Textbook of Oral and Maxillofacial Surgery

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Chapter 27

Care of the hospitalized oral surgery patient

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Peoperative Management

Need, real or imagined, causes the patient to seek care; a working relationship between the patient and the surgeon thus begins. Meyer summarized the basic requirements of this relationship as trust and communication.

Evaluation and selection of patient for surgery. The dynamic emotional tension associated with the oral cavity exceeds that of any other body orifice. Thus the oral surgeon may, even with a most innocuous examination, represent a threat of varying significance to the patient.

It is the responsibility of the surgeon to decide if an operative procedure is justifiable when both the need and the expected results of surgery are considered, and the patients should be advised accordingly. The parents or guardians of the patient who is a minor must be informed also.

An example of a consent form is shown. This facsimile is provided *only* to give a general format. The practitioner should use a form provided by the institution in which he or she works or one drawn up by legal counsel based on the concepts of informed consent in the state in which the procedure is to be performed. An operative permit should be used in the office as well as the hospital. The form should be signed in the presence of an adult witness, that is, the nurse or assistant, not the surgeon. It is desirable for the witness to be present during the discussion of the risks involved. After the signatures are attached the surgeon should again ask the patient or responsible party or both if there are any question about the consent, procedural risks, expected results, or consequences if the operation is not done. A written notation should then be entered on the chart that the risks of the procedure were generally discussed with the patient and others (parents, wife, husband, guardian) and no guarantee of results was implied or given.

The motivations of the disgruntled or litigious patient are complicated by legal advisors, the quest for monetary gain, and the third party intervention of insurance companies. This intervention intimidates the physician-patient relationship directly - it is "the soil on which lawsuits are grown". The surgeon should proceed with caution in evaluating the patient who has one or a combination of the following conditions or dispositions:

1. Multiple surgical experiences interspersed with disabling medical illness or multiple procedures on one organ system.

2. Multiple complaints out of proportion and not related to clinical findings.

3. More concern for improving appearance, real or imagined, than for correcting functional impairment.

4. A history of using multiple medications, particularly sedatives, tranquilizers, and mood elevators.

5. A domineering family or friends who are coercing the patient into having the procedure.

6. Nervous disorders and symptoms of anxiety and depression.

7. Intense urgency - a patient who cannot waiit to have the procedure done.

8. Obsessive distrust in a demanding patient who asks detailed and meticulous questions about techniques.

9. Excessive secrecy, particularly in patients who avoid answers to direct or indirect questioning by the surgeon.

10. Indecision (the surgeon should not urge the operation to solve the indecision).

The question "What results do you expect from this operation?" and "Why do *you* want this operation?" should be directed to the patient. The answers to these questions are often revealing. Evaluation of the patient in regards to his or her manifestations of being a positive or negative reactor may be helpful in predicting the response to the procedure.

Patients who appear to be emotionally unstable should have psychiatric consultation before proceeding with elective surgery. "When a surgical procedure is indicated as a result of a threat to the patient's life, a disturbed mental state in the patient is not considered a contraindication to surgery".

Preparation of patient for surgery. High regard for the feelings of the sick person is of utmost importance in the preparation of the patient for a surgical procedure. The surgeon must tread the narrow line between providing enough information to achieve an informed consent and giving information that may cause undue alarm; this responsibility draws deeply on the attending surgeon's wisdom and ability to communicate. A discussion of the risks involved, the anticipated yet not guaranteed outcome, and possible or probable complications of the proposed treatment as well as likely consequences of not treating the condition must be discussed with the patient or the responsible party or both, preferably in the presence of a member of the office staff or hospital staff. Duly warranted notations should bemade on the patient's chart or office record. Even in emergency situations, consideration should be given to these matters.

Questions related to the type of anesthesia to be used, the method of administering the anesthetic, and the need for a preoperative medical evaluation and laboratory evaluation should be discussed with the patient and the responsible party before admission whenever

possible. Assurance that general anesthesia will keep the patient asleep throughout the surgical procedure, as well as a statement that preoperative enemas are not generally used for oral surgery preparation, will perform a great service in calming the stormy preoperative sea.

Review of past and present medical problems. There is no substitute for the physician's knowledge of the patient. The physician and attendants are required, morally and legally, to be sufficiently acquainted with the physical and emotional status of the patient to be alerted to potentially complicating circumstances. An adequate medical history must be obtained from the paitent or some responsible individual. When possible, this may be obtained by having the patient complete a written questionnaire. The patient's or responsible party's signature should be affixed to such a questionnaire with specific acknowledgment that he has read and completed the form. An example of a medical questionnaire is shown. When time permits, more deatiled computerized medical histories often are useful in screening out pertinent from less important information in the medical history. Most computerized questionnaires direct the physician's attention to the areas for which a more detailed medical history is desired. The following questions are considered to be pertinent to a preoperative medical history.

1. Have you ever had a reaction to any specific drug or food?

2. Have you ever had a major allergy such as asthma, hay fever, eczema, or hives?

3. Are you now, or have you recently been, under the care of a physician? (If the answer is "yes", a brief call to that physician is indicated.)

4. Are you now taking *any* type of medication or have you recently completed a course of medication? (Specific questions should be directed toward the prior usage of adrenocortical hormones, tranquilizers, sedatives, anticoagulants, antimetabolites, and x-ray therapy. Again, it is extremely important that the patient understand why the surgeon is interested in this information, and the questions should be versed in a language that is comprehensible to the patient.)

5. Do you limit your physical activities for any reason? Do you avoid climbing stairs? Are you bothered by shortness of breath or chest pain on exertion?

6. Have you ever had a nervous breakdown?

7. Are you pregnant?

Because of the increasing number of surgical procedures performed on older persons, the trend toward more extensive surgical operations, and the increasing amount of surgical care required for trauma and other emergency surgical problems, every surgeon has an increasing responsibility for the proper evaluation of the patient's preoperative pulmonary status. Elective operations in persons with active sinusitis, tonsillitis, acute bronchitis, or a cold should be postponed until the infection has been cleared for 1 to 2 weeks. Cigarette smoking is the most common cause of simple bronchitis, and "anyone who smokes in excess of 20 cigarettes per day can be assumed to have abnormal pulmonary function".

The following positive findings in the preoperative history may be clues to postoperative ventilatory problems: (1) childhood respiratory infections, (2) pneumonia or pleurisy before the discovery of antibiotics, (3) brnochitis often associated with cigarette

smoking, (4) the presence of morning sputum, (5) old chest injuries, (6) current physical activity, and (7) asthma. Preoperative thoracic roentgenograms frequenly are valuable. However, it must be remembered that x-ray films are not pulmonary function tests but only static photographs of the lung parenchyma and thoracic structures.

Preoperative cardiovascular evaluation is aided greatly by an accurate history in that good exercise tolerance is indicative of a good cardiovascular reserve. A history of orthopnea, paroxysmal nocturnal dyspnea, angina, or dyspnea on mild exertion suggests serious heart disease. Evidence of fluid retention, increased venous pressure, and hepatomegaly indicate low cardiac reserve, and elective surgery should be avoided in those cases. The thoracic roentgenogram is useful in determining cardiac size, and the ECG provides indirect data.

An accurate drug history must be part of the routine history on hospital admission for any reason. If there is any doubt about drug dependence, the patient should be placed on a maintenance dosage of whatever drug he has become habituated to so that postoperative grand mal seizures may be prevented. Abrupt withdrawal in a patient physiologically addicted to barbiturates or nonbarbiturate sedatives such as meprobamate (Miltown, Equanil), glutethimide (Doriden), methyprylon (Noludar), ethchlorvynol (Placidyl), chlordiazepoxide hydrochloride (Librium), diazepam (Valium), and ethinamate (Valmid) can produce delirium or convulsions or both. The phenothiazines are not thought to produce physiological addiction and can usually be stopped abruptly without producing delirium or convulsions, according to Hastings.

The ability of tissue to heal is controlled by many factors, one of the more important being the nutritional status of the patient. Knowledge of the preoperative nutritional condition of the patient is important for this reason. The surgical patient should be maintained or restored to a nutritional balance during all phases of diagnosis, therapy, and convalescence. In the healthy oral surgical patient, an uncomplicated parenteral or oral program or both of alimentation that will maintain adequate circulatory volume, prevent dehydration or electrolyte imbalance, and spare breakdown of body protein often is all that is needed to achieve nutritional balance. This program can be supplied by appropriate amounts of water, glucose, salt, and potassium if parenteral alimentation is indicated. Intravenous administration of 5% dextrose (0.25% saline) solutions within the daily fluid volume tolerance (2.500 to 3.000 mL in the average healthy adult) will supply approximately one third of the caloric requirements (500 to 600 calories) of an average, healthy, resting, afebrile adult. The patient's remaining energy needs are supplied by catabolism of stored glycogen, fat, and protein. Fever, trauma, infection, or need for extensive tissue repair may increase caloric needs as much as fivefold. More careful planning and hyperalimentation is required for the patient who, in the preoperative state, is severely debilitated by chronic disease or malnutrition or who is unwilling or unable to eat properly because of trauma, sepsis, or surgical complications. The need for a vitamin supplement should not be overlooked, and it can be supplied orally or parenterally by any of the several commercial preparations available. In a patient with liver dysfunction or who is taking broad-spectrum antibiotics, vitamin K should be administered to reduce the chance of hypoprothrombinemia. For this reason the adolescent who has been on tetracycline for months or years for control of acne vulgaris may tend to develop more ecchymoses and have poor clot formation when elective surgery is done.

The oral surgery patient requiring a long-term liquid diet can combine imagination with a food blender and maintain an adequate nutritional balance. The new, chemically formulated, bulk-free elemental diets (Vivonex H-N, Codelid 62H) provide nutritional support, although they are somewhat expensive. Patients objecting to the taste of the elemental diet can be fed through a small-gauge, nasogastric feeding tube (No 8 French transnasal

intragastric infant size). When there is intestinal function, this form of hyperalimentation is preferred over parenteral hyperalimentation administered through a subclavian vein catheter into the venae cava.

Preoperative laboratory workup. A complete blood count that includes an evaluation of the hemoglobin and hematocrit indices, a total white blood cell count with a differential count, and an assessment of the circulating platelets, as well as a gross and microscopic urinalysis, should be routine in the preoperative laboratory workup. A carefully recorded history and physical examination usually will direct attention to the presence of any bleeding disorder severe enough to be of consequence. In the event of such a disorder, a hematological consultation can be requested. A partial thromboplastin time (PTT) test and an assessment of the number of circulating platelets are frequently used indices in the preoperative screening for hemorrhagic tendencies. The SMA-12/60 (Sequential Multiple Analyzer) screening battery is processed preoperatively in many progressive hospitals. (It should be done on a fasting blood sample.) Allowable deviations above the normal range, such as an elevated alkaline phosphatase level in growing children, are to be expected and should not cause undue concern.

Preoperative orders. Whenever possible, telephone orders should be avoided. Written or typed orders should be sent with the patient at this admission to the hospital. There are obvious practical and medicolegal implications for this suggestion. Some hospital services are not permitted to accept orders given over the telephone. Typical preoperative orders generally include the following items:

1. *Admitting diagnosis.* Most hospitals require that this be placed on the patient's chart within 24 hours after admission and assume that this is a working diagnosis that may be modified or changed completely by the time of discharge.

2. *Dietary orders.* These should be specific, according to the dietary requirements indicated (for example, nothing by mouth, low salt, mechanical soft, 2.500-calorie high-protein, surgical liquids).

3. *Physical restrictions.* Specificity is desirable (for example, bed rest, ambulatory, bathroom privileges, head elevated, bed rest with bedside commode).

4. *Laboratory requests and special tests.* There should be a specific reason for ordering each of these tests. Many tests performed on one patient are uncomfortable and expensive for the patient. This is a double-edged philosophy, however; it should be remembered that failure to order necessary and indicated laboratory tests simply out of deference to the patient's pocketbook and comfort is not a satisfactory defense before a lay jury.

"Routine lab" in most hospitals usually indicates a complete blood count, gross and microscopic urinalysis, and serology. "Special lab" includes certain definitive testing procedures or perhaps the SMA-12/60 screening battery or other chemistries. Special hematological tests pertaining to clotting factors usually are ordered under this designation. In this scientific age, physicians need to be reminded that a laboratory test is not a diagnosis. The latter is a judgment based on the patient's history and the results of the physical and epidemiologic examinations. Laboratory tests merely confirm the judgment. If the need for blood is anticipated after such tests have been performed, a type and crossmatch for the desired volume or units is requested.

5. *X-ray requests.* Specificity in ordering the roentgenographic studies and certainty that the radiologist has sufficient clinical information about the patient or his problem is of utmost importance so that an enlightened radiographic diagnosis may be attained.

6. *Medications.* The appropriate use of antibiotics can reduce the incidence of infection and postoperative morbidity in many oral surgical procedures such as impacted third molars, osteotomies, cystectomies, apicoectomies, bone grafts, and others. The need for prophylactic use of antibiotics in the patient with valvular heart disease, with or without a valve prosthesis, has been recommended by the American Heart Association. At the present time, oral or parenteral penicillin therapy or both appears to be the prophylactic method of choice. Some authorities, however, believe that a broader spectrum coverage is indicated to protect the invidual from some of the gram-negative and penicillin-resistant organisms that have been cultured from patients with bacterial endocarditis.

The judicious use of appropriate amounts of glucocorticoids to suppress the inflammatory responses of pain and edema after trauma to the head and neck region, iatrogenic or otherwise, is practical in oral surgery. The antipyretic effect of glucocorticoids reduces the diagnostic usefulness of fever as a sign of infection. Massive doses of corticosteroids to reduce cerebral edema secondary to closed head injuries as well as in the shock-lung syndrome and in gram-negative septicemias is not accepted and well documented. Broad-spectrum antibiotic coverage is used in conjunction with this therapy. When surgery involves the removal of impacted third molars, especially if the inferior alveolar neurovascular bundle is involved, the preoperative and immediate postoperative use of corticosteroids and broad-spectrum antibiotics is justified. Corticosteroids are also useful for the reduction of edema and for postoperative discomfort in the surgical correction of jaw deformities. Absolute contraindications for this course of medication are tuberculosis (active or healed), ocular herpes simplex, and acute psychosis. Relative contraindications are diverticulitis, active or latent peptic ulcer, fresh intestinal anastomosis, renal insufficiency, hypertension, thromboembolic tendencies, osteoporosis, diabetes mellitus, acute and chronic infections including fungus and viral diseases (chicken pox), myasthenia gravis, and others.

7. *Sedative drugs.* Drug to be given the night before surgery should be chosen with care, following an adequate drug history of the patient. Maintenance doses of the sedatives must be used in patients with a heavy drug use history, and barbiturates should be avoided in the very young and the elderly. Cooperation with the hospital's department of anesthesia in prescribing these drugs is beneficial to all concerned.

8. *Special orders.* The administration of intranasal vasoconstrictor agents such as 0.25% phenylephrine hydrochloride (Neo-Synephrine) in the form of nose gels or sprays immediately prior to removing the patient to the operating room is frequently desirableif endotracheal intubation is planned. This maneuver will facilitate respiration through the nose during an oral surgical procedure performed while the patient is under local anesthesia.

Antiembolism stockings may be advisable for the elderly, for women taking oral contraceptives, or for any patient with a history of recent pelvic surgery, deep vein thrombosis, or thrombophlebitis of the lower extremities. These individuals may have their venous flow impeded by bed rest, lengthy operations, or prolonged immobility.

Female patients should be asked to remove all eye makeup before retiring the preceding night.

Complications and Preventive Measures

Skin and nerve injury. Pressure points on the body, especially on heels, elbows, and hands, must be avoided at the risk of peripheral nerve injury and stasis damage to the skin.

Bacteremia. Complete sterilization of the skin or oral cavity cannot be accomplished. However, the bacterial count can be reduced significantly. Shaving of hair-bearing skin should be done as near to the time of surgery as possible to prevent bacterial colonization of the unavoidable abrasions caused by shaving. Subsequently the operative site can be cleansed vigorously with a suitable detergent. At the present time the iodophors or povidone-iodine preparations are popular for cleansing. Scopp demonstrated in a double-blind study that the povidone-iodine mouthwash reduced bacteremia during exodontics. Of patients treated with the iodine preparation, 28% had bacteremia as compared to 56% of the group receiving placebos. The properly performed intraoral preparation supplemented with appropriate prophylactic antibiotics for patients susceptible to endocarditis is recommended highly. The routine preoperative preparation of the oral cavity, with either a suitable mouthwash for the patient under local anesthesia or with a physical scrubbing and application of one of the iodophors for patients under general anesthesia, is to be highly recommended prior to the extraction of teeth and other intraoral surgical procedures.

Eye protection. Prior to draping, with the patient under general anesthesia, the eyelids should be closed carefully so that no eyelashes are turned under, and the lids should be taped shut with paper tape to protect the cornea and the sclera. The eyes are then covered with sterile ophthalmic pads or some form of metallic eye shields such as the Fox eye shield that is taped from the supraorbital rim to malar eminence. Methylcellulose (artificial tears or Liqui-film) drops or an ophthalmic ointment of low allergenicity may be placed in the conjunctival fold as an additional measure. It is important that female patients be requested to remove all eye makeup the evening prior to surgery.

Pharyngeal protection. After the patient has been anesthetized and intubated either nasoendotracheally or oroendotracheally or if the anesthesia is being administered through tracheostomy tube, it is desirable to insert some form of moistened sterile gauze pack into the oropharynx to screen it from the oral cavity. Most endotracheal tubes are cuffed so that they will prevent the passage of blood, water, or other secretions into the trachea around the endotracheal tube. For various reasons, however, the cuff may not provide a complete seal. During lengthy procedures, it is wise to deflate the cuff periodically to prevent possible pressure against the tracheal mucosa. The pack should be placed carefully and gently so that unnecessary irritation to the oral and pharyngeal mucosa is avoided. The pack so placed functions as a protective screen, preventing foreign bodies from passing into the pharynx.

Lip protection. In preparation for an intraoral procedure, the lips and oral commissure should be anointed thoroughly with a water-soluble cream, preferably containing one of the corticosteroid agents, to reduce postoperative cheilitis. Petroleum lubricants such as petrolatum (Vaseline) and others are not as satisfactory as the suggested creams because the petroleum base material tends to macerate the skin. Repeated usage of the corticosteroid creams throughout the procedure markedly reduces the incidence of pressure necrosis and cheilitis after oral surgery. This is particularly useful in the patient with dermatographia.

Malignant hyperthermia. Malignant hyperthermia is a serious operative complication and the surgeon must be watchful of it. This complication is described as a syndrome of rapid increase in temperature while the patient is under anaesthesia. It occurs usually in apparently

healthy children and young adults with an average age of 21 years. There is no sex differential. The syndrome reportedly may follow a familial pattern, indicating a nonsex-linked autosomal dominance. Metabolic causes are believed to be related to the uncoupling of oxidative phosphorylation. Other theories suggest that there is an aberrance in hypothalamic control or that it may be related to a latent or known myotonia, which produces a muscular rigidity subsequent to the administration of succinylcholine. Other causes for the elevation of temperature may be one of the following: (1) loss of cooling mechanisms by radiation, evaporation, conduction, or convection; (2) infection; (3) dehydration; (4) allergic reactions; (5) belladonna derivatives; (6) shivering; and (7) endocrine mechanisms such as thyrotoxicosis or pheochromocytoma. The clinical picture generally develops approximately 2 hours after the anesthesia has started. There is an increased temperature accompanied with flushing and sweating, rising at an approximate rate of 1°F every 10 to 15 minutes. Tachycardia, tachypnea, hypoxia resulting from metabolic uptake, metabolic acidosis (some pHs have been recorded as low as 6.7), a warm soda lime container caused by high cardon dioxide production, hypovolemia caused by extracellular fluid loss, convulsions, sialoadenopathy, disseminated intravascular clotting, myoglobinuria are symptoms associated with this usually fatal syndrome.

The treatment of malignant hyperthermia consists of immediate rapid cooling of the patient. Everything else is incidental unless this is accomplished. This may be done by the following methods:

1. Using water blankets, ice, chilled gastric lavage, iced intravenous solutions of lactated Ringer's solution, and a pump bypass with a cooling system if available.

2. Hyperventilation with 100% oxygen.

3. Correction of acidosis and administration of bicarbonate solution, THAM buffer, or TRIS buffer.

4. Administration of calcium ion.

5. Diuresis to prevent renal failure produced by myoglobinuria.

6. Nondepolarizing muscle relaxants (of questionable effectiveness).

7. Haloperidol to block the uncoupling.

Postoperative Care

One of the most critical periods for the surgical patient is the immediate postoperative phase, covering the period of time from the end of the operation until the time when he regains consciousness. It is during this phase that the danger of aspiration, cardiac arrest, and circulatory or respiratory depression is greatest.

Operating room to recovery room. The best method of removing the patient from the operating table to the recovery room bed generally is by placing him on a roller, thus protecting the patient's and the attendants' vertebral columns. The attending surgeon or the responsible assistant should accompany the patient to the recovery room with a recovery room note made on the patient's chart and written postoperative orders. "Many of the physiological disorders which are easily recognized in the fully awake, non-medicated patient are modified,

abated, or entirely eliminated by residual anesthesia. In the recovery room, this presents major difficulties in recognizing problems such as hypoxia, hypoventilation, and hypovolemia".

Aldrete method (Apgar). A method of scoring patients recovering from the effects of anesthesia, similar to the Apgar evaluation of the newborn infant, has been described by Aldrete. This rating is based on the repeated evaluation of blood pressure, respiration, color, cosciousness, and activity, which are measured every 15 minutes. Unit values of 0 to 2 are given to each of the measured vital signs, thus giving the recovery room personnel more definite guidelines to determine when the patient may safely return to his room or to the intensive care unit, as required. A rating of 10 on this scale indicates that the patient is in the best possible condition. Scores of 8 and 9 are considered safe, but patients given 7 points or less are considered to be in danger.

Recovery room notations. The surgical resident's recovery room note should include a comment regarding the following factors: (1) level of consciousness, (2) pupillary size, (3) airway patency, (4) breathing patterns, (5) pulse rate and volume, (6) skin warmth and color, (7) body temperature, and (8) if the patient is catheterized, a 30 to 50 mL per hour urine output.

Operative notes. The operative notes should describe the operation in specific terms as follows: (1) procedure, (2) surgeon and assistant(s), (3) anesthesia (by type, name, and agents), (4) findings, and (5) estimated blood loss.

Postoperative orders. A review of the patient's known allergies and drug idiosyncrasies should be made; subsequently the orders may be written as follows:

1. Vital signs or "Apgar" rating. These should be evaluated every 15 minutes until stable.

2. Observation of airway for obstruction. Use humidified oxygen by mask, cather or other appliance, if desired. (See section on complications for special orders.) (A P_{O2} of less than 40, PCO_2 greater than 65 with an aterial pH of under 7.25 are absolute indications, in most cases, or the need for respiratory assistance.) A humidified atmosphere provided by a cool mist vaporizer or an ultrasonic vaporizer is desirable. Intermittent positive pressure breathing apparatus with suitable inhalants may be desired to assist in the ventilation of the patient. Some form of acetylcysteine or isoproterenol (Isuprel) may be utilized if indicated, particularly in the treatment of atelectasis or pneumonitis or in the heavy smoker to loosen heavy secretions and thus free them to be brought up spontaneously by coughing.

3. Position. Elevate the head 20 to 30 degrees (bathroom privileges, bedside commode, or bed rest, as indicated).

4. Ice packs or cold compresses to desired areas, if indicated. (The application of bilateral flat ice packs over the sites of osteotomies or third molar extractions, held in place by a 10-cm elastic bandage, is useful in reducing edema and postoperative bleeding.)

5. Parenteral fluid orders. If any are needed, and the type of fluid and volume and rate of the flow (for example, follow present intravenous solution with 1.000 mL 5% dextrose in 0.2% normal saline at 125 mL per hour, intake and output, if indicated, to be recorded). (See section on fluids and electrolytes.)

6. Analgesic. Medication for postoperative pain to be given orally or parenterally, as desired; troche or lozenge if desired for relief of pharyngeal irritation. (This is often useful to reduce postintubation discomfort, and these analgesics frequently contain topical anesthetics; beware of allergies.) The use of potent narcotics to control severe pain should be of short duration and limited to patients with acute distress or those with inoperable cancer who require long-term relief. The use of antidepressant drugs in the pain regimen has been shown to provide increased relief of pain and often allows the dose of narcotic to be reduced or eliminated.

7. Antibiotic. This is usually a continuation of the drug begun prior to or during surgery or may be chemotherapeutic, added later in light of operative findings.

8. Anti-inflammatory drugs. Continuation of glucocorticosteroids that were given preoperatively or intraoperatively may be indicated. (When the procedure has been short and the trauma minimal, 4 mg of dexamethasone given intravenously before or after the induction of anesthesia generally is adequate. If an oral dose of 4.0 mg dexamethasone was begun the evening before surgery, it is frequently continued into the first postoperative day. The use of glucocorticosteroids is beneficial in the infant child or adult as a means of reducing postintubation laryngitis or tracheitis.)

9. Antiemetic. These usually are given parenterally or by suppository as required. (Meticulous hemostasis on intraoral procedures and the avoidance of oral fluids until the patient has completely regained consciousness will often eliminate the need for an antiemetic.) Selected phenothiazines continue to provide the most desirable results.

10. Sedative medications if indicated or desired, depending on the patient's need.

11. Other medications or special orders. (For example, resume Doctor Jones' standing orders regarding the patient's insulin therapy.)

12. Diet orders. If the patient has been hydrated adequately prior to and during surgery and gastrointestinal functioning has resumed after general anesthesia, it is deemed advisable to start the patient on clear liquids or surgical liquids and to progress as tolerated to full liquid or soft diet. These aliments should be delayed until the patient has returned to the full level of consciousness. The best possible diet under the prevailing conditions is essential, that is, a full, nutritious, high-protein diet administered in sufficient amounts to meet the energy requirements of the patient. It is not enough for the surgeon to prescribe a high-protein, high-caloric, high-vitamin diet. Such an order may be a total failure for the following reasons: the diet presented to the patient is not as specified; the diet presented may not be eaten in whole or in part because of anorexia, lack of palatability, or lack of nursing care to encourage eating; the food eaten may be wholly or partially lost because of diarrhea or vomiting. The surgeon should know enough of the details of the fundamental principles of nutrition to apply them and to see that they are properly carried out.

Postoperative rounds. All patients in the postoperative state must be evaluated completely for evidence of complications that may jeopardize or protract recovery.

Progress notes during the postoperative phase should include an evaluation of the following factors:

1. Level of consciousness.

2. Patency of the airway.

3. Evaluation of the patient's cardiopulmonary system.

4. Pulse rate and volume, blood pressure, and body temperature.

5. Skin warmth and color.

6. Intake and output.

7. Condition of the wound.

8. Survey of the nurses' notes (not necessarily in this order but of utmost importance).

9. Specific patient complaints.

Postoperative Complications

Acute ventilatory failure. The supply of oxygen to the various tissue cells is probably the most fragile link between man and his environment. Thus *acute ventilatory failure* is the most urgent of all emergency preoperative or postoperative complications, and common causes are obstructions by secretions, foreign bodies, local trauma, or swelling. Ventilatory failure can be eliminated or bypassed immediately by intubation or tracheostomy. The position of the patient's head and neck may be the subtle cause of a serious obstruction of the upper airway in the unconscious patient. Narcotics and sedatives should be administered with extreme caution in the restless patient until it is certain that the restlessness is not related to cerebral hypoxia rather than pain. The advantages of tracheal intubation, either by endotracheal tube or tracheostomy tube, are obvious when these problems occur. Strict asepsis, particularly in respect to the suction catheter, in any patient with tracheal intubation is absolutely essential. Sterile catheters used by individuals wearing sterile gloves should be mandatory. The sterile, disposable tracheal suction kits help to prevent the entry of pathogenic organisms in the tracheobronchial tree. According to Kinney, tracheal intubation for a period of 4 to 7 days is generally accepted; thus the need for tracheostomy is eliminated in many cases. Emergency tracheostomy has thus become justificable only when tracheal intubation is not possible. A consultation from the respiratory therapy division is highly recommended. Pontoppidian recommends intubation or tracheostomy and ventilation in the adult patient whose respiratory rate is greater than 35 per minute with vital capacity of less than 15 mL per kilogram, respiratory force of less than 25 cm of water, alveolar-arterial oxygen gradient greater than 350 mm Hg, and the ratio of dead space to tidal volume while on mask-administered oxygen therapy greater than 0.6. In the patient recovering from respiratory failure, spontaneous respiration requires the ability to produce minimal vital capacity of 10 mL per kilogram. When the vital capacity exceeds 15 to 20 mL per kilogram and the patient is on spontaneous respirations, the removal of the endotracheal or tracheostomy tube is generally possible. When the alveolar-arterial oxygen gradient is greater than 350 mm Hg, weaning the patient from the mechanical ventilator is not successfully accomplished in most instances.

Aspiration. The *aspiration of gastric contents or blood* at the time of the injury or during the induction or recovery from anesthesia can lead to significant pulmonary problems.

Restlessness to the point of belligerency, tachycardia, tachypnea, and occasionally cyanosis should alert the surgeon to this possibility. Physical examination of the chest, auscultation of the breath sounds, and an upright chest film can be used to confirm the diagnosis almost invariably. By early recognition and prompt removal of foreign material from the tracheobronchial tree, secondary sequelae may be reduced or avoided. The prophylactic use of corticosteroids every 6 hours and significant doses of broad-spectrum antibiotic agents supplemented by adequate ventilation therapy are indicated.

Positive end-expiratory pressure (PEEP) appears to be of benefit in improving oxygenation following gastric acid-pulmonary injury as in other instances of pulmonary insufficiency. However, care must be taken to use the lowest level of PEEP required to achieve adequate oxygenation at an acceptable inspired oxygen level. Increased levels of PEEP have been shown to increase the rate of fluid loss from injured pulmonary capillaries.

Aspiration can be avoided often by ascertaining that the stomach is empty prior to surgery. Intubating the patient in the head down position and maintaining the patient on his side or in a head down position during the period of unsconsciousness will reduce the incidence of aspiration. The use of cuffed endotracheal tubes is recommended, yet the cuff cannot be relied on entirely because it may be improperly infalted or may leak enough air to permit the passage of blood or gastric contents into the trachea.

Laryngeal edema. Another complication is *edema of the airway* after either oral or nasal intubation. This problem is more likely to occur in infants and children because of the peculiar anatomy of the subglottal trachea. The attending surgeon and others responsible for the care of the patient must be on constant alert for evidence of sudden or gradual obstruction of the airway. The judicious use of glucocorticoids, ultrasonic nebulizers with oxygen therapy, and, reintubation or a tracheostomy are measures that must be available in the postoperative armamentarium. Tracheostomy in the infant is an extremely dangerous procedure and is to be avoided whenever possible because of serious long-term complications. Bag and mask or mouth-to-mouth respiration will force air through a laryngospasm in almost every case.

Epistaxis. Bleeding after nasal intubation may be reduced or controlled with preoperative and postoperative nasal vasoconstrictor agents (0.25% phenylephrine solution), elevation of the patient's head, sedation, and, if necessary, judicious and gentle packing of the bleeding site with well-lubricated 1/4- or 1/2-inch (0.7- or 1.2-cm) gauze. Should these measures fail, it may be necessary to insert a posterior nasal pack.

Sore throat. Pharyngitis is not an uncommon complaint after intubation, and the possibility of this uncomfortable situation occurring should be explained to the patient preoperatively. The early use of a cool mist vaporizer or ultrasonic nebulizer, as well as oral troches containing a topical anesthetic agent (if the patient is not allergic to the topical anesthetic), is successful in reducing postoperative complaints of this type. The uncomfortable symptoms usually disappear within 8 to 12 hours after intubation. If they should worsen, the surgeon should be alerted to the possibility of pharyngeal mucosal tears and infection, which subsequently may extend into the pharyngeal spaces or mediastinum.

Nausea and vomiting. The advent of parenterally administered general anesthetic agents has tended to reduce the incidence of *postoperative nausea and vomiting* as a process of normal recovery from general anesthesia. When protracted nausea and vomiting occur in the postoperative period, the usual indication is that something of a more serious nature has occurred. Unrelieved, *acute gastric dilatation* may be lethal within 1 to 2 hours if not

relieved. Tachycardia, prostration, and hypotension often are associated with this remarkably painless problem. The dilated and tympanitic epigastrium extends well up into the left thoracic cavity. Elevation of the left diaphragm and roentgenographic evidence of a large gastric bubble are highly suggestive. Moyer recommends that gastric suction be instituted in any case of protracted nausea and vomiting. After lengthy procedures, insertion of a proper-sized nasogastric tube prior to the cessation o fgeneral anesthesia and extubation is recommended highly. Once the nasogastric tube is inserted, it should be attached to a low-pressure gastric suction machine. This will facilitate the emptying of the stomach of swallowed blood and thereby reduce the chances of vomiting during and immediately after the patient's emergence from general anesthesia. In the absence of intestinal obstruction and electrolyte imbalance, the maintenance of continuous gastric suction should restore the stomach to functional tone within 36 to 48 hours. Because of the usual loss of potassium and sodium salts during surgery, these elements must be replaced along with the proper fluids to restore the body's chemical balance. Other causes of postoperative nausea and vomiting include ileus, cardiac failure, and infections, as well as the countless number of emetic drugs or drugs that have emetic tendencies. The occurrence of projectile vomiting indicates the need for a neurological evaluation for the presence of increased intracranial pressure. If ileus, uremia, gastric atony, and hypokalemia can be eliminated as possible causes of the nausea and vomiting, then use of a suitable phenothiazine for the control of nausea and vomiting may be indicated. The discontinuance of drugs that have been administered for other reasons may be necessary also.

Generally, it is wise to avoid all oral fluids and medications until the patient is reacting well and bowel sounds are present. Until this status has been reached, medications, fluids, and nutriments may be supplied by the parenteral route. When intraoral surgery has been carried out, good hemostasis to prevent ingestion of blood from the surgical wound is needed. Oral medications usually are tolerated more successfully if taken with foods; this dilutes any irritant effect on the gastric mucosa.

Edema. The oral surgery patient may have edema from many causes, the most common being physical trauma, infection, increased venous pressure, and decreased lymphatic flow. Other less likely causes are decreased arterial blood flow, decreased intravascular oncotic pressure, excessive sodium retention, and cardiac failure and immobility. This undesirable postoperative complication may be reduced by maintaining the operating table in such a position that the field of surgery is elevated above the level of the heart, by maintaining good hemostasis through careful handling of tissues, by the judicious administration of corticosteroids preoperatively and postoperatively, and by the elevation, cooling, and compression of the area of surgery during the immediate postoperative period.

Hyperthermia. The most common causes of *postoperative fever* are wound infection, urinary tract infection, pulmonary complications, thrombophlebitis, and increased osmolarity because of lack of water or salt excess.

The use of estrogen-containing oral contraceptives is now accepted as being associated with six to seven times higher risk of venous thromboembolism, a precursor to pulmonary embolism. The intraoperative fall in antithrombin III activity during exodontics in women takin oral contraceptives has been prevented by a small preoperative dose of subcutaneous heparin.

Bacteremia or septicemia caused by acute thrombophlebitis complicating a continuous intravenous infusion has become a prominent cause of "third-day surgical fever". When it is necessary to administer antibiotic or other irritating solutions intravenously, these should be

delivered into the intravenous system by way of a Sol-U-Set type of dilution apparatus rather than by giving the undiluted agent directly into the tubing. The careless use of intravenous catheters is to be criticized, and the tendency to leave them in as long as possible is to be avoided. When possible, the appropriate size scalp vein needle is usually preferred for the administration of parenteral fluids. When continuous intravenous solutions are required over a period of days, a change of the intravenous setup at 24- to 48-hour intervals is recommended with a change in venipuncture site. Routine inspection of the venipuncture site at least every 8 hours is the single most important factor in avoiding the serious sequelae of postinfusion phlebitis. The infusion should be stopped immediately if phlebitis is suspected. More subtle and less common causes of postoperative fever are drug reactions, recurrent malaria, central neurological disturbances, bacterial enterocolitis, and artificial situations such as the heating of the thermometer with hot liquids or a match and taking the temperature after the ingestion of food or soup or after the patient has just completed smoking.

Needless to say, common sense demands that elective surgery be postponed in a patient who is febrile until recovery has been established. This does not mean that surgery has to be postponed when it may represent a crucial diagnostic maneuver to establish the process causing the fever.

An oral body temperature of 100°F (37°C) in the immediate postoperative period or fever that persists for more than 6 hours, according to Allison, must cause a surgeon to consider certain specific problems that often complicate recovery. In an attempt to determine the cause of the postoperative fever, the following useful procedures should begin immediately:

1. The patient's entire clinical status should be carefully appraised with particular reference to the state of hydration, the relationship of the febrile course to any of the medications being used, and the possibility of a hypersensitivity phenomenon having occurred in the patient's past medical history.

2. Examination of the wounds, surgical and otherwise, and cultures if there is suggestive evidence of infection should be performed.

3. Clinical evaluation of the lungs and urinary tract and appropriate studies of the urine and sputum with cultures when indicated should be done. Gram stain examination of the sputum or urine may also be useful.

4. Blood cultures should be obtained whenever there is the slightest suggestion of sepsis, bacteriemia, or peripheral vascular collapse of unexplained cause.

5. Chest radiographs should be taken if pulmonary embolization or infection is suspected. A pulmonary perfusion scan with technetium ^{99m}Tc microspheres is the best screening procedure in suspected cases of pulmonary embolism. An arterial oxygen tension above 90 mm Hg in a patient breathing room air tends to rule out a major pulmonary embolism.

6. Postoperative electrocardiogram, particularly if there has been a preoperative electrocardiographic evaluation, may be useful in localizing the source of the fever.

It should be recalled that fever as a sign of postoperative infection may be absent or markedly depressed if the patient has been placed on corticosteroid drugs.

Hypotension. *Shock* is described by MacLean as "inadequate blood flow to vital organs or failure of the cells of vital organs to utilize oxygen". The precise, expeditious, and successful treatment of shock according to Hardy "depends upon an orderly approach to diagnosis, with recognition of physiologic priorities". Shock in the recovery room or in the postoperative patient may be related to hypoxia, hypercarbia (inadequate ventilation), coronary insufficiency, arrhythmia, or electrolyte imbalance. Other causes may be endotoxic shock, pulmonary embolus, and excessive medication. Miscellaneous causes may be related to drug reactions, transfusion reactions, fat embolism, hepatic failure, and anaphylaxis. According to MacLean, eight measurements should be assayed in the initial assessment and follow-up on all patients in shock:

1. Arterial blood pressure (normal range of adult male, 120/80).

2. Pulse rate (80 per minute).

3. Central venous pressure (5 cm H_2O).

4. Urine flow (50 mL per hour).

5. Cardiac index (3.2 litres per min per m^2).

6. Arterial blood - P_{O2} (100 mm Hg); P_{CO2} (40 mm Hg) and pH (7.4).

7. Arterial blood lactate (12 mg per 100 mL).

8. Hematocrit (35% to 45%).

Fat embolism. The *fat embolization syndrome* occurs when fat appears in the circulating blood in droplets that are large enough to obstruct arteries and capillaries. Fat globules may present in the urine and sputum. Serum lipase and tributyrinase levels rise between the third and seventh posttrauma days. The blood gases are abnormal. The classic case is described as a person who is recovering from an accident involving fractures of the long bones, pelvis, or ribs or from an operation or a person in fine health who becomes short of breath, then febrile and disoriented. Hypertension follows with a small fast pule and oliguria, and finally, the patient becomes comatose. The diagnosis is made certain by the discovery of petechiae over the neck and anterior chest and inner aspects of the thighs. The level of serum lipase is of diagnostic value because the lung parenchyma produces lipase in an attempt to remove the emboli of neutral fat from the lung. The byproducts of this fat hydrolysis are the fatty acids, and these cause serious damage to the pulmonary capillary endothelium and reduce the lung surfactant activity.

Because of his or her position on the trauma team, the oral surgeon may occasionally have need to recognize this entity. Present therapy consists of massive doses of corticosteroids given intravenously for 3 days along with positive pressure ventilation supported by rapid-acting diuretics when indicated. Intravenous heparin, alone or with alcohol, is of doubtful value.

Psychological problems. In the immediate postoperative period, transient *emotional upsets* are not uncommon. They usually become manifest about the third postoperative day as an anxiety or depressive reaction that may produce insomnia, poor appetite, fear, apprehension, and decreased pain threshold. Anxiety in rare cases may progress to a point of

acute depersonalization, causing the patient to make sudden and unpredictable suicidal or assaultive attemps. Most of the postoperative emotional upsets are of a nature that respond to discussion and reassurance by the surgeon as well as discriminating use of sedatives. Often a visit from the dietician or special attention by the nursing service will be of significant help to the patient experiencing this difficult episode.

Hypertension. Occasionally *hypertension* rather than hypotension will be a problem in the postoperative management of the oral surgery patient. If the condition has occurred preoperatively and is of a relatively long-standing duration, the patient probably will be under specific treatment and perhaps a diagnosis is known. A persistent elevation of the diastolic blood pressure above 90 to 95 mm Hg with a corresponding rise of the systolic pressure to 150 to 200 mm Hg is cause for concern in the postoperative patient, unless this has been a pressure to which the patient has been accustomed for some time. Obvious causes of hypertension are postoperative pain, hypercarbia, mechanical errors in taking the measurement or administration of vasopressor or catecholamine agents. If these factors can be eliminated readily and the hypertension continues to mount upward, intramuscular or intravenous administration of one of the *Rauwolfia* derivatives (reserpine, 5 mg) may be useful in preventing a blood pressure elevation to the point at which the patient goes into left heart failure or has a cerebrovascular accident. Titration with sodium nitroprusside drip could be life saving.

An undiagnosed pheochromocytoma or hypercalcemia related to hyperparathyroid activity or the infusion of calcium salts may be implicated. A phenothiazine, such as chlorpromazine administered in amounts from 25 to 50 mg parenterally, may be useful in controlling hypertension if the drug is not contraindicated because of existing central nervous system depression.

Convulsions. *Convulsions* may be one of the most distressing abnormalities of the postoperative period. The most common causes of the occurrence of convulsions, particularly in children, are hyperthermia, anoxia, hypocalcemic tetany, and toxemia resulting from an infection or drug sensitivity. Whatever the cause, it must be investigated and definitive, specific therapy directed toward the correction of the situation. The intravenous administration of diazepam or appropriate barbiturates, such as amobarbital or secobarbital given initially intravenously, generally will control the convulsions. An amount is given sufficient to arrest the convulsions. Attention must be directed toward the adequate respiratory ventilation of the patient.

Fluid and Electrolytes

The management of fluids and electrolytes preoperatively, intraoperatively, and postoperatively is a necessary aspect of surgical care. Certain fundamentals will be reviewed. The subject can be studied in depth in the references.

From a practical standpoint most losses or gains of body fluids come from the extracellular fluid volume, which comprises approximately 20% of the body weight, 5% intravascular (plasma) and 15% extravascular (interstitial).

Preoperative phase. Preoperative extracellular fluid replacement is of great importance because incomplete replacement of fluid may lead to prompt hypotension with the induction of anesthesia. The nonanesthetized patient is able to compensate for a mild volume deficit, and therefore the circulatory collapse may appear to be insidious in the awake patient.

The preoperative evaluation of the patient and the replacement of blood loss when indicated cannot be overemphasized.

Intraoperative management of fluids. It is generally recognized that there should be a complete replacement of blood loss plus approximately 450 to 500 mL per operative hour of lactated Ringer's solution, up to a total of 3.000 mL, given intraoperatively. Blood should be replaced as it is lost, with the exception of the first 500 mL.

For the elective surgical procedure requiring blood replacement, autogenous blood can be drawn over a 2-week period prior to surgery and stored for reinfusion at the time of operation. This is the safest type of whole blood transfusion.

Postoperative management of fluids. Once in the recovery room, the patient's fluid status must be assessed. This survey involves the review of the preoperative fluid status, the volume lost and gained during the operation, and a clinical evaluation of the patient's vital signs and urinary output. Orders are written to cover replacement of known existing fluid deficits plus maintenance for the remainder of the day. For the critically ill patient who has received or lost a large volume of fluid, the replacement is ordered a liter at a time and the patient's status is reviewed frequently until it is stable. Postoperative fluid volume management requires accurate measurement of sensible losses, as well as the intake of fluid and electrolytes from all sources, and an estimation of the insensible losses and replacement, if indicated, with the appropriate fluid or electrolytes or both. It is unnecessary and probably unwise to administer potassium during the first 24 hours after surgery unless there is a definite potassium deficit. Shires suggests that in the later postoperative period approximately 1 liter of fluid be given to replace the urinary volume necessary to handle the excretory work load (800 to 1000 mL); he uses the otherwise healthy 70-kg man as an example. Sensible losses such as gastrointestinal fluids and salivary fistulas are replaced for volume, whereas urine volume is not. The insensible loss is estimated at 600 to 900 mL per day, unless fever, hyperventilation, and unhumidified tracheostomy, or hypermetabolism is present; then the volume lost may reach 1.500 mL. In the patient with an uncomplicated postoperative course, the determination of sodium and other electrolytes is generally unnecessary if the parenteral fluid therapy is not continued as the sole source of intake for over 2 to 3 days. The choice of fluid to replace the sensible and insensible losses need not be complicated. Five percent dextrose in 0.2% normal saline solution, administered at the rate of 100 to 125 mL an hour, may be used. After the first 24 hours, if parenteral fluids are maintained, 40 mEq of potassium chloride solution may be added to the volume. Some authorities prefer 2.000 mL of 5% dextrose in water with 40 mEq of potassium and 500 mL of 5% dextrose in normal saline.

Complications in fluid balance. The most frequent and important problems in fluid balance in the surgical patient are related to changes in extracellular fluid volume. Circulatory instability manifested by hypotension and tachycardia is often the earliest postoperative sign of extracellular fluid volume deficit. Furthermore, the level of consciousness, pupillary size, airway patency, respiratory pattern, body temperature, pulse rate and volume, and skin color must be evaluated. A 30 to 50 mL hourly urine output is minimal. Replacement of the extracellular fluid loss in the postoperative phase reduces the incidence of changes in the composition and concentration of the extracellular water. Attention to the clinical signs of fluid overloads such as weight gain, heavy eyelids, hoarseness, and dyspnea usually will prevent this abnormality of fluid volume from developing or progressing.

Disorders in fluid balance may affect change in the following:

1. Extracellular fluid volume (isotonic salt solution is added or lost).

2. Concentration of osmotically active particles (ion-free water alone is added or lost).

3. Composition when concentration of ions other than sodium are altered.

4. Distributional alteration when there is loss of extracellular fluid into a non-functional space such as in a burn, ascites, or hemorrhagic shock.

Factors affect by acid-base imbalance. As a result of acid-base imbalance, the following four clinical entities can occur.

1. *Respiratory acidosis* may be produced by any condition or combination of conditions that result in inadequate ventilation (atelectasis, pneumonia, airway obstruction). The clinical signs of restlessness, hypertension, and tachycardia in the postoperative patient may indicate the presence of hypercapnia. Treatment consists of providing adequate ventilation and correcting the pulmonary problem when possible.

2. *Respiratory alkalosis* in the surgical patient is caused usually by hyperventilation resulting from apprehension, pain, brain injury, or overventilation by mechanical respirators. If the condition is mild, no therapy is required. When the cause of hyperventilation can be determined and corrected, the problem is eliminated.

3. *Metabolic acidosis* may occur as a result of acute circulatory failure or renal damage, chloride excess, loss of lower gastrointestinal fluids, administration of unbalanced salt solutions, and uncontrolled diabetes mellitus. Correction of protracted metabolic acidosis may require the use of sodium bicarbonate. When cardiopulmonary arrest occurs, restoration of blood flow, pulmonary ventilation, and administration of sodium bicarbonate is required.

4. *Metabolic alkalosis* usually occurs when some degree of hypokalemia exists. It occurs when there is an uncomplicated loss of acids (H ion) or retention of bases. Because of the associated hypokalemia, cardiac arrhythmias, paralytic ileus, digitalis intoxication, and tetany may develop. Dangerous hyperkalemia (greater than 6 mEq per liter) is unusual if kidney function is normal. Generally, it is unwise to administer potassium during the first 24 hours postoperatively unless there is a definite hypokalemia. These deficits should be replaced after an adequate urine output is obtained. The daily replacement of potassium for renal excretion is 40 mEq plus 20 mEq for gastrointestinal loss if indicated; it should not be administered parenterally in concentrations of more than 40 mEq per liter as potassium chloride.

Blood Transfusion Reactions

Blood transfusion is indicated in the following cases:

1. To maintain blood volume and treat or attempt to prevent shock. (Measured blood loss is replaced as it occurs; in hypovolemic shock the degree of replacement depends on the clinical findings in regard to the pulse, blood pressure, peripheral circulation, venous pressure, and urine output.)

2. To improve or maintain oxygen-carrying capacity.

3. To promote or maintain coagulation.

4. For exchange of blood in neonates.

5. As a prime for a biomechanical apparatus such as a pump oxygenator.

Complications. The possible complications associated with blood transfusions are as follows:

1. Incompatible blood (ABO). - This problem can be prevent in most cases by proper identification of the recipient receiving the proper crossmatch.

2. Hemolytic reactions. - Simultaneous reactions reportedly occur in from 0.2% to 1% of transfusions and have 36% mortality; delayed hemolytic reactions occur several days after the transfusion with the mortality of 1.8%.

3. Allergic reactions.

4. Pyogenic reactions.

5. Febrile reactions.

6. Air embolism.

7. Circulatory overload.

8. Cardiac arrests:

   a. Hypothermia.
   b. Citrate toxicity.
   c. Hyperkalemia.

9. Thrombophlebitis.

10. Delayed transmission of disease:

    a. Hepatitis. - The instance is 1% for whole blood and 12% for pool plasma.
    b. Postinfusion syndrome.
    c. Syphilis.

11. Oozing hemorrhage. - This occurs in 33% of patients receiving ten or more units of whole blood.

Symptoms of an untoward reaction to a transfusion usually are manifest during the initial 50 to 100 mL of each unit of the infusion.

Rate of infusion. The rate of infusion is begun generally at 2 to 3 mL per minute and increased as follows:

1. For an elective transfusion into a normal circulatory system, infuse 8 to 10 mL per minute with 60 to 80 minutes per transfusion.

2. In the embarrassed cardiovascular system, especially in the elderly, infuse at 4 to 5 mL per minute, 130 minutes per transfusion.

3. In acute hypovolemia, infuse at maximal obtainable rates until systolic blood pressure of 100 mm Hg is attained.

Careful attention given to preoperative and postoperative care assures the surgical patient optimal conditions for recovery.