

## Evaluation of Semon's Law in Laryngeal Paralysis

by

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**F**ew opinions in laryngology have ever aroused as much interest and debate as the one expressed by Felix Semon in 1881.

In his famous article «On the abductor Fibers of the Recurrent laryngeal Nerve», later on known as Semon's Law or Rule, he formulated that the function of abduction of the vocal cord, has a proclivity to disease over the function of adduction.

Although Rosenbach in 1880, just one year before, had noticed the fact, Semon was the first to establish it on a recognized clinical basis.

His clinical observations based on the study of 22 cases of vocal cord paralysis, mainly the fact that almost always the abductor muscles get paralyzed before the adductors, and an exhaustive review of the literature, led him conclude to reject the «theory of homogeneity» in the fibers of the recurrent nerve. That hypothesis was contending that the fibers of the nerve are all identical and that different stimuli can be transmitted through all of them, stimulating at one time the action of one set of muscles and at another time the action of their antagonists».

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Semon established that the filaments of the recurrent nerve are strictly differentiated throughout the course of the vagus, and even possess ganglionic centers of their own; and subsequently, he found histological proofs in the recurrent nerve to support his thesis.

Then, Semon asked himself whether this number of cases is covered and matched by a similar number of cases in whom, under the same circumstances, only the adductors become affected? His answer was: «Not only have I ever seen such a case, but in the whole range of the laryngeal literature which is known to me, I have not been able to find a single case, in whom primary organic disease of the brain or of the nerve trunk was proved and that by clinical observation and post-mortem examinations it could be taken as the cause for isolated paralysis of the adductors».

Summarizing Semon's contention, he stated that, in the organic diseases of the recurrent laryngeal nerve, there is first a failure of the fibers that supply the posterior crico-arytenoid muscle, and later a failure of the rest of the fibers, so that first the dilator of the glottis is affected, and later on the constrictors.

#### EXPLANATION OF SEMON'S LAW

Many attempts have been made and several hypotheses have been proposed to explain the Semon's Law amongst which the important ones are:

1-*Semon*: «Constitutional weakness of the centers, nerves and muscles controlling the function of abduction». Semon believed that this proclivity of the function of abduction to disease over the function of adduction is quite analogous to a similar proclivity of the extensor muscles of the upper and lower extremities to become sooner affected than the flexor muscles.

2-*Morell Mackenzie*: The abductor nerve fibers are situated in the periphery of the recurrent laryngeal nerve, while the adductor fibers are rather more centrally located. Therefore, the abductors are disabled sooner than the adductor fibers.

3-*Donaldson*: Irritation and pressure on the recurrent nerve will cause stimulation of the abductor fibers first, wearing them out sooner and leaving the adductor fibers intact.

4-*Negus*: Phylogenetically, Negus has done extensive work on various species and noticed that the first evidence of the larynx occurs in a lower form of the lung fish. The primitive larynx consists simply of a sphincter muscle surrounding the origin of the rudimentary trachea from the esophagus. Constriction protects the lung from food, and dilatation is produced by relaxation of the sphincter. In man and higher animals these dilator fibers constitute the crico-arytenoides posticus, while the sphincter muscle splits up in the adductor muscles. Negus' conclusion is that the primary function of the glottis is adduction, while abduction is secondary and he believes this fact gives stronger support to Semon's Law.

5-*Lemere*: Lemere has also done extensive work in this line and underlines that the fundamental difference between the function of abduction and adduction might be analyzed from morphological and biological viewpoints:

Histologically he has noticed that: a) in the recurrent nerve the abductor fibers are weaker, less numerous, more excitable and less resistant to trauma than adductor fibers; b) in the laryngeal muscles special studies revealed to him that abductor muscle fibers contain certain lipid granules. Their color is red, they die soon, their chromaxie is longer and their resistance to trauma is less than that of the adductor muscle fibers.

Phylogenetically, Lemere agrees with Negus and embryologically believes that the abductor muscles are different from the adductors. In the latter group, the muscles develop more or less in relation to one another, while in the former, they develop separately from the adductors.

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In addition to the above mentioned theories, few others also have been proposed. While certain truth may be found in some of them, none of them seems to be enough adequate and satisfactory to explain

the special behaviour of the vocal cords concerning the Semon's Law. In reevaluating this subject, Clerf has expressed opinion that there is no definite evidence available to indicate that there is lessened resistance of the abductor muscles to disease, as thought by Semon himself.

Morell Mackenzie's hypothesis concerning peripheral situation of the abductor fibers in the recurrent nerve, and therefore more subject to injury, has been refuted by Murtagh and Campbell, who found no exclusive peripheral location of the abductor fibers in the nerve.

The phylogenetic theory advanced by Negus may be true to certain extent, but seems to be inadequate and far overshadowed by the anatomical discovery made recently by Todd and Vogel in the United States.

Todd in 1938 demonstrated the presence of motor endplates on the internal branches of the superior laryngeal nerve in the interarytenoid muscles of man which has not been shown before.

Lemere, going through extensive experimental works on dogs had not found any endplates from the superior laryngeal nerve in the interarytenoid muscle. Therefore he had concluded erroneously his observation to the result that no such endplates should be present in man either.

Philip Vogel, in 1952, made a whole review of this matter in Chicago and used an improved technic of his own, repeated Lemere's experiments in dogs and went through extensive dissection and histological studies of human larynges and concluded that:

1- *In the dog*; his results are in agreement with those of Lemere and that the internal laryngeal nerve is purely sensory.

2- *In man*; the internal laryngeal nerve is not purely sensory, but contains also some motor fibers which innervate the interarytenoid muscle. This muscle receives also innervation from the recurrent nerve. Therefore, it is not only innervated by both sides, but in each side it receives double innervation from both the superior and the inferior laryngeal nerves.

This anatomical discovery could very well be considered as a basis for explanation of Semon's Law.

In a previous article (*Acta Medica Iranica*, 1956, I, 69-83) we showed that the crico-thyroid muscle is not only a tensor of the vocal cord, as described in all textbooks, but it is also an adductor. We also made reference that in abductor paralysis of the larynx following injury to or pressure on the recurrent laryngeal nerve, the combined adductor function of the crico-thyroid and the superior laryngeal nerve innervation of the interarytenoid muscles were responsible for the paramedian position of the vocal cord.

Therefore, adding those results together, one may conclude that the entire problem of the abductor paralysis of the vocal cord as well as that of the explanation of Semon's Law (which was originally proposed to solve the first problem) could be analyzed and solved through our new knowledge of the anatomy of the larynx and particularly through the construction and physiology of the superior laryngeal nerve.

#### SUMMARY AND CONCLUSIONS

We have discussed historical and clinical aspects of Semon's Law concerning the behaviour of the vocal cords in the recurrent laryngeal nerve paralysis and the existing different theories for its explanation.

Although one may find certain truth in some of the old theories, nevertheless, it seems far more logical and satisfactory to us to search the explanation of the Semon's Law through our new knowledge of the anatomy of the superior laryngeal nerve in man and its motor fibers which innervate the interarytenoid muscle.

#### RÉSUMÉ ET CONCLUSIONS

Nous avons discuté les aspects historiques et cliniques de la Loi de Semon concernant le comportement de la corde vocale suivant la paralysie récurrentielle du larynx, et les théories différentes proposées pour son explication.

Malgré qu'on peut trouver certaines vérités dans quelques unes des théories anciennes, il nous semble plus raisonnable et satisfaisant de trouver l'explication de cette Loi dans notre nouvelle connaissance de l'anatomie du nerf laryngé supérieur chez l'homme, et, ses filets moteurs pour l'innervation du muscle interaryténoïdien.

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## Appendicitis

REPORT OF THREE HUNDRED AND TWENTY SEVEN CASES\*

by

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**D**uring the Iranian New Year Holidays ( March, 1956 ) I studied all the surgical interventions performed by myself or under my supervision. I was touched to note that acute appendicitis was on top of all other surgical procedures. This gave me the impression that acute appendicitis still continues and will continue to be the most frequent indication for surgical intervention and sometimes the most vital problems of general surgery. Going through the literature, one finds a large number of statistics covering many thousands of cases of appendicitis. Therefore submitting a report for 327 cases is rather simple. Nevertheless I do believe it is worthy to report the experience which I gained from this survey.

The material of this report belongs to two hospitals of Tehran : The Railway's Hospital and city Hospital. About 80% of the cases are taken from the Railway's Hospital, that its surgical Service handles all the surgical problems of 25,000 workers and officemen with their family, adding up to a population of almost 80,000. Over a period of two years, we had a total of 1918 surgical procedures. Of this number, 758 were on the gastro-intestinal tract; from which 327 cases were intervention for appendicitis.

In this survey, we encountered every kind of pathological form and anatomical variety.

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