterase deficiency, malignant hyperthermia). An anesthesia preoperative history and physical examination also focuses on the airway, heart, and lungs, seeking to identify evidence of any disorders or abnormalities of these organ systems that could compromise intraoperative anesthesia management and postoperative surgical care.

More extensive and in-depth examination, optimization, and management of specific medical disorders or organ system compromise (neurologic, cardiac, vascular, pulmonary, hepatic, electrolytes, bariatric, psychiatric, and hematologic) are sometimes necessary that would constitute medical subspecialty consultation separate from the more "routine" preoperative surgical assessment described above. For example, preoperative preparation of the high-risk maxillofacial surgical patient may benefit from consultation by those who will be subsequently collaborating with the surgeon during the postoperative period if critical care management of high-risk surgical patients should become necessary. This consultation process can be coordinated between the surgeons in conjunction with the protocols established by the practitioners from the preadmission testing center. A similar concept, known as the "Perioperative Surgical Home" (PSH, further described below), permits for a more seamless transition for the patient should any need for postoperative critical care management become necessary. However, decisions regarding specialty consultation, how and when such requests should be made, may not always be obvious. Therefore, several subspecialty organizations have developed protocols and guidelines for the practitioner to implement such as those provided by the American College of Cardiology and American Heart Association (ACC/AHA) [13]. These guidelines can provide a level of consistency when concerns related to the high-risk maxillofacial surgical patient (i.e., symptomatic or new-onset cardiovascular disease) are presented to the surgeon.

Summations from a host of aspects of the maxillofacial patient's preoperative assessment, based on their medical condition(s) and any necessary input from consultants, will permit the anesthesiologist to grade each patient according to a I-to-V (along with modifier E and optional VI) rating scale. Table 2.1 describes such a system that has become a well-established terminology grading mechanism and identified as the American Society of Anesthesiologists (ASA) physical status classification [14, 15]. These patient physical status classification categories have proven efficacious for assessing the fitness of patients prior to surgery, as well as predict perioperative morbidity and mortality [8, 16, 17].

Table 2.1 ASA physical status classification

Modified from American Society of Anesthesiologists physical status classification*		
Class	*Description*	*Examples*
I	• There are no organic, physiologic, biochemical, or psychiatric disturbances • Surgical etiology does not entail a systemic disturbance • Surgical problem is localized	Otherwise healthy patient [Patient for "routine" (nonimpacted) dental extraction(s), bunion repair, hernia repair, lumpectomy, asymptomatic fibroids]
II	• Mild to moderate systemic disturbance(s) • Systemic disturbance may or may not be related to the reason for surgery	Well-controlled hypertension, h/o asthma, anemia, tobacco use, controlled diabetes, mild obesity, age < 1 year or >70 years, malignancy without evidence of significant spread or physiological disturbance, controlled seizure disorder, moderate hyperparathyroidism, treated hyper- or hypothyroidism, localized colitis, localized Crohn's or diverticulitis, renal stones, asymptomatic pituitary tumor, painful or moderately bleeding fibroids
III	• Severe (but not incapacitating or acutely life-threatening) systemic disturbance that may or may not be related to the reason for surgery	Angina, poorly controlled hypertension, poorly controlled diabetes, symptomatic COPD or asthma, massive obesity, renal failure on dialysis, poorly controlled thyroid dysfunction, widespread inflammatory bowel disease, S/P chemotherapy, pituitary tumor with systemic effects, brain tumor with focal signs, sleep apnea, O_2 sat 90–93%, atrial fibrillation with controlled heart rate, h/o cerebrovascular accident, fibroids causing significant anemia (leading to hypotension and/or need for transfusion)
IV	• Severe systemic disturbance that is life-threatening with or without surgery • Systemic disturbance where invasive monitoring likely required to manage the patient prior to induction of anesthesia	"Unstable" angina, CHF, debilitating respiratory disease, hepatorenal failure, brain tumor with significant neurological dysfunction or increased ICP, severe sleep apnea with pulmonary hypertension, O_2 sat < 90 at rest, recurrent V-tach/V-fib, significant compromise from atrial fibrillation, recent CVA (≤ 1 month) or recurrent TIAs, symptomatic cerebral aneurysm or arteriovenous malformation, fibroids causing dangerous deep vein thrombosis requiring current anticoagulation (h/o significant threat of pulmonary embolus)
V	• Moribund patient who has little chance of survival • Patient submitted to surgery as a last resort • Desperation measure and/or resuscitation effort	Patient with acutely deteriorating brain function due to bleeding cerebral aneurysm, "crash" in cardiac catheterization laboratory
VI	• Brain-dead patient for organ harvesting	
E	• Modifier for any patient in whom an emergency operation is required	Patient with acute trauma, recent food ingestion, postoperative problem requiring emergency surgery

COPD chronic obstructive pulmonary disease, *S/P* status-post, *h/o* history of, *CHF* congestive heart failure, *ICP* intracranial pressure, *V* ventricular, *CVA* cardiovascular accident, *TIA* transient ischemic attack

There remain three important components of the anesthesiologist's preoperative assessment process that the ASA physical status classification system does not directly address including, but not limited to:

1. Reports or history of airway problems (e.g., difficult mask ventilation/intubation, sleep apnea) and examination of the difficult airway (seek additional references for more detailed information)
2. Risk(s) and/or complexity associated with the maxillofacial surgical procedure
3. Potential for any adverse reaction(s) to administration of anesthesia secondary to an anesthesia-specific patient disorder (unless the etiology itself would be a cause for a higher ASA physical status score)

However, these concerns must always be incorporated into perioperative perspectives when managing a maxillofacial patients' surgical care. Even though influences and effects of a maxillofacial patient's surgical condition on systemic well-being is incorporated into the ASA physical status scoring system, the nature and complexity of the actual planned surgical procedure(s) is not part of and should not influence the score.

A possible negative impact upon patients from proposed maxillofacial surgery and influence on the focus of the preoperative assessment has been emphasized by the ACC/AHA in the guidelines for cardiac evaluation prior to noncardiac surgery [13]. This impact is related to the nature of the planned surgery and its capacity to have any effect upon parameters of the preoperative assessment that has also been addressed in the literature [8, 18]. Several investigators, authors, and other practitioners have classified surgery into three (or more subdivisions) categories by risk stratification in order to assess for potential patient-specific compromise associated with planned maxillofacial surgery:

- Low risk—minimal physiologic stress potential or risk toward the patient (independent of a patient's medical condition), rarely requires the need for blood transfusion, invasive monitoring, or ICU care, e.g., office-based surgery and minor surgery (routine dental extraction).
- Moderate risk—increased physiologic stress and risk (such as fluid shifts), typically with minimal blood loss, but the potential must be appreciated, e.g., full-mouth extractions secondary to the teeth that have been affected by extensive caries and/or periodontal disease.
- High risk—significant perioperative stress and potential for added postoperative physiologic stress, increased likelihood to require a blood transfusion and/or larger amounts of fluids or body fluid shifts, invasive monitoring, and postoperative management in ICU setting, e.g., extensive maxillofacial surgery linked to short-term stroke and heart attack risk or maxillofacial surgery that deals with high-risk medically compromising patients.

There are patients presenting for maxillofacial surgery where the potential for an associated disorder can be inferred. For example, patients with a medical history of aortic and/or peripheral vascular disease have a higher likelihood of significant coronary artery disease, or when a patient's diabetes is associated with an autonomic neuropathy, they are also predisposed to an increased likelihood of coronary artery disease [18]. It has been suggested that structuring preoperative interventions, especially in the medically compromised patient, be designed to lessen the probability of adverse perioperative outcomes. This is possible when preoperative assessments on those with significant comorbidities are structured in accordance with what has been termed "precaution protocols" (i.e., cardiac ischemia precautions (grades 1–3) and hypertension precautions). Degree(s) of precaution incorporated should be made dependent on both the severity of underlying disease and possible ramifications toward the surgical risk(s) involved [19].

2.3.1 Assessment of Anesthesia-Related and Anesthesia-Specific Disorders

Systemic disorders, as well as a history of an adverse perioperative reaction/interaction to medications, can have an impact on perioperative care of the surgical patient and predispose patients to the need for unanticipated perioperative events. Preoperative assessment of the maxillofacial patient should involve identification of disorders, adverse reactions to, or allergy from use of any of the anticipated intraoperative anesthetic agent(s) or antibiotics used during surgery [20–26]. For example, use of inhalational agents (anesthetic agent possessing general anesthetic properties delivered by inhalation) should be avoided in the patient with a history of or immediate family member with a history of malignant hyperthermia.

Patients describing a history (or family history) of prolonged intubation hours following minor surgery could have a likely diagnosis of atypical pseudocholinesterase that causes an inability to metabolize succinylcholine (depolarizing neuromuscular blocking drug). Such a diagnosis can be confirmed with a blood test identifying decreased pseudocholinesterase activity that should be further explored and then caution expressed to perioperative team members to avoid use of succinylcholine [21]. Patients with a diagnosis of myasthenia gravis can also present with perioperative prolonged muscle paralysis precipitated by anesthesia. Myasthenia gravis is characterized as autoimmune destruction of acetylcholine receptors capable of resulting in progressive weakness (neuromuscular "fade") following repeated muscle stimulation or persistent muscle activity [22]. Damage to the acetylcholine receptors will predispose the muscular system neuromuscular junction complex to exaggerated responses caused by non-depolarizing neuromuscular blocking medications (i.e., curare, pancuronium, vecuronium, atracurium, and rocuronium). Management of the maxillofacial surgery patient with a history of myasthenia gravis during preoperative planning is to determine if it is appropriate to discontinue anticholinesterase medications the day prior to scheduled surgery (cessation of anticholinesterase drugs facilitates anesthesia management since such agents can influence effects of neuromuscular blocking agents). However, making such a decision should not be attempted in those with a history of severe muscle weakness or for patients who are anticholinesterase-dependent.

Malignant hyperthermia is a true life-threatening systemic response. It is caused by increased intracellular concentrations of calcium that can be precipitated by inhalational anesthetic agents (alter muscle cell membrane integrity) and depolarizing muscle relaxants like succinylcholine (leading to simultaneous contractions of skeletal muscles) [23]. Clinical signs/symptoms include hypercarbia, hyperthermia, arrhythmias, acidosis, muscle rigidity, increased creatinine kinase, and myoglobinuria. Safe anesthesia management of the susceptible MH patient is first to recognize the condition (by patient report or history of diagnosis in an immediate family member) and to then plan accordingly by avoiding known triggering agents during the perioperative period. Without a prior history of MH, it cannot be diagnosed until a crisis develops in a susceptible patient. However, there is an increased possibility of MH in some patients with particular diagnosis such as muscular dystrophy, those with strabismus, and patients with neurofibromatosis. Confirmation of MH can be made with muscle biopsy testing showing a positive caffeine-halothane contracture test.

Historically, mortality was high from MH prior to the introduction of dantrolene (an antidote medication that can stabilize muscle cell membranes and limits intracellular calcium levels). There was a time when anesthesiologists would electively administer dantrolene (prophylactic dantrolene can cause muscle weakness and gastrointestinal upset) and pretreat the MH-susceptible patient. However, it is now believed that dantrolene pretreatment is not necessary, provided non-triggering anesthetics are administered. Therefore, total intravenous anesthesia (TIVA) can be employed using an oxygen-flushed anesthesia machine, monitoring end-expired carbon dioxide, and having dantrolene along with MH protocol supplies readily available. Table 2.2 summarizes the treatment regimen/protocol to be used if a potential diagnosis of MH is suspected and/or confirmed. In addition, MH may first become recognized during the postoperative period, further necessitating an understanding of the potential signs and symptoms along with knowledge of diagnostic and therapeutic interventions.

Adverse reactions and life-threatening responses to neuromuscular blocking agents may occur in patients with denervating disorders/diseases including amyotrophic lateral sclerosis, history of massive tissue trauma, denervating injuries (stroke or major nerve injury), and muscle disorders (muscular dystrophy) [21–23]. Patients with serious denervation disorders can experience proliferation of extra-junctional acetylcholine receptors such that when these receptors are exposed to succinylcholine an exaggerated efflux of potassium can occur along with life-threatening hyperkalemia and profound muscle contractions. Burn injury patients and those who have suffered from major soft tissue trauma are also predisposed to succinylcholine-induced hyperkalemia [27]. Muscle integrity can also be compromised by myopathies such that fasciculations (brief and spontaneous uncoordinated muscle contractions) caused by succinylcholine could result in a massive efflux of potassium or precipitate rhabdomyolysis [24–26].

Table 2.2 Treatment protocol for malignant hyperthermia

1.	Call for *help*
2.	Remove all possible *triggering agents*. Discontinue the anesthesia and stop surgery as soon as possible. Change the airway tubing and/or anesthesia machine if possible
3.	*Hyperventilate* with 100% oxygen in order to decrease $PaCO_2$ and increase oxygenation
4.	Administer *dantrolene* (≥2.5 mg·Kg^{-1} IV, repeated as needed (i.e., titrate to heart rate, temperature, pCO_2 or followed by a rapid infusion of an additional 7.5 mg Kg^{-1}). Most cases will respond to 3–5 mg Kg^{-1}. Alternatively, infuse 1 mg kg^{-1} min^{-1} until relief of adverse signs is detected, and then repeat half the initial dose at 4-hour intervals until all signs and symptoms have resolved. If the episode does not resolve within several minutes, then an additional 10 mg Kg^{-1} (possibly much higher doses) should be used, or a rapid infusion may be titrated to effect
5.	Place an arterial line, CVP catheter, urinary catheter, and core temperature monitor
6.	*If severe hyperthermia is present*, cool the patient by packing in ice, infusing cooled saline, and possibly lavaging the stomach, rectum, and peritoneum (cooling measures should be stopped when the body temperature reaches approximately 38 °C to avoid hypothermia)
7.	*If acidosis is severe and unresolving,* consider administering sodium bicarbonate. Otherwise, it may be best to avoid the Na^+ and bicarbonate load that is also provided by the dantrolene solution
8.	*Maintain urine output* with fluids and diuretics, BUT NOT with lactated Ringer's solution as it contains K^+ and Ca^{2+}. An output of ≥0.2 mL kg^{-1} hr^{-1} should prevent myoglobin cast formation
9.	Administer *procainamide* (≤1 gm/70 kg/30 min) if arrhythmias persist following dantrolene administration. In addition to procainamide being an antiarrhythmic, it inhibits drug-induced contractures in MH-susceptible muscle in vitro (not as effectively as dantrolene). Procainamide may be infused until the arrhythmias have resolved, unless the QT interval is prolonged by 50% or more. Such prolongation indicates significant cardiac depression, which may be treated with isoproterenol. The safety of other antiarrhythmics has not been proven; lidocaine and other amide local anesthetics have been used safely; calcium channel blockers are less helpful and may be contraindicated
10.	*Maintain cardiac output*, which may be compromised in the context of acidosis, hyperkalemia, hemoconcentration, arrhythmias, and their treatment
11.	Treat *hyperkalemia* (using insulin at 0.1–0.2 units kg^{-1} and dextrose at 0.5–1.0 mg Kg^{-1}), *hypoglycemia* (which may result from the hypermetabolic state), *hypovolemia, coagulopathy,* and other related abnormalities. If hypokalemia develops, treat it slowly because of potentially decreased renal function and the possibility that a marked increase in K^+ may retrigger an MH episode

Monitor patients for a minimum of 24–48 h. An MH crisis can recrudesce following successful resolution of the initial episode. Recrudescence is especially likely if all parameters have not fully returned too normal (e.g., heart rate). *Dantrolene should be continued for* several doses (possibly for 24 h), and the dosing interval should be titrated to symptoms (taking into account that the $t_{1/2}$ of dantrolene given IV is 12 h and that therapeutic plasma levels (>2.5 μg mL^{-1}) typically persist for 4–6 h following 2.5 mg kg^{-1} IV)

Note: The Malignant Hyperthermia Association of the United States (MHAUS) is an organization with 24-hour numbers:
209-634-4917 for emergency calls as well as public information
607-674-7901 for patients and families
800-644-9737 (800-MH HYPER) for immediate expert consultation
website: http://www.mhaus.org

2.3.2 Preoperative Laboratory Testing of the Maxillofacial Patient

Across the board, ordering of preoperative screening tests, as opposed to a more coordinated and directed testing approach, has been reviewed in the literature [7, 8, 28–33]. Directed testing has proven to be more cost-effective and efficient [34–36].

There is evidence that routine testing and indiscriminate blood screenings are of little-to-no direct patient benefit. For example, even for the older patient, it has been found that "routine" laboratory testing protocols were less predictive of perioperative morbidity than ASA physical status classification or surgical risk stratification [37]. It is also identified that the more tests that are ordered, there is a greater likelihood that an abnormal testing result will be found ("…for every 20 tests ordered, the chance that all results will be in the normal range is only 36%.") [16]. Arbitrarily, performing preoperative screening tests that have a low specificity for a significant disorder and/or low prevalence in a given patient population can result in false-positive findings that could further lead to costly, time-consuming, and even hazardous patient workups.

It has been shown to be more preferable and cost-effective to establish preoperative testing guidelines wherein strategic testing parameters are based upon information obtained during the preoperative assessment such as:

1. Presence of a medical condition determined from the preoperative history and physical examination (as reflected by overall ASA physical status or specific disease/disorder);
2. Patient categorized in a "high-risk" group based on epidemiology data (i.e., EKG for male patient ≥70 years of age);
3. Legitimate benefit from obtaining an otherwise nonselective baseline testing parameter secondary to the real potential of intra- and/or postoperative change(s) (i.e., high-risk surgical intervention); and
4. Anticipated need for more intensive postoperative care (ICU admission) that would have an impact upon preoperative tested indices.

Consistent with the above criteria [7], the ASA has also proposed general guidelines for preoperative testing [38]; however, *total* evidence to identify explicit decision parameters or rules for ordering preoperative tests based on specific patient factors is lacking.

A proposed preoperative laboratory testing guideline for the maxillofacial surgery patient is identified in Fig. 2.1. It has been developed by selecting specific guideline data from several national organizations and tailored to the maxillofacial surgery patient in order to facilitate preoperative assessment and preparation (providing consistency while maintaining practitioner flexibility). Indications toward determining testing parameters are based on patient age (i.e., no testing required in a healthy patient <45 years old who is undergoing minor surgery), surgical risk stratification (i.e., minor-, moderate-, or high-risk surgery), and medical disease or comorbidities. The columns of the figure include suggestions for additional testing that may be required prior to different surgical procedures (based on overall surgical complexity as well as specific medical comorbidity aspects) and/or recommended testing due to varied medical conditions in order to assess for readiness of surgery as well as provide baseline information for those patients where perioperative problems may be suspected intra- or postoperatively. Some testing selections should be performed within 30 days of planned surgery (shaded areas) as the results of these tests may prove vital to the assessment of the given disease/disorder. Additional testing (including repeat testing on the day of surgery) may be indicated if new or worsening of existing medical issues should surface or with exacerbation of preexisting disease(s) and/or surgical signs and symptoms. As per a recent ASA Practice Advisory, "More recent test results may be desirable if the medical history has changed, or when test results may play a role in the selection of a specific anesthetic" [38].

2.3.2.1 Instructions for Optimization of Patient Medications

On the day of scheduled surgery (despite the desire to minimize oral intake several hours prior to surgery), patients are typically directed to take some of their morning prescription medications with just enough water to swallow the medication. The prescription agents routinely taken/continued on the day of surgery include cardiac (digitalis and beta-blockers), respiratory/asthma (e.g., metered-dose inhalers), antiseizure, endocrine, steroid, and gastrointestinal medications (for treatment of gastroesophageal reflux disease). Other groups of medications that should be continued on the day of surgery if scheduled to be taken in the morning, with few exceptions, include analgesics and chronic pain agents (possible exception, aspirin-containing medications and nonsteroidal anti-inflammatory drugs), antianxiety drugs (possible exception, monoamine oxidase inhibitors (MAOIs) and tricyclic antidepressants), and antihypertensive

TEST	MINOR SURG. IN HEALTHY PATIENT (w/in 90 days)				Additive Medical Factors for Moderate & High Risk Maxillo facial Surgery																						
					HIGHRisk Surgical Procedures (within 90days)			ClinicallySignificantandChanging Medical Disorders and/or Medication (white-w/in 90 days; gray-given test for given disorder likely should be w/in 30 days)																			
	HealthyAdult <45	45-54 y/o	55-69 y/o	≥70 y/o			Anticipate > 2u	Hypertension	Smoking	Morbid Obesity	h/o Stroke	Cancer (?metastatic)	Seizure Meds	Cardiovascular	Respiratory	Daibetes	Hepatic	Renal	Fluid or Lyte Loss	Autoimmune/Lupus	EtoH/DrugAbuse	Steroids/Cushings	HIV	Parathyroid	Unstable Thyroid	Anticoag/Bleeding	Suspected Pregnan.
ECG		M	Y	Y	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	±	Y	Y	Y	Y	Y	Y		
CBC+plates			Y	Y	Y		Y			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Lytes				Y	Y		Y	Y		Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
BUN/Creat				Y	Y		Y	Y			Y	Y		Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y		
Glucose				Y	Y		Y			Y	Y	Y		Y		Y	Y	Y			Y	Y	Y	Y	Y		
LFTs					±							Y	Y				Y				Y		Y				
Calcium																								Y			
PT/PTT					S		Y										Y	Y		Y	Y					Y	
U/A (?culture)					S																						
CXR					±							S			Y								S				
Hormone Levels					±																				Y		
Bleed Time																										±	
Pregnancy					Y																						Y
DrugLevels													S								±						
TumorMarkers												S															
Clot	**Depends primarily on extensiveness of proposed surgery andper Institutional Blood Bank guidelines.**																										

Fig. 2.1 General suggestions for adult maxillofacial surgery preoperative testing. *Y* usually indicated, *M* usually indicated for male, *S* may be requested and reviewed by surgeon as part of surgical w/u,; ± if situation acute/severe. *Comments*: (1) Testing for a given disorder depends on severity of the disorder in the context of planned surgery, i.e., are the tests likely to generate potentially clinically significant information and provide information that would be an important component of the H&P (e.g., a brief course of steroids or a h/o asymptomatic mitral valve prolapse does not warrant testing). (2) Times and test listings are suggestions: they are not absolute and should not preclude other testings in given settings nor should they prevent a case from proceeding if the anesthesiologist and surgeon deem that to be appropriate. (3) An anesthesiologist would not routinely order a chest X-ray unless there is suspected airway compromise or an acute pulmonary problem; if the surgeon or PCP wants a CXR for another reason (e.g., metastatic workup), then it is the responsibility of that individual to follow up on the report

medications (possible exception, angiotensin converting enzyme (ACE) inhibitors and angiotensin II receptor blockers). There are also differences among certain classes of medications that could prove critical to patient perioperative management and must be appreciated. For example, to decrease the risk of intraoperative acid aspiration, it is a routine to continue H2-blockers and proton pump antagonists. However, over-the-counter particulate antacids such as Tums should be withheld (and substituted with an alternative medication if deemed necessary) on the day of surgery due to potential adverse deleterious effects (i.e., aspiration of the drug particulate matter).

2.3.3 Antihyperglycemic Medications

On the morning of a patient's maxillofacial surgery, oral hypoglycemic agents should be withheld in addition to consideration that some of these medications (i.e., the long-acting agents) be discontinued on the evening prior to surgery, especially if a patient is prone to morning hypoglycemia.

Patient instructions on insulin (short-acting versus long-acting) administration on the day of scheduled surgery can be complex and are handled differently for inpatients compared to outpatient surgery candidates. On the morning of surgery for an inpatient, a portion of the morning insulin dose is commonly provided (to facilitate "tight" blood sugar control) with an ability to administer intravenous glucose if required. However, for the outpatient coming in from home on the day of surgery, they should be instructed not to take any of their morning insulin (concerns of inducing hypoglycemia while patients are en route or waiting in the hospital). Further challenges arise when instructing an insulin-dependent patient's evening prior to surgery insulin administration. For example, depending upon the likelihood of hypoglycemia if a patient does not eat breakfast upon awakening, consideration toward the amount of long-acting insulin taken the night before surgery may need to be reduced. For all insulin-dependent patients upon arrival to the hospital on the day of their scheduled surgery, dosing of insulin for outpatients can be titrated according to blood sugar concentration testing.

2.3.4 Antihypertensive Medications

Preoperative assessment of the maxillofacial surgery patient must include queries about hemodynamic status, presence of hypo- or hypertension, use and duration of antihypertensive medications, and duration and evidence of any changes in the diagnosis of the disorder or prescription medications used for treating the disease. Hypertension can be associated with an increased surgical risk ranging from benign perioperative blood pressure fluctuations (stage I (mild) and stage II (moderate) hypertension with systolic <180 mmHg and diastolic <110 mmHg) to a more escalated concern of hyper- and/or hypotension with the potential for progression to myocardial ischemia and stroke in more extreme circumstances [13, 39–42]. However, moderate hypertension could also be associated with pathophysiology of organ injury and predispose patients to dangerously high pressures during the intraoperative period. Such patients would benefit from enhanced at-home therapy, and these individuals may also require intervention and treatment on the morning of surgery. Medical intervention/treatment and possibility of delaying elective maxillofacial surgery should be seriously considered for the patient presenting with stage III hypertension (severe, systolic >180 mmHg or diastolic >110 mmHg) in order to permit medical therapy [13, 40, 43, 44] as the ACC/AHA guidelines recommend that such blood pressure be "controlled" before surgery [13].

Hypertensive patients can also present with left ventricular hypertrophy (associated with increased afterload from persistent vasoconstriction), coronary artery disease, poor exercise tolerance, chronic renal insufficiency and hypovolemia, and/or history of cerebrovascular disease (i.e., transient ischemic attaches). When end-organ disease/damage is suspected, an electrocardiogram and serum creatinine measurement should be obtained [38]. History of difficult and/or poorly controlled hypertension should alert the practitioner to look for evidence of other treatable causes such as: pheochromocytoma, hyperthyroidism, increased intracranial pressure, coarctation, hyperadrenalism, renal disease, renal artery stenosis, acromegaly, hypercalcemia, and extreme anxiety.

Maxillofacial surgery patients should be maintained on most of their antihypertensive medications, especially beta-blockers, up to and including the morning of surgery [13, 38]. Withdrawal of beta-blocker antihypertensive medications, like many other antihypertensive agents, could result in a perioperative situation associated with “rebound” hypertension and tachycardia [41]. However, there are certain classes of hypertensive medication that should be routinely withheld unless preoperative consultant recommendations indicate that such agents should be continued to avoid patient compromise or harm. These classes of antihypertensive drugs that should be withheld on the day of surgery include:

1. Diuretic medications (unless they are vital to the management of congestive heart failure or continued treatment is necessary due to fluid and electrolyte disturbances) to avoid hemodynamic compromise, intravascular volume depletion, and excessive bladder filling during surgery
2. Angiotensin converting enzyme (ACE) inhibitors
3. Angiotensin receptor blockers (ARBs) unless continuation is vital to the prevention of severe hypertension or administration is necessary to reduce afterload in a failing heart [44]

Therefore, it is recommended to withhold these antihypertensive medications on the day of surgery since continuing them can result in significant intraoperative hypotension and hypovolemia that can become even more pronounced with perioperative blood or fluid losses and general anesthesia [44, 45].

2.3.5 Antithrombotic Medications

Tables 2.3 and 2.4 provide information related to both the classes (Table 2.3) in addition to preoperative guidelines (Table 2.4) for the surgical patient who is taking coagulation-altering medications. There are several other sources and data-based protocols that can be used to help instruct and guide the surgeon when dealing with those patients taking coagulation-altering medications [46–52]. The perioperative care team needs to have a general understanding of information within these guidelines in order to more properly instruct the maxillofacial surgery patient related to how to best manage these agents preoperatively and to determine if, and when, to withhold medications with antiplatelet and anticoagulant effects.

Table 2.3 Classes of hemostasis-altering medications

Herbal medications [53] • Garlic • Ginkgo • Ginseng
Antiplatelet medications • Aspirin (ASA) • Nonsteroidal anti-inflammatory drugs (NSAIDs) • Thienopyridine derivatives (ticlopidine, clopidogrel) • Platelet glycoprotein IIb/IIIa inhibitors (GPIIb/IIIa receptor antagonists)
Unfractionated heparin (UFH) intravenous and subcutaneous
Low-molecular-weight heparin (LMWH)
Vitamin K antagonists: warfarin
Thrombin (factor IIa) inhibitors • Desirudin • Lepirudin • Bivalirudin • Argatroban
Factor Xa inhibitors • Fondaparinux • Rivaroxaban • Apixaban • Edoxaban
Thrombolytic and fibrinolysis medications • Tissue plasminogen activator (tPA) • Streptokinase • Urokinase • Anistreplase

Table 2.4 General guidelines for drugs that influence platelet function and coagulation

Drugs	Typical guidelines for withholding	Comments
• Aspirin or aspirin-containing products (effect lasts 7–10 days, duration of the platelet)	• Up to 10 days prior to surgery	• Aspirin as an analgesic or other nonspecific reasons • Decision by surgeon, anesthesiologist, primary care physician, and/or cardiologist based on risks/benefits [54] • At times, continued for those with cardiac (CABG), carotid, and pacemaker surgery (unless otherwise indicated)
• Nonsteroidal anti-inflammatory drugs (NSAIDs) • Cyclooxygenase inhibitors (COX-2 inhibitors)	• Up to 5 days prior to surgery • Up to 5 days prior to surgery	• PCP or surgeon should determine if patient can tolerate discontinuance (e.g., may lead to flare-up of arthritis?) • Many surgeons elect to maintain patients on cyclooxygenase type 2 inhibitors, in that they do not appear to affect platelet function [55–57]
Clopidogrel (Plavix) Ticlopidine (Ticlid)	• Up to 7–10 days prior to surgery • Up to 10–14 days prior to surgery (the actual risk of spinal hematoma with ticlopidine and clopidogrel is unknown)	• Often discontinued even if aspirin continued • Patients who have had recent percutaneous coronary intervention may require antiplatelet therapy with clopidogrel or ticlopidine for several weeks [58–62] • Consult and follow instructions provided by internist, cardiologist, or cardiac surgeon in context of perioperative risk with respect to surgical bleeding or stent thrombosis • Platelet transfusion (possibly methylprednisolone) may reverse effects of thienopyridines
Dipyridamole (Persantine) GPIIb/IIIa inhibitors (profound effect on platelet aggregation)	• Discontinue use 1 day prior to surgery • GP IIb/IIIa antagonists are discontinued within 4 weeks of surgery (the actual risk of spinal hematoma with the GP IIb/IIIa antagonists is unknown)	• Consult and follow instructions provided by internist, cardiologist, or cardiac surgeon in context of perioperative risk with respect to surgical bleeding or thrombotic event [63, 64] • Time to normal platelet aggregation is 24–48 h for abciximab and 4–8 h for eptifibatide and tirofiban • Patients of recent percutaneous coronary intervention may require antiplatelet therapy for several weeks
Anticoagulants		
Coumadin [65–70]	• Up to 4–5 days prior to surgery	• If surgery is minimally invasive, may not need to return prothrombin time to baseline • If anticoagulation is critical, add low-molecular-weight heparin or IV/SQ heparin after Coumadin stopped • Check INR or prothrombin time to confirm return of normal coagulation
Low-molecular-weight heparin (e.g., enoxaparin (Lovenox)) [71–73]	• Discontinue use 12 h prior to surgery	• May replace Coumadin preoperatively because of its short half-life • Increased risk of bleeding if given in combination with other agents

Table 2.4 (continued)

Drugs	Typical guidelines for withholding	Comments
IV/SQ heparin (therapeutic and full- or low-dose and prophylactic standard heparin)	• Discontinue use 2–4 h (IV) and 4–6 h (SQ) prior to surgery	• Increased risk of bleeding if given in combination with other agents
Thrombotic agents (e.g., streptokinase, tPA)	• Discontinue use 1–2 days prior to surgery	
Fondaparinux 2.5 mg SC QD	4 days	With a shared assessment, a 2 half-life interval discontinuation may be considered in low-risk maxillofacial surgery
Dabigatran	4–5 days (normal renal function) 6 days (impaired renal function)	With a shared assessment, a 2 half-life interval discontinuation may be considered in low-risk maxillofacial surgery
Rivaroxaban	3 days	With a shared assessment, a 2 half-life interval discontinuations may be considered in low-risk maxillofacial surgery
Apixaban	3–5 days	With a shared assessment, a 2 half-life interval discontinuations may be considered in low-risk maxillofacial surgery

2.4 Perioperative Surgical Home as a Model for Preoperative Assessment of the Maxillofacial Surgery Patient

Healthcare in the United States has been a subject of national debate and is facing continued concerns toward the quality, scope, quantity, and cost of delivering care. Solutions for the most optimal answers are complex and multifactorial, but perioperative care, especially providing an ideal means of preoperative surgical assessment, is one dilemma to improve upon and to provide added value toward healthcare in the United States. An ideal preoperative surgical assessment, structured as a component of the current perioperative system, is one way to better (1) manage the increasing costs of delivery of surgical care, (2) focus on reducing perioperative complications, (3) minimize longer than necessary lengths of hospital stays, and (4) eliminate or reduce excess readmission rates [74–76].

The Perioperative Surgical Home (PSH) is a practice model being proposed as a potential solution to the current fragmented perioperative system. The PSH is defined as "a patient-centered and physician-led multidisciplinary and team-based system of coordinated care that guides the patient throughout the entire surgical experience" (as stated by the American Society of Anesthesiologists) [76, 77]. Goals of the PSH is to provide improved clinical outcomes with better perioperative service (inclusive of optimal preoperative assessment) with the purpose to achieve these goals and establish benefits for all users of the service (patients, surgeons, hospital administrators, etc.) from this practice model.

Concept of the PSH model and context of the preoperative surgical assessment aim to reduce the variability in perioperative care given that variability increases the likelihood for errors and/or complications. Variability could be reduced through assuring continuity of care and treating the entire perioperative episode of care as a "continuum" rather than discrete episodes (i.e., preoperative, intraoperative, postoperative, and post-discharge). Such an endeavor can be accomplished by having one team responsible for managing all aspects of the continuum from the time that the patient and the surgeon make the decision for surgery until a predetermined number of days post-discharge. During the surgical encounter, goals of the PSH are to ensure that the best evidence and best practices are applied and utilized in a consistent and standardized way for all patients scheduled for surgery. If such a paradigm does not exist or is not clear, then the PSH team should develop an agreement to establish standardization for that particular practice model that can then be applied to all patients. Localized systems and policies remain important in decision-making; for example, at each step of the continuum from the decision to undergo maxillofacial surgery until a predetermined number of days after surgery, patients will be informed, educated, and involved in decision-making and treatment planning. By applying these types of concepts, a unique opportunity exists to improve outcomes and decrease the length of stay and other metrics to improve surgical experiences and patient satisfaction.

There are major differences between the current structure of perioperative care and the future patient-focused system under a PSH model. Briefly, patient-centered care and shared decision-making would replace the present physician-centered care under the PSH model. PSH model considers preferences and values of the patient in all healthcare decisions that are often found to be associated with better outcomes, decreased utilization of expensive preoperative tests and procedures, and decreased "routine" use of preoperative specialty consultation [78]. Patient expectation management, including standardized protocol-driven preoperative health and risk assessment, preoperative optimization of underlying medical conditions, perioperative standardized anesthesia/nursing/surgical protocols, strategies for fluid management, and discharge planning (enhanced recovery after surgery), is determined in advance through the PSH pathway. Multimodal analgesia, a targeted postoperative recovery plan, early ambulation, nutrition management, rescue protocols from perioperative complications, and smooth transition of care to an appropriate discharge setting are all part of a PSH pathway. An important aspect and aim of the PSH is not to replace the surgeon's role in the perioperative period, but rather to assure adherence to mutually agreed upon pre-, peri-, and post-recovery protocols and to better manage any medical issues that arise during each episode of surgical care.

2.5 Preoperative Optimization of the Maxillofacial Surgery Patient

Preoperative consultation with critical care team consultants is sometimes necessary for the care of selected high-risk maxillofacial surgery patients [35, 74]. Such preoperative planning provides an opportunity to optimize a high-risk patient's preoperative condition, obtain necessary baseline presurgical laboratory screening values, and improve planning for any potential postoperative medical requirements [79]. However, such preoperative interventions can be costly and are not always effective, and any mild improvement in physiological indices does not necessarily translate into improved clinical outcomes. Therefore, for those maxillofacial surgery patients whose preoperative physiologic parameters are not severely deranged, routine preoperative optimization in the critical care setting is not well established and frequently adds nothing that could not otherwise be achieved with careful preoperative screening and management performed in a PAT center along with the patient's primary care physician preoperative evaluation and adequate perioperative preparation and instruction by the maxillofacial surgeon. As an example, it has been suggested that postoperative morbidity in the patient with ischemic heart disease is reduced with preoperative optimization (i.e., guided by a pulmonary artery catheter) [80]. This may be important for the patient with significant left ventricular dysfunction or enable one to increase cardiac performance in the compromised patient, but according to the classification of evidence used by the ACC/AHA guidelines (2002 and 2008), there is no conclusive evidence that it is useful or effective in noncardiac surgery [81].

Goals for an optimal preoperative assessment would be to decrease the number of unnecessary tests and screening procedures, reduce the need for intraoperative blood transfusions, avoid extending the length of time in the hospital following surgery, improve upon a patient's pain management experience, enhance communication with consulting physicians (when necessary) and surgeon, and optimize surgical outcomes with heightened patient satisfaction. There is an evolving concept of more rigorously coordinating and integrating preoperative assessment during perioperative management, referred to as the PSH, that has parallels to the advantageous concept of a patient-centered medical home. This model shares a vision of improved clinical outcomes, reductions in cost of care, patient engagement throughout the surgical care plan, and improved surgical care coordination between all players of the healthcare team. The literature reports consistent and significant positive findings related to the PSH initiatives and guidelines.

Conclusion

An optimal perioperative management plan for the maxillofacial surgery patient may have the greatest impact on preparing patients for surgery and ensuring their safe and effective transition to home or other designated facilities (i.e., postoperative rehabilitation). Optimization and enhancement of care should continue to focus on comparison of improved outcomes from changing policies and practices to research focused on the discovery of innovative preoperative practice models, improving information technology, and contributing to the implementation and evolution of evidenced-based practice principles through physician leadership and redesign of pre- and perioperative processes.

References

1. Kehlet H. Multimodal strategies to improve surgical outcome. Am J Surg. 2002;183(6):630–41.
2. Williams FM, Bergin JD. Cardiac screening before noncardiac surgery. Surg Clin North Am. 2009;89(4):747–62.
3. Cecconi M, Corredor C, Arulkumaran N, et al. Clinical review: goal-directed therapy-what is the evidence in surgical patients? The effect on different risk groups. Crit Care. 2013;17(2):209.
4. Kern JW, Shoemaker WC. Meta-analysis of hemodynamic optimization in high-risk patients. Crit Care Med. 2002;30:1686–92.
5. Fisher SP. Cost-effective preoperative evaluation and testing. Chest. 1999;115(suppl):96–100.
6. Katz RI, Dexter F, Rosenfeld K, et al. Survey study of anesthesiologists' and surgeons' ordering of unnecessary preoperative laboratory tests. Anesth Analg. 2011;112(1):207–12.
7. Czoski-Murray C, Lloyd Jones M, McCabe C, et al. What is the value of routinely testing full blood count, electrolytes and urea, and pulmonary function tests before elective surgery in patients with no apparent clinical indication and in subgroups of patients with common comorbidities: a systematic review of the clinical and cost-effective literature. Health Technol Assess. 2012;16(50):i–xvi, 1–159.
8. Main C, Moxham T, Wyatt JC, Kay J, Anderson R, Stein K. Computerised decision support systems in order communication for diagnostic, screening or monitoring test ordering: systematic reviews of the effects and cost-effectiveness of systems. Health Technol Assess. 2010;14(48):1–227.
9. Michota FA Jr. The preoperative evaluation and use of laboratory testing. Cleve Clin J Med. 2006;73(Suppl 1):S4–7.
10. Dexter F, Maxbauer T, Stout C, et al. Relative influence on total cancelled operating room time from patients who are inpatients or outpatients preoperatively. Anesth Analg. 2014;118(5):1072–80.
11. Lemmens LC, Kerkkamp HE, van Klei WA, et al. Implementation of outpatient preoperative evaluation clinics: facilitating and limiting factors. Br J Anaesth. 2008;100(5):645–51.
12. van Klei WA, Moons KG, Rutten CL, et al. The effect of outpatient preoperative evaluation of hospital inpatients on cancellation of surgery and length of hospital stay. Anesth Analg. 2002;94(3):644–9.
13. Fleisher LA, Beckman JA, et al. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery)., American Society of Echocardiography., American Society of Nuclear Cardiology., Heart Rhythm Society., Society of Cardiovascular Anesthesiologists., Society for Cardiovascular Angiography and Interventions., Society for Vascular Medicine and Biology., Society for Vascular Surgery. Anesth Analg. 2008;106(3):685–712.
14. Hopkins TJ, Raghunathan K, Barbeito A, et al. Associations between ASA physical status and postoperative mortality at 48 h: a contemporary dataset analysis compared to a historical cohort. Perioper Med (Lond). 2016;5:29.
15. Owens WD. American Society of Anesthesiologist physical classification system is not a risk classification system. Anesthesiology. 2001;94(2):378.