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(*Continued from p.* 44.)

Eight Cases of Purulent Meningitis, Operated upon by the Haynes Method, with Post-mortem Findings in Five.—Ewing W. Day (Pittsburg).—During the past year the writer has treated twelve cases of suppurative meningitis, nine of them by drainage of the cisterna magna. Two of these were secondary to lobar pneumonia, the infecting meningeal organism being pneumococcus; two followed fractures of the base of the skull, involving the roof of the naso-pharynx, through which there was pneumococcic infection; five were of otitic origin, including two cases that had a purulent labyrinthitis, the organism being *Streptococcus pyogenes* in three of these, and a mixed infection in the other two. It is interesting to note that, in four of these cases with streptococci in the meninges, two showed staphylococci among other bacteria, but no streptococci in the pus from the ear and mastoid.

Feeling that early operation is an important factor in success in these cases, an attempt was made to estimate the probable lapse of time between the invasion of the meningitis and operation. In one case, a baby, the cisterna magna was drained thirty-six hours after the first signs of fretfulness, and twenty-one hours after the first convulsion. In another case, with chronic purulent otitis media and acute labyrinthitis, under close observation in the hospital, with cerebro-spinal fluid free from bacteria, temperature normal for two days, and without vertigo or pain, patient had a chill and a temperature of 102° F. at 2 p.m., and was operated on at 4 p.m. In this case it was believed that only a few hours intervened between the invasion of the meningitis and the establishment of drainage. Another case, under hospital observation, was operated upon in from twenty-four to thirty-six hours after the onset of the meningitis. One case was in an advanced stage of the disease and in a hopeless condition when admitted to the hospital, and in the remaining five operation was performed in the third or fourth day of the disease. In only one case was there any evidence of œdema of the fundus veins, out of four cases that were under observation before the meningitis was diagnosed, and in which the fundus was examined daily. Blood-pressure was taken twice a day, and in no case could there be demonstrated any constantly increasing pressure. The length of time between operation and death varied widely. In the cases operated upon early the interval was one, three, and twenty-two days respectively; in those operated upon after three or four days of illness the interval was eighteen hours, thirty hours, two days and four days. In the late hopeless case it was three days. In the case which recovered the period of invasion was indefinite and the diagnosis not positively proved.

The establishment of free drainage for the cerebro-spinal fluid was without special difficulties, except in one case due to an unsuspected abscess of the right cerebellar lobe crowding that lobe across the median line. In seven cases the amount of fluid drained in twenty-four hours averaged about 8 oz. In one case, in which the dressings were weighed before being applied and again immediately on removal at the end of twelve-hour periods, there was a daily drainage of cerebro-spinal fluid of

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5440 grm. (11⅞ oz.) for a period of eight days, no allowance being made for evaporation. In the case that recovered there was an almost dry cisterna magna, with a probable flow of not more than 2 or 3 oz. in ninety-six hours.

The symptoms present in seven cases were those characteristic of meningitis. In two, where the meningitis was secondary to fracture of the base of the skull, there were extreme restlessness and, later, violent delirium, the symptoms being diminished by draining the cisterna magna. In all cases but one, which gave a dry tap, the diagnosis of meningitis was confirmed by lumbar puncture.

Following the operation in all save the two which were secondary to fracture of the skull, there was considerable deviation from the usual clinical course of suppurative meningitis. Suppurative meningitis treated by drainage of the cisterna magna presents three well-defined periods: (1) the period of invasion, (2) the period of improvement, (3) the period of sepsis. An explanation for this clinical course is as follows: The cerebro-spinal fluid from its course in the lateral ventricles passes to the brain surface *viâ* the third and fourth ventricles and cisterna magna, thence through the dural spaces to disappear mainly into the venous circulation of the superior longitudinal sinus. In meningitis, as this fluid flows over the infected areas, it gathers the products of the infected areas and carries them in a steady stream into the venous circulation, and this produces the relatively constant high septic temperature characteristic of the disease. When the cisterna magna is opened, the fluid is deviated from its normal course and no longer passes over the infected brain surface, but leaves the skull at the cisterna magna, the toxins no longer being washed into the circulation. This results in a fall of the temperature, the relief of the brain-pressure, and the period of improvement. All the infection tangled up in the meshes of the arachnoid spaces does not drain back to the drainage-opening, and these remaining foci Nature is unable to overcome. The period of improvement will continue until absorption from these areas ushers in the period of sepsis.

From the clinical observation of the nine cases, and from the *post-mortem* findings, the following conclusions were reached: Drainage of the cisterna magna hinders the development of a diffuse meningitis over the hemispheres, prevents the accumulation of inflammatory exudate in the subdural spaces, but appears to have no effect upon the accumulation of pus in the pia arachnoid, and does not influence the progress of the infection at the base of the brain. The accumulation we found present in all *post-mortems*, extending from the optic commissure backwards over the crura, pons, medulla and the upper anterior portion of the spinal cord.

Dr. Samuel J. Kopetzky thanked Dr. Day for his fair and unbiassed criticism of the Haynes method of operation. The criticism with reference to the dangers of the method had not been borne out in Dr. Day's experience nor in his own. It has never been claimed that drainage of the cisterna magna is a cure for meningitis; it was stated that it is a method of controlling the pressure factors, and these, once in control, then other agents—sera, drugs, or antitoxins—can be used with hope of better success than is now obtainable in these cases where the pressure factors dominate the clinical picture. The dryness of the cortex reported by Dr. Day must not be taken as a bad sign,—one comes across the same experience in operations for tumours, and it is not found to deleteriously affect the final results. The high mortality in our operative cases of meningitis is striking, but one should remember that the mortality

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percentage in all intracranial work is high, and this in itself must not be considered against the procedure. Dr. Day's division of the periods of meningitis is a distinct advance. His work of estimating the onset of the disease, however, is not agreed to by the speaker's findings. There is a period when the patient presents no clinical symptoms whatever on which a diagnosis can be made, and the speaker insisted that the chemical tests would give the earliest possible indication of the presence or absence of a meningitis. If the operation under discussion is to accomplish anything at all it must be done in the very earliest possible period of the development of the disease. He cited a case of Dr. McKernon's in which the patient entered the hospital on March 14, with no other symptoms than headache. The diagnosis of meningitis was made by chemical test on March 15. The first clinical sign of the disease in the form of a Kernig appeared on the 19th, and on the 21st the child was dead. In this case when the Kernig appeared it was too late, in the speaker's opinion, to undertake the operation. Regarding the lack of finding of an advance in blood-pressure and signs in the fundus of the eye, the speaker did not claim that all cases of meningitis present these, but did contend that when present they are indicative of increased cranial tension, and his contentions are supported by the observations of Harvey, Cushing and others. He cited a case of Dr. Duel's, said by him to be hopeless from the start, in which the blood-pressure and vaso-motor changes were found only a few hours before death. With reference to the treatment of meningitis, attention was called to the use by McKernon and others of urotropin, which had been successful in a certain number of cases, the drug having been used empirically. Recently a test has been devised which will show whether or not urotropin is broken up into free formaldehyde; for unless it is broken up into free formaldehyde, it is useless to continue the administration of the drug. This test consists of the following: Phenolhydrozin, 5 per cent. sol., 3 drops; sodium nitro-prusside, 5 per cent. sol., 3 drops; sodium hyroxid, saturated sol., excess; added to 1 c.c. of cerebro-spinal fluid. Unless this shows the green colour indicative of free formaldehyde, it is useless to continue giving urotropin.

Dr. Francis P. Emerson reported one case of temporo-sphenoidal abscess with meningeal symptoms, in which the symptoms were general and urgent, and the Haynes operation was done at once. The following day the usual mastoid operation was performed on the right side, and a temporo-sphenoidal abscess evacuated through the tegmen. The patient, A. McF——, was admitted October 26, 1912, with the following history: Male, aged twenty-two; chronic otorrhœa of the left ear. There was a chronic suppurative process until he was aged fourteen. One week ago an otalgia was followed by an increase in secretion. The patient had a marked general headache for one week, with vertigo and projectile vomiting. There had been soreness in the neck and back, with cramps in the stomach for twenty-four hours. The sensorium was cloudy. There was a rotary nystagmus to the right. The pupils were equal and reacted to light. There was a marked rigidity of the neck. The knee-jerk was absent. Kernig marked and *tâche cérébral* present. Babinski and ankle-clonus not present. The cerebro-spinal fluid was very cloudy, but not under pressure. The white count was 31,400. Urine negative. The fundus was also negative. Blood-pressure 125. Cultures from the cerebro-spinal fluid were contaminated. The patient made an uninterrupted recovery.

Dr. Joseph C. Beck reported having operated upon seven cases since last year, details of which were recently presented in Chicago, before the

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local Oto-Laryngological Society. Dr. Day's work corroborated his own findings. Out of the seven cases reported one had recovered. The correctness of the diagnosis of diffuse suppurative meningitis might be doubted in this case. It followed septic sinus thrombosis of the pneumococcus type. The patient, a young girl, is now perfectly well, seven months after the operation. Another case was parallel with that reported by Dr. Emerson. The diagnosis was made with all the clinical and chemical tests. In this case there was an increase in the cellular elements, unlike the one which recovered. This patient, a man, could not be put in the face-down position, ceasing to breathe as soon as this position was assumed. He died the night of the operation. At autopsy a large temporo-sphenoidal abscess was found. The operation, of course, did not relieve this abscess, which was the cause of death. He added that the patient who recovered had a marked Kernig.

Dr. Lester Mead Hubby said too much stress must not be placed on blood-pressure findings, as a rising blood-pressure occurs, in his experience, only in the very beginning of a meningitis, previous, in fact, to the appearance of the Kernig, Babinski, stiff neck and Brudzinski phenomena. The disappearance of high blood-pressure must be accounted for by the depressing action on the vaso-motor centres of cholin, neurin, and possibly other toxins collecting in the cerebro-spinal fluid. The question as to whether to do the cisterna drainage only should be answered in the negative. The cisterna and the site of the manufacture of the germs should be drained with the greatest possible speed consistent with the least amount of jarring and the least amount of blood-loss. His experience with the Haynes operation was limited to seven cases—one of his own, and the others of other observers. All were fully developed meningitis at the time of operation, and none recovered. Three were nearly moribund at the time of operation and died within twelve hours after the operation. The other four lived three, five, five and a half, and nine days after the operation. The interesting point in his case was the disappearance of the copper-reducing dextrose and the presence of lactic acid in the spinal fluid at least six hours previous to the appearance of Kernig, Babinski, retracted head, etc.

Dr. Klotz, of Pittsburgh, had the opportunity of studying the pathological conditions of the cases reported in Dr. Day's paper. In the autopsy findings of septic meningitis several points stand out very prominently. In the unoperated cases there is always evidence of collection of much inflammatory exudate upon the surfaces of the brain and at the base with the accumulation of excess fluid in the subdural spaces. In similar cases that have been operated upon, the subdural spaces are free from fluid and are quite dry. There is no evidence of pressure from a collection of fluid in the subdural spaces when the operation into the cisterna magna has been carried on. In other words, this operation gives excellent drainage of the subdural spaces. On the other hand, it is noted, however, that such drainage does not assist in the removal of the exudate in the pia arachnoid, and in the cases studied there was no evidence that the opening of the cisterna magna had any unfavourable effect upon the course of the disease.

Dr. Day, in closing the discussion, emphasised the fact that in presenting this paper he had expressed no opinion whatever with reference to the merits of the operation, and that whether the operation be a good one or a bad one it had nothing to do with the scope of the paper. The greatest improvement in the cases cited was evidently due to the relief of pressure. In one case, in which the patient lived twenty-one days after the

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cisterna was opened, the operation was justified, if for no other reason than that it permitted the father to see the child with clear mentality for nine days before death. There could be no doubt concerning the fact that the operation does relieve pressure. The two abscess cases mentioned by Dr. Beck and Dr. Emerson were probably not cases of diffuse suppurative meningitis but circumscribed. Three years ago he had reported three cases of suppurative meningitis cured by drainage of the subdural space. Two years later one of these patients returned, with re-filling of the abscess-cavity and death. Autopsy performed. Failure of methylene-blue under pressure to penetrate certain areas of the dura indicated that the former meningitis had been circumscribed, and it was hardly just to include such cases in estimating the value of the operation under discussion. There is much yet to be learned with reference to the circulation of the cerebro-spinal fluid. The amount of drainage obtained by operation does not represent the normal secretion; it represents the most that can be secreted under artificial conditions. The arterial pressure must be higher than the pressure of the cerebral fluid; likewise, the pressure in the venous circulation must be lower than that in the arterial circulation. If the arterial pressure is equal to the pressure of the fluid there will be no secretion. When the cisterna magna is opened the amount of fluid obtained represents the fluid secreted with zero pressure in the ventricles. The operation has not been successful in saving life. It carries the patient over the dangers of cerebral pressure only to die from sepsis. He believed Dr. Kopetzky to be wrong when he said that by making the diagnosis in the early stage the drainage operation will effect a cure. Even if the cases are seen early and the disease demonstrated by chemical tests, there will be points or puddles in the arachnoid spaces which cannot be drained through the cisterna magna. The infected fluid from these areas will eventually reach the undrainable area at the base and the formation of pus will follow.

(*To be continued.*)

Abstracts.

PHARYNX.

Freedman, L. M.—On the Function of the Tonsils. "Annals Otology," vol. xxii, p. 188.

The author concludes that the tonsil has a function, but probably only in the early years of life, and assumes that there is other tissue in the body, as, for instance, the lymph-glands, which have the same function—mainly protective. Removal of the tonsil, therefore, does not remove from the body any organ or tissue absolutely necessary to the system; but, if not diseased, its removal leaves the individual with one defence less. *Macleod Yearsley.*

Wilson, J. Gordon, M.A., M.B. (Chicago).—The Significance of Plasma-cells in the Tonsil. "Journ. Amer. Med. Assoc.," August 2, 1913.

From a review of the literature and his own investigations, the writer considers that plasma-cells are normally present in the tonsil, and that with the absorption of toxins, either from the crypt or from extra-

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