COMPLICATIONS OF ANESTHESIA DURING RADICAL SURGERY ABOUT THE HEAD AND THE NECK

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Although the literature contains many articles describing various techniques for the administration of anesthesia to patients subjected to operative procedures about the head and the neck, comparatively little has been written on the subject of the complications that may occur during the course of surgery and in the immediate postoperative period. Since the anesthesiologist plays an important role in the diagnosis, the prevention, and the treatment of these untoward events, the Department of Anesthesiology of Memorial Center has devoted considerable time to a study of the factors that facilitate this threefold approach and, in consequence, reduce the hazards of radical surgery in the area of the head and the neck. The results of our observations are summarized in the present article.

Airway

It is unnecessary to emphasize the necessity for maintenance of an unobstructed airway during operative procedures in the anatomical region under consideration. Since it is also essential to permit the surgeons free access to the site of operation, a technique was devised several years ago to meet the various requirements of safe anesthesia for surgery about the head and the neck. Although modifications have been necessitated by the introduction of new anesthetic agents and improved mechanical devices, the essential features of this method are those described in 1949 by Schweizer (1).

A condition that requires special consideration is that in which easy introduction of an endotracheal tube is prevented by distortion of the nasal, the oral, or the laryngeal passages by tumor or deformities due to previous surgery or trauma. In the hands of an experienced anesthesiologist, successful oral or nasal intubation can be performed in the majority of these patients by a technique devised by Howland (2). After an infusion of normal saline or 5 per cent dextrose in water has been started in one arm to permit the administration of an intravenous barbiturate to counteract any untoward reaction from the topical anesthetic agent, the posterior pharynx and the nasal passages

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are sprayed with a small amount of 10 per cent cocaine or 5 per cent Cyclaine® by means of a de Vilbiss atomizer. When adequate desensitization has been obtained, a Miller or other narrow bladed laryngoscope is introduced, the epiglottis exposed, and both upper and lower surfaces covered with a few drops of 10 per cent cocaine or Cyclaine from a laryngeal cannula attached to a 5 cc. syringe. The laryngoscope then is withdrawn to permit the patient to rest while the cocaine is taking effect. After a short interval, the epiglottis is elevated and the vocal cords exposed by direct visualization. One-half to 1 cc. of the topical agent is instilled into the larynx via the laryngeal cannula, care being taken to ensure that some of the drug is placed directly on the cords. The ensuing cough permits rapid diffusion of the cocaine throughout the larynx and the upper tracheobronchial tree. Shortly thereafter, an endotracheal tube readily can be introduced by the oral or the nasal route. During the past year this technique has been improved by the transtracheal instillation of 2 cc. of 10 per cent cocaine or 5 per cent Cyclaine a few minutes prior to the initial laryngoscopy. The patient then is anesthetized with an intravenous barbiturate and the tube connected to the anesthesia machine for the administration of nitrous oxide and oxygen.

However, it must be emphasized that, in the case of patients with severe deformity or obstruction of the airway, the technique described is safe only in the hands of an anesthesiologist with considerable experience in direct laryngoscopy and with sufficient knowledge of head and neck pathology to judge its limitations. The equipment and the personnel necessary to perform an emergency tracheostomy should always be in the operating room before intubation is attempted.

Unless these conditions can be met, it is preferable to perform a preliminary tracheostomy in all patients in whom endotracheal intubation presents unusual problems. The life-saving benefits of a tracheostomy outweigh any possible disadvantages. The latter are, in fact, of little significance, since the scar of a properly performed tracheostomy is minimal and the tube usually can be corked a day or two after the operative procedure.

Brief mention should be made of another group of patients who present no problem from the standpoint of endotracheal intubation but in whom it is difficult to maintain a free airway in the postoperative period after removal of the endotracheal tube. Included in this category are individuals with a partial or a total mandibulectomy, with large packs in the nasopharyngeal region following removal of lesions in this area, with temporary or permanent paralysis of one or both vocal cords, or patients in whom both internal jugular veins have been removed. A tracheostomy performed at the end of the operative procedure provides the best means of ensuring a free airway in these cases.
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Carotid Sinus Reflex

Operative manipulation in the region of the bifurcation of the common carotid artery into its internal and external branches is a frequent source of complications in head and neck surgery. This region, known as the carotid sinus, is supplied by branches of the glossopharyngeal, the vagus, and the sympathetic nerves. Reflex activity initiated by stimulation of this area results in the clinical manifestations of vagus activity; namely, bradycardia, hypotension, and cardiac and respiratory arrhythmias. The severity of the symptoms varies in different patients, but prompt treatment should be instituted at once to avoid a prolonged depression of the vital functions.

Measures aimed to prevent the development of a carotid sinus reflex should be employed routinely in all operative procedures involving the upper cervical region. The most effective method of attaining this objective is infiltration of the sinus area with procaine or other local anesthetic agent prior to manipulation. If hypotension and bradycardia occur in spite of this precautionary measure, the first step is cessation of all surgical activity. This is followed by the intravenous injection of ½₉₀ to ¾₇₂ gr. of atropine sulfate. The combined treatment usually results in restoration of the abnormal signs to the preoperative condition within a short time. If a favorable response does not occur, an intravenous vasopressor can be used to bring about the desired elevation of blood pressure. Controlled respiration is employed in all cases of respiratory depression.

Patients who exhibit overactivity of the carotid sinus preoperatively are sedated with ½₉₀ to ¾₇₂ gr. of atropine sulfate in addition to a narcotic or a barbiturate prior to surgery. Efforts have been made to employ ganglion-blocking agents such as hexamethonium bromide for the control of carotid sinus reflexes, but only a minimal degree of success has been attained since doses of a size adequate to prevent reflex activity produce the undesirable side effect of hypotension.

Pneumothorax

Tension pneumothorax is an infrequent but a potentially dangerous complication of operative procedures in the lower cervical region. Although accidental surgical entry into the pleura accounts for a small number of these cases, a review of the literature together with a study of the incidence of pneumothorax on the Head and Neck Service of Memorial Hospital indicates that the majority are due to factors other than a rent in the dome of the pleura.

Since 1884, articles by Champneys (3), Leiner (4), Keis (5), Ackerman and Bricker (6), Goldberg (7), Neffson (8), Forbes (9), Aisner (10), and others have described the presence of mediastinal emphysema with or without a concomitant pneumothorax in operative procedures such as thyroidectomy, radical neck dissection, and tracheostomy for
acute respiratory obstruction. In several cases, a fatal termination resulted from inadequate treatment or failure to recognize this serious complication.

Two theories have been advanced to explain the mechanism of production of a tension pneumothorax during the course of surgical procedures in the lower cervical region. The first theory, which provides an explanation for the majority of cases of this complication, is based on anatomical considerations. A review of the anatomy of the lower neck reveals that, between the middle and the deep layers of the deep cervical fascia in the area containing the trachea and the esophagus, a direct communication exists between the neck structures and the superior mediastinum. It is obvious, therefore, that air passes into the mediastinum whenever the surgical procedure involves division of the middle layer of the deep cervical fascia. Since tension mediastinum and tension pneumothorax complicate only a small number of these operations, it is equally apparent that other factors must play a role in their production. The most important of these is labored respirations due to excess mucus secretions, coughing, laryngospasm, or other pathological conditions. As a result of the increased negative intrathoracic pressure associated with respiratory distress, air under atmospheric pressure is drawn into the mediastinum through the widened superior orifice on inspiration. With partial closure of the opening during expiration, part of the inspired air is trapped under pressure in the mediastinum. The process continues until the pressure gradient across the mediastinal pleura is large enough to cause rupture of the pleura, with the production of a homolateral, contralateral, or bilateral pneumothorax. Although, in some cases, the intramediastinal pressure may not greatly exceed atmospheric pressure, pleural rupture can still occur because the high negative intrapleural pressure of respiratory embarrassment is sufficient to cause a large pressure differential across the pleural membrane.

Air under pressure in the mediastinum seeks other pathways of escape in addition to entry into the pleural cavity. It may dissect into the soft tissues of the neck, the face, the thoracic wall, and the axilla, producing subcutaneous emphysema, or it may travel along the aorta and the esophagus into the retroperitoneal region of the abdominal cavity. A corollary of the latter situation is the occurrence of mediastinal emphysema and unilateral or bilateral pneumothorax following rupture of an abdominal viscus.

A second etiological explanation for the presence of a tension pneumothorax was proposed by Macklin and Macklin (11) as a result of their observation that many patients with influenza pneumonia develop a spontaneous unilateral or bilateral pneumothorax. These investigators felt that the precipitating factor was a rupture of dilated alveoli (compensating for areas of atelectasis or pneumatic consolidation) with subsequent escape of air into the interstitial tissues sur-
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rounding the pulmonary vessels. The air then followed the course of these vessels to the hilar area to form a tension mediastinum and its sequelae.

In clinical anesthesia, Macklin's theory offers an explanation for the development of a tension pneumothorax in patients subjected to an excessive amount of positive pressure or those in whom the presence of excess secretions results in patchy atelectasis with compensatory overdistension of the remaining alveoli.

The signs and symptoms of tension pneumothorax in the anesthetized patient frequently are attributed to other causes unless the anesthesiologist is alert to the possibility of its occurrence in operative procedures involving the lower cervical region. The best diagnostic feature of this condition is a disparity between the marked respiratory efforts of the patient and the minimal motion of the breathing bag. This frequently is accompanied by an asthmatic type of breathing with a prolonged expiratory phase. As the intrapleural tension increases, dyspnea becomes severe, and cyanosis, tachycardia, subcutaneous emphysema, cardiac arrhythmias, and hypotension make their appearance. In many patients, physical examination fails to reveal conclusive evidence of a pneumothorax, so that absence of signs obtained by auscultation and percussion should not delay therapy if the general picture indicates the presence of air under tension in the pleural cavity. In the average case of tension pneumothorax complicating neck surgery, abnormal symptoms and signs first are observed about midway through the operative procedure—that is, after surgical division of the middle layer of the deep cervical fascia. The appearance of respiratory and circulatory changes shortly after the onset of operation suggests the presence of mediastinal emphysema and its sequelae produced by the factors described by Macklin and his co-workers.

The anesthesiologist plays an important role in the prevention of tension mediastinum and pneumothorax. Since respiratory obstruction or bucking is one of the major causative factors of this condition, it is essential that all patients subjected to operative procedures in the lower neck region be assured of a free airway and smooth anesthesia. It is noteworthy in this respect that, in the series of cases of pneumothorax reviewed by Bowden and Schweizer (12), the majority were in a group anesthetized by relatively inexperienced residents in anesthesia. Preliminary insertion of a bronchoscope or endotracheal tube reduces the incidence of this complication in children in whom it is essential to perform a tracheostomy for respiratory obstruction.

Should pneumothorax occur during the course of an operative procedure, prompt therapy is necessary to prevent severe morbidity or a fatality. The advisability of obtaining radiographic confirmation of the diagnosis before employing definitive therapy is determined by the condition of the patient. Valuable information may be secured by an emergency roentgenological examination of the chest if the
symptoms are still mild, but, if the patient exhibits severe respiratory distress or circulatory collapse, immediate treatment is imperative. The most effective therapy of a tension pneumothorax is drainage of the pleural cavity through the third or fourth intercostal space an-

MEMORIAL CENTER
ANESTHESIA RECORD

NAME: N. D.
DATE: 3/3/49
AGE: 46
ROOM: 1006
MIDDLE: Y.

Wt. 123 T. 90 P. 80 B.P. 125
R.B.C. 40
H.P. 6
B.U.N. 16

Anesthetist: OLGA SCHWEIZER

Surgical
Result: Fair

M.M. R.M.

PM.

1 P.M.

3 P.M.

5 P.M.

7 P.M.

Pre-operative
Preparation:

Time:

11:30 p.m.

Morph.

Atropine:

Supo.

Sed.

Add.

Supplementary:

Induction:

Smooth
Maintenance:

Tension

Pneumothorax

Condition at Close

Satisfactory

Sponge Count:

Infusion source:
N. Saline

Transfusion source:

Total

Aneresia

Amount

Technic

Reason

Pentothal 2.5% (1.5 gm) + N.O2. IV - Absorption in circuit

Pentothal 2.5% + d-tubocurarine chloride 100 units oral intubation

Pre-operative Diagnosis: Cancer of thyroid with rt. cervical node metastases

Operation: Rt. hemithyroidectomy and radical neck dissection

Post-operative Diagnosis: Same

Surgeon: Drs. F. F., J. L., C. M.
Nurse: Misses L and W.

Irrigation:

Fig. 1. Complications of Anesthesia During Radical Surgery about the Head and Neck.
to the operative site. Failure to obtain air under tension suggests the presence of a contralateral pneumothorax. Similarly, failure to effect rapid relief of symptoms after drainage of a pneumothorax on one side indicates bilateral involvement, a condition which necessitates the same type of therapy on the opposite side. The use of positive pressure for the administration of oxygen is contraindicated in patients suffering from tension pneumothorax, since it tends to aggravate the respiratory distress.

A typical example of the development of a bilateral tension pneumothorax during the course of an operative procedure in the lower cervical region is shown in figure 1. In this patient, partial respiratory obstruction followed accidental kinking of the endotracheal tube.

The effectiveness of the catheter drainage type of therapy is shown by the significant improvement in morbidity and mortality at Memorial Center since the initiation of this form of treatment in comparison with the results obtained by a more conservative approach to the problem.

**Bilateral Neck Dissections**

Fear of severe complications due to a sudden marked elevation of intracranial pressure caused a delay of many years in the clinical application of operative procedures involving removal of a second internal jugular vein. The histories of patients presenting symptoms of extreme congestion of the face, violent nosebleeds, exophthalmos, and respiratory depression were reported by Ewald (13), Duval (14), LeClerc and Roy (15), Sugarbaker (16) and others to support their contention that a second radical neck dissection or a simultaneous bilateral procedure carried an almost prohibitive risk.

A closer study of the anatomical and the physiological readjustments necessitated by elimination of two of the main channels of venous return from the head indicates that this earlier attitude was unduly pessimistic. The extensive collateral venous circulation which remains after removal of both internal jugular veins is shown in table 1. Additional proof is furnished by Guiss and his co-workers (17), who demonstrated the collateral flow by injecting neo-iopax® into the frontal vein, and by Batson (18), who estimated that the total cross-sectional area of the vertebral venous system alone is probably greater than that of the two jugular veins.

In addition to the collateral venous circulation, several other compensatory mechanisms assist in preventing undue elevation of the spinal fluid pressure. Kety, Shenkin, and Schmidt (19) found that the critical level of cerebrospinal fluid pressure is about 450 mm. of water, above which there is a progressive and significant decrease in cerebral circulation. It long has been known that the volumes of blood and cerebrospinal fluid within the dural sac bear an inverse relationship to each other (Monro-Kellie doctrine). Consequently, unless a vent is provided, a marked rise in spinal fluid pressure follows obstruction
to venous drainage from the cranial cavity. Such a vent occurs whenever the patient is placed in the reverse Trendelenburg position. Pooling of spinal fluid in the lumbar region not only permits expansion of the intracranial venous bed without excessive increase of spinal fluid pressure, but also may facilitate absorption of fluid in the lumbar area by elevating the hydrostatic pressure gradient. In addition, the "head-up" position improves venous flow in the collateral circulation which remains after removal of both internal jugular veins. A second factor of importance is the adequate communication existing between the intracranial and the extracranial portions of the venous system. Shenkin, Harmel, and Kety (20) found that the direction of blood flow is predominantly toward the extracranial areas, a fact which may explain the phenomenon (observed in many patients) of marked venous congestion of the face in the absence of an abnormally elevated spinal fluid pressure.

TABLE 1

**COLLATERAL CIRCULATION AFTER REMOVAL OF BOTH INTERNAL JUGULAR VEINS**

1. Vertebral plexus
   a. Internal vertebral plexus—situated in the space between the dura and the bony wall of the spinal canal
   b. External vertebral plexus—surrounds the vertebral arches and traverses the deep muscles of the neck and the back; communicates at each body segment with the intercavitory veins of the thorax and the abdomen and the veins of the abdominal wall

2. Occipital vein
3. Posterior jugular vein
4. Profunda cervical vein
5. Collecting veins of posterior cervical region
6. Pharyngeal, pterygoid, orbital, and esophageal plexuses
7. Emissary veins—direct communication between the dural sinuses and the superficial veins lying outside the bony wall of the cranial cavity

These theoretical considerations are borne out by clinical experience. Schweizer and Leak's (21) studies of spinal fluid pressures in a series of controls, unilateral radical neck dissections, and bilateral radical neck dissections (performed simultaneously or at successive operations) revealed that the rise in spinal fluid pressure which follows division of the lower end of a second internal jugular vein is not significantly greater than the elevation of pressure which occurs uniformly after division of the first vein. No important variations were found between the different groups with respect to the final pressures obtained at the end of the operative procedure, and a rapid postoperative return to normal was noted in all patients. These investigators also confirmed the observations of Masserman (22) and Hamilton (23) that an increase in spinal fluid pressure could be produced by methods other than division of an internal jugular vein. Shifting the position from lateral to supine, turning the head to the side, coughing, or straining resulted in an elevated pressure in all groups including the controls (table 2).
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The histories of 35 patients in whom simultaneous bilateral radical neck dissections have been performed at Memorial Center within the past few years were reviewed to determine the type of complication associated with removal of both internal jugular veins. In spite of the age of these patients (the majority were in the sixth and the seventh decades), and the fact that they were subject to a variety of serious preoperative complications in addition to their primary disability, all but one tolerated the operative procedure without evidence of serious distress. The one exception displayed a sudden rise of blood pressure associated with a pulsus alternans during dissection of the second side. Hypertension persisted for a half hour, followed by a transient fall in pressure to 70/40 with a subsequent rise to a normal level.

The facial edema and cyanosis, present in varying degree in almost every patient subjected to removal of both internal jugular veins, are of little significance unless associated with other signs of increased intracranial pressure. In many individuals, marked edema is not evident.

### Table 2

**Comparison of Spinal-Fluid Pressures in mm. of Water in First, Second, and Simultaneous Bilateral Radical Neck Dissections**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Initial Pressure (on Side)</th>
<th>Supine Pressure</th>
<th>Pressure with Head Turned to Side</th>
<th>Pressure After Anesthesia</th>
<th>Pressure After Division Internal Jugular Vein—First Side</th>
<th>Pressure After Division Internal Jugular Vein—Second Side</th>
<th>Highest Pressure During Operation</th>
<th>Range of Pressure During Operation</th>
<th>Final Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. P.</td>
<td>80</td>
<td>230</td>
<td>270</td>
<td>260</td>
<td>410</td>
<td>600-</td>
<td>600-</td>
<td>200-600-</td>
<td>400</td>
</tr>
<tr>
<td>B. K.</td>
<td>280</td>
<td>250</td>
<td>350</td>
<td>360</td>
<td>600-</td>
<td>600-</td>
<td>600-</td>
<td>210-600-</td>
<td>220</td>
</tr>
<tr>
<td>W. G.</td>
<td>110</td>
<td>260</td>
<td>280</td>
<td>440</td>
<td>360</td>
<td>440</td>
<td>240-440</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>D. J.</td>
<td>160</td>
<td>200</td>
<td>260</td>
<td>240</td>
<td>480</td>
<td>600-</td>
<td>600-</td>
<td>200-600-</td>
<td>270</td>
</tr>
<tr>
<td>Y. W.</td>
<td>140</td>
<td>240</td>
<td>350</td>
<td>300</td>
<td>360</td>
<td>460</td>
<td>230-460</td>
<td>270</td>
<td></td>
</tr>
</tbody>
</table>

**First Radical Neck Dissections**

| E. P.   | 40                        | 220             | 290                           | 200                       | 440                                                  | 440                                  | 200-440                         | 300                            |                |
| C. M.   | 140                       | 280             | 340                           | 260                       | 540                                                  | 600-                                | 600-                            | 260-600-                   | 340             |
| M. L.   | 140                       | 240             | 320                           | 240                       | 440                                                  | 580                                  | 200-580                         | 300                            |                |
| G. F.   | 70                        | 250             | 300                           | 300                       | 400                                                  | 490                                  | 300-490                         | 340                            |                |
| G. H.   | 120                       | 260             | 260                           |                            | 600+                                                 | 600+                                 | 240-600+                        | 250                            |                |

**Second Radical Neck Dissections**

| G. D.   | 20                        | 160             | 180                           | 220                       | 300                                                  | 460                                  | 480                             | 180-480                     | 290             |
| A. K.   | 100                       | 210             | 240                           | 220                       | 480                                                  | 440                                  | 600+                            | 220-600+                   | 340             |
| T. F.   | 180                       | 250             | 300                           | 280                       | 580                                                  | 520                                  | 600+                            | 280-600+                   | 300             |
| O. A.   | 120                       | 240             | 280                           | 220                       | 600+                                                  | 580                                  | 600+                            | 240-600+                   | 220             |
| M. O.   | 140                       | 170             | 340                           | 340                       | 380                                                  | 520                                  | 590                             | 240-590                      | 350             |

**Simultaneous Bilateral Radical Neck Dissections**
until twenty-four or forty-eight hours after the termination of the operative procedure.

In contrast with the benign operative course, 4 of the 35 patients in the group under consideration developed symptoms suggestive of increased intracranial pressure during the first few days of the postoperative period. Marked cyanosis and shallow respirations were associated with the application of a tight pressure dressing at the termination of operation in one 70 year old man. Significant improvement followed elevation of the head and loosening of the dressing. Another patient developed a sudden episode of cyanosis, loss of consciousness, and incontinence on the first postoperative day. He recovered rapidly without therapy and exhibited no further symptoms during the remainder of his postoperative course. The only evidence of increased intracranial pressure in the third patient was a grade 2 papilledema with venous engorgement discovered on the second day after operation. An initial spinal fluid pressure of over 600 mm. of water (with the patient seated) was reduced to 300 mm. without untoward sequelae by slow withdrawal of 50 cc. of spinal fluid. The fourth patient was a 36 year old narcotic addict who was subjected to a laryngectomy and bilateral radical neck dissection. A semicomatose condition with marked cyanosis, circulatory collapse, and severe depression of respiratory rate occurred on the morning of the second postoperative day, following a twenty-four hour period of regularly spaced doses of methadone. Treatment with n-allyl-normorphine and norepinephrine effected temporary improvement but persistent relapses terminated in cessation of respiration. Resuscitative measures, including spinal tap for reduction of a spinal fluid pressure of 600 mm. of water (patient seated), were unsuccessful and the patient died several hours after the onset of symptoms. Postmortem examination failed to reveal either gross or microscopic evidence of increased intracranial pressure.

From the preceding discussion, it is evident that the greatest danger in bilateral removal of the internal jugular vein occurs, not on the operating table, but in the first forty-eight hours of the postoperative period. It is our impression that use of a continuous spinal needle as a safety measure during the operative procedure is an unnecessary precaution, but it is advisable to keep the patient in a moderate reverse Trendelenburg position to facilitate venous return through the collateral circulation and, secondarily, to decrease the loss of blood.

Stephen and his co-workers (24) showed that, with the probable exception of Avertin®, none of the anesthetic agents in common use produces a consistent increase in intracranial pressure. However, it is essential to maintain smooth anesthesia and to ensure adequate oxygenation and carbon dioxide elimination at all times, since hypoxia, hypercarbia, and labored respirations play an important role in elevation of the intracranial tension.

A tracheotomy is performed routinely at the end of every opera-
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tion in which both internal jugular veins have been sacrificed to eliminate the danger of respiratory obstruction from laryngeal edema. Although the application of moderate pressure by means of a surgical dressing is necessary to secure good adherence of the skin flaps in a radical neck dissection, excess pressure should be avoided since it may lead to obstruction of the collateral venous return. One of the most important factors in the prevention of serious complications in the postoperative period is the immediate assumption of a steep "head-up" position at the end of the operative procedure, a position which is maintained in the days immediately following the surgical procedure.

Should signs of increased intracranial pressure develop in spite of these precautionary measures, our experience indicates that slow drainage of spinal fluid by means of a lumbar puncture will effect a reversal of this condition within a relatively short period. No untoward effects have resulted from this therapy.

A point frequently overlooked is the fact that complications similar to those discussed in the preceding paragraphs can occur during the course of any operative procedure performed on a patient who has had a previous bilateral resection of the internal jugular vein. The persistence of laryngeal edema for several months after the primary procedure is shown by the death of one patient in our present series from respiratory obstruction six months after vein removal and the necessity for emergency tracheostomy in another after a period of fifteen months. A third individual was subjected to reoperation for recurrence of cancer several months after a simultaneous bilateral radical neck dissection. Surgery was performed without elevation of the upper part of the body, with the result that excessive oozing from venous engorgement complicated the entire procedure, producing a prolonged state of marked hypotension. In the postoperative period, the persistent generalized bleeding decreased with the institution of a steep "head-up" position. Fundoscopic examination on the fourth postoperative day revealed bilateral occlusion of the central retinal artery with edema of the macula and slight edema of the disk.

In view of these experiences, it is our impression that all patients who have been subjected to removal of both internal jugular veins should be reoperated on in a moderate reverse Trendelenburg position if this is not contraindicated by the surgical procedure. It also is advisable to perform a tracheostomy at the end of operation to eliminate the danger of respiratory obstruction from persistent edema.

Summary

The complications of radical surgery in the area of the head and the neck have been discussed. These include respiratory obstruction, the sequelae of stimulation of the carotid sinus region, tension pneumothorax, and the effects of removal of both internal jugular veins.
The review also includes preventive measures and the most effective types of therapy.

REFERENCES

2. Howland, W. S.: Personal communication.