

proved to be correct by the few cases in which I have seen an attempt to employ the various forms of local anæsthesia in the place of general anæsthesia in the presence of valvular disease. I have seen more than one such case in which the shock was so great that the patient's condition was made infinitely worse, and in which the condition improved as soon as the local anæsthetic was discarded and general anæsthesia was employed. One case seen through the kindness of Dr. Keen especially illustrated this. First, spinal anæsthesia was used, then local anæsthesia, and, finally, ether and oxygen. The changes in the condition of the patient formed one of the most interesting things seen in medicine. The woman, pale, lead-color, with pulse almost absent at the wrist, apparently in a desperate strait, under the influence of ether and oxygen instantly revived. The skin, which a few minutes before was livid and lead-gray, showed the restoration of the capillary circulation, so that she went through the whole operation in a successful manner. It is true that after the operation she had grave circulatory disturbance with some tendency to œdema of the lungs. This, I think, was due more to the shock of the operation than to the administration of ether.

In conclusion, I might say from my own observation of intraspinal injection as an anæsthetic that it will soon be regarded as a medical curiosity. I believe it has not the wide scope of usefulness with which it was heralded, and that in a short time it will be relegated to the same obscurity as Bourgeon's method for the cure of phthisis by the injection of hydrogen sulphide and carbonic acid gas into the rectum.

SOME CONDITIONS OTHER THAN AORTIC ANEURISM WHICH DETERMINE THE OCCURRENCE OF THE TRACHEAL TUG.¹

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SINCE the brief note of Oliver,² in 1878, announcing the occurrence of the tracheal tug in aneurism of the aorta and the method for detecting it, the value of the phenomenon as a diagnostic sign has been somewhat in dispute. Macdonnell,³ using a large clinical experience, committed himself to the statement that "tracheal tugging is never prescut except in aneurism." Ewart,⁴ Toulmin⁵ and others have found on systematic examination of persons not the subject of aneurism that a more or less pronounced tracheal tug is present in a large proportion

¹ Read by title at the meeting of the Association of American Physicians, May, 1901.

² Lancet, 1878, vol. II, p. 406.

³ Ibid., 1891, vol. I, p. 535.

⁴ British Med. Journ., 1892, vol. I, p. 596.

⁵ Journ. Amer. Med. Association, 1897, vol. XXIX, p. 4.

of cases, and Ewart found it more common in males than in females. Auerbach¹ and others have shown that the presence of tumors in certain situations about the aortic arch can cause the tug, and Norris² has recently reported a case in which the sign was prominent without post-mortem examination revealing physical conditions explaining it.

The excuse for the present paper is, first, that the deductions here presented are based on a much greater number of cases than seem to have hitherto been applied to the subject; second, I venture to believe that a satisfactory explanation of the tracheal phenomenon both in physiological and in most pathological conditions has been demonstrated.

My attention was first definitely directed to the tracheal tug as a diagnostic sign in the case of a gentleman who, for four or five years preceding his death, at the age of sixty, had suffered from a purulent bronchitis, in the abundant expectoration of which tubercle bacilli could only be demonstrated during the last year of life. This patient was racked by paroxysms of a loud, rather ringing cough; the aortic heart sound was much accentuated; the pulmonary signs seemed to indicate pressure by an intrathoracic mass, and during the last year or more of life there developed a very distinct tracheal tug. A tentative diagnosis was made of intrathoracic tumor, malignant (in former years a supposed sarcoma had been removed from the breast), glandular, or aneurismal, complicating tuberculosis. At the autopsy no tumor was found. The lungs were voluminous and contained rather few scattered tubercles, but there was striking thickening and stiffening of the bronchioles and pulmonary bloodvessels, with massive induration of the root of the left lung. Microscopical preparations of the lung, made under the direction of Dr. J. A. Wilder, showed beginning fibrosis of an extraordinary degree. In addition, the left pleura was throughout closely adherent to the chest wall.

On reflection there developed a simple and interesting explanation of the occurrence of the tracheal tug as dependent on the anatomical conditions discovered at the autopsy. When the aorta, looped over the left bronchus, presses upon the air tube sufficiently to transmit to it a pulsation, the downward stroke of the pulsating artery is expended both upon the trachea and on the upper lobe of the left lung. The lung tissue is normally of such extreme extensibility, and its surface glides so readily on the thoracic wall, that any ordinary impulse transmitted by the aorta to the bronchus stretches the lung tissue rather than pulls down the relatively fixed trachea. On the other hand, when the left lung is anchored to the chest wall, as it were, by close

¹ Abstract in AMERICAN JOURNAL OF THE MEDICAL SCIENCES, March, 1901, p. 340.

² American Medicine, March 20, 1901, p. 108.

plurcal adhesions, and when in addition the normal extensibility of the pulmonary tissues is diminished by infiltration or fibrosis, the pulse of the aorta must be registered in movements of the trachea to an increased amount compensating for the lessened mobility of the lung. Moreover, just as the lever of the sphygmograph performs wider excursions as the pressure of its spring on the artery is increased up to a certain point, so we should suspect systolic downward pulsation of the trachea to manifest itself especially under physiological conditions in which the approximation of the aorta to the trachea where it crosses the latter is closest.

In order to test the validity of this reasoning, I have during the past year examined 430 persons as to the possession of a tracheal tug. No selection whatever was made as to the kind of cases studied. They included normal individuals as well as subjects of diseases other than known aortic aneurism. In each case the personal history was ascertained, and in nearly all a physical examination of the chest was made. Though it would be desirable to have a far greater number of cases on which to base conclusions, I have to express grateful appreciation for assistance afforded me by many colleagues and friends. Very slight experience made it evident that a downward pulsation of the larynx immediately following systole of the ventricles is an extremely common phenomenon. These laryngeal movements form, as regards their amplitude, a continuous series varying from a just perceptible impulse transmitted to the fingers of the observer at the end of inspiration, to a strong downward twitch of the larynx approaching in vigor the tracheal tug in an appropriate case of aneurism. I have never seen in any of my subjects so marked a tug as that developed in some examples of aortic aneurism. But every aneurism and its signs must have a beginning, and the diagnostic importance of the tracheal tug should depend largely for its specific value on being manifest when the other signs of aneurism have not yet reached their full development. Many observers must have been struck with the gradual disappearance of the tracheal tug in cases of aneurism in which, by one means or another, aneurismal pulsation has been diminished by deposit of fibrin. The suspicion, of course, suggests itself that at least the slightest impulses here described are nothing more than the shocks of carotid pulsation transmitted to the larynx. In answer to this it may be said that the impulse or twitch can only be felt when the fingers are applied to the larynx in such a way as to detect a downward jerk; it is not observed on simply touching the front or sides of the cartilages. To obtain the tug the procedure originally proposed by Oliver cannot be improved upon. The patient should be seated with the head well thrown back. This position elevates the larynx and puts the trachea on the stretch, so that downward impacts are less likely to be lost. The observer,

standing behind the patient, places the tips of either his forefingers or middle fingers under the rim of the subject's cricoid cartilage and presses gently upward. Sometimes only the thyroid cartilage can be satisfactorily grasped. Under these conditions the whole larynx is felt to make an inspiratory excursion downward with a return upward in expiration, and a more or less evident tug may be sometimes felt, usually, but not always, confined to the phase of inspiration. The downward, respiratory movement of the larynx becomes very marked with deep inspiration, and when the chest is fixed in this phase of respiration the larynx tends to become rigidly fixed in its lowest position. The downward movement of the larynx is said to be due to the inspiratory contraction of the sternothyroid and sternohyoid muscles. The extraordinary prominence of this movement in conditions of dyspnoea and its frequent lethal significance in disease seems to be out of proportion to the benefits that can be ascribed to the movement. Although the non-aneurismal tracheal tug tends to be confined to the phase of inspiration, the downward movement of the larynx in this condition, and, in fact, any fixation of the larynx by its extrinsic muscles, evidently must interfere with the mechanical conditions permitting the transmission of the movement of the trachea to the larynx. It has frequently occurred in the course of my observations, particularly with subjects of nervous disposition, that a laryngeal twitch which was prominent at the beginning of an experiment completely disappeared when the patient's attention was directed to the respiratory movements. This anomaly was for a time attributed to possible variation in the amplitude of the aortic pulse, as apparently Ewart¹ would explain it, or even to change in the elasticity of the pulmonary parenchyma, such as West² has suspected may arise from contraction of its intrinsic muscle fibres. Finally, however, the simpler and more satisfactory explanation was hit upon that the failure of the larynx to transmit the pulsatile movements of the trachea is due to such depression of the former organ through its sternal muscles as to relax the membrane connecting the rim of the cricoid with the trachea.

The general results of my observations are thrown together in a table at the end of this paper, but they may be made clearer by the following statements: In the table the results of the examinations as to the presence or absence of the signs of tracheal tug are classified in the vertical columns according to the prominence of the sign. In the column headed "none" are placed the cases manifesting no pulsatile tracheal movement. In the column "slight" are cases in which only a slight pulsatile twitch was felt. In the column "d" the tracheal twitch was distinct, and the distinctness of the sign was more and more

¹ Loc. cit.

² Allbutt's System of Medicine, vol. v. p. 338.

pronounced in the cases in the succeeding columns until in d" the prominence of the tug might well lead to the suspicion of the existence of a developing aneurism of the transverse portion of the aortic arch. It may be remarked that in my list three cases, in which there could be no fair suspicion of aortic aneurism, exhibited a slight "diastolic shock" which Hall¹ believes to be pathognomonic of aneurisms of the aorta. My subjects varied in age from three years to eighty-five years. The youngest person manifesting a tracheal tug was sixteen years old. The tracheal sign was found relatively most frequently in persons between twenty and fifty years old, the age of greatest frequency being somewhat more advanced in cases having pulmonary disease. Of the 430 cases, 245 were males and 185 were females. The sexes are kept separate in the table, for reasons which will appear later. In order to test the efficiency of the conditions previously discussed to produce a tracheal tug, all cases were divided into three groups. I. Normal individuals, or those in which there was no evidence of left-sided pleural adhesions or pulmonary fibrosis. II. Cases manifesting the signs of tuberculosis at the left apex or giving distinct history of the disorder; also cases which had suffered pleurisy or pneumonia on the left side. III. Cases of marked atheroma or emphysema, including chiefly persons advanced in years. The cases were also grouped according to age.

It is assumed that cases in Class I. had lung tissue of normal elasticity and were without pleural adhesions; that in the members of Class II. there were probably pleural adhesions on the left side, as well as diminished extensibility of pulmonary tissue; in Class III. the extensibility alone of the lung tissue was assumed to be affected.

Of the 245 males examined, 113 are recorded as normal as regards their pulmonary condition. Of these 61 manifested no tracheal twitch, and 52, or 46 per cent., of the 113 exhibited a twitch. No less than 37, or + 32 per cent., of the 113 exhibited a very evident tracheal tug of varying degrees of distinctness. Of 112 males showing evidence of pulmonary lesions probably causing adhesions of the left pleura, only 17 were without signs of the tug, while 95, or 84 per cent., possessed it, and 71, or + 63 per cent., of the 112 showed a very prominent tug.

A striking exception to the occurrence of the tracheal phenomenon in pulmonary disease was found in some tubercular cases in which extensive excavation occupied the site of the left upper lobe of the lungs. This apparent anomaly rather supports the position here assumed as to the conditions determining the transmission of the tug, for when a large mass of pulmonary tissue is absent the bronchus distributed to it cannot be supposed to be fixed on the side of the lung. Also, it is

worth observing that in two cases of left-sided pneumothorax (accompanying tuberculosis) there was no tug whatever. Of the male cases of the third class, those showing signs leading to a suspicion of greatly diminished extensibility of the pulmonary tissue, there were twenty examples. Of these 10, or 50 per cent., showed a tug, a proportion differing little from that found in normal cases; but of the 10 cases, in 6, or 30 per cent., the tug was of a decided character.

A comparative study of the 185 female cases leads to interesting conclusions. In 125 normal persons 99 were found without tracheal twitch, and 30, or \pm 23 per cent., with it. Of the latter only 10, or less than 10 per cent. of the whole, showed anything like a distinct tracheal tug. On the other hand, of 47 female cases with probable left pleural adhesions, 34, or \pm 72 per cent., manifested pulsatile tracheal movement, which in 20 cases, or \pm 42 per cent. of the 47, was marked in character. In the third class of females there were but 9 cases showing a tug in 4, or 44 per cent.

The conclusion is manifest that *a tracheal tug quite palpable in character is, in the majority of cases, associated with and dependent upon adhesions of the left pleura. Diminished extensibility of the lung tends to produce the same phenomenon, and the tug is most pronounced when the conditions are combined.*

It still remains to explain why perfectly normal subjects so often exhibit a distinct laryngeal jerk following the heart-beat. This fact seemed to me a mystery until, in the course of observations, a satisfactory explanation developed.

It is noteworthy that the proportion of normal males manifesting the tracheal sign is exactly double that of females of the same class, whereas the difference between males and females having pulmonary lesions is not nearly so marked. Now, the type of masculine respiration is diaphragmatic, while that of feminine breathing is costal. In downward movements of the diaphragm the heart also descends to some extent,¹ and probably draws the aortic arch closer upon the left bronchus and thus improves the chances for the transmission of its pulsation to the trachea. After this explanation it is clear why healthy females should fall so far behind normal males in the frequency of the tracheal pulsation. It is also to be expected that the tracheal phenomenon should, in its milder manifestations, be confined to inspiration. It is easy to prove on anyone exhibiting the tug and having good control over the respiratory muscles that the tracheal jerk accompanies inspiration by the descent of the diaphragm, but that it is absent when air is drawn into the chest only by elevation of the ribs.

¹ F. H. Williams. Medical Uses of the Röntgen Light. AMERICAN JOURNAL OF THE MEDICAL SCIENCES, June, 1899, p. 678.

A second conclusion may, therefore, be drawn from these observations, namely, *that in the normal individual descent of the heart with inspiratory movement of the diaphragm may so press the aortic arch upon the left bronchus as to impart to the trachea the aortic pulse, recognizable at the larynx as a palpable tug of greater or less distinctness.*

THE NUMBER OF CASES MANIFESTING VARIOUS DEGREES OF TRACHEAL TUG.

	Age in years.	Males, 245.						Females, 185.						
		None	Slight	d	d'	d''	d'''	None	Slight	d	d'	d''	d'''	
I. Normal persons and those without signs or history of pulmonary disease.	0 to 10	3	...	...	...	...	...	2	...	...	...	...	...	1
	11 " 20	5	1	6	1	1	1	15	4	...	...	...	...	...
	21 " 30	10	6	12	6	3	...	51	8	4	3	...	...	...
	31 " 50	29	6	5	...	...	...	22	7	3	1	1	...	...
	51 " 70	13	2	2	...	...	...	7	1	...	...	...	...	...
Over 70	1	...	...	...	...	...	2	...	...	...	...	...	...	...
II. Persons with signs or history of tuberculous, pleuritic or pneumonic affection of the left lung.	0 to 10	...	...	1	...	...	...	2	1	1	...	...	...	...
	11 " 20	...	...	8	16	9	2	6	6	4	5	1	...	1
	21 " 30	7	8	10	16	4	5	4	5	1	2	2	1	2
	31 " 50	10	13	10	16	4	5	4	5	1	2	2	1	2
	51 " 70	...	2	...	1	1	...	...	1	1	...	...	...	...
Over 70	...	1	...	...	...	...	...	1	...	...	...	...	...	...
III. Persons manifesting marked emphysema or arterio-sclerosis.	0 to 10	1	...	...	...	...	...	...	...	...	...	...	...	...
	11 " 20	...	...	...	...	...	...	...	...	...	...	...	...	...
	21 " 30	1	1	1	...	1
	31 " 50	...	2	1
	51 " 70	5	1	1	1	3	...	1
Over 70	1	1	2	

PRIMARY SARCOMA OF THE THYROID GLAND.

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THE history of abnormal conditions of the thyroid gland begins several centuries ago. Although traces of naïve knowledge of enlargements of the thyroid body, and indeed of true sarcoma of this organ, also date back many years, a close study of the literature bearing on thyroid tumors has brought to light astonishingly few cases of sarcoma, especially of primary sarcoma. From the earliest publication of Alibert, in 1817, the subject passes unnoticed save the three cases reported by Raynaud, Forster, and Virehow, until 1879, when our knowledge of the subject was very materially advanced by Kaufmann. The basis of this observer's study was seven collected cases, three of which he had observed and examined himself.

The later literature has been enriched by other cases reported from time to time mainly by Continental writers. Thus Morf, after a critical search through the literature in 1899, was able to collect, including his own case, only forty examples of this uncommon disease. To this number I have been able to add fifteen others not included in Morf's paper, thus making a total of fifty-five recorded cases. It is only fair to point out, however, that these figures indicate too great an infrequency. Later statistical investigations will undoubtedly show that primary sarcoma of the thyroid gland is much less uncommon.

According to Mueller,¹ secondary sarcoma is also uncommon. Thus of 102 cases of primary sarcoma elsewhere, metastatic invasion of the thyroid and pancreas was noted in only 3.1 per cent. of the cases.

A consideration of the relative frequency of primary carcinoma of the thyroid, especially as compared with that of sarcoma, is not without interest in this connection. Kaufmann, in 1879, had collected twenty-three cases of primary carcinoma, twelve of which had been studied by himself. Rose, in the same year, published a dozen new cases, and Poncét, in 1899, succeeded in collecting fifty other cases, mostly from the comparatively recent literature. The frequency varies, like that of sarcoma, in different sections of country. Thus, Lücke states that he personally observed ten cases in two years in Berne, and states that in goitrous districts malignant disease of the thyroid occurs with greater frequency than elsewhere.

Limacher, of Berne, in 7641 autopsies found carcinoma of the thyroid 38 times, while Chiari, of Prague, found the lesion only 11 times in 7700 post-mortems. Winawater collected from the post-mortem records of several German universities 548 cases of carcinoma of the thyroid. Of these, 0.73 were primary in the gland. Among 7294 cases of carcinoma collected from British hospitals, in only seven instances was the thyroid the primary seat of the tumor. The relative frequency is about 3 or 4 to 1 of sarcoma.²

The case the subject of this paper was clinically observed in the service of Prof. Weir at the Roosevelt Hospital, and later came into my hands for autopsy. The salient points bearing on the clinical and anatomical features alone shall be given.³ The following are some of the main features excerpted from the history protocol:

J. M., a married woman, aged forty-five years, born in Scotland, was admitted into the hospital January 3, 1901, complaining of a small mass in the neck. The family history is negative as regards tumors, syphilis, or tuberculosis. Ten weeks before present admission into the hospital the

¹ Cited by Lueke u. Zahn. *Chirurg. der Gesch.*, 1 Theil. Deutsch Chirurgie.

² For consideration of primary carcinoma of the thyroid, with bibliography, consult A. E. Halstead, "Carcinoma of the Thyroid Gland," *Medicine*, Detroit, February, 1901, p. 107.

³ The author is indebted to Dr. George Emerson Brewer, of New York City, for the clinical side of the case.