

# POLIOMYELITIS

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## INTRODUCTION:

*The medical profession agrees that poliomyelitis is caused by a filterable virus, whose only known host is man. How this virus spreads, how it enters the body, and what happens to it, are still not completely known, although great strides have been made in this area in the last decade.*

*There are three distinct types of polio, Spinal polio, Bulbar polio, and Spino-bulbar polio. It is the cranial nerve type of bulbar polio which is of most concern to the speech therapist.*

## IMPLICATIONS FOR THE SPEECH THERAPIST.

### SPEECH INVOLVEMENTS IN BULBAR POLIO.

In the upper cranial nerves the third, fifth, sixth, seventh and eighth nerves suffer involvement. Most frequent involvement falls on the tenth nerve. In the Minnesota epidemic of 1945, 99% of the patients with bulbar type showed symptoms indicating the tenth nerve was affected.

In the cranial group, symptoms vary from patient to patient, affecting most of the processes of speech. Most frequent conditions are nasal quality, hoarseness, laryngeal stridor, unilateral or bilateral weakness of the tongue, adductor paralysis of the vocal folds, accumulation of saliva in the oropharynx, difficulty in swallowing, paresis of the velum, occasionally aphonia, and reflex spasm of the laryngeal musculature. (4).

### ANALYSIS OF SPECIFIC NERVE INVOLVEMENT:

The following is a breakdown of the results of the involvement of these cranial nerves. Also included is the order of frequency of occurrence according to a study of 107 bulbar cases admitted to the University of Minnesota Hospital in 1945:

(1) Vagus — 10th Nerve: 96 cases. Motor fibers are carried from this nerve to the larynx, pharynx, velum, and posterior root of the tongue. Unilateral paralysis causes weakness of the soft palate, pharynx and larynx. Changes in the voice, such as hoarseness, weakness or progressive weakness or difficulty in speech are due to involvements of the vagus nerve. These are often early symptoms of this bulbar type polio and should be interpreted

as danger signals pointing to obstruction of the airways.

Complete bilateral paralysis of the Vagus nerve is almost always fatal. There is complete paralysis of the pharynx, rendering both vocal cords motionless in a halfway position between abduction and adduction. The glottis cannot close, the patient can neither speak nor breathe. This, of course, leads to suffocation, unless a tracheotomy is performed.

(2) Facial—7th Nerve: 71 cases. Supplies motor fibers to the lips and face. Paralysis may involve the whole or lower part of the face and accordingly, affect different facial muscles engaged in speech. The patient cannot whistle or blow out his cheeks. The lack of control of lips and cheeks also prevents him from correctly producing the sounds, p, b, t, d, ch, j, g and possibly others. The vowels will also be involved.

(3) Accessory—11th Nerve: 40 cases. A few motor fibers from the 11th nerve branch to the muscles of the pharynx, velum, and posterior root of the tongue. Some of the motor fibers go to the muscles which are used in forced inhalation.

(4) Hypoglossal—12th Nerve: 15 cases. Carries motor fibers to some of the extrinsic muscles and to the intrinsic muscles of the tongue. Also to certain muscles used in forced exhalation. Unilateral paralysis causes a deviation of the tongue to the paralyzed side, causing slight impairment in mastication and possibly faulty articulation. Bilateral paralysis

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results in the inability to protrude the tongue at all—affecting "th" and promoting sloppy articulation.

(5) Trigeminal—5th Nerve: 10 cases. Carries motor fibers to the muscles of the mandible. Paralysis may cause disturbances in chewing and mastication. A unilateral paralysis of these muscles is rarely seen in polio. (5, 4, 7).

(6) The Glossopharyngeal—9th Nerve: Is sometimes involved. It carries a few motor fibers to the pharynx, velum, and to the posterior root of the tongue. Paralysis generally occurs, concomitantly with the tenth nerve involvement; it contributes to difficulties in swallowing. (2).

Because the speech mechanism is so highly developed and complicated, it must be given special consideration in the general re-education program that follows an attack of bulbar polio. Frequently, it will be found that difficulties in swallowing, regurgitation of food, and pooling of saliva have ceased but speech has not readjusted itself to its former normal function. It has also been observed that while there may be almost complete paralysis of the soft palate and associated inability to move the palate in speaking, the reflex activities of swallowing, laughing, etc., frequently may be impaired only partially or not at all. (7).

It is regrettable, but none the less true, that speech deficiencies resulting from this form of polio have received much less attention from the medical personnel than any other phases of this disease.

#### PREMISES FOR SPEECH THERAPY:

Nelson (4) in considering therapy for dysfunctions in speech resulting from bulbar polio, states some general concepts for speech therapy in this situation. They are as follows:

1. The musculature of the speech mechanism, in which is included the muscles which expand and contract the rib cage, the larynx, pharynx, velum, jaw, tongue and lips, is made up of the cross-striated or red muscles, having the same composition as any of the skeletal muscles and hence under the control of the Central Nervous System. However, a number of differences which distinguish the speech muscles from other skeletal muscles must be noted. The axonal endings are more complex in the speech musculature, especially in the muscles of the larynx, than in most of the other big muscles. The speech organs, for the most part, are unpaired mid-line structures. Some

of the impulses going to the muscles controlling the speech functions are under control of the cortex; in other impulses, partial control is exercised; and in some instances there is little or no volitional control, as in gagging or in the sneezing reflex. The task of stimulating inert musculature over which there is little voluntary control is indeed more difficult than in those muscles which are under the control of the cortex.

2. The cerebral cortex is so little affected by the virus of polio that it may be accepted that the patient can rapidly begin to relearn patterns of motor activity which formerly were smoothly and automatically regulated by a brain stem without severe lesions. These new patterns of motor activity which are so important to recovery of speech function are governed by the cerebral cortex.

3. Lesions in the brain stem must reach a certain threshold of severity, varying with the margin of safety of each center, before dysfunction of speech can be observed. Recovery of function results from two processes: first, the regeneration of neurons not damaged sufficiently to be destroyed; second, the re-routing of nerve impulses from interrupted primary pathways. The first process is usually complete in the first month after the virus invades, but the second process is a long term relearning activity.

4. Where there is muscle atrophy, caused by denervation, a compensatory muscle action may be had from muscle fibers with intact innervation. Such compensatory muscle action likewise is a slow relearning process.

5. Nerve cells may be injured to an extent incompatible with recovery. Such injury will account for much of the early paralysis. But because of the margin of safety of nerve cells in the cranial nuclei controlling motor activity in speech, irreversible damage resulting in complete paralysis is not frequent.

6. The impact of polio on the human system is violent physically and psychologically. Speech is a basic human process, and an interruption of its function is fraught with frustration. Speech therapy must treat the whole person consistent with other administered therapies, and consider all of the psychological trauma left in the wake of the disease.

7. Audio-stimulation can well be utilized by the speech therapist. Where lesions in the brain stem must be bypassed to restore function, new cerebral and motor configurations must be set up. Audio-stimulation is part of this process.

9. The day to day improvement is slight and is usually not discernible to the patient or to those closely associated with him. It is important to the patient to know that he is improving. Therefore, the therapist should use whatever means he can to have the patient observe his improvement. Perhaps the most practical method is to retain samples of speech obtained at intervals on a wire or tape recorder.

9. Except for very young children, speech therapy in bulbar polio will consist of helping the patient to release skills which have been lost. Since most of the patients will have experienced normal communication before their illnesses, they will appreciate the goals for which the therapist strives. Motivation should be excellent.

10. Many of the techniques used by the physical therapist can be adapted to improve the speech of bulbar polio patients. For example, the pattern of large muscle movement can be broken down and analyzed in terms of its component parts. Intensive work on isolated parts of a larger action is often productive and very frequently necessary. In this respect, Nelson quotes from Westlake (6) who has made some suggestions concerning cerebral palsied speech which might well be applied to the speech of a victim of polio. Westlake points out "that a detailed scrutiny of muscle activity, frequently reveals remedial defects which interfere with the speaking act." He then goes on to say that the speech act can be fractioned into these abilities:

- a. Ability to sustain an even exhalation for 10 seconds.
- b. Ability to sustain an even tone for 10 seconds.
- c. Ability to open and close the lips 10 times in 10 seconds.
- d. Ability to open and close the lips 10 times in 10 seconds, while the mandible is stabilized by keeping the upper and lower teeth together.
- e. Ability to raise tip of tongue to the rugae 10 times in 10 seconds, while the mandible is stabilized by setting a rubber block, about a quarter of an inch thick, between the teeth.
- f. Ability to move the tongue tip from one corner of mouth to other 10 times in 10 seconds.
- g. Ability to extend the corners of the lips from the round position 5 times in 10 seconds when the mandible is stabilized by keeping the teeth together.

- h. Good peristaltic activity of the tongue—ability to propel foods from the front of the mouth to the back of the mouth and swallowing them."

These rates are arbitrary, and are used only for reference of measurements and there are, of course, many other possibilities in which the speech functions can be divided. Westlake says this approach has four advantages:

- "a. It describes the over-all motor adequacy.
- b. It isolates foci of particular difficulty.
- c. It encourages a systematic therapy since it constitutes a map of an important aspect of the speech training."

11. Perhaps the most frequent disability of speech resulting from bulbar polio is hypernasality. The therapist should be aware of the more recent experimental evidence which indicates that the naso-pharynx port need not be closed for nasality-free speech.

According to McDonald and Koeppe-Baker, (3). "There is a critical point at which a critical balance is established between oral and nasal resonance. If this critical point is not reached, nasality will occur." To these authors, the determination of the path of the air stream, the action and position of the tongue is of much greater significance in cleft palate speech than the action of the palate. Although these men question the efficacy of blowing exercises for cleft palate speech, Nelson (4), Zausmer (7), and Baker and Sokoloff (1) all agree that blowing should provide help for the palatal and pharyngeal weakness growing out of bulbar polio. Blowing provides exercise against resistance, which kind of exercise has been effective in restoring tonus and strength to other muscles of the body. This does not preclude giving attention to direction of the air stream and position of the tongue in both cleft palate and bulbar polio cases showing signs of hypernasality.

#### SPECIFIC THERAPY IN POST-BULBAR POLIO SPEECH:

Since the characteristic syndrome of post-bulbar polio speech resembles that of cleft palate, the therapy generally attempted is closely allied to the techniques utilized with cleft palate.

To strengthen velar action and make soft palate more pliable and movable, many types of blowing exercises are found helpful. (1, 7) Candles, pin-wheels, soft balloons, harmonicas, whistles, feathers, ping-pong balls have all been found useful gadgets.

Other techniques found to be helpful in stimulating velar activity are panting and yawning exercises and massage of the palate by a sterile swab or finger. The latter therapy tends to encourage a gag reflex which elevates the palate. In cases where there are residual traces which show activity in the velum, electrical stimulation of the palate to increase the movement of this structure may be attempted. (This type of therapy should be under the direction and surveillance of a physician who is a specialist in physical medicine.) (1).

Ear training is of great importance since all authorities agree that a major problem with most patients is their inability to tell the difference between nasal and non-nasal sound. (7).

#### SUMMARY.

The pathological effects of this disease that result in speech disorders are generally in the Bulbar-Cranial type group with many and varied types of disorder according to the amount, type and extent of involvements of the nerves. Nasality seems to be the most common speech problem. Due to the paucity of material, the speech correctionist must take from other sources and work on this disorder much as she would for nasality for Cleft Palate speech.

It is important to remember that the "impact of polio on the human system is violent physically and psychologically. Speech being a basic human process, an interruption of its function is fraught with frustration." Therefore, we must have a gestalt approach and treat the whole person consistently with the other administered therapies. (4).

A fundamental principle to keep in mind is that the organism reacts as a whole and that anything that affects a part of the organism will have an effect on the whole organism.

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#### ERRATUM

The Editor wishes to draw attention to the error that appeared in the article "The Treatment of Habitual Dysphonia," *Journal of the South African Logopedic Society*, September, 1954, Volume 2, Number 1. The sentence on page 13 in the first paragraph under the heading POSTURAL EXERCISES should read:

"... A mirror allowing him to see head and shoulders is essential," and not "A mirror allowing him to see head and should is essential."