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Standards of Care in Anesthesiology

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STANDARDS OF CARE IN ANY MALPRACTICE action until recently varied with the standards set by the practice of medicine in any given community. This legal doctrine served well in an era of the general practice of medicine. No patient expected, nor did any court demand, that the country doctor, operating under adverse conditions, perform the same surgical feats as the specialist in the medical center. However, when this doctrine was formulated, the law did not differentiate between general practitioner and specialist, but rather, between general practitioner and general practitioner.

Medicine today is becoming too complex and involved for any one man to fairly and thoroughly comprehend its vast ramifications. The solution to this complexity, therefore, has been found to be medical specialization. Specialty training not only upgrades the standards of medical practice, but also brings the standards of care in a particular field within well-defined limits. The basic principles of surgery, for example, are the same in a small hospital with a certified surgeon as they are in a large hospital with the university professor. The same anesthetic agent is used for the patient in the small hospital as is used in the medical center. The specialist has brought with him all the modern technics and the latest products of medical research, so that the medical standard difference between the small community and the large city is one only of population.

Medicine is composed of two very essential elements: One is knowledge of the basic sciences and technics, and the other is judgment. The skilled physician is the one who has not only the basic knowledge of scientific fact and clinical practice but also the ability to take these pieces of the jigsaw puzzle and by judgment fit them into a total picture. Legal and medical standards of care deal with basic knowledge and technics. These are the settled facts, the basic formulae and the equations of medical practice. Errors, on this level, are justly viewed as malpractice.

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But, it is legally, morally and professionally incorrect to view an error in judgment as malpractice. It is not negligence for a dentist to extract a tooth, if, as far as reasonably can be ascertained, the tooth is diseased and must be removed. However, if after the extraction the infected wound is not energetically treated with antiobiotic drugs, this is an error according to the basic-knowledge standards of dental care.

Diplomates of the American Board of Anesthesiology must meet the rigid requirements of this specialty. Anesthesiologists in all sections of the country must meet the same requirements. Hence, the anesthesiologist in a small town is as well qualified as the anesthesiologist practicing in a large city. With this basic premise in mind, it is not difficult, therefore, to set down the medical standards of care in anesthesiology—which in turn determine the legal standards of care in this specialty.

Spinal Anesthesia

The object of spinal anesthesia is to produce the loss of sensation and the paralysis of musculature of the lower trunk and the legs. Loss of sensation is accomplished by depositing in the subarachnoid space (Figure 1) an anesthetic solution to produce this effect upon the nerves of the spinal cord present in this space. Anesthesia is usually accomplished by insertion of a needle 3½″ to 4″ long which is fitted with a stylet occluding the lumen of the needle. In order to avoid carrying bacteria into the subarachnoid space, it is necessary to prepare the skin of the back (in the area of the injection) with a suitable antiseptic solution. Failure to carry out aseptic technic is negligence.

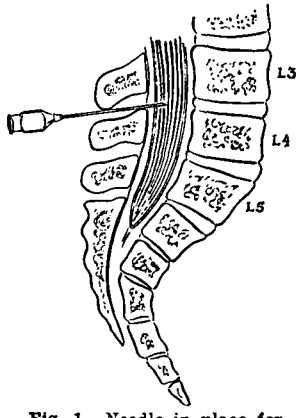

Fig. 1. Needle in place for administration of spinal anesthetic agent.

The patient is usually placed in the proper position, as chosen by the anesthesiologist, and held in that position by an assistant. This prevents the patient from moving unexpectedly. When the skin surface is prepared, the anesthesiologist must, under sterile conditions, put on a pair of sterile rubber gloves and drape the areas of the injection with sterile linen (Figure 2). The needle is usually

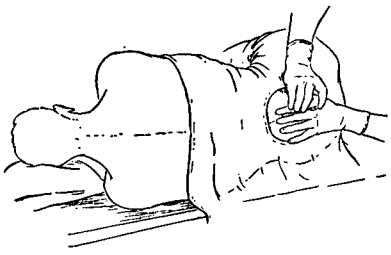

Fig. 2. Administering Spinal anesthesia.

inserted in any interspace between the second lumbar vertebra and the first sacral vertebra. Insertions of the needle at vertebrae higher in the spinal cord are hazardous, inasmuch as the needle may injure the spinal cord itself. In the hands of an expert, however, subarachnoid injections of the spinal cord can be made at any level. The making of spinal injections at any particular level is not per se evidence of negligence on the part of the anesthesiologist.

Before injections, the instruments for spinal anesthetic must be properly washed and rinsed in demineralized water and then placed in an autoclave at 254° temperature under 20 pounds pressure of live steam for a period of fifteen minutes. Such a technic prevents foreign matter and live bacteria from being injected in the subarachnoid space which may result in inflammation and infection along the spinal cord. The anesthetic agents usually used for spinal analgesia are prepared at the pharmaceutical houses in sterile glass ampules. It is necessary, however, that before these ampules are used that they too be put into the autoclave so that the outside of the glass ampule as well as the contents are absolutely sterile. Should they not be autoclaved, negligence may be inferred. The practice of storing these glass ampules in jars containing alcohol and formalin solution is mentioned only to be condemned. In spite of the finest methods of manufacture, some glass ampules have microscopic holes in them which may allow alcohol and formalin to enter the ampules, leading to very serious consequences if injected into the subarachnoid space.

When the needle is inserted under aseptic conditions in the proper vertebral interspace, and the stylet removed, some spinal fluid will flow from the lumen of the needle. A few milliliters of anesthetic agent are then injected and the needle is removed. Upon insertion, however, frequently the apprehensive patient will jump as the various layers of the back are pierced by the needle. This is not an uncommon situation and varies from patient to patient. The hypersensitive patient frequently jumps as the nerve roots are touched by the spinal needle, but it is

seldom that any damage occurs to these rootlets. In fact, it is almost impossible to avoid touching them even under the best of techniques.

If the spinal anesthetic technique is correct and the anesthetic agent free of contaminants, the loss of sensation and paralysis of the musculature is obtained in a few minutes and should begin to disappear within a few hours. Total recovery occurs within twenty-four hours.

There are a number of instances of patients suffering prolonged or permanent paralysis after spinal anesthesia. This occurs despite the use of great care, by skilled specialists. Recently, the courts have given judgments to these patients on the ground of negligence of the attending anesthesiologist. Such a trend is most inequitable, because negligent acts often are not pleaded and proved, but the case reaches the jury on the legal ground of *res ipsa loquitur*. It is submitted that this unjust burden of liability on the anesthesiologist will succeed only in denying to patients the great benefits of spinal anesthesia. There is a very slight element of danger in the use of this technic, because no two human anatomy-detail patterns are exactly alike, and in a very few instances unique individual idiosyncrasies may occur.

Paralysis following spinal anesthesia, although admittedly it can occur, is rare. In over 30,000 spinal anesthesias administered in the Cleveland Clinic, there has not been a single instance of permanent paralysis. Such paralysis can occur when there is an unusual reaction to the anesthetic agent, or when contaminants are introduced. Should there be no break in sterile technic and the above precautions recognized, negligence cannot be inferred, ipso facto. Such legal inferences as *res ipsa loquitur* place an undue burden on the practice of anesthesiology.

Continuous Spinal Anesthesia

In continuous spinal anesthesia, a catheter is inserted into the subarachnoid space and anesthetic agents can then be injected when necessary for prolonged anesthesia. This technic is employed for long operations or in poor-risk patients to whom minimal but repeated doses of anesthetic agents may be administered. The incidence of post-spinal headaches after continuous spinal is rather high, and must be expected. However, this is a small price to pay for the safety of the anesthetic pro-

cedure and for the ideal operating conditions it provides for the surgeon in the poor risk patient. The possibility of damaging the nerves of the cauda equina with the catheter are great. These factors all are taken into consideration before deciding which technic to apply. But poor medical judgment in choosing this technic should never be grounds for negligence.

An indwelling catheter may supply an avenue for the introduction of infection. In spite of antibiotic treatment, such infection may set up an inflammatory condition known as arachnoiditis or meningitis. The catheter is placed in the subarachnoid space for definite purpose and the possibility of infection has been weighed against the benefits to be accrued. If active antibiotic therapy is instituted, as it must be, negligence cannot be presumed.

General Anesthesia

During general anesthesia, the patient is unconscious. The protective reflexes have now been attenuated and the patient is no longer able to protect himself against injury. As a result, injury to the anesthetized patient frequently occurs without notice. In the insensitive and totally relaxed body under anesthesia, trauma will not be prevented by the usual protective reflexes, as it is prevented in the conscious state. The patient cannot cry out with pain. Responsibility for the prevention of such injuries then falls solely upon the anesthesiologist. It is incumbent upon him to make anesthesia as safe as possible, by realizing and guarding against all the complications and pitfalls.

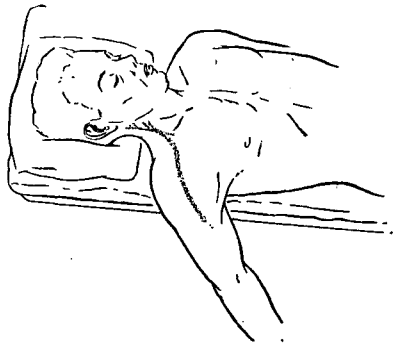

Fig. 3. Arm hanging over edge of operating table.

Nerve and bone injuries are among the most common and severe of all complications occurring during general anesthesia. The anesthesiologist must protect the relaxed limbs. The arm, for example, should not be hyperextended from the side of the body on arm boards, as is customary in many institutions, nor allowed to hang over the edge of the operating table (Figure 3).

Since the patient often is totally relaxed, a small cushion must be placed under the lumbar spine in order to maintain the lumbar curve. If this is not done, the lumbar curve frequently straightens out, resulting in strained ligaments and resultant backache post-operatively. This same possibility of complication occurs if the head is not placed upon a pillow, so that the normal cervical curve of the neck is not maintained. If such precautions are not taken, the patient may have varying amounts of post-operative discomfort in the lower spine and in the neck.

In all general anesthetic procedures, a venocylsis is required, (an indwelling needle within the lumen of a vein, through which a solution is continuously infused into the venous system). Care must be taken that such a needle is not inserted within the lumen of an artery. By arterial injection, irritating drugs or solutions flow in great concentration to the end of the extremity, and the tissues supplied will receive a toxic dose of agent. During anesthesia when the patient is receiving an intravenous fluid, it is necessary that periodic examinations be made of the extremity or extremities in which the needles are inserted. The needle can very easily become dislodged from the lumen of the vein and enormous amounts of fluids, as well as irritating agents, can be infused into the tissues of the extremities. When irritating drugs are administered, large areas of slough of skin may result from subcutaneous injection of such agents, causing severe injury to the extremities.

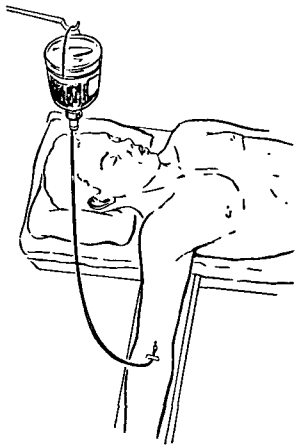

Fig. 4. Blood Transfusion. Arm extended from operating table on arm board.

During surgery, blood often may be administered to the patient in relatively large amounts. Should occasion arise when blood is to be administered, the anesthesiologist should always have the arms extended from the sides of the patient on adequate arm boards (Figures 4 and 4a) and the needles fully visualized. If these needles become dislodged from the lumen of the vein, large amounts of blood can be deposited under the skin, with severe results. This is especially true if blood is being infused under pressure.

Unless it is impossible to secure a good vein in the upper extremity, venoclysis in the legs is to be frowned

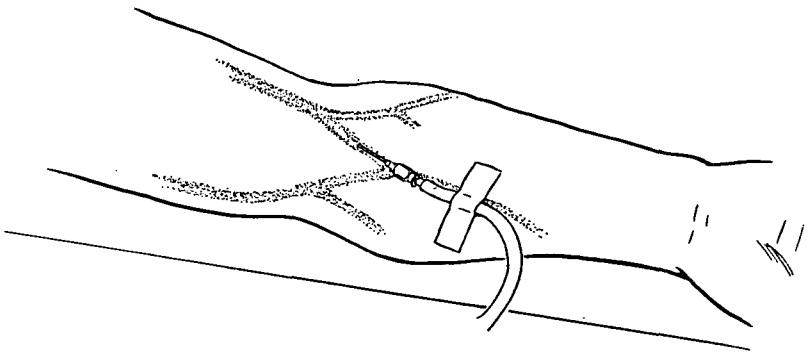

Fig. 4a. Intravenous administration of fluids or blood.

upon. The circulation of the lower extremity during anesthesia is not as forceful as that in the upper extremities. Drugs injected into the leg veins thus might irritate the lining of the veins, predisposing to a thrombophlebitis or an injury to the wall of the veins with resulting coagulation of the blood. However, many occasions arise when an intravenous needle in the leg becomes mandatory. This procedure is frequently employed. Its use per se should never be presumed to be negligence.

Phlebothrombosis is defined as the coagulation of the blood within the lumen of the vein. During anesthesia, the occurrence of phlebothrombosis follows the retardation of the blood flow and external pressure upon the lower extremity. The most common cause of phlebothrombosis is having the legs crossed during anesthesia. Other prophylactic steps, besides avoidance of crossing of the legs, are: (1) avoid low blood pressure, and (2) prevent pressure under the knee joints similar to that caused by crossing of the legs. One of the most common methods for preventing phlebothrombosis is, of course, the use of elastic stockings to milk the leg veins of blood.

When large amounts of fluids or blood are planned to be administered to the patient during surgery, it is better to place a large plastic catheter within the lumen of a large vein of the arm by an open cutdown, rather than to depend upon a metallic needle to remain within the lumen of the vein. This is quite common in children who are undergoing major surgery. At this time an ankle vein is usually opened by a surgical incision and a small lumen plastic catheter inserted into the saphenous vein. It is very difficult for this plastic catheter to rupture a vein, and it is practically impossible for it to be pulled out if it is

adequately secured to the skin. In some cases, in order that rapid action of the drug be obtained, it is not uncommon for this catheter to be fed up into the major vessels within the abdomen. At this point, there is absolutely no possibility of an thrombophlebitis or phlebothrombosis occurring, because of the great volume and the rapidity of flow of blood at this point. In adults, when large amounts of fluids are to be infused, or blood is to be transfused, instead of relying upon an indwelling needle, it is not uncommon to cut down upon the extremity, usually the upper extremity, and insert a similar plastic catheter into a suitable vein. This catheter may also be threaded through the vein into one of the great veins within the chest.

It must be remembered that because of the patient's insensitivity to pain, he may be severely burned during general anesthesia, without immediately visible reaction on his part. Such burns can be either chemical or electrical. Chemical burns are usually the result of skin being prepared for the surgical procedure. At this time the skin is covered with chemical antiseptic solutions. If such solutions are allowed to pool underneath the patient or at the groin, a severe chemical burn may result. This is negligence.

If ether is administered by the open-drop technique (that is, dropping liquid ether upon a mask covering the nose and mouth), care should be taken not to allow ether to drop on the eye. If this occurs, a severe chemical conjunctivitis results, with severe post-operative discomfort. For this reason, it is essential to keep the eyes closed, or to place over them a protecting membrane of polyethylene plastic or rubber. Great care should always be taken not to create excessive pressure over the eyes when a mask is placed over the face. Negligence of this type causes occlusion of the central retinal artery, injuring the vision in the eye.

Danger of Explosions

Explosions within the operating room are an ever-present hazard, and for the most part are avoidable. It is common in anesthesia to use explosive agents. These include ether vapor, cyclopropane, and ethylene. Explosions are set off by static or electrical sparks. The former are usually the results of movements of personnel and equipment within the room; the latter from motors or the like. All equipment in the operating room must be grounded, and all floors in the operating room must be

grounded, and all floors in the operating rooms must be conductive. In this manner, all equipment should be electrically neutral to each other. Grounding is usually accomplished by chains being dragged from all fixtures, machines, operating table, etc. Conductive rubber is used on all wheels. The anesthetist must not be dressed in wool, plastics, or rubber-soled shoes, unless the latter are made of conductive rubber. It is customary in most operating suites to have a staticometer. This simple machine measures the conductivity of the shoes. If within the "safe range," that person by standing upon the conductive floor in the operating suite, is grounded, the same as all the equipment. Therefore, if any piece of equipment or person correctly grounded come into contact, there should not be a static spark. Compliance with these few rules reduces the possibility of explosions to a minimum. Lack of these preventative measures is negligence.

Electrical sparks are rarely the cause of explosions, because they are so easily prevented. It is axiomatic in the operating room that no electrical connections or disconnections should be made when explosive agents are being administered to the patient! Switches for the overhead lights as well as outlet plugs must be located at least 54 inches from the floor. At this height, lights may be switched or electrical connections made or unmade whenever necessary. However, electrical switches located below the 54-inch level should never be used during the course of anesthesia. Electrical equipment in which an electrical spark is possible should never be used in the operating room unless it is "shockproof." Electric motors and the like can be made shockproof for use below the 54-inch level; however, there are decided disadvantages to this equipment: particularly the excessive cost of the equipment and the increased bulk. The electrocautery, the electrocoagulation current, and the electrofulgeration current equipment should never be used during cyclopropane, ether, or ethylene anesthesia. The likelihood of explosion with such combinations is very great, and their use in this situation constitutes gross negligence.

Moving the Patient

Injuries during transportation of the patient under general anesthesia are quite common. These movements are not always under the control of the anesthesiologist. The latter frequently

deposits the unconscious patient in the Recovery Room for continued observance by registered nurses. Inasmuch as the patient is unconscious and unable to protect himself, and indeed, is totally relaxed, injuries to the patient during transportation or in changing his position are common. The extremities may dangle over the sides of the carriage or bed, placing pressures upon the nerves in the arm or the leg, or even dislocating or fracturing the bone of the extremity. If not protected, the arm might dangle underneath the patient when he is moved, causing either fracture or dislocation of the arm. Care must also be taken so that indwelling needles may not be displaced and injure other tissues within the extremity when the patient is moved.

Another common source of possible danger to the patient lies in the regulating mechanism of the intravenous fluids. Occasionally during transportation or moving of the patient in the bed this mechanism becomes disturbed, causing the intravenous fluids to flow into the vein at a very rapid rate. If the patient is an elderly patient, overload of the right heart may very easily occur from excessive intravenous fluids, causing heart failure, and if uncorrected, death.

Specific Anesthetic Agents

Cyclopropane

Cyclopropane is an explosive gas, heavier than air, having a density of 1.42. Escaping cyclopropane gas will be concentrated at the floor level. When used in an operative procedure, care is always exercised to obtain a closed system. Leaks of the mask fitted upon the face must be reduced to a minimum. The practice of high flows, with the excess escaping into the room atmosphere pressure, must be condemned. Should a large leak persist, explosive concentration will build up on the floor. Any spark, static or electric, may then set off a fatal explosion. It is incumbent on the anesthetist and other operating room personnel to adhere to all the rules relating to prevention of static and electrical sparks. It should be unnecessary to mention that the electric cautery and coagulation current must never be used. Grounding technics must be strictly adhered to. Should an explosion occur, the cyclopropane in the patient's chest will rupture and burn the lungs. Unless all precautions were exercised, explosions must be presumed to be negligent.

Ether

Ether vapor has frequently been referred to as the safest anesthetic agent. As a result many liberties are taken when it is used in surgical anesthesia. Ether is a liquid at room temperature and is highly flammable. Since its specific gravity is 2.6, it, too, is heavier than air and will concentrate along the floor. The explosion hazard, though frequently not appreciated, is very great. Electric cautery and electrocoagulation equipment should not be used when this agent is employed. However, this general rule is frequently violated. Many surgeons consider ether, when used in the closed system, as non-explosive. Yet it is a fact that ether-oxygen mixtures are among the most explosive of all anesthetic mixtures. The use of electrical equipment during ether-oxygen anesthesia must be condemned.

Some authorities state that ether used by the open-drop method of administration is non-explosive. They contend that the ether-air mixture is not usually within the explosive range. Although such contentions are good rules of thumb, it seems on closer thought that there are many non-explosive agents that could be selected. The selection of ether when electrical equipment is to be used should be considered to be negligence.

Ethylene

Ethylene is an anesthetic agent the use of which has diminished to the vanishing point. It is highly explosive and must be used in such high concentrations that it no longer should be considered a part of the anesthesiologist's aramentarium.

Chloroform

Chloroform was one of the original anesthetic agents, being first used on Queen Victoria at the time of her delivery. From this auspicious introduction to obstetrics, chloroform enjoyed a long and continued popularity with parturient women. However, other agents have supplanted it in this field. As a result, it now is seldom used in any segment of anesthesia. Although re-evaluations have been made of the agent in the light of modern anesthetic equipment, it still has not been again accepted as a useful agent. Granted that it still enjoys use in home deliveries, its use in the future may verge on negligence. Though non-explosive, its toxic effects upon the liver and heart when

accompanied by too little oxygen are often overwhelming even on a good-risk patient.

Pentothal

One of the greatest advances in anesthesia in the last thirty years has been the introduction of pentothal sodium solution. The terrifying induction into general anesthesia by the placing of a mask over the face, and the breathing of obnoxious gases is obviated by an injection of pentothal. A needle is inserted into the arm vein and a few milliliters of pentothal solution painlessly injected. Immediately the patient becomes increasingly drowsy and quietly falls asleep. When he awakens, the surgical operation has been completed and he has none but pleasant memories of his anesthetic experience. Coupled with these great advantages, however, are several disadvantages. Should pentothal be negligently injected subcutaneously, because the needle becomes dislodged from the lumen of the vein, its irritant nature will cause destruction of the surrounding skin and deep tissue. Great care should always be exercised to prevent such extravasation.

Inasmuch as pentothal is a very powerful, fast anesthetic agent, the competent anesthesiologist is aware of the possibility of an overdose. This is manifested by depression or absence of breathing. While this is a very simple complication for the experienced anesthesiologist to cope with, the novice or untrained person might be considered as negligent in using the agent.

Extreme care must be exercised in the administration of pentothal so that it is never mistakenly injected into an artery. Pentothal is a very irritating agent. If injected through error into an artery, it will be carried in overwhelming concentrations to the end arteries and fine nourishing vessels of the hand. In such concentrations, extreme extensive injury will follow. This is gross negligence.

Nitrous Oxide

Nitrous oxide, when used in adequate amounts of oxygen, is the safest of all anesthetic gases. Its only effect on the human body is to produce loss of pain sensation. However, it must be combined with pentothal induction for balanced anesthesia. When so used, the combination is one of the most useful in modern anesthesiology. It is non-explosive and the patient may

be carried in light planes of surgical anesthesia. These advantages cause the combination to be commonly accepted as one of the safest of anesthesia.

Local Anesthesia

By local anesthesia is meant the injection of an anesthetic agent into the skin for blocking sensation of pain. It is used primarily for operations on circumscribed areas of the skin or operations on the extremities. The number of anesthetic agents available to produce this analgesia are legion. Cocaine was the original local anesthetic drug used, but has fallen into disrepute because of its powers of addiction. Cocaine is now limited to surface anesthesia of mucous membranes. Even in this use, the possibility of death from cocaine reaction is great.

Procaine is by far the most common local anesthetic agent used. It is probably the safest. Sensitivity and other reactions to procaine are not common. The anesthesia produced is profound but seldom prolonged. In order to extend its period of effectiveness, adrenalin is frequently added in small amounts. Herein lies the great risk of local anesthesia. It is not unknown for the operating room nurse to mistakenly hand the surgeon a syringe already supposedly loaded with local anesthetic agent. After injection, the surgeon, by the reaction of the patient, discovers it to be undiluted adrenalin solution. If the patient is in the older age brackets or in a weakened condition, this massive injection of adrenalin may be overwhelming. A common practice to prevent such an injection is for the surgeon to taste a few drops of the solution by squirting it upon his face mask. Should it be other than the familiar taste of procaine, the anesthestic solution should be discarded. The surgeon and operating room nurse should both read the label of a previously unopened bottle of anesthetic solution. Only by these precautionary steps can one prevent the negligent injection of caustic poisons into the body.

Endotracheal Anesthesia

One of the greatest advances in anesthesiology has been the introduction of the endotracheal tube. In this technic of anesthesia, a tube is inserted into the trachea (wind pipe) and is attached to a respirator-gas machine. With the patient asleep, he can no longer swallow his tongue or obstruct his breathing.

The lungs can be forcefully inflated with oxygen and anesthetic gases. Should the patient stop breathing, artificial respiration is easily maintained. Now the massive anesthetic mask is replaced by a simple tube, allowing the surgeon to have easy access to the head, face and neck. Before the introduction of the modern endotracheal tubes (Figure 5), general anesthesia for surgery of the head was dangerous and most delicate.

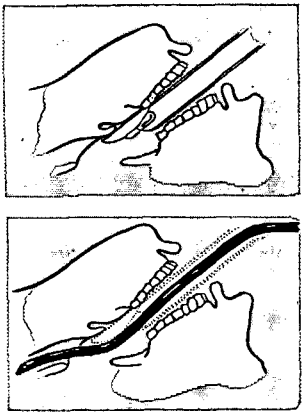

Fig. 5. Endotracheal intubation.

The introduction of the endotracheal tube requires visualization of the larynx through the mouth by use of a laryngoscope. This is not always a simple procedure even in the hands of an expert. Untoward difficulties often confront the anesthesiologist, even under the most ideal anesthetic conditions. In these difficult situations it is frequently necessary to exert great pressure on the upper incisor teeth and to use them as a fulcrum. In order to avoid chipping or other damage to the teeth, an adhesive or rubber guard is placed over the teeth. This will absorb some of the force exerted. In extreme emergencies, however, and especially when dental prosthesis have displaced the natural teeth, the great pressures may dislodge teeth. This does not necessarily indicate negligence. It is one of the dangers inherent in the procedure. It is incumbent upon the anesthesiologist, however, to recognize damage to the teeth. If fragments or dentures are dislodged, it is necessary for him to recover the fragments from the mouth and pharynx. In fact, it is accepted practice in many institutions to X-ray the chest of all patients who have had teeth dislodge during endotracheal intubation. Severe complications result from aspiration of teeth in to the trachea and fine bronchi of the lungs. This can cause an obstruction of the air passages to the lungs leading to atelectasis and abscess formation. Should a fragment of a tooth be visualized in the lungs, it must be removed by direct bronchoscopy. This consists of inserting a long metal tube into the trachea, and by means of forceps grasping the dental foreign body and removing it through the tube. Failure to X-ray the lung and to remove the fragments, if any are found, leads to severe complications and is negligence.

Endotracheal intubation is often used in emergency situations when general anesthesia is indicated and the patient has a full stomach. When the endotracheal tube is inserted into the trachea, the epiglottis is not capable of preventing food or other particles from entering the respiratory passages. Should the patient regurgitate while the patient is intubated, the stomach contents then might freely enter the trachea and drown the patient. To prevent this catastrophe, a cuff must be used on the endotracheal tube, or the pharynx must be packed with gauze, thus preventing entrance into the respiratory tree. Failure to take these preventive steps at least verges on negligence.