THE MANAGEMENT OF THE ANESTHETIZED PATIENT * †

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Much has been written about the medical complications related to anesthesia which occur in surgical patients. A review of the literature of the past ten years, however, reveals only an occasional article dealing with the traumatic complications. By traumatic complications we mean those injuries such as muscle or ligament strain, nerve damage, or vascular compression, which may occur to a patient during operation and which are entirely unrelated to the surgical procedure. Nevertheless, this phase of the care of the surgical patient is of great importance, because an otherwise uneventful postoperative course may be marred by unexpected, but preventable, trauma suffered during surgical intervention with resultant increased morbidity. The sequelae of such trauma may vary from temporary discomfort to permanent disability. Furthermore, the more serious traumatic complications have a medicolegal significance. The import of such a possibility was emphasized in a malpractice suit (1) reported in the Journal of the American Medical Association in March 1945. A traumatic injury to the brachial plexus was sustained by an anesthetized patient owing to the improper adjustment of shoulder rests. The court’s decision was against the defendants which included the surgeon, the anesthesiologist and the special nurse who attended the patient. To obviate trouble and embarrassment to the surgeon by a malpractice suit, the anesthesiologist, by virtue of his training in anesthesia, his knowledge of operating room procedure and the routine of the surgeon, is in the best position to protect the patient against such injuries.

Although injuries to the patient have occurred during transportation to and from the operating pavilion, the greater incidence of traumatic complications occurs while on the operating table. Injuries to the patient incurred during transportation will be considered first.

THE POSTANESTHETIC PERIOD

Injuries to anesthetized patients have occurred through improper handling. Undue flexion, extension or abnormal rotation of the head on the neck or of the neck on the body, have produced painful torticollis.

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from simple muscle strain or even a subluxation of the cervical spine. Older patients who may have arthritis of the cervical spine with limitation of motion may suffer severe injury as a result of forceful rotation of the head to either side or undue extension of the head. Injuries of the head or of the extremities also may occur as the result of accidents during transportation while moving the litter through doorways, around corners and in and out of elevators. In addition, the possibility must not be overlooked of the accidental overturning of a stretcher. Such an experience has been noted, but fortunately the patient did not sustain any injury.

The possibility of patients suffering from burns from hot water bottles left in the bed is well known. Such injuries often have been the basis for malpractice suits (2).

**Precautions:** There are simple precautionary measures which must be observed to prevent injuries to the patient during the postanesthetic period.

1. To prevent injuries to the head and neck, the attendants should lift the patient carefully on to the stretcher or into the bed. The patient's head should be supported by the attendant as he lifts the shoulders of the patient. All lifting movements should be coordinated to effect a smooth and gentle transfer of the patient.

2. The arms and legs should be placed in a normal, comfortable position and no part of the body should overhang the edge of the stretcher. In obese patients or in orthopedic patients in casts, however, this is often impossible. In these cases care must be exercised to avoid injury to the projecting extremities.

3. The patient should be placed in the center of the bed with his arms at his sides. Careless handling may allow a patient to lie with his arm or hand in an uncomfortable position and result in muscle strain or trophic disturbances.

4. Hot water bottles, if used, should be removed from the bed before the patient is put in bed.

**The Anesthetic Period**

In routine skin preparation when ether, alcohol and a tincture are applied after the patient is anesthetized, severe burns of the groins, serotum or vulvae have occurred, especially in sensitive patients. In operations around the head and neck extreme care must be exercised to prevent burns of the eyes, and to prevent entrance of these chemicals into the orifices of the head. Rarely, the wrong solution may be used. In one such instance pure phenol was used instead of alcohol on the abdomen, resulting in severe burns of the abdomen, groin and vulva. This necessitated postponement of the operation and prolonged hospitalization of the patient. A settlement was effected in this case without suit.
An undue amount of pressure of the rubber face mask over the bridge of the nose may produce painful areas and even ulceration. When the mask is permitted to exert pressure on the globes of the eyes, a reduction of intra-ocular tension may result. This is characterized by ocular pain and blurring of vision. Brittain and Brittain (3) noted 13 cases of unilateral hypotony in 300 anesthetized patients. They observed upon examination of volunteer subjects that even light pressure upon the globe of the eye would produce a decrease in intra-ocular tension, resulting in severe pain and blurring of vision. These symptoms, however, disappeared in six hours or less. Corneal abrasions also may occur as a result of excessive pressure of the face mask upon the partially opened eye. Occasionally a patient will exhibit a slight tonus of the upper lids exposing the cornea and the conjunctiva, resulting in corneal drying with ulceration and acute conjunctivitis.

Contact of the face mask may produce a dermatitis or even an infection. In one case, an oval area of pustular lesions, occupying the position of contact of the face mask developed within twenty-four hours following operation. This staphylococcc infection may have originated from an improperly cleaned face mask.

Injuries which may occur during insertion of intratracheal tubes have been recorded in the literature (4), and will not be discussed in this paper.

Muscle and Ligamentous Strain

The various surgical positions when maintained for extended periods of time frequently contribute to the production of traumatic complications.

When the patient is in the supine position backache postoperatively may follow strain of the lumbar and sacral ligaments when the lumbar convexity is not supported (5). Pressure over the tendo achillis should be avoided when a tall patient extends beyond the foot of the table. Painful tenosynovitis has been observed as a result.

In the lithotomy position, the stirrup standards must be fixed securely and the legs well supported to prevent sudden fall of an extremity. Moreover, during a prolonged operation upon an elderly patient in the lithotomy position, postoperative calf pain may be produced which can simulate an acute thrombophlebitis. If the stirrups are placed too high, flexion of the thighs on the abdomen may be excessive, producing sacro-iliac and sciatic pain. On the other hand, stirrups which are placed too low may also produce pressure and pain of the calf muscles and thighs. Strain of the adductor muscles of the thighs may be produced by excessive "spread" of the thighs.

In the Trendelenburg position the patient's knees should be over the break of the table to prevent undue pressure on the calves of the legs. Such pressure will result in pain which often may be confused with an early thrombophlebitis.
The gallbladder and kidney bridge should be elevated only when actually needed and only as high as is indicated. Moreover, they should be depressed as soon as practicable, because of the severe back pain which may be experienced postoperatively, and which in some patients is even more severe than the pain of the operative area.

Nerve Injuries

Compression and stretching of nerves and nerve trunks cause the most serious complications. Such injuries may be produced in various ways.

Unless the elbows are in a comfortable position at the sides of the body free from pressure of the metal fittings at the edge of the table, whether the patient is in the supine, prone or lateral position, paralysis of the radial or ulnar nerve may be produced. Moreover, with the arm on an arm board, the wrist may be tied too tightly, producing peripheral neuritis.

Injuries to the radial nerve are produced mainly through compression of the nerve against the humerus in the middle third of the upper arm. They are characterized by wrist drop or such sensory loss as numbness and tingling along the outer aspect of the forearm. The thumb frequently cannot be abducted or extended (6). Pressure on the inner aspect of the arm, forearm or elbow may produce symptoms of paralysis of the ulnar nerve, characterized by numbness and tingling in the little finger or even paralysis of the ring and little finger.

When the patient is placed in the lithotomy position or in the kidney or lateral position, the peroneal nerve may be compressed between the metal of the operating table and the head of the fibula, inducing a palsy manifested by foot drop and paresthesia.

Injury of the brachial plexus during anesthesia may be the result of stretching of the nerve fibers from forced posture or of compression of the nerve. Clausen (8), in his excellent discussion on postoperative paralyses of the brachial plexus, described the anatomical fixation of the nerve trunks by the paravertebral fascia at the transverse processes and by the axillary fascia in the arms. Abnormal tension on these points of fixation may cause injury to the nerves. Clausen enumerated the factors and mechanisms which tend to increase the distance between the points of fixation of the nerves, which are responsible for injuries to the brachial plexus. He described the mechanism of injury as follows:

1. Extreme abduction and extension of the arm forces the clavicle to compress the plexus against the first rib, although the increased tension distal to the point of compression produces the injury.

2. Lateral deviation and extension of the head may produce injury to the plexus especially when the shoulder is depressed.

3. Marked abduction of the arm increases the distances between the arm and the transverse processes with resultant tension.
"4. With the arm in external rotation, abduction and extension, the head of the humerus produces an axillary prominence around which the nerve courses, thereby putting the plexus on a stretch.

"5. When the arm is brought down forcefully, the first rib becomes a prominence over which the nerves must pass producing tension on them."

Thus, it may readily be deduced how the varying positions of the patient on the operating table may bring about tension on the brachial plexus and trauma. With the patient in the supine or prone position, if the arm is raised above the level of the shoulder, undue strain will be exerted on the plexus. Faulty arm position is commonly seen when the arm is placed on an arm board for intravenous medication, at an angle greater than 90 degrees; when the patient is in the prone position if the arms are placed above the head, and also, in the lateral position when the arm is abducted for operations on the chest.

When the patient is in the Trendelenburg position with improperly adjusted shoulder braces, compression of the plexus on the first rib may produce injury. Occasionally, with the arms abducted at 90 degrees or less and in an apparently safe position, the head and neck may be displaced too far laterally, producing tension on the plexus. Furthermore, with a patient in the lateral position, it is extremely important to maintain the axis of the head and neck in the same plane as the thoracic spine to avoid undue strain on the plexus. In his report of 9 cases Clausen has observed that injury to the brachial plexus is manifested by tenderness in the supraclavicular fossa which appears from five to ten days after operation. The loss of motor power is usually more prominent than loss of sensation. Sensory impairment may be hypesthesia, anesthesia, hyperesthesia or paresthesia. Usually the loss of motor function and the sensory disturbances are of short duration and recovery is complete. Permanent effects, however, have been observed.

Vascular Disturbances

Some of the trophic changes of the upper extremities, characterized by numbness and paresthesia, may be manifestations of vascular or nerve trauma or a combination of both.

Wright (9) has ably described the neurovascular syndrome produced by hyperabduction of the arms. He demonstrated that hyperabduction of the arms in individuals with normal anatomy can produce obliteration of the arterial pulse, and if the position is maintained, trophic changes and even gangrene of the tips of the fingers may result. Wright believed that the mechanism involved in the production of this syndrome consists of: (1) the stretching of the brachial plexus and the subclavian axillary vessels under the coracoid process, with some pinching under the pectoralis minor muscle and (2) compression of the plexus
and vessels between the clavicle and the first rib, when the arm is hyperabducted. Others (10, 11, 12, 13) have described similar phenomena.

The dangers of vascular and nerve injury as a result of improper or prolonged application of a tourniquet are well known and will not be discussed.

**Precautions:** Thus, from a knowledge of the mechanism of production of the traumatic complications affecting the anesthetized patient during the anesthetic period, certain precautions may be emphasized with the view of preventing the occurrence of such injuries.

**The Supine Position.**—1. The arms should be placed at the sides in a comfortable position. The hands and fingers should be placed in the neutral position.

2. If the patient is obese it may be necessary to place a pad under the arms to protect the elbows.

3. If the patient’s feet extend beyond the table, a pad should be used to provide support, thereby preventing undue pressure on the tendo achillis.

4. If an arm board is used, the board should be padded, and the arm should be abducted not more than 90 degrees. In addition, tight bandaging of the wrist should be avoided.

5. Exaggerated movements of the head and neck must be avoided. The limits of head mobility may vary widely in different individuals.

6. The position of the knees should be at the break of the table in the event that the Trendelenburg position will be required.

**The Trendelenburg Position.**—1. Well-padded shoulder rests should be placed not at the base of the neck but over the coracoid processes. Furthermore, the curve of the shoulder braces should be adjusted to conform with the contour of the patient’s shoulders.

2. The knees should be over the break of the table.

3. In this position, the possibility that the nurse’s instrument stand may compress the tibiae should not be overlooked.

4. The patient should be returned to the horizontal or near horizontal position as soon as possible so that the pressure of the braces on the shoulders may be released.

**The Lithotomy Position.**—1. The stirrup standards must be placed at the proper height and secured carefully.

2. The legs should be placed on the outside of the standards and the inner sides of the legs should be padded if necessary.

3. Hyperabduction of the thighs should be avoided to prevent undue strain on the adductor muscles.

4. If knee-holding stirrups are used, the legs must be placed carefully in the required angulated position to provide even support so that the entire weight of the extremity will not be borne by the calves of the legs.

5. The legs should be raised and lowered simultaneously for the lithotomy position.
The Prone Position.—1. Many of the precautions recommended for the supine position may be applied to the prone position.

The Gall Bladder and Kidney Positions.—1. The use of the bridge should be withheld until it is actually needed and it should be lowered as soon as it is practicable.

2. When the patient is in the lateral position, the placing of the arms always has presented a problem. Recently, Begenauf (14) described a new double arm rest for this position which may provide a solution to this problem.

SUMMARY

The importance of the management of the anesthetized patient to avoid preventable traumatic complications has been emphasized. The medicolegal significance, the injuries produced, the mechanism of production, and the precautions to be observed have been discussed. A review of the literature of the past ten years and relevant experiences of the authors have been presented. It has not been the purpose of this paper to present the usual anesthetic and surgical complications with which we are all familiar and about which a great deal has been written. Perhaps certain traumatic complications which can and undoubtedly have occurred, have been overlooked. The literature is meager on this phase of the care of the anesthetized patient. The anesthesiologist, cognizant of the factors involved in the production of such injuries, with the cooperation of the surgeon, can direct all personnel in the proper management of the anesthetized patient.

REFERENCES