DEAF-MUTISM, WITH REPORT OF CASES*

MAURY M. STAPLER, M.D.

Visiting Aurist, Macon Hospital; Special Surgeon, G. S. & F.
R. R. System.
MACON, GA.

There is much evidence to prove that occlusion of the Eustachian tubes is the primary cause of deafness in the majority of cases among children who retain their speech. An attempt to point out why occlusion of the tubes is probably the primary cause also of deaf-mutism is one of the purposes of this paper. To do this I must first call attention to those conditions in the middle ear which are the prompt results of complete and partial occlusion of the Eustachian tubes.

CAUSES OF DEAF-MUTISM

When the occlusion of the tubes is complete the surrounding tissues absorb the gases in the air which is pent up in the middle ears. A vacuum is thus created and the atmospheric pressure of fifteen pounds to the square inch is brought to bear on the occluded openings of the tubes and tympanic membranes. We may expect such a pressure to rupture the membranes or force entrance through the tubes. When the tubes are only partially closed or entirely closed except in the act of swallowing, at which time the pharyngeal muscles pull them open and allow some air to enter the middle ears, the membranes may not be ruptured but subjected to

Suction instrument for reducing dislocations of the ossicular chain in deaf-mutes.

considerable pressure which would have the effect of forcing them inward.

This movement of the membranes carries the ossicular chains inward also, and the brunt of the pressure is borne by the foot of the stapes where it rests in the oval windows. The pressure may be sufficient to cause inflammatory reaction where the stapes impinges within the windows. The amount of the pressure and, therefore, the intensity of the reaction will be in proportion to the amount of air which finds its way through the occluded tubes; the less air, the greater the pressure and the inflammatory reaction. The resisting power of the tissues varies with the general condition of the subject affected, and the amount of damage will therefore be different for the individual; in one slight damage may occur; in another the inflammatory reaction may be sufficient to destroy the adjacent tissue and extend to the more essential parts within the labyrinth and produce the pictures found in autopsies of the deaf showing much destruction of the nerve routes. Such patients are incurable, of course.

Erroneous opinions might have arisen easily from such findings; the investigators, seeing inflammatory evidence localized here about the labyrinth only, might decide that the primary cause was spontaneous laby-

rinthitis when the primary cause was perhaps to have been found in the occlusions of the tubes by adenoids in the pharynx or by granulations in the fossa of Rosenmüller.

But this is a digression. I wish to point out what seems the very important fact that forcing the stapes too deeply into the oval windows and its retention there is equivalent to a dislocation of the stapes, because the stapedius muscle, the only function of which is to support the stapes in its proper relation to the labyrinth, would be put on such continuous tension as would cause it to lose its contractile power. Occlusion of the Eustachian tubes causing pressure on the tympanic membrane sufficient to dislocate the stapes and prostrate the stapedius muscle, then will cause deaf-mutism if it occurs in young children. Given sufficient occlusion to prostrate the stapedius, any very young child might become a deaf-mute, because hearing depends on the proper position of the stapes. When the stapes is forced into the oval windows Nature depends on the stapedius muscle to replace it; if the power of the muscle is lost the stapes can not replace itself. It may lie ever so lightly in the window and the stapedius could not replace it any more than a string tied to it could replace it of its own volition. For that muscle to gain control of the stapes and give hearing once more, the stapes must be placed in position.

The reason we have not given hearing to deaf-mutes heretofore is that we could not pull the stapes outward from the oval windows; that is, we could not reduce the dislocation. Neither inflation nor suction with Politzer's bag will effect the reduction. Pulling or pushing the tympanic membranes will not avail. Nature in her efforts often clears the Eustachian tubes and re-establishes the air pressure, and on inspecting the ears we see the tympanic membranes and the malleus in their proper positions and the ears to all appearances normal.

There is considerable play in the ossicular chain between the malleus and the incus, which permits the membrane with the malleus to swing outward when the tubes are opened. Such movement does not move the stapes outward or permit the tone of the stapedius to return.

We have long needed some artificial device to act as a substitute for the prostrated stapedius to pull the stapes back to its proper position. It has been repeatedly demonstrated that just as soon as the stapes is set in proper position a deaf-mute will hear. The stapedius will regain its power and the hearing will remain unless the tubes are again occluded and the stapedius prostrated. This applies alike to congenital and the acquired deaf-mutism.

I have attempted to devise an instrument which will raise the stapes and give hearing to such deaf-mute patients as have not had the stapes bound too strongly by the results of inflammatory processes. That it would tend to move the stapes may be demonstrated by attaching the instrument to a glass model of the ear which I have also constructed.

In applying this method for relief of deaf-mutism it is necessary that the tubes be open. The attitude of a child's mind should be expectant and cooperative because the centers of hearing and speech are dormant in deaf-mutes.

I have exhibited from time to time to the profession some practical results I have been able to get in apply-

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ing the method to the relief of deaf-mutism. Those patients shown at Savannah and some treated since retain their hearing and speech. After hearing is established the use of words has to be acquired and it usually necessitates persistent teaching. The work is being done under considerable handicap because of lack of material.

Dr. Love, of Glasgow, who has had ample opportunity to observe, says that about 70 per cent. of deaf-mutes have enlarged tonsils or adenoids, which would indicate that in a large number of deaf-mutes occlusion of the tubes is the primary cause of their deafness. What percentage of these may be benefited is yet to be determined.

In the attempt to demonstrate new medical ideas, mistakes are apt to be made and burning criticism will surely follow. It is usually of that old brand which condemns without investigation and would crucify professional character without a trial. It has caused lasting heartaches to some of the best and brightest men the medical profession has ever known.

The criticisms are, as a rule, of such a nature as to be easily refuted; if, however, the publication of the scientific principle were withheld until criticisms were refuted, the truth would lose something of its prestige, the deaf something of value, while the physician sought some selfish vantage.

REPORT OF CASES

In order that comparisons may be drawn between the first cases having hearing established and those coming later, I have selected the cases of two patients whose hearing was established in 1898-9, and other cases which have come to me within the past twelve months:

CASE 1.—The patient, M., aged 18, a deaf-mute from birth, came for treatment in 1898. On inspection, the general appearance of the ears were normal, the tympanic membranes somewhat retracted. On a test of air conduction, there was perception of loud sounds when made very near, somewhat better in the left ear than in the right. The bone conduction was normal. The patient had adenoids which were not removed. The tonsils were not diseased. He was under treatment once a day for three months, at the end of which time he had hearing in his left ear for words spoken in a conversational tone, but no improvement in the right ear. He has retained his hearing and learned to talk. Various experiments were tried in this case, and hearing was not improved until an attempt was made to raise the stapes from the oval windows by suction.

CASE 2.—The patient, Miss S., aged 12, a deaf-mute from birth, came for treatment in 1899. On testing by aerial conduction, I found that hearing existed for loud voices near by. Bone conduction was normal; tympanic membranes normal in appearance and in position; except for a few adenoids which were not obstructing the Eustachian tube, the throat also was normal. There was marked improvement in the hearing after the first treatment. After ten days the patient could hear words spoken in a low tone. She retains hearing for conversational tones. No effort has been made to train her to speak, and she has picked up only a few words. She is very poor, and her mentality is below the average.

The next cases are those which came to me this year.

CASE 3.—The patient, Miss J., aged 10, came for treatment in February, 1908, with a history of deafness caused by measles one year previous. Her ears suppurated and she became profoundly deaf and lost the power of speech almost entirely while under the care of other specialists. Examination revealed retracted tympanic membranes and adenoids which closed the Eustachian tubes; bone conduction good; hearing by aerial conduction nil. After three months she could hear words spoken near the left ear. After eight months she hears conversation by use of the speaking-tube in the left

ear, but hears very little with the right. She has regained the power of speech and carries on conversation by use of the speaking-tube. There is a slow but steady improvement in hearing through the use of the suction massage instrument.

CASE 4.—A little girl, aged 4, child of a physician, came July 25, 1908, with a history of congenital deaf-mutism. Her parents stated that they noticed that she did not begin to talk at the usual age. They then discovered that she was deaf. On inspection the tympanic membranes were strongly retracted, and there was evidence of adenoids and closure of the Eustachian tubes. Bone conduction was good. The patient gave no evidences of hearing by aerial conduction. I began treatment by removing the adenoids thoroughly under general anesthesia. She was then allowed to go home for a week. When she returned, treatment was given once a day for a week, at which time she began to hear and talk. She was again taken home, caught cold and returned after ten days with catarrhal discharge from both ears, the Eustachian tubes being tightly closed. Under treatment again, these conditions were relieved, and the patient began to talk once more. After three months she now hears a whisper at a distance of three feet, speaks words and sentences quite freely, and gives promise of gaining her lost powers in full.

CASE 5.—The patient, a boy, aged 8, came for treatment July 28, 1908, with a history of having had some hearing and speech when about 2 years old. He had suddenly stopped speaking. At the time he came to me his hearing by aerial conduction was good for words spoken near and in a very loud tone. He retained the use of the words "mamma" and "papa." On inspection, tympanic membranes were found to be slightly retracted, and there was partial closure of the Eustachian tubes. He had been operated on the year before for adenoids without any beneficial effect on his hearing. Under general anesthesia, I removed with my finger granular tissue from Rosenmüller's fossa. Treatment began three days afterward, and improvement came in the patient's hearing, speech, and general expression at once. After three months, he hears and speaks almost normally, and his expression has changed from that of a semi-idiot to that of a bright, beautiful boy.

CASE 6.—The patient, a girl, aged 16, had begun to speak at the usual age and suddenly ceased. She was taken to a specialist and had adenoids removed with no good effect on her hearing. I found her profoundly deaf and dumb. The tympanic membranes were slightly retracted, and air could be forced through the Eustachian tubes. I operated for adenoids under general anesthesia, and broke down granular masses in the fossa of Rosenmüller. The next day I made an attempt to raise the stapes, and after the treatment could get no evidence whatever of any ability to receive sound. She is one of the many patients in whom probably the adhesions binding the ossicular chain are too strong to be broken.

The family history as to other deaf-mute members was negative in all these cases.

THE CONDITION OF THE PERIPHERAL BLOOD VESSELS IN SHOCK.—In the article with the above title, by Drs. M. G. Seelig and E. P. Lyon of St. Louis, in THE JOURNAL, Jan. 2, 1909, page 45, the accompanying illustration was incompletely printed. Through a defect in the cut the heavy marks in the line showing the seconds were eliminated, rendering the illustration pointless.

Fig. 2.—Tracing indicating outflow of blood in experiment on Dog 3. Very low blood pressure. Animal in profound shock approaching *exitus letalis*. Division of sciatic (X) followed by a proportionately more rapid outflow from femoral vein than in Fig. 1. Time markings, 1 second. The distance between the heavy marks represents the time required for the flow of 5 c.c. of blood.