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CONTACT ULCER GRANULOMA AND OTHER LARYNGEAL COMPLICATIONS OF ENDOTRACHEAL ANESTHESIA

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THE purpose of this paper is to discuss the anatomic, physiologic and pathologic facts of laryngology and bronchology that seem to have bearing on the problems of the anesthesiologist. The faults of technic in intubation have been fully covered by Gillespie (1), Jackson (2, 3, 4) and others.

Since the publication of the classic and authoritative book of Gillespie (1) a great change has taken place, and this change has largely been due to this book as well as to other authoritative articles written by anesthesiologists (5). The complication of gross laryngeal and adjacent tissue trauma has been eliminated by the development of skin in laryngeal technic on the part of the anesthesiologists. The other laryngeal complications recorded in the literature are contact ulcer granuloma, acute edema of the larynx requiring tracheotomy, and asphyxia.

CONTACT ULCER GRANULOMA

In the early reports of laryngeal granuloma as a sequela of endotracheal anesthesia it was regarded as a newly discovered lesion.

Farrior (1942) (6) noted that the lesion in these cases is a typical contact ulcer with granuloma formation, described and illustrated by Jackson (7). New and Devine (1949) (8) made the same observation; they collected from the literature 9 cases of contact ulcer granuloma following endotracheal anesthesia and added 9 cases from their own experience. All of the contact ulcers so far reported in the literature as sequent to endotracheal anesthesia were in the granuloma stage, hence they were all cases of delayed diagnosis. It takes time for

granuloma to develop. As stated by Jackson and Jackson (9) "Non-specific granuloma is most commonly superimposed on a contact ulcer."

Charles M. Norris (10) stated that at the Temple University Hospital during the five year period 1948 through 1952, 48 cases of contact ulcer granuloma were recorded, of which 6 (12.6 per cent) followed endotracheal anesthesia. In 3 of the 6 cases, the granuloma occurred while the patients were in the hospital (2 after thyroidectomy and one after cervical spine operation for dislocated intervertebral disc). The other 3 patients had had operations elsewhere under endotracheal anesthesia.

Contact ulcer of the larynx was first described in 1928 (11) by Chevalier Jackson, on the basis of 248 cases observed in forty years. In 1935 Jackson and Jackson reported 45 additional cases, making a total of 293 cases. In none of these cases was the laryngeal condition a sequela of endotracheal anesthesia or of endolaryngeal instrumentation. Sixteen colored illustrations from oil-color paintings from life show that in all but 2 of the cases illustrated the contact ulcer was in the granuloma stage when first examined.

ETIOLOGY

In view of the clinical fact that contact ulcer granuloma is a morbid clinical entity long known to laryngologists (7, 12, 13, 14) it seems best to consider first the known causes of the lesion as observed in the preponderant number of cases in which endotracheal anesthesia was not used. The following clinical facts were observed by Jackson and Jackson (7, 9, 12, 13, 14).

Anatomic and Physiologic Factors Related to Causes of Contact Ulcer Granuloma.

There are three reasons why nonspecific ulcer of the larynx is localized on the tip of the vocal process of the arytenoid cartilages: (1) the extremely thin mucoperichondrial covering of these tips; (2) incessant *movement* of the arytenoids, and (3) constant and powerful projection into the lumen of the airway and hammering together of these cartilaginous points. This forcible approximation and contact occurs with every laryngeal sound that is made, every cough, every semitussive clearing of the voice, every time muscular effort of the arms requires fixation of the thoracic cage, or abdomen, and with every protective effort of the larynx against intrusion by any liquid or solid or irritant gaseous foreign body.

The relation of these anatomic and physiologic facts to contact ulcer granuloma is as follows: (a) If an endotracheal tube is introduced before laryngeal reflexes are entirely abolished the tube acts as a foreign body, causing a powerful clamping in the glottic closure so that the tube scrapes over the vocal processes of the arytenoids which

project their thinly covered points against the tubal surface. (b) This mechanism recurs if anesthesia diminishes sufficiently so that laryngeal reflexes reappear. (c) Because the tips of the vocal processes project prominently into the lumen, they may be hooked by the slanted open distal end of the endotracheal anesthesia tube at intubation. (d) The autonomic movements of the arytenoids are not abolished by small degrees of anesthesia and they continue incessantly to rub the tips of the vocal processes of the arytenoids against the surface of the tube. This physiologic rubbing is probably the most frequent cause of trauma ending in contact ulcer granuloma sequent to endotracheal anesthesia. The studies of Jackson and Jackson (7) indicate that the usual exciting causes of contact ulcer (unrelated to anesthesia) are traumatic, but the trauma described by these authors is indirect; that is to say it is inflicted on the larynx by the action of the laryngeal muscles. The usual traumatic mechanisms are: (1) movements of the larynx; (2) the hammer-and-anvil mechanism; (3) cough; (4) the "throaty" type of voice, and (5) vocal abuse.

These mechanisms act as exciting initial causes producing contact ulcer or as perpetuating factors causing contact ulcer granuloma by interference with healing.

These mechanisms may be discussed in relation to contact ulcer granuloma following endotracheal anesthesia.

Movements of the larynx may be briefly summarized. Vertical movements of the larynx as a whole are as follows: (a) rhythmic fall on inspiration, followed by a rise on expiration. The excursions are shorter during quiet respiration, much longer during deep inspiration. At 20 cycles per minute there are 40 of the sliding excursions per minute. (b) Rise of the entire larynx followed by a reciprocal fall at each swallowing cycle. These movements occur subconsciously and autonomously in the normal drainage function of the esophagus. Movements of the tongue cause a to-and-fro drag and release on an oral tube.

Arytenoid movements are (a) rhythmic and autonomic rocking and sliding to-and-fro at each respiratory cycle during deep anesthesia. For example, at 20 cycles per minute there are 40 rocking and sliding movements per minute. (b) Phonatory movements of the arytenoids are similar to the respiratory movements. Although the complete excursion required for sound production would be frustrated by the presence of the tube, if the attempt were made, for the limited range the vocal processes would rub against the tube. (c) Tussive movements normally are reflex autonomic, tight and powerful closures, potentially traumatizing in their gripping of the tube especially when the tube is inserted and slid down through the glottis, before anesthesia has abolished the cough reflex; or later, in case anesthesia should be diminished.

The incessant normal physiologic movements referred to in the foregoing paragraphs obviously would, with an endotracheal anesthesia

tube in place, result in ceaseless rubbing of the inward projecting tip of the vocal process of the arytenoids. Every typist knows that rubbing with a rubber eraser will perforate the paper in, say, two or three minutes. Rubbing of the tip of the vocal process of the arytenoid on a tubal surface may continue for two or three hours. Any roughening of the surface of the endolaryngeal part of tube would greatly intensify the trauma produced by the rubbing. The thin mucoperichondrial covering of the tip of the vocal process has no underlying tissue to cushion it against the relatively hard cartilage.

The anesthesia tubes are glass-molded and smooth when they leave the factory, but from use and abuse or lack of care in cleaning they may readily be roughened. Some of the synthetic rubber may become roughened in spots by alcohol, or by certain detergents and lubricants.

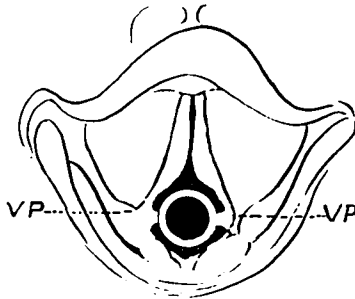


FIG. 1. Schematic sketch showing how the vocal processes (VP) of the arytenoid cartilages of each side rub against the surface of the endotracheal anesthesia tube, in the ceaseless physiologic movements of the arytenoids.

Recoil of an elastic anesthesia tube adds to the up-and-down movement in the larynx because the upper end is fixed in the nose or the pharynx. After such drag there is a recoil of a resilient tube. This constitutes an additional etiologic factor of potentially traumatizing rubbing movement. Some endotracheal anesthesia tubes have little or no elasticity under ordinary conditions.

Core molds (4, 9, 15) remain in the larynx for two weeks, more or less; then they are changed for molds of a larger size. Notwithstanding the pressure, we have not seen a case of contact ulcer resulting from core molds. The following explanations are suggested: (a) The core mold goes up and down as if integral with the larynx; if it were fixed at one end so as to be held while the larynx slid up and down on the core mold, there would be rubbing. (b) In cases of cicatricial laryngeal stenosis, for the treatment of which core molds are used, the arytenoids, if present, are propped so far apart that there is no rubbing of the tips

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of the vocal processes. (c) The crico-arytenoid joint is fixed by arthritis and adhesions during the original pathologic process that produced the stenosis, and there is no rubbing movement against the surface of the rubber core mold. (d) There is no elastic recoil of the rubber that could cause rubbing.

Trauma of the hammer-and-anvil type is the name given by Jackson and Jackson [1935 (7)] to a mechanism previously described (Jackson, 1928) (12) as a causative factor in *contact ulcer*. It is the impact of the hammering of the cartilaginous vocal process of one arytenoid against the vocal process of the opposite arytenoid. The hammering traumatizes the mucoperichondrium of one or both sides, producing unilateral or bilateral contact ulcer. There is usually a small area of necrotic cartilage in the bed of the ulcer, at the tip of the vocal process. As is usual in traumatized laryngeal perichondrium and cartilage, flabby granulations develop and especially if healing is frustrated by continued vocal abuse, granuloma forms. The lesion then becomes a nonspecific ulcerogranuloma. In these cases it is the trauma produced by hammering that is both the primary and the perpetuating cause. In case of primary trauma incidental to endotracheal anesthesia, the use of the voice afterward would add the trauma of the hammer-and-anvil as the frustrater of repair and the cause of chronicity and thus of ulcer formation. The trauma of the hammer-and-anvil, as pointed out by Jackson and Jackson (7), is an indirect form of trauma, inasmuch as it is inflicted on the larynx by the laryngeal muscles. It occurs also in violent persistent coughing.

Another form of indirect trauma causative of contact ulcer granuloma noted originally by Jackson and Jackson (7) is the "throaty type of phonation". In these cases the voice has a rough, usually deep-toned sound as if formed in the pharynx. It is not the same as "guttural," although the guttural voice may be a factor in some cases. As with the trauma of the hammer-and-anvil, the effect in the causation of contact ulcer granuloma is greatly increased in cases of *vocal abuse*, such as incessant conversation, occupational overuse or forcing the voice.

The traumas produced by the hammer-and-anvil, cough, vocal abuse and the throaty type of voice thus being known as causes of contact ulcer granuloma when endotracheal anesthesia has not been employed, it is logical to conclude that they would be causative factors in the development of contact ulcer granuloma in case of direct trauma, however slight it might be, occurring incidental to endotracheal anesthesia (16).

In a discussion of etiology of contact ulcer granuloma it seems relevant to mention 2 cases in which the respective anesthetist stated that he had used a tube made by himself from a piece of smooth rubber tubing by cutting off one end at a slant. In one of the cases the intubation was nasal, in the other it was laryngoscopic. Both probably

were instances of makeshift for emergency cases, but the use of such a tube would seem to be potentially traumatizing as compared to the instrument maker's glass-molded Magill tube. Two causative factors are inherent in such a makeshift tube. (a) The surface of even the smoothest ordinary rubber tubing is rough, at least in spots, if not over the entire external surface. (b) The sharp inner edge of the cut off slanted end of the tubing would be especially prone to become hooked over one or both vocal processes, as compared to the glass-molded tube.

To anyone with a full realization of the delicacy and sensitiveness of that thin covering of mucoperichondrium over the vocal process, lack of care with the endotracheal tube seems worthy of consideration as a potential cause of trauma in the rubbing of the constantly moving arytenoids. Apparently, no more care is given the endotracheal tube than any other tubing in medical and surgical use. It seems advisable to establish a plan of meticulously careful routine for which the suggestions are submitted under the subhead of prophylaxis.

In the available literature there is one report of systematic laryngeal examination after anesthesia in which an indwelling tube was used. In 1913 Jackson (2, 17) reported results as follows: "Post-anesthetic laryngoscopy in 80 cases has shown that there is no reaction in the larynx from the presence of the insufflation tube, even in a prolonged anesthesia by insufflation. . . . From observation of these cases the author is prepared to say that there is less irritation of the larynx from an intratracheal insufflation than from anesthesia of corresponding duration by the open method." The anesthetic was ether, both in the group in which insufflation was employed and in the group in which the open method was used. The tubes were silk-woven, sizes 18 and 20, French scale, for the adult male larynx, and were introduced orally through the laryngoscope.

PATHOLOGY

The gross pathologic changes in contact ulcer granuloma are shown in the color drawings of Jackson and Jackson (7, 13, 14). These drawings were made from patients in whom the primary trauma was not due to endotracheal anesthesia; however, granuloma is a secondary lesion due to frustration of healing, regardless of the cause of the primary trauma.

Only two autopsies in cases of contact ulcer are recorded in the literature (18). Full reports of the gross and histologic tissue changes are given. Histology of contact ulcer and contact ulcer granuloma as found in the tissue specimens from complete operative removals is discussed and illustrated by Jackson and Jackson (7, 13, 14).

Histologically considered, the lesion is an ulcerogranuloma, located on the tip of the vocal process of one or both arytenoid cartilages. In many cases the cartilage of the extreme tip is necrotic. If not sub-

jected to ill-advised surgery this necrosis shows no tendency to extend beyond the tip.

LARYNGEAL COMPLICATIONS OTHER THAN CONTACT ULCER GRANULOMA

The most serious laryngeal complication, other than contact ulcer granuloma, is acute edematous stenosis. This is most likely to occur in children for two anatomic reasons: (1) the abundance of loose areolar tissue in the subglottic region, and (2) the small lumen which is occluded by very little swelling (3, 4, 9, 14, 19).

A number of cases of asphyxia following endotracheal anesthesia have been reported. Almost all of them were of two or three hours duration. This, of course, may be necessary because of the character of the operation for which the anesthetic is given, but in all such cases the child should be watched closely after operation. Sedatives post-operatively are dangerous. The interns and nurses should know the cardinal signs of obstructive laryngeal dyspnea. These signs are obvious and low tracheotomy should be done immediately when they develop. Intubation is dangerously unreliable in these cases. When the acute edema is caused by the presence of a tube, introduction of another tube is contraindicated. The tracheotomy should always be low. As shown years ago by Jackson (19), high tracheotomy is the chief cause of difficult decannulation and cicatricial laryngeal stenosis.

The symptoms of laryngeal obstruction, as given by Jackson and Jackson (13, 14, 20) are as follows: 1. Indrawing at any one or more of the following locations: suprasternal notch; around the clavicles, and epigastrium (most conspicuous in children). Fully developed "funnel breast" is dangerously late in acute cases, and should not be awaited before doing tracheotomy.

2. Ashy gray pallor (when cyanosis is present it is dangerous late).

3. Choking, gagging and waking in terror every time the child falls asleep.

4. Restlessness. This is due to air hunger and terrifying sense of suffocation; it is a danger signal calling for immediate tracheotomy. Loss of sleep will become overpowering and the child will die without struggle.

When the symptoms in the foregoing list develop acutely the patient becomes alarmed at the sense of suffocation, he inspires deeply and forcibly, and the more forcible the effort the less air he gets. He becomes more and more restless from that terrifying sense of suffocation. Prior to the time the importance and significance of this cause of restlessness were emphatically stated, (3, 14, 19) sedatives were given for it, and only too often the child, worn out by his fight for air, gave up the struggle and slept quietly away. These were not endotracheal anesthesia cases. They are mentioned here to support the suggestion

of Jackson and Jackson (13, 14, 20) that when acute laryngeal stenosis is a possibility, there should be written at the top of the order sheet for that patient, "No sedatives to be given this patient without written order from the chief."

PROPHYLAXIS OF CONTACT ULCER GRANULOMA

From the anesthesiologist's point of view prophylaxis logically divided into two phases: (1) prevention of direct trauma and (2) prevention of granuloma formation by a regimen of silence to insure prompt healing.

Prevention of direct trauma at intubation has been fully covered by Gillespie (1), Flagg (21), Jackson (3, 16, 20, 22) and others. It not only requires skill and gentleness in introduction, but also meticulous care and inspection of the tube. Anesthesiologists of today have the skill, but it may be well to add a few words about gentleness. Some men and women are gentle-handed and other are heavy-handed; however, all may develop care and skill. It is well to have in mind two old paraphrased aphorisms of the bronchoscopic clinic, "be sure you are right, then look to see what is wrong" and "be sure you are right, but not too sure." The bronchoscopist is never sure enough to force the bronchoscope.

Although prevention of trauma at intubation is of importance, nevertheless, as stated under "Etiology," it is a mistake to take for granted that it is the only form of trauma or that it is always the cause of contact ulcer granuloma incidental to endotracheal anesthesia. Such trauma is rare when a soft, flexible, glass-molded tube is introduced through the nasal route. The only conceivable misadventure in the introduction of such a tube could be the hooking of the open, slanted, distal end of the tube over one or both projecting vocal processes. When this occurs, trauma could be avoided if the anesthesiologist would wait a few moments for a deep inspiratory arytenoid excursion so that the tube could be unhooked before an attempt made to advance it.

Particular care should be taken to avoid trauma to the larynx of children, during intubation or by a rough or prolonged indwelling tube. As stated by Jackson (3, 4, 13, 14, 20) the subglottic tissue of children is particularly liable to edematous reaction because of the relatively large proportion of loose areolar tissue in its cellular structure. As previously mentioned, bronchoscopists avoid prolonged bronchoscopy in children especially under about 2 years of age.

In the prophylaxis of granuloma formation, the mechanism of the primary trauma is immaterial, whether it be during intubation, or the hooking of the open, slanted, distal end of the tube over a projecting vocal process, or the result of a makeshift tube, a rough surfaced tube, or of two or three hours rubbing of the vocal processes against the tube. These are all primary causes; contact ulcer and granuloma

formation are secondary processes owing to frustrated healing. Therefore prophylaxis calls for early diagnosis and complete rest of vocal processes.

Early diagnosis requires that every patient who has had endotracheal anesthesia should have at least a mirror laryngoscopy. If this leaves any doubt he should have a diagnostic direct laryngoscopy before discharge. Direct laryngoscopy is the only practical method of examining the larynx of children. Hoarseness alone is not absolutely diagnostic but the patient should be put on a regimen of silence anyway.

As a matter of prophylaxis, *care of the tube* is important. In many clinics endotracheal tubes receive only the routine cleaning given on various other tubing of natural or synthetic rubber in medical and surgical use. This disregard for the care of tubes to be used near the prominent and sensitive vocal processes of the arytenoids calls for attention. The following plan is suggested:

(a) The nurse who is to do the cleansing should have special instructions as to care in handling the tubes to avoid kinking or anything that could cause roughening of the smooth glass-molded surface.

(b) Modern dish-washing detergents, if used, must first be tested and be used with caution until their effect on natural rubber or on the particular synthetic rubber of which most anesthesia tubes are made is known. It would be well to obtain from the manufacturer advice concerning the best method of cleansing. If water is used, the tube must be sterilized in a greaseless sterilizer so that water will spread on its surface.

(c) Before each use the tube should be meticulously inspected for rough spots, kink cracks, and to determine the general smoothness of its surface. Visual examination of the entire surface of a long round object of small diameter, like a nasal endotracheal anesthesia tube, rarely dependably thorough. It should be supplemented by careful passage of its entire length between the palpatory surfaces of the sensitive bare index finger and thumb, before the tube is sterilized. Any suspicious spot should be examined with a magnifying glass. Re-examination by palpation with gloved finger and thumb after sterilization is advisable. The slightest imperfection on a smooth glass-molded surface renders the tube unfit for use in the larynx. Anesthetizing tubes are perfectly smooth when they leave the factory, but sometimes they are roughly handled before they reach the anesthesiologist's table.

(d) Any tube whose use has been followed by a contact ulcer granuloma should be sent to the laboratory for meticulous examination as a matter of research.

TREATMENT

Treatment of contact ulcer granuloma is simple and well known to laryngologists. In the early stage when trauma of the tip of the vocal

process is noted by postoperative laryngoscopy, a complete rest of the larynx should be enforced to allow healing to take place. For complete vocal rest the patient should write everything he has to say.

If, however, diagnosis has been delayed until contact ulcer has fully developed, the regimen of silence is still indicated, but a much longer time will be required for healing. Then will come the great difficulty of enforcing silence. The incessant conversationalist, who needs most, will use his voice to tell everyone about the physician's order not to talk. He will usually insist he never talks much.

When diagnosis has been delayed until a granuloma has fully developed, the tumor will usually require removal. This, however, will be subject to decision of the laryngologist in the particular case. Removal will not lessen the necessity for silence, but by promotion of healing of the ulcer it will usually shorten the duration of this regimen and the voice and breathing will improve immediately. What is even more important, the strain on the laryngeal muscles resulting

FIG. 2. Contact ulcer granuloma due to the indirect trauma of vocal abuse. No intubation or other endolaryngeal instrumentation of any kind had preceded the contact ulcer or the granuloma in this or any of the similar cases. (From oil-color drawing from life by Chevalier Jackson reproduced in color in references 7, 13, 14.)

from interference with approximation of the cords will be relieved at once.

In the removal, the tumor should be superficially nipped off with cupped forceps. Local medical treatment of the base is unnecessary and may permanently impair the voice. The traditional radical treatment of the base of a benign growth is absolutely contraindicated in the larynx. The contact ulcer granuloma comes away without giving any sense of resistance if no normal tissue is included in the grasp of the forceps. Early in its development contact ulcer granuloma is sessile (fig. 2); later it usually becomes more or less pedunculated; but in either case it can be nipped off accurately flush with the bed of the ulcer with the use of direct laryngoscopy. Removal of the necrotic cartilaginous tip of the vocal process is usually contraindicated.

To prevent recurrence of the contact ulcer granuloma it is essential for the patient to remain silent until healing is complete. If he does not, recurrence may be expected.

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PROGNOSIS

The prognosis in cases of minor trauma to the tip of the vocal process of the arytenoid following endotracheal anesthesia is the same whether it is due to hooking of the open slanted distal end of the tube over the vocal process in intubation; forcing the tube through the closed glottis; rubbing of the processes against the surface of the tube by their constant physiologic movements; a rough surfaced tube; a makeshift tube, or to other causes. With early diagnosis and complete rest by means of silence, minor trauma of the tip of the vocal process will heal promptly and the voice will be unimpaired. If the patient uses his voice even in a whisper, contact ulcer will usually follow and if use of the voice is continued, a granuloma will develop. At first the granuloma is usually sessile (fig. 2), but it becomes more or less pedunculated. The pedicle may in time become so slender that it cannot support the tumor.

A pedunculated contact ulcer granuloma may be expelled by coughing, but this event is so rare that it should not be awaited.

Under proper treatment contact ulcer and contact ulcer granuloma are curable in practically 100 per cent of the cases. If treatment is not delayed the voice is usually good.

If allowed to persist a contact ulcer granuloma will impair the finest qualities of the voice by the strain on the laryngeal muscles owing to interference with approximation of the vocal cords.

SUMMARY

1. "Nonspecific granuloma of the larynx is most commonly superimposed on a contact ulcer" (9). This is true whether the initial contact ulcer was caused by direct instrumental trauma or by indirect trauma inflicted by the laryngeal muscular mechanism, or to any one or more of the postulated etiologic factors herein discussed.

2. The usual site of contact ulcer granuloma is the tip of the vocal process of one or both arytenoids.

3. The reasons for the particular pathologic susceptibility at this site are anatomic and pathologic. The arytenoids are in constant movement and the tips of the prominent vocal processes, with their thin mucoperichondrial covering, are normally projected forcibly into the laryngeal lumen and slapped together.

4. The autonomic movements of the larynx are not abolished by a safe degree of anesthesia. If an endotracheal tube is in place the tips of these processes are rubbed to-and-fro in close contact with the tube. If the trauma to the thin mucoperichondrium is sufficient the result is a contact ulcer the healing of which is sluggish, as with exposure of perichondrium anywhere. Healing is frustrated by use of the voice. The result of frustrated healing is granuloma formation.

5. With these cartilaginous processes rubbing their thin mucoper-

chondrial covering to-and-fro against a rubber or synthetic tube, say twenty times a minute during a two or three hour operation it is illogical to attribute all the trauma sustained by that thin mucoperichondrial covering only and always to instrumental trauma at intubation.

6. Contact ulcer granuloma is a definite morbid entity, well known to laryngologists for many years. One clinic reported 249 cases, none of which followed endotracheal anesthesia (17) or any form of instrumental trauma.

7. Whether a contact ulcer granuloma is incidental to endotracheal anesthesia or due to other causes the prognosis with proper treatment is good. When an early diagnosis is made a good voice may be expected.

REFERENCES

1. Gillespie, Noel, A.: Endotracheal Anesthesia, ed. 2, Madison, Wisconsin, University Wisconsin Press, 1948.
2. Jackson, Chevalier: Technique of Insertion of Intratracheal Insufflation Tubes, *Surg. Gynec. & Obst.* 17: 507-509 (Oct.) 1913.
3. Jackson, Chevalier: Peroral Endoscopy and Laryngeal Surgery, St. Louis, The Laryngoscope Co., 1915.
4. Jackson, Chevalier, and Jackson, Chevalier, L.: Bronchoesophagology, Philadelphia, W. B. Saunders Company, 1950.
5. Monod, R.; Aubin, A., and Thierry: L'Anesthésie par Intubation Endotrachéale et Endobronchique, *Anesth. et Analg.* 2: 422-464 (June) 1936.
6. Furrion, J. B.: Contact Ulcer of Larynx Developing After Intratracheal Anesthesia, *Arch. Otolaryng.* 36: 238-239 (Aug.) 1942.
7. Jackson, Chevalier, and Jackson, Chevalier, L.: Contact Ulcer of Larynx, *Arch. Otolaryng.* 22: 1-15 (July) 1935.
8. New, G. B., and Devine, K. D.: Contact Ulcer Granuloma, *Tr. Am. Laryng. Assn.* 70: 42-53, 1949.
9. Jackson, Chevalier, and Jackson, Chevalier, L.: Diseases of the Nose, Throat and Ear, Philadelphia, W. B. Saunders Company, 1945.
10. Norris Charles, M.: Personal Communication to the Author.
11. Jackson, Chevalier: Contact Ulcer of Larynx, *Ann. Otol. Rhin. & Laryng.* 37: 227-230 (March) 1928.
12. Jackson, C. L.: Etiology and Treatment of Contact Ulcer of Larynx, *Laryngoscope* 43: 718-721 (Sept.) 1933.
13. Jackson, Chevalier, and Jackson, Chevalier, L.: The Larynx and Its Diseases, Philadelphia, W. B. Saunders Company, 1937.
14. Jackson, Chevalier, and Jackson, Chevalier, L.: Diseases and Injuries of the Larynx, ed. New York, The Macmillan Company, 1942.
15. Jackson, Chevalier: Stenosis of Larynx with Special Reference to Curative Treatment with Core Molds, *Tr. Am. Laryng. Rhin. & Otol. Soc.* 42: 12-24, 1936.
16. Jackson, Chevalier: Laryngeal Trauma Incidental to Endobronchial Anesthesia, in Coates and Schenck, *Practice of Otolaryngology*, Chap. 16, Hagerstown, Md., W. F. Prior Company Inc. (In preparation.)
17. Jackson, Chevalier: Insufflation Anesthesia, (Editorial) *Laryngoscope* 23: 955 (Sept.) 1913.
18. Peroni, Achille: Contact Ulcer of Larynx, Pathologic Observations, *Arch. Otolaryng.* 17: 741-746 (June) 1933.
19. Jackson, Chevalier: High Tracheotomy and Other Errors the Chief Causes of Chronic Laryngeal Stenosis, *Surg. Gyn. Obst.* 392-398 (May) 1921.
20. Jackson, Chevalier, and Jackson, Chevalier, L.: Bronchoscopy, Esophagoscopy and Gastroscopy, ed. 3, Philadelphia, W. B. Saunders Company, 1934.
21. Flagg, Paluel, J.: Incidence and Control of Trauma Accompanying Endotracheal Anesthesia; Survey Based on Response of 150 Leading Laryngologists and My Experience 25 Years in Use of Method, *Arch. Otolaryng.* 53: 439-445 (April) 1951.
22. Jackson, Chevalier: Anesthetic Attachment for Bronchoscope, *Laryngoscope* 20: 153 (Feb.) 1910.

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