

The treatment of brain abcess by the induction of protective adhesions between the brain cortex and the dura berfore the establishment of drainage / Charles E. Dowman.

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Publication/Creation

Chicago : American Medical Association, 1923.

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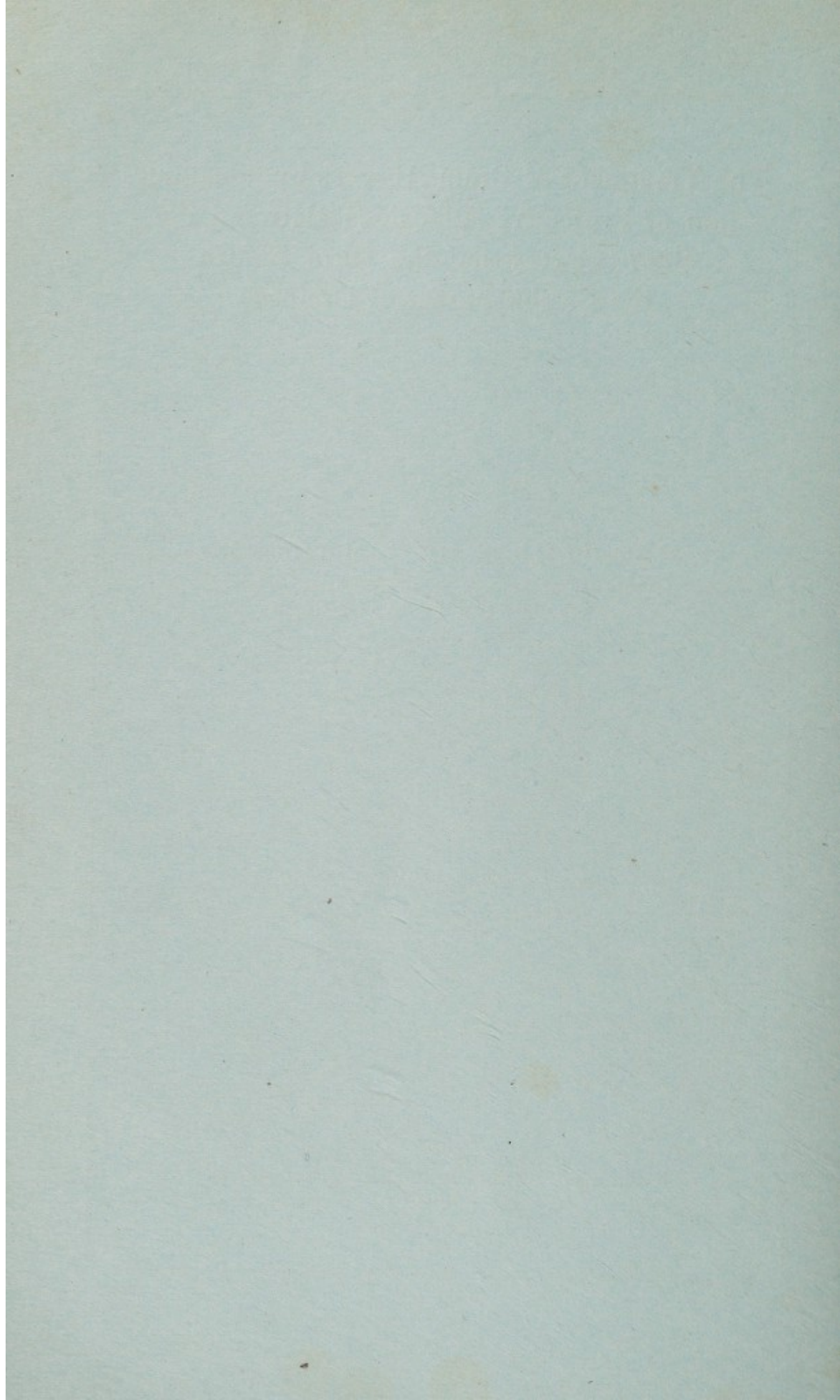
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Reprinted from the Archives of Surgery
May, 1923, Vol. 6, pp. 747-754

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CHICAGO



THE TREATMENT OF BRAIN ABSCESS BY THE INDUCTION OF PROTECTIVE ADHESIONS BETWEEN THE BRAIN CORTEX AND THE DURA BEFORE THE ESTABLISHMENT OF DRAINAGE

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Although medical literature is replete with reports of isolated cases of brain abscess-with recovery, the percentage of recovery would doubtless be distressingly small were the full reports of all such cases made known. In reviewing the literature, one is impressed with the lack of uniformity of technic in the operative treatment of brain abscess, as well as with the lack of emphasis placed on certain fundamental principles, the observation of which is essential in order to obtain a reasonable degree of success.

In 1920, Lemaitre¹ called attention to the importance of walling off the subarachnoid space in the treatment of brain abscess. Since the publication of his article, I have adopted the method described below, which has been used with a degree of success sufficient to warrant its publication.

There are two complications in the treatment of brain abscess which are responsible for most of the poor results; namely, meningitis and brain fungus. Meningitis results, as a rule, from the contamination of the subdural and subarachnoid spaces at the time of, and subsequent to, the establishment of drainage of the abscess; and brain fungus occurs when a too extensive opening has been made in the skull and dura.

The contamination of the subdural and subarachnoid spaces can be largely prevented if adhesions between the brain cortex and dura are induced before permitting the free evacuation of the abscess cavity. This can be readily accomplished provided the technic described below is rigidly adhered to. After these protective adhesions have been formed, free drainage can be accomplished without fear of meningeal contamination, a principle which has been recognized for many years in the treatment of abscess of the liver, lungs, etc.

1. Lemaitre, F.: Walling Off the Subarachnoid Spaces: Its Application to the Treatment of Cerebral and Cerebellar Abscesses of Otitic Origin and Also in a General Way, to Surgery of the Brain, *Ann. Otol., Rhinol. & Laryngol.* **29:1** (March) 1920.

Brain fungus can hardly occur unless an opening is made in the skull and dura, of a size sufficient to allow the brain to protrude. If the necessary opening is made just large enough to permit the entrance of the exploring needle and for the small drains to follow, the brain meets a natural barrier instead of an opening and cannot, therefore, escape.

TECHNIC OF OPERATION

Before selecting the point of attack, every reasonable method for accurate localization should be used. An entrance through contaminated areas (frontal sinus or mastoid) should be avoided for two reasons: First, the diagnosis of abscess may prove wrong; second, the abscess, if present, may not be reached with the exploring needle. By taking this precaution, the danger of producing an infection of the cranial contents will be obviated.

The incision should be just long enough to permit the entrance of a perforator and small burr. It should be made as nearly as possible over the suspected site of the abscess. After a small opening has been made through the skull, the dura is incised, the incision being just long enough to assure the operator that a cortical vessel will not be injured by the exploring needle. An ordinary straight ventricular puncture needle, with centimeter markings, is then inserted in the direction of the suspected abscess. As soon as the abscess is reached and a few drops of pus have escaped into a sterile test tube, the needle is withdrawn slightly until the pus ceases to appear. The exact depth and direction of the needle are then calculated.

The prevention of the free escape of pus at the time of operation cannot be too strongly emphasized. In the first place, a contamination of the wound is to be avoided, a condition which can hardly be prevented if the pus is allowed to escape freely through and around the needle. In the second place, the thorough evacuation of the contents of the abscess at this time may relieve the increased intracranial pressure to such an extent as to allow the brain cortex to lose its firm contact with the dura at the point of incision and to permit infection of the neighboring meninges. Such a spread of the infection can be prevented if the cortex becomes firmly adherent to the dura around the dural opening before free drainage is established.

After the depth and direction of the abscess have been calculated, the needle is entirely withdrawn, and a small filiform drain of folded rubber tissue is inserted down the track of the needle in the direction of, but not into, the abscess. The wound is then covered with a properly fitted dressing, which is not changed for two or three days. During this time, the rubber tissue wick, acting as a foreign body, stimulates the formation of adhesions between the brain cortex and the dura, forming a well-defined ring around the drain. At the first dressing, the wick

may be inserted into the abscess. This usually causes very little drainage unless the pus is under great tension. Two days later, the second dressing may be performed, and a second small rubber tissue wick inserted down the track along the side of the first. The dressings may then be changed daily, for by this time the protective adhesions are widespread and firm enough to permit the gradual enlargement of the drainage track by means of additional small wicks of rubber tissue. Within a week or ten days, it is safe to withdraw these wicks and to substitute a drainage tube (preferably the eye portion of a No. 10 English rubber catheter) down the well-formed drainage track into the abscess. Usually, free drainage does not take place until tube drainage is established. The dressings from this time may be performed as frequently as desired, the tube being removed and cleansed if suspected of being clogged with exudates. No undue haste in permanently withdrawing the drain should be practiced. As long as there is any drainage whatsoever, the tube should be kept in situ and only removed permanently when all evidences of the infection have subsided. It is a safe practice to leave the tube inserted for a week or ten days after active drainage has ceased, and gradually withdraw it by daily shortening. It may be two or three months before the drainage tube may be dispensed with, although the average case does not require such a long time.

REPORT OF ILLUSTRATIVE CASE

The following case of a small series has been selected to illustrate the value of the method of treatment described above.

HISTORY

M. D., aged 17 years, referred by Dr. C. A. Thigpen of Montgomery, Alabama, was admitted to the Piedmont Sanatorium, July 28, 1922. June 27, the patient first consulted Dr. Thigpen, whose letter concerning her condition is as follows: "On the evening of June 27, she was brought to me in a prostrate condition. What attracted attention at first inspection was a closed right eye with much edema and exophthalmos, the typical picture in children of acute fronto-ethmoiditis. Temperature was 103 F., pulse 120. I operated without delay, making a brow incision. The right frontal sinus was small but filled with thick creamy pus and some granulations. At the same time, I removed the anterior end of the right middle turbinate, broke down the anterior ethmoid cells and established free communication with the frontal cavity. Relief was prompt, the temperature and pulse gradually returning to normal; headaches ceased, and, on the ninth day, she was able to leave the hospital. About a week later, she began to have increased temperature and a return of the headaches, necessitating the reopening of the frontal wound and the curetting away of the granulations. The wound has been kept open ever since. The improvement was again prompt and continued so until three days ago when she went into a state of collapse, with slow pulse, cool extremities, etc. At this time, the optic disks were beginning to show evidence of increased intracranial pressure. I, therefore, have made a diagnosis of brain abscess." She had suffered from fairly constant

headaches, excepting for a few days following the operations, since the onset of the present illness. They had been located principally in the right frontoparietal region. Vomiting, projectile in character, had occurred several times during the preceding week. Double vision, lasting two days only, had occurred five days previously, but was not present at the time of examination. Three or four attacks of dizziness, momentary in duration, had occurred during the previous two weeks, causing her to grasp an object to keep from falling, and had been relieved by lying down. The family history was unimportant, except for arrested "lung trouble" in the mother. The patient had had influenza five years previously, the usual diseases of childhood, and tonsillitis, four years previously.

NEUROLOGIC EXAMINATION

Head.—There was an operation scar, with a small discharging sinus (mucopurulent), on the right side of the bridge of the nose; slight, though definite, dilatation of the veins over the right frontal region; slight edema of the upper eyelids, more marked on the right than on the left. The veins of the upper right eyelid were quite prominent. Both eyes showed a mild degree of exophthalmos, more marked on the right than on the left.

Cranial Nerves.—The retinal veins were greatly engorged. The optic disk was completely obliterated, presenting the picture of a recent, though definite choking. The same conditions obtained on the left as on the right, though to a less marked degree. There was a moderate degree of photophobia on both the right and left sides. No changes were found in the visual fields. The pupils were equal, and reacted to light and in accommodation. All external eye movements were well performed, except when the patient looked to the extreme left. There was no nystagmus. Voluntary and emotional movements of the face were slightly sluggish on the left, as compared with the right. All other cranial nerves functioned normally.

Cerebrum.—There was a fine tremor of the outstretched fingers of the right hand, and no disturbance of memory, except in regard to the recent operation, concerning which the patient had no clear remembrance. There was no frank disorientation. The patient was right-handed. There was no aphasia, no uncinate gyrus symptoms, and no hemianopsia. No convulsions, either general or localized, had occurred. There was no paralysis nor weakness of the various groups of muscles of the extremities on the right or left. Slight weakness of the left facial muscles was observed. Ankle clonus was not obtained either on the right or left. No sensory disturbances were observed on the right or left. There was no astereognosis or disturbance of joint sense.

Cerebellum.—No asynergia was demonstrated on the right or left. There was no nystagmus.

Reflexes.—The abdominal and epigastric reflexes were active and equal on the two sides. The arm reflexes and knee jerks were hyperactive on the right and highly exaggerated on the left. The Achilles jerk was hyperactive on the right and highly exaggerated on the left. Babinski, Gordon and Oppenheim reflexes were absent on the right and left. Kernig's sign was absent on the right and left.

Sphincters.—There was no disturbance of the sphincters.

GENERAL EXAMINATION

General Condition.—At the time of examination, the pulse was 64; the blood pressure: systolic, 98; diastolic, 50, and pulse pressure, 48.

Urinalysis.—The reaction was acid; specific gravity, 1.014. Albumin, sugar and indican were absent. Numerous epithelial cells, a fair number of pus cells and an occasional red blood cell were demonstrated in a noncatheterized specimen.

Blood.—Examination revealed: hemoglobin, 80 per cent.; erythrocytes, 4,250,000; leukocytes, 8,900. Differential count: polymorphonuclears, 69 per cent.; small mononuclears, 30 per cent.; transitionals, 1 per cent.

COMMENT

The development of symptoms and the finding of increased intracranial pressure subsequent to a verified suppurative fronto-ethmoiditis were strongly suggestive of brain abscess. The headaches on the right, the greater choking



Fig. 1.—Lateral view of skull with grooved director passed through the opening in the skull, down the drainage track into the abscess.

of the right optic disk than of the left, the fine tremor of the outstretched fingers of the right hand, the exaggerated deep reflexes on the left, and the slight weakness of the left facial muscles suggested that the most likely site of the abscess was the right frontal lobe.

OPERATION

Under local anesthesia, induced by 1 per cent. procain-epinephrin solution infiltration, an incision, 2 cm. long, was made along the hair line in the right midfrontal region. The opening into the skull was accomplished with a perforator and small burr. An incision, 0.5 cm. long, was made in the dura.

Through this small opening, a straight ventricular puncture needle was passed through the cortex of the brain, downward, slightly forward and mediad. At a depth of 3 cm., a slight resistance was encountered, which was interpreted as being the capsule of the abscess, or possibly the dura overlying an epidural abscess. The needle was gently pushed through the resistance, and pus escaped under great pressure. In spite of the immediate withdrawal of the needle, 10 c.c.



Fig. 2.—Postero-anterior view of skull, with the grooved director passed through the opening in the skull, down the drainage track into the abscess.

of pus had escaped into a sterile test tube before the flow was stopped by withdrawing the needle. A small filiform wick of folded rubber tissue was then inserted down the track of the needle, to the capsule but not into the abscess. The edges of the scalp wound were whipped over with continuous catgut in order to control hemorrhage, and a plain gauze dressing was applied.

DIAGNOSIS

There was a large abscess at the base of the right frontal lobe, 3 cm. below the cortex, at the site of the incision. The pus was thin and greenish. Culture revealed *Staphylococcus aureus*. The brain was under greatly increased tension.

COURSE

July 29, 1922: The dressing was changed, but the drain was not disturbed. Practically no drainage had occurred, and the general condition was good.

July 31: The dressing was changed, and a drain was inserted for 0.5 cm., causing an immediate escape of a moderate amount of pus. The temperature and pulse were normal. There was no evidence of meningitis and no change in the disks. The headaches were not so severe, but they had not been completely relieved.

August 2: The dressing was changed. Drainage had saturated several thicknesses of gauze, but the flow was not free. The drain was manipulated slightly but was not changed. The condition of the patient was excellent.

August 4: The dressing was changed. A slightly larger rubber tissue wick was substituted for the one inserted at the time of operation. Drainage was satisfactory, though not very free.

August 5 to 9: Daily dressings were performed. Drainage was fair but not abundant.

August 10: The drain was removed, and a grooved director was inserted through the drainage track into the abscess. As soon as this was done, fully 30 c.c. of pus escaped. A roentgenographic examination was made with the director inserted into the abscess (Figs. 1 and 2). The director was withdrawn, and a very small rubber catheter drain was inserted into the abscess.

August 12: There was no drainage. The tube was removed, and a No. 10 English rubber catheter drain was inserted, causing immediate free drainage.

August 13 to 24: Daily dressings were performed. Abundant drainage had occurred, which had gradually become less and less. The patient had no symptoms.

August 25 to September 17: The dressings were changed every three or four days. At each dressing, the tube was shortened slightly. Practically no drainage had occurred. The tube was removed completely, September 17.

September 24: The patient was discharged from the hospital. The wound was healed. All symptoms and neurologic findings were absent. Her condition was excellent.

October 4: A letter from Dr. Thigpen was received to the effect that the patient was in excellent condition and apparently cured.

COMMENT

This case is reported fully because it is a typical illustration of what should be expected in most cases of single abscess of the brain, when the abscess can be located with the exploring needle. Large openings into the skull and dura with the immediate establishment of free drainage, I believe, are responsible for the majority of poor results in this type of lesion, as the development of meningitis and brain fungus are to be expected under such conditions. If preformed adhesions between the dura and cortex are present, immediate drainage might be effected with safety. Such a condition, however, is rarely encountered, except in

cases of abscess following injury caused by some foreign body. If protective adhesions are not already present, they should be induced before free drainage is established.

Decompression in cases of brain abscess is particularly to be condemned. As soon as the increased intracranial pressure under such circumstances is relieved by decompression, there is a tendency for the abscess to be dislocated in the direction of the decompression, thereby promoting further destruction of brain tissue, which should not occur if the abscess is drained through a very small opening in the skull.

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