SECOND EDITION

Facial trauma and concomitant problems

EVALUATION AND TREATMENT

Edited by

WILLIAM B. IRBY

Contributors

Russell L. Blaylock, M.D.

Neurosurgeon, High Point;
Visiting Neurosurgeon,
Baptist Hospital,
Bowman Gray School of Medicine,
Winston-Salem, North Carolina

Lon R. Doles, D.D.S.

Private Attending Oral and Maxillofacial Surgery,
Clinical Associate,
Medical University of South Carolina,
College of Medicine,
Charleston, South Carolina

Pinckney L. Harper, Jr., D.D.S.

Clinical Associate Professor,
Medical University of South Carolina,
College of Dental Medicine,
Charleston, South Carolina

William B. Irby, D.D.S., M.S., F.A.C.D.

Professor Emeritus,
Medical University of South Carolina,
College of Dental Medicine,
Charleston, South Carolina

J. Ken McDonald, Ph.D.

Professor of Biochemistry,
Medical University of South Carolina,
College of Dental Medicine,
Charleston, South Carolina

Anthony M. Moser, M.D.

Pathologist,
Trident Regional Hospital,
Charleston, South Carolina

David W. Shelton, B.S., D.M.D., F.I.C.D.

Colonel, United States Army,
Chief, Oral Surgery Service
and Director, Oral Surgery Residency Training Program,
Brooke Army Medical Center,
San Antonio, Texas;
Clinical Professor, Dental Branch,
Department of Surgery,
The University of Texas Health Sciences Center,
Houston, Texas;
Adjunct Professor, Department of Oral Surgery,
College of Dental Medicine,
Medical University of South Carolina,
Charleston, South Carolina

Michael R. Zetz, D.D.S.

Clinical Associate Professor,
Medical University of South Carolina,
College of Dental Medicine,
Charleston, South Carolina

Preface

The objective of the second edition of *Facial Trauma and Concomitant Problems: Evaluation and Treatment* is to provide a comprehensive and practical guide for residents and practitioners of oral and maxillofacial surgery, for persons in those specialties of medicine that are concerned with the care of the traumatized patient with facial injuries, and for dentists who wish to enhance their knowledge in these areas.

Every effort has been made to assure that this edition is an improvement over the first, and it is my conviction that this goal has been achieved. Five subjects were carefully selected and have been structured to afford pertinent data relative to the evaluation and treatment of the traumatized patient with particular emphasis on facial trauma. The author of each chapter has responded to the challenge and presented his material in an authoritative and practical manner.

Chapter 1, "Principles in the Management of Facial Trauma," covers the basic principles that are essential to the optimal treatment of facial trauma. Although the basic concepts of treatment have undergone few changes in the past 5 years, considerable material has been added to complement and update the previously presented principles to assure complete coverage of all aspects of the treatment of facial injuries.

Chapter 2, "Airway Management in Acute Maxillofacial Trauma," fills a void in the literature relative to the role that the tracheostomy should assume in the early care of facial trauma. Indications and contraindications for its use are stressed, with particular emphasis on the fact that this is rarely an emergency room procedure. Alternative measures, especially the endotracheal tube, for assuring a patent airway are emphasized. Proper timing of the tracheostomy, when indicated, is shown to be in keeping with the best in patient care.

Diagnosis and treatment of concomitant injuries is presented in a concise but complete manner in Chapter 3, "Concomitant Injuries—Diagnosis and Treatment." This chapter is a most worthy addition to the literature and should long serve as a guide to those surgeons who are challenged with problems encountered in the patient with multiple injuries.

Chapter 4, "Concomitant Problems of Nontraumatic Origin," is directed to the hospital management of the injured patient. Current concepts in the management of problems encountered in blood loss, fluid imbalance, pulmonary edema, impaired

kidney function, and so on are presented. This chapter affords a wealth of data and should serve as a readily available reference for the resident and practitioner.

A more complete and updated presentation of laboratory values essential to the effective evaluation and treatment of the ill or injured patient is given in Chapter 5, "Laboratory Values." Significance in variations from normal is stressed. This chapter proved to be a most valuable component of the first edition. Its status as a necessary facet in the enlightened treatment of the traumatized patient will become even more meaningful in this edition.

The optimum in evaluation and treatment of facial injuries should be the goal of every surgeon who assumes responsibility for this interesting and important facet of trauma. Additionally it is essential that the surgeon be alert to and enlightened regarding the diagnosis and concepts of care of both the obvious and the occult injuries that the patient may have suffered. It is my sincere hope that the contents of this book will serve as an important contribution to the achievement of these goals.

William B. Irby

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Principles in the management of facial trauma

William B. Irby

In preparing the revision of this chapter, it has become quite evident that few changes of concepts have occurred since I formulated the original set of principles in 1974. Exceptions are the views of certain ophthalmologists relative to the advisability of surgically treating blowout fractures of the floor of the orbit, a gradual change of opinion concerning the necessity of immobilizing the mandible as a treatment for condyle neck fractures in children, and evidence that contaminated soft tissue wounds of the face are best managed by delaying the closure.

Additional subjects of interest that have received considerable attention in recent years and that will be included in this chapter are the management of nasoethmoid injuries, control of hemorrhage associated with Le Fort II and III fractures and nasal fractures, and the concepts and techniques involved in the treatment of wounds of certain areas or structures of the face such as the eyebrow, eyelid, lacrimal pathway, canthal ligaments, ear, nose, lips, facial nerve, and parotid gland and duct. Measures that the surgeon may take to prevent infection and assure an optimum cosmetic result will be discussed. These include the use of topical antibiotic solutions as an irrigant, proper selection of sutures, retention of the original dressing for an adequate period of time, and the proper time for removal of sutures.

It has been my good fortune to have had extensive experience in the treatment of facial injuries over a time span that included three wars and a marked increase in the use of high-speed vehicles. Drawing on this background, I have developed a set of principles of treatment that have proved helpful and effective for me in the management of facial injuries. Adherence to these principles has consistently afforded gratifying results. Conversely it has been repeatedly demonstrated that failures are inevitable if sound principles, performed in correct sequence, are ignored.

It is my sincere hope that the principles of treatment presented in this chapter will serve as a guide to the resident and an aid to the practicing surgeon.

PHILOSOPHY OF TREATMENT

As a preface to a discussion of the principles of treatment, it is appropriate to express my philosophy of the role of the oral surgeon in the treatment of facial trauma.

It is well known that education in dentistry includes a knowledge of occlusion, jaw relationship, muscle function, and biodental materials, together with a highly developed level of manual dexterity. This background, which coupled with good residency training, makes it possible for the oral surgeon to offer treatment of high caliber and to be well qualified in the management of facial injuries.

Over the past three decades, oral surgeons have been more than equal to the challenge, and the profession's record of performance during three wars has been unprecedented. Both in private and in military practice throughout the world, the achievements of oral surgeons in the management of facial trauma have been outstanding. Despite this enviable record, there still remain some who seem to feel obliged to question whether oral surgeons are employing all of their skills and knowledge to the fullest advantage. In some cases, the answer, perhaps, must be in the negative. Regrettably some oral surgeons (and others) appear to have fallen into the pitfall of approaching every case with ligature wires, arch bars, and scalpel instead of employing all methods at their disposal. Those who treat facial trauma should ask themselves whether it is fair to the patient to immobilize his jaws for 4 to 6 weeks when, in many cases, a simple splint would allow him to open his mouth and to enjoy a wholesome diet. It would be proper to ask whether patients are dismissed without checking the occlusion and adjusting for any possible discrepancies. It would be appropriate to ask, also, if general anesthesia is being used for many procedures that might be accomplished more easily by regional or local block anesthesia and with a greater margin of safety.

These are but a few of the questions that oral surgeons must ask themselves, and, to continue to deserve their prominent position, they must be constantly on the alert in employing all of their knowledge and resources to the benefit of their patients' well-being. I sincerely hope that the principles outlined here will serve as a stimulus and will elicit a utilization of all possible resources and, in consequence, the optimum in results.

PRINCIPLES

The fundamentals of procedure that follow are listed for the purpose of affording the reader an overview of the contents of this chapter. The discussions following the listing will not involve, to a great extent, the details of technique but, instead, will seek to emphasize the principles underlying effective treatment of facial trauma.

1 □ In most instances, severe facial injuries, especially those with concomitant injuries, are best managed by a systematic approach with treatment divided into three phases: emergency, early, and definitive.

Emergency treatment

2 □ Adequate respiratory exchange should have the highest priority in emergency treatment.

3 □ Hemorrhage must be controlled.

4 □ The patient should be examined for possible concomitant injuries.

Early treatment

5 □ A tracheostomy should be performed if indicated.

6 □ Strict attention must be given to the care of the tracheostomy tube, and it should be removed as soon as possible.

7 □ The neurologic status should be recorded every hour if the patient has experienced a period of unconsciousness or received a severe blow to the head or neck.

8 □ Radiographs of the cervical spine should be ordered in any instance suggesting a significant blow to the head or face.

9 □ The patient should not be sent to the x-ray department until his condition has stabilized and the danger of respiratory obstruction or shock no longer exists.

10 □ Soft tissue wounds should be inspected throughly, cleansed by irrigation, debrided conservatively, and the skin mobilized to obtain closure in event of tissue loss.

11 □ Open, contaminated wounds should be kept clean and covered with moist sterile dressings. Closure of these wounds should be delayed.

12 □ Closed wounds that are infected should be subjected to repeated irrigation through polyethylene tubes.

13 □ Bone should be debrided conservatively.

14 □ Chronically infected bone should be debrided of all necrotic tissue, and the fragments should be immobilized; the wounds should be irrigated repeatedly, using polyethylene tubes.

15 □ In cases of infected wounds, cultures should be obtained, sensitivity tests run, and the appropriate antibiotic prescribed.

16 □ When there are extensive or penetrating wounds or wounds associated with fractures of the mandible, drains should be inserted. These drains should be removed in 48 hours.

17 □ When treating through-and-through wounds involving the mouth, the tissues should be closed from inside out.

18 □ Some method should be employed to stabilize fragments of the mandible when a portion of the body has been avulsed.

19 □ A nasogastric tube should be inserted in the presence of severe damage to oral tissues.

20 □ Secondary manipulation of repaired wounds of the lips and cheeks should be avoided.

21 □ The initial dressing covering a wound should be left in place for a minimum of 48 to 72 hours.

22 □ Sutures of non-reactive materials such as Dacron or nylon, placed without tension, may be left in the face from 5 to 7 days.

23 □ Lacerations or blunt trauma to certain anatomic structures of the face, namely, the eyebrow, eyelid, lacrimal pathway, canthal ligaments, ear, nose, lips, facial nerve, and parotid gland and duct require special knowledge and skill in their treatment.

24 □ Ocular injuries require special precaution or attention.

25 □ A displaced maxilla should be reduced as early as feasible if the injury is complicated by cerebrospinal fluid drainage.

26 □ Drainage of cerebrospinal fluid from the nose or ear must not be blocked.
27 □ Antibiotic therapy should be administered when indicated.
28 □ One must be certain that the patient has had tetanus immunization.
29 □ Lumbar puncture should not be requested unless meningitis is suspected.
30 □ Feeding methods that will ensure adequate fluid, caloric, and vitamin intake should be employed.
31 □ The jaws should be temporarily immobilized until definitive reduction of the fractures can be accomplished.
32 □ In the treatment of fractures compounded by soft tissue wounds, it is sometimes safe and practical to complete the case as a single-stage procedure if the patient's general condition is satisfactory.
33 □ Local anesthesia is effective and desirable for accomplishing many surgical procedures, especially in the early phase of treatment.
34 □ Impressions of the dental arches should be taken and study models should be made for diagnostic purposes and possible splint construction.
35 □ Do not attempt to establish an occlusion that did not exist prior to fracture.
36 □ Panorex, occlusal, and periapical x-ray visualization often afford additional and necessary information.
37 □ All radiographs necessary for accurate interpretation of the nature and extent of fractures of the maxilla and mandible must be obtained.

Definitive treatment

38 □ In general, the most conservative treatment that will effectively reduce and stabilize the fractures should be the procedure of choice.
39 □ Each case should be analyzed and treated individually, using the method of treatment most applicable.
40 □ A constant awareness should be maintained of the advantages and disadvantages of accepted methods employed for the reduction and fixation of facial fractures.
41 □ Splints offer certain highly desirable advantages that are not available through other methods for accurately reducing and stabilizing fractures of the mandible and maxilla.
42 □ Splints frequently afford necessary immobilization of fractures of the dentulous mandible and maxilla, making it unnecessary to employ intermaxillary fixation.
43 □ It is both desirable and practical to develop the capability to construct acrylic splints and to do this in the oral surgical suite.
44 □ All teeth in the line of fracture that are loose or nonvital or that have fractured roots should be removed.
45 □ When there are teeth in the line of fracture being treated by open reduction, the use of drains appears to reduce the incidence of infection, but, if infection does occur, it is suggested that the teeth in the line of fracture be rechecked for vitality, fractures of roots, and the like.
46 □ It is also recommended that removal of any partially erupted mandibular third molars be given serious consideration.
47 □ Open reductions of severely comminuted fractures of the body of the mandible are frequently associated with complications such as infection.
48 □ In the dentulous mandible, open reduction with transosseous wires must be

supplemented with some other type of fixation in order to stablize the fragments.

49 □ Fractures of the dentulous alveolus may be effectively reduced and stablized by employing simple acrylic splints.

50 □ Fractures of the edentulous mandible may be treated by a number of methods, but success in treatment demands adherence to certain specific fundamentals of treatment.

51 □ Stabilization of splints or dentures to the edentulous ridges may be accomplished by several methods. Each has its advantages and disadvantages, but, in general, the utilization of Kirschner wires passed through the flange of the splint and through the alveolus is very effective.

52 □ Fractures of the body of the mandible complicated by laceration of the lingual tissues and exposure of underlying bone may be effectively treated by covering the involved area with a lingual splint.

53 □ When heavy elastic traction is applied to teeth in the anterior portion of the dentition, a wafer of "cold-cure" acrylic should be inserted to prevent extrusion of the teeth.

54 □ Fractures of the symphysis and the third molar areas are often easily treated by transoral open reductions, but intraoral open reductions of fractures of the body of the mandible are frequently unsatisfactory.

55 □ Fractures involving the body of the mandible in children may generally be treated effectively by closed reduction methods.

56 □ When performing an open reduction of the angle of the mandible, the oral surgeon should be certain that the teeth are in occlusion prior to insertion of transosseous wires.

57 □ Fractures of the ascending ramus of the mandible seldom require open procedures unless there is severe displacement of the fragments.

58 □ Fractures of the coronoid process seldom require treatment.

59 □ It is generally conceded that most fractures involving the necks of condyles in adults are best treated by conservative or closed methods.

60 □ There appears to be no justification for open reduction of condyle fractures in children unless there is mechanical interference with mandibular movement.

61 □ In many cases of condyle fractures in children, freedom of mandibular movement appears to be the treatment of choice, with immobilization being contraindicated.

62 □ Fractures of the palate should be reduced early if there is an oronasal communication.

63 □ In the management of displaced fractures of the maxilla and associated bones, the first step should be to restore and stabilize correct occlusal relationship.

64 □ Once the maxilla has been returned to its correct relationship with the mandible and with the base of the skull, fractures of associated bones may be accurately fixed to the reduced maxilla.

65 □ Wires over the zygomatic arches should not be used to support a fracture of the maxilla if such fracture is associated with fractures of the condyles.

66 □ Upward traction alone should not be used when treating severe comminutions of the maxilla, since this may result in a shortening of the face.

67 □ In the treatment of severely comminuted midface fractures, and especially in those complicated by bilateral subcondylar fractures, the use of craniomandibular support is highly recommended.

68 □ Special attention must be given to comminuted fractures in the nasoethmoid area.

69 □ An open reduction of severely comminuted fractures of the orbital rim is generally contraindicated.

70 □ For all patients in whom a fracture of the orbital floor is suspected, a forced duction test should be performed.

71 □ Considerable controversy exists, at present, relative to the advisability of performing a surgical procedure on the pure blowout fracture of the orbital floor.

72 □ Should a decision be made to treat a blowout fracture of the orbital floor, the procedure may be successfully accomplished by either the antral or subeyelid approach.

73 □ If the antrum has not been entered, a nasal antrostomy is seldom indicated.

74 □ Fractures of the zygomatic bone frequently may be reduced by simple elevation if the displacement is not too great and if the fracture lines are favorable for stabilization.

75 □ Many displaced fractures of the zygoma are best treated by open reduction.

76 □ In the event of loss of bone in the frontal or maxillary process, extracranial support has proved to be essential in many cases.

77 □ Depressed fractures of the zygomatic arch may sometimes require open reduction.

78 □ In the treatment of severe comminution of the zygomatic bone, it may be necessary to support the fractures by gauze packing placed lateral to the maxilla (in the infratemporal fossa).

79 □ In the treatment of multiple facial fractures, the best results are obtained by an orderly approach in the following manner: (1) reduction and stabilization of mandibular fractures, (2) occlusion of mandibular teeth to the maxillary dentition, and (3) reduction of fractures of associated bones to a correctly reduced maxilla.

SYSTEMATIC APPROACH TO TREATMENT

1 □ In most instances, severe facial injuries, especially those with concomitant injuries, are best managed by a systematic approach with treatment divided into three phases: emergency, early, and definitive.

A. Emergency
   1. Immediate
      a. Airway
      b. Hemorrhage
      c. Shock
   2. Urgent—other injuries
      a. Head
      b. Body
      c. Extremities

B. Early
   1. Debridement of bone

2. Temporary immobilization of jaws
3. Securing of impressions
4. Tracheostomy, if indicated
5. Supportive measures

C. Definitive
1. Radiographs
2. Definitive reduction of facial fractures
3. Possible closure of soft tissue lacerations over reduced fractures

It has been demonstrated repeatedly in combat situations and in emergency rooms that receive large numbers of trauma patients that proper triage of patients is essential. Additionally, experience has shown that an organized approach to treatment is very important. In the management of patients who have suffered severe facial injuries, it is imperative that attention be first directed to those conditions posing an immediate threat to patient survival, the first of which may be an obstructed airway. Attention to the control of hemorrhage also demands high priority and must be dealt with as soon as possible. The treatment of shock may well be classified as an emergency situation, especially if it is of a profound nature. On many occasions, fluid replacement must assume a priority that is second only to the relief of an obstructed airway. Fluid replacement is almost consistently initiated in the time interval in which hemorrhage is being controlled. The fact that most patients need to be typed and cross-matched before whole blood is administered does not preclude the use of blood substitute such as lactated Ringer's solution until blood is available.

Once the immediate life-threatening conditions have been controlled, attention must be directed to a thorough examination of the patient for both obvious and hidden injuries. Chapter 3 covers these problems in detail, and they are included at this point for the purpose of emphasizing that they constitute the second priority of patient evaluation and of possible order of treatment.

It is fortunately true that facial injuries, with the exception of an obstructed airway, seldom pose a threat to the patient's life, whereas body and head injuries may threaten the survival of the patient. Because of this, it is most important to delay those procedures classified as "early" until the patient has been thoroughly examined and assurance has been given that his condition is relatively stable and can withstand further stress. This may involve a time span varying from several hours to several days, depending on the general condition of the patient. It is emphasized that these procedures are not emergency room measures and should, whenever possible, be performed in the controlled atmosphere of the operating room.

Attention is called to the fact that the procedures listed as "definitive" are sometimes best managed in the period immediately following the release from the emergency room. The decision to complete the case must be based on the general condition of the patient and many other factors that will be discussed under principle 32. In general, an orderly, step-by-step progression of treatment ensures the most satisfactory result with the greatest margin of safety. There is no necessity for rushing into an unplanned and inadequately diagnosed procedure when an orderly program of treatment offers much greater assurance of success.

Of even greater importance is the safety of the patient. To subject a patient to surgery, especially under general anesthesia, within the first 12 hours following in-

jury is to invite a consistently higher mortality rate. The fact that a high percentage of facial injuries do not demand early surgery supports the view that proper diagnosis, proper supportive therapy, and adequate planning should precede either the surgical or the definitive phases of treatment of facial injuries.

EMERGENCY TREATMENT

2 □ Adequate respiratory exchange should have the highest priority in emergency treatment.

The extreme importance of clearing an obstructed airway cannot be over-emphasized. It is also of great importance to stress the fact that there are a variety of procedures useful in providing an adequate respiratory exchange and that the indication for doing a tracheostomy in the emergency room is indeed rare. The procedure carried out with benefit of operating room resources and facilities will be discussed in detail in Chapter 2.

There are many well-established methods of relieving respiratory obstruction where facial trauma is involved. Again, the value of a standardized approach is emphasized because it is to no avail to attempt any procedure if foreign material in the pharynx is obstructing respiration. Therefore, the first step should always be to examine the oropharynx and the larynx; if mucus, blood, teeth, portions of a denture, or other foreign bodies are present, these should be removed immediately. A laryngoscope and adequate suction are essential for this procedure.

In cases not associated with gross comminution or with loss of a portion of the mandible, experience has demonstrated that the simple procedure of pulling the tongue forward and inserting an oropharyngeal airway (Guedel type) adequately relieves obstruction. Soft latex tubes or airways passed through the nares and into the oropharynx often prove to be helpful (Fig. 1-1). Attention is directed to the necessity for frequent suctioning of the tubes, for they are easily occluded by blood or mucus. If control of the tongue has been lost because of avulsion of the anterior portion of the mandible, a suture may be placed through the tip of the tongue, pulling it forward and securing it in this position by attaching the ends of the suture to clothing covering the upper body.

When posterior displacement of the mandible caused by bilateral fractures of the body or condyles results in airway obstruction (Fig. 1-2), a simple but often neglected procedure consists of manipulating the mandible forward into its preexisting relationship with the maxilla. It may be stabilized in this position by several intermaxillary wires, which connect with wires around the anterior teeth.

The methods previously described are simple and require little time and effort. However, in severe cases involving gross comminution or avulsion of bone and where extensive swelling and edema of soft tissues are anticipated, it becomes mandatory to pass an endotracheal tube in order to ensure airway patency. This procedure can usually be easily accomplished in the emergency room. Once these tubes are in place, complete control of the patient's airway is assured. Endotracheal tubes may be left in place from 2 to 3 days without causing undue damage to the vocal cords and trachea. However, a cuffed endotracheal tube should be deflated for 5 minutes every 3 to 5 hours in order to prevent tissue necrosis. Cuffed tubes are generally indicated for unconscious patients or those who require a mechanical respirator.

A listing of procedures designed to assure adequate respiratory exchange would

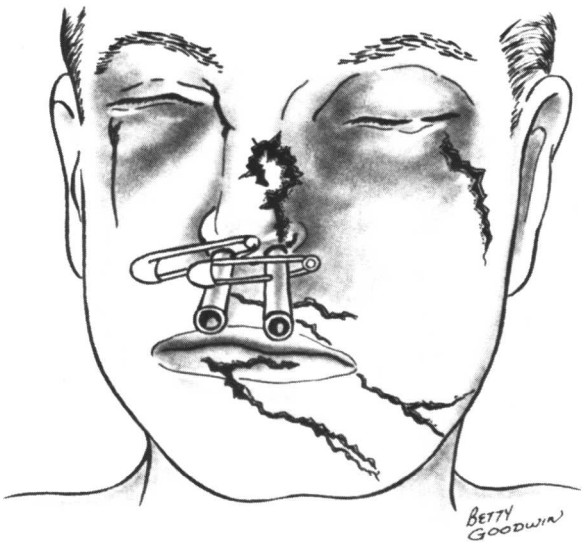

Fig. 1-1. Soft latex tubes, passed through the nares and into the oropharynx, assure an airway in the presence of a severe maxillary fracture.

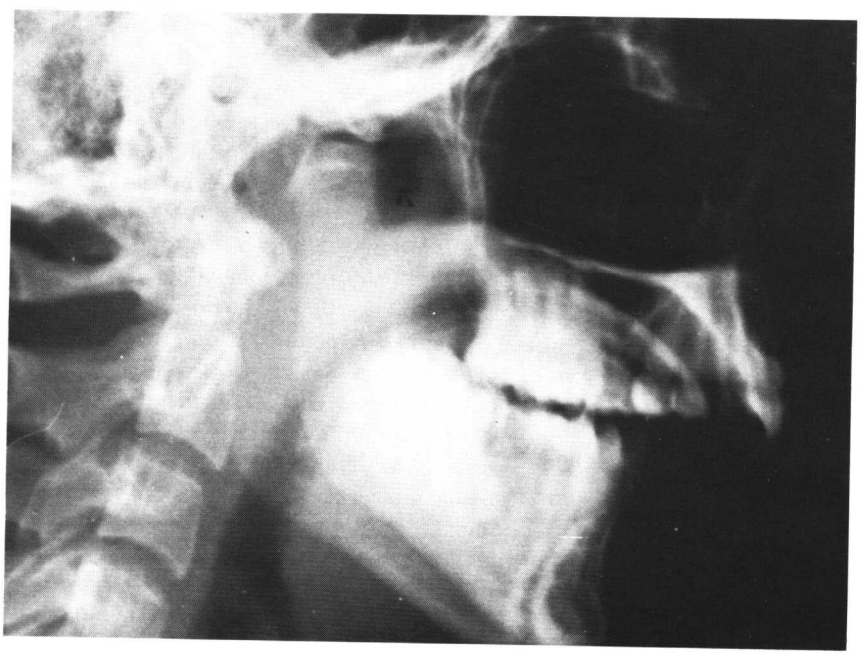

Fig. 1-2. Extreme posterior displacement of the body of the mandible associated with bilateral fractures of the mandibular condyles. The airway was occluded.

not be complete without mention of the cricothyroid membrane puncture or coniotomy. Once an opening has been created, a tube may be inserted to provide an airway and for possible oxygen administration. It appears that the choice of this procedure falls between passing an endotracheal tube and doing a tracheostomy, the cricothyroid membrane puncture being preferred over an emergency room tracheostomy but not as desirable as employing the endotracheal tube. Therefore, its use as an emergency procedure should be reserved for those cases in which an endotracheal tube is not available or it is impossible to intubate the patient.

3 □ **Hemorrhage must be controlled.**

Massive hemorrhage may result from extensive wounds of the maxillofacial region, for this region is rich in blood supply and collateral circulation is considerable. Patients with extensive facial wounds frequently are not bleeding freely by the time they are seen in the emergency room, since their blood volume has been depleted and severed arteries have been occluded by muscle contraction and clot formation. However, on replenishment of blood volume, hemorrhage often becomes a problem.

The first step in control of hemorrhage should be application of pressure dressings, preferably hot and moist. On cessation or diminution of bleeding, individual bleeding points may be clamped and ligated. In many cases it is frequently necessary to tie off the internal and external maxillary arteries in deep wounds. Ligation of the lingual artery is frequently necessary in the presence of severe wounds of the middle or posterior third of the tongue. Occasionally, deep and persistent bleeding can only be controlled by ligation of the external carotid artery.

Hemorrhage associated with Le Fort II and III and nasal fractures may occasionally be persistent, difficult to control, and even life threatening. This is because of two factors: the inaccessibility of the vessels that traverse these areas and the nature of the fractures.

In the Le Fort II fracture, there occurs a separation of the nasal bones and the frontal process of the maxilla from the frontal bone. The fracture lines then pass laterally through the lacrimal bones, through the anterior floor of the orbit, and through the infraorbital rim at or in close proximity to the zygomaticomaxillary suture. The fractures extend posterolaterally along the lateral wall of the maxilla, through the pterygoid plates, and into the pterygomaxillary fossa. In the midline, the fracture extends from the nasofrontal articulation through the upper portion of the perpendicular plate of the ethmoid bone and the vomer. In severe injuries with displacement and communition, there may be extensive injury to the labyrinth of the ethmoid bone and to the lacrimal regions.

The Le Fort III or craniofacial disjunction constitutes a complete separation of the facial bones from the cranial base. The lines of separation generally extend through the zygomaticofrontal, maxillofrontal, and nasofrontal sutures and include the floors of the orbits, the body and perpendicular plate of the ethmoid bone, and the pterygoid plates of the sphenoid bone. This type of fracture is generally associated with multiple fractures of the facial bones.

Severe hemorrhage associated with Le Fort II and III fractures is seen most often in the nose, but, on occasion, persistent and difficult-to-control hemorrhage may be associated with displaced fractures of the posterior wall of the antrum that involve the structures of the pterygopalatine fossa. Knowledge of the blood supply

to the middle third of the face is, therefore, essential to adequate control of hemorrhage.

The nasal mucous membrane derives its blood supply from two major sources, namely, the internal and external carotid arteries. The anterior and posterior ethmoidal arteries are branches of the ophthalmic artery, which springs from the internal carotid artery. These ethmoidal arteries leave the ophthalmic artery within the orbit, course through the anterior and posterior ethmoidal canals, respectively, to obtain an intracranial course, and then turn downward, either through the cribriform plate or anteromedially to it. They enter the nasal canal through its roof to supply the roof as well as approximately the upper one third of the nasal cavity. The anterior ethmoidal artery, normally much larger than the posterior ethmoidal artery, is distributed to approximately the anterior and upper third of the lateral wall of the nose and a similar portion of the septum. The posterior ethmoidal artery supplies the region of the superior concha and a corresponding portion of the septum. It is important to note that if bleeding is originating from above the middle concha, it is most likely of ethmoidal vessel origin. Nasal bleeding arising from the mucosa of the middle and inferior conchae and a corresponding portion of the nasal septum is likely to be emanating from a branch of the sphenopalatine artery, which arises from the internal maxillary artery in the pterygomaxillary fossa and enters the posterior nasal cavity through the sphenopalatine foramen.

Excluding the ethmoidal arteries, bleeding associated with trauma into the nose, maxillary sinuses, and nasopharynx involves branches of the internal maxillary vessels, a branch of which is the sphenopalatine artery. The pterygopalatine fossa, a distribution center of the vessels of the middle third of the face, is consistently involved in displaced fractures of either the Le Fort II or III category and may be the site of rupture of one or more branches of the internal maxillary artery. In the anterior portion of this fossa arise the infraorbital, posterior superior alveolar, descending pharyngeal, sphenopalatine, greater and lesser palatine, and vidian arteries. Severe hemorrhage into the maxillary sinus may result when the fracture is of such severity as to sever one or more of these vessels within the fossa or along the posterior wall of the sinus.

Hemorrhage control in either the nose or the maxillary sinuses should first be attempted by efficient packing. In the nose, the use of a posterior nasal pack or Foley catheter should often be complemented by local packing. This frequently arrests the hemorrhage or diminishes the flow to a point at which the site of hemorrhage can be determined. Digital pressure on the common carotid artery and packing of different regions of the nose may also aid in determining the source of bleeding, which is essential to its control. Should it be determined that the source of bleeding is above the middle concha, the ethmoidal artery is most likely to be involved. Should the point of bleeding be below the level of the dome of the middle concha, its origin is most probably the sphenopalatine vessels.

Bleeding in the upper nose as a result of rupture of one or both ethmoidal arteries is often controlled temporarily by nasal packing. However, on removal of the packing, hemorrhage is very apt to recur. Should this happen, the pack should be replaced and the patient immediately scheduled for surgery to ligate the ethmoidal vessels. This procedure may be performed under local anesthesia and consists of the steps on the following page: