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BRAIN ABSCESS

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**THE
BRITISH ENCYCLOPAEDIA
OF MEDICAL PRACTICE**

INCLUDING

**MEDICINE SURGERY
OBSTETRICS GYNAECOLOGY
AND OTHER SPECIAL SUBJECTS**

Under the General Editorship of

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VOLUME TWO

APRAXIA TO CARRIERS IN INFECTIVE DISEASE

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Reference may also be made to the following titles:

BRAIN: REGIONAL
DIAGNOSIS

BRAIN TUMOUR
CEREBROSPINAL FLUID

1.-AETIOLOGY

187.] The commonest source of cerebral abscess is suppuration in the *Suppuration*
middle ear, which accounted for 56 per cent in a series of 194 cases

recently collected by Evans from post mortem statistics. In the same series suppuration in the nasal cavity, or its accessory sinuses, was responsible for 7.2 per cent.

Trauma

Trauma is another, but less common, cause of cerebral abscess from direct invasion. Such an abscess may follow a large compound fracture or, perhaps more commonly, a small puncture of the skull, as by a nail or other sharp object.

Blood infections

The most frequent source, after direct invasion from otitis media, is infection from the blood-stream. In this group of cases, amounting to 24 per cent in Evans's series, intrathoracic suppuration (bronchiectasis or empyema) accounted for nearly half the number; the rest arose from various forms of pyaemia. Of these, staphylococcal infection is the most important, both numerically and for the reason that the symptoms which attend invasion of the blood-stream by this organism may be mild and fleeting, and those which betray the cerebral focus of slow development. The connexion, therefore, between the cerebral symptoms and a past history of a boil or carbuncle with some general illness is often missed.

In a small number of cases an abscess of the brain may be discovered without any clinical or post mortem evidence of the source of infection.

2.—CLINICAL PICTURE

The symptoms of cerebral abscess fall into three groups: toxic symptoms; symptoms of increased intracranial pressure; and symptoms resulting from local damage to the brain. All these are usually present in some degree, but any one group of symptoms may preponderate, so that we may for instance see one patient, whose leading symptoms are those of a focal lesion with little evidence of increased intracranial pressure, and another with headache, vomiting and papilloedema, but without any significant localizing signs—the toxic symptoms in both cases being little in evidence. More rarely, are encountered cases in which an obscure pyrexia, associated with headache and severe toxic symptoms, has aroused the suspicion of a general infection, such as enteric fever.

Abscess from direct invasion: stages

When the abscess develops as the result of direct invasion, as from the ear or frontal sinus, the evolution of symptoms, as a rule, comprises three stages. In the first, that of invasion, there may be complaint of headache, and if the patient is under medical observation, a transient rise of temperature may be noted. The symptoms of this stage are often fleeting and of insufficient degree to excite attention. Following this is a stage which may last several weeks or months, during which the abscess is clinically latent. In the third stage, symptoms of local damage and increased intracranial pressure develop.

In some cases, however, the symptoms of the first stage are progressive; the temperature remains high, and severe headache and drowsiness

supervene, together with localizing signs. In some of these fulminating cases death ensues within a few days of the onset of symptoms, but in a fair number the process of suppurative encephalitis resolves to form an encapsulated abscess. It is in this group of cases, especially, that the surgeon is advised to hold his hand until subsidence of the acute symptoms warrants the assumption that the abscess has become encapsulated.

In the pyaemic cases the cerebral metastasis is usually marked by a rise of temperature, with headache and malaise; a fulminating course is of more common occurrence, especially in cases originating from intrathoracic suppuration, but the initial symptoms may subside and be followed by the long latent interval which, as already mentioned, is characteristic of the abscess resulting from direct invasion.

*Abscess from
pyaemia*

It has already been implied that an encapsulated or chronic abscess may exist for weeks or months without causing symptoms. Retrospective inquiry will sometimes show that during this period there have been symptoms, such as occasional headache, malaise, anorexia, loss of weight and constipation, though the patient may have been leading a normal existence.

The transition from the stage which is clinically latent to that in which symptoms of increased intracranial pressure are evident is probably never abrupt, but may be rapid, so that a patient, who has been doing his work without difficulty, may in the course of a few days develop all the symptoms of serious cerebral illness. Headache of increasing severity is the symptom which, as a rule, arouses the first suspicion of intracranial mischief. The association of drowsiness, and perhaps vomiting, is important, but usually it develops later. Papilloedema is an inconstant accompaniment of this stage, valuable as a diagnostic point if present, but often lacking even to the end. The headache, though it may be intermittent, is often severe. In a cerebellar abscess it is frequently referred to the back of the head and neck, though the pain may radiate forward to the temple and brow. When the abscess is above the tentorium the headache is often generalized, but an abscess situated in the lower part of the temporal lobe may give rise to pain which is referred to that part of the head.

*Late
symptoms*

Sometimes, as already stated, the symptoms of increased pressure may be of negligible degree, and the patient is brought, not for headache or drowsiness, but for symptoms referable to the local lesion, such as dysphasia or ataxy. This clinical picture is more often encountered in children than in adults.

It is the abscess situated in one of the 'silent' areas of the brain—frontal or right temporal—which is most likely to present no symptoms other than those of increased intracranial pressure—headache, vomiting and papilloedema—and which may, in the absence of any history of infection, be discovered in the course of an exploration for suspected tumour.

In the later stages of a cerebral abscess, the pulse and temperature are,

as a rule, normal or sub-normal. The cases with a swinging temperature and toxic symptoms are usually of pyaemic origin, and it may be that the pyaemia, rather than the abscess, is responsible for these symptoms. Occasionally, however, an abscess which has arisen from direct spread of infection may in its later stages present a clinical picture of this kind. Usually in such a case there is an extradural as well as an intracerebral abscess. The development of an intracranial abscess from middle-ear disease, and especially an abscess in the cerebellum, is not infrequently preceded by lateral sinus thrombosis with its attendant symptoms.

Extradural abscess

Extradural abscess is invariably the result of direct spread of infection from the bone, arising from otitis media, frontal sinusitis or local osteomyelitis of the skull. It most commonly occurs in the middle fossa from otitis media. An extradural abscess is rarely of such a size as to cause symptoms of increased intracranial pressure, or even localizing signs from compression of the underlying brain. It is more apt, however, than a cerebral abscess to be a cause of toxic symptoms and, occasionally, of fever. The predominant symptom is neuralgic pain, which, in the case of an abscess in the middle fossa, is referred to the temple, occiput and brow on the affected side. Such pain may be continuous, or may occur in bouts over a period of many months without the appearance of any other signs, though it may from the first be associated with, or later be followed by, an abscess in the underlying brain. The cerebrospinal fluid in a case of extradural abscess is often normal, but it may show changes of the kind seen in cerebral abscess.

Subdural abscess

Subdural abscess also results only from direct invasion from infected bone. It is rare and its symptoms are with difficulty distinguished from those of an abscess in the subjacent brain. Occasionally, however, one of these abscesses originating from otitis media may cause attacks of Jacksonian epilepsy. This is a symptom which, in the absence of generalized meningitis, does not occur with temporal lobe abscess.

3.—PROGNOSIS

Pathological studies leave no doubt that brain abscess can subside spontaneously. Such a course is, however, rare and is apt to be followed after a variable interval by rapid formation of a new abscess in the neighbourhood of the old one. It may be assumed for practical purposes that without operation the outcome is almost invariably fatal.

Causes of death

The most frequent cause of death in brain abscess is diffuse purulent leptomeningitis. The abscess ruptures into the adjacent ventricle or into the subarachnoid spaces. In a considerable number of cases, however, especially in abscess of the cerebellum, death is due to local or general rise of intracranial pressure without any severe spread of infection; the patient becomes unconscious and dies after a few hours, not infrequently from sudden failure of respiration. In other cases the onset of

coma may be followed by fatal broncho-pneumonia; this is particularly common when the brain abscess is secondary to bronchiectasis.

Patients with brain abscess may also die from septicaemia or from meningitis, the result of spread of infection—not from the brain abscess itself, but from the primary pyogenic focus.

The results of operation are better for cerebral than for cerebellar abscess, but the mortality rate on the whole is to-day high, especially in acute cases. The remarkable success of Clovis Vincent with a new method for treating acute abscesses gives hope for improvement in the results. *Mortality*

4.—DIAGNOSIS

(1)—Blood and Cerebrospinal Fluid

The leucocyte count in cerebral abscess is not very often of value as a guide to diagnosis. It is often normal, and even if raised seldom reaches a figure that provides conclusive evidence of the presence of pus. *Blood picture*

Examination of the cerebrospinal fluid almost always provides conclusive information. Lumbar puncture in a case of suspected cerebral abscess is, however, by no means without danger. In all patients with a severe degree of increased intracranial pressure there is some risk of a sudden increase of pressure upon the medulla, and in the presence of an abscess there are the additional dangers of provoking the spread of meningitis, or the rupture of a supra-tentorial abscess into the ventricle. When the diagnosis can be clearly arrived at without its aid, lumbar puncture is, therefore, perhaps best omitted. If it is to be performed, the stage should first be set for operation, the patient being moved into a hospital or nursing home for the purpose. A fine needle should be used and no more fluid removed than is necessary for the examination; 2 c.c. should suffice and, if a manometer is used, its contents should not be wasted. *Cerebrospinal fluid*

The pressure of the cerebrospinal fluid may be grossly increased or within normal limits. The most constant abnormality in its constituents is a rise of protein from the normal 0.03 per cent to a figure in the neighbourhood of 0.1 per cent. With this there is also usually an increase of cells to between 10 and 200 per c.mm. Unless there is an associated meningitis, or the abscess is leaking into the ventricular system, the majority of cells—sometimes all—are mononuclear, but a small proportion of polymorphonuclear cells usually affords evidence of a suppurative process. It must, however, be admitted that in rare instances a chronic encapsulated abscess may be present with a normal cerebrospinal fluid.

(2)—Localizing Signs

The localizing signs of cerebral abscess cannot be covered completely in this section. The reader is referred to the article entitled BRAIN: REGIONAL DIAGNOSIS (p. 609). But in view of the preponderance of

abscess from middle ear infection, and (to a much less degree) from the nasal sinuses, the signs of abscess in the temporal lobes, cerebellum and frontal lobes will be described briefly.

(a) *Right Temporal Lobe*

An abscess in this situation usually gives rise to no localizing signs unless it reaches a large size. The diagnosis commonly rests upon the association of a right-sided otitis media with headache (often referred to right temple and brow), examination of the cerebrospinal fluid, and exclusion of cerebellar signs, rather than upon positive evidence of temporal lobe damage.

Symptoms

Apart from the occasional presence of papilloedema, the earliest neurological sign is usually a slight weakness of the left side of the face, particularly in its lower half, seen when the patient is smiling or showing the teeth. A large abscess may cause more evidence of left hemiparesis, the weakness being first apparent in the hand; and with this the abdominal reflexes on the left are diminished or lost, and the plantar response becomes extensor. An abscess involving the posterior part of the lobe not infrequently presses upon the fibres of the optic radiation causing an homonymous hemianopia usually beginning with loss of the upper quadrants. Rarely an abscess may extend far enough forward to involve the uncinate gyrus and cause epileptic attacks with the characteristic uncinate aura—a momentary unpleasant and indefinable smell or taste, sometimes associated with loss of consciousness and movements of lips or jaw.

(b) *Left Temporal Lobe*

To the signs already described of a right temporal lobe abscess there are added, in the case of a right-handed person, those which may result from interference with the function of speech. The commonest variety is that known as nominal dysphasia. The patient understands all that is said to him, and can both read and write. In ordinary conversation he may show no abnormality, but, when asked to name in succession a series of a dozen objects, he fails perhaps over one, describing it in terms of its use, or having recourse to a synonym. An abscess situated in the posterior and upper part of the lobe may cause a more general disorder of speech, in which comprehension of the spoken and written word are impaired. It is on account of the dysphasia, which is often a prominent symptom when looked for, that an abscess in the left temporal lobe is more easily recognized than one in the right; but an abscess may be present in the middle part of the left temporal lobe without localizing signs.

*Disorders
of speech*

(c) *Cerebellum*

The importance of pain referred to the suboccipital region has already been mentioned in connexion with cerebellar abscess. This is often associated with bouts of occipito-frontal headache, and vomiting is of

rather more frequent occurrence in association with the headache than in the case of a supra-tentorial abscess. Papilloedema also occurs, on the whole, earlier than in the case of a temporal abscess.

The signs of a unilateral cerebellar lesion, as seen with an abscess, are as follows. Nystagmus is important, and nearly always present. It is usually coarser and slower on deviation of the eyeballs to the side of the abscess, though often present also on looking to the other side. In some cases an unwillingness or slowness in deviation of the eyes to the affected side is the precursor of nystagmus, and at rest there may be deviation of the eyes to the opposite side. The upper limb on the affected side is ataxic. This sign is made apparent by asking the patient alternately to touch his own nose and the observer's finger, or to perform other tests needing accurate co-ordination. *Ataxy*

In standing or sitting, the head is sometimes tilted, the occiput, as a rule, being inclined to the shoulder of the affected side. In walking the patient may stagger and deviate towards the affected side.

Attacks of vertigo may occur in cases of cerebellar abscess, and are difficult, if not impossible, to distinguish from those caused by labyrinthine disease. In the later stages symptoms of pressure upon the medulla may be conspicuous—slowing of the pulse, periodic slow breathing, attacks of unconsciousness, dysarthria and dysphagia.

(d) *Frontal Lobe*

Localizing signs in a case of frontal abscess are often absent or inconspicuous. There is perhaps a greater tendency than in the case of an abscess elsewhere for the patient to show evidence of mental dilapidation. Apart from drowsiness there are apathy, inattention, defective memory for recent events and deterioration of the personality. The abscess arising from sinusitis usually lies in the anterior part of the frontal lobe and it is only, therefore, when it attains a large size, or is surrounded by a large area of oedema, that signs of hemiparesis, or motor dysphasia, develop. At this stage attacks of Jacksonian epilepsy sometimes occur. It must be admitted of the frontal abscess, as of that in the right temporal lobe, that the diagnosis usually rests upon the association of a known infection of the neighbouring bone with the general signs of an intracranial abscess. *Mental symptoms*

(3)—**Exploratory Puncture**

When the diagnosis of abscess appears probable, and there is reasonable evidence of its situation, either from the clinical signs or the presence of a source of invasion, exploratory tapping may be usefully employed for its localization. In a few cases, in which the patient becomes partly or completely comatose before full examination of the nervous system has been made, it is the only way in which the diagnosis can be made.

Through a surgically clean field a small burr hole is made in the skull, and the brain is explored by a hollow, blunt needle. The exploration can *Technique of exploratory puncture*

be carried out without appreciable damage to the brain, and in such a way as to afford reasonable certainty that an abscess is not overlooked, for an abscess in one cerebral hemisphere invariably produces great collapse of the corresponding lateral ventricle, while the capacity of the opposite ventricle remains normal or is even slightly increased.

The usefulness of this procedure can be demonstrated in various types of cases. Thus, following mastoiditis, an abscess may be suspected in one temporal lobe, but the diagnosis may not be certain owing to the possibility that the symptoms may actually be produced by focal leptomeningitis or some other lesion. An incision can be made over the temporal lobe through a sterile field, and the brain can be gently explored for abscess by passing a hollow needle. If no abscess is present the temporal horn of the lateral ventricle should be encountered at a depth of 4 to 6 cm. and should yield over 5 c.c. of cerebrospinal fluid. Such a finding virtually excludes the presence of abscess, not only in the temporal lobe but in any other part of that cerebral hemisphere. If there is a cerebellar abscess both lateral ventricles are dilated, and each yields more than 15 c.c. of fluid when tapped.

This method of exploratory tapping is probably not often enough used. In the past most explorations for brain abscess have been made through infected wounds, such as mastoid wounds, owing to the belief that it was necessary to follow the track of the abscess from the diseased bone into the brain. But tracks may not exist, or may be so small that they are only visible under the microscope.

(4)—Ventriculography

In certain cases it may be necessary to obtain more precise knowledge of the situation of the abscess than that given either by clinical investigation or by exploratory puncture, and then the ventricles must be filled with air and radiograms taken. This method is dangerous unless immediately followed by operation. Recent experiences, however, have shown that with this precaution it can be used even in acute cases of abscess with satisfactory results (Clovis Vincent).

(5)—Differential Diagnosis

Cerebral symptoms occurring in association with otitis media may be due to causes other than abscess. It is not very uncommon, for instance, for a patient, especially a child, after a mastoid operation, to exhibit headache and a slight rise of temperature, perhaps for a week or two, without any subsequent developments. In some cases the cause of these symptoms is obscure, in others they are due to a mild and transient meningitis. Whenever a phase of this kind gives rise to the suspicion of intracranial infection, it is advisable to examine the cerebrospinal fluid. If it shows abnormality, the patient should be kept under observation for several months with the possibility of an abscess in mind, the examination of the cerebrospinal fluid being repeated and a normal report obtained before he is discharged.

*Cerebral
symptoms
following
mastoid
operation*

The symptoms of an acute, purulent meningitis may resemble those of a cerebral abscess, and the two conditions are often present together. Examination of the cerebrospinal fluid will provide the evidence of meningitis. A co-existing abscess may reveal itself by the presence of characteristic localizing signs, but in the presence of meningitis an abscess is sometimes only revealed by exploratory tapping.

*Diagnosis
from acute
purulent
meningitis*

There is another uncommon, but important, cerebral complication of otitis media, sometimes known as otitic hydrocephalus, whose symptoms may closely resemble those of an abscess. The history of such a case generally, but not always, includes the story of a lateral sinus thrombosis. The patient, usually a child, has attacks of headache and vomiting with papilloedema, but localizing signs are absent, and between the attacks of headache the patient appears alert and well. The cerebrospinal fluid is under grossly increased pressure, but its constituents are normal. These features taken together almost always suffice to make the distinction from abscess clear, though no single one of them is infallible. The differential diagnosis is of great importance since the patients with hydrocephalus recover if treated by lumbar puncture, without operation.

*From otitic
hydrocephalus*

Labyrinthitis occurring in otitis media is often difficult to distinguish from a cerebellar abscess. Vertigo, nystagmus, headache and vomiting are common to both. The vertigo of labyrinthitis is, however, as a rule more severe, lasts longer than that met with in cerebellar abscess, and is often associated with a sudden onset of deafness and tinnitus. Moreover, in labyrinthitis the inco-ordination of voluntary movement, as elicited by the finger-nose test, is lacking, whereas it is usually present if the lesion is in the cerebellum. Labyrinthitis and cerebellar abscess may, however, co-exist.

*From
labyrinthitis*

Tuberculous meningitis, especially if there are focal symptoms, may have to be distinguished from cerebral abscess, but a full examination of the cerebrospinal fluid will almost always make the distinction clear.

*From
tuberculous
meningitis*

In a small group of cases, already mentioned, the differential diagnosis from a general infection, such as enteric fever, may arise. These are usually pyaemic abscesses of which the source is often obscure. Thorough neurological examination, together with examination of the cerebrospinal fluid, will usually suffice for a correct diagnosis.

*From general
pyaemia*

The differential diagnosis from intracranial tumour is most likely to arise in the case of a chronic abscess causing symptoms some time after a mild (usually staphylococcal) pyaemia, or a similar abscess developing long after an acute and transient infection of the middle ear or nasal sinuses. Such cases are rare; they are sometimes disclosed only at operation. The presence of an occasional polymorphonuclear leucocyte in the cerebrospinal fluid may afford the clue.

*From intra-
cranial
tumour*

5.—TREATMENT

The method of treating brain abscess varies according to the age of the abscess and the firmness of its capsule. In the acute stage, which

comprises the first three to four weeks from the time of infection, the abscess is not firmly walled off from the surrounding oedematous brain and there is considerable risk that operative intervention will favour rather than prevent the onset of fatal meningitis.

The policy of delaying operation after diagnosis and localization must be based on a fairly accurate conception of the age of the abscess and the state of the infection. The age of the abscess can usually be accurately gauged from careful attention to the history of illness, and the state of infection is indicated by the cerebrospinal fluid. In acute abscess without meningitis it is wise to delay operation whenever possible. In acute abscess with a large increase of cells in the fluid (up to 1,000 per c.mm.) it is also generally best to delay, watching the patient and sampling the spinal fluid from time to time. In cases of acute abscess with living organisms in the cerebrospinal fluid, the state of the patient may be so desperate that immediate operation is justified. With chronic abscess there is no reason for delaying operation.

*Operation of
Clovis
Vincent*

If the surgeon must intervene in the acute stage on account of the severity of coma or the risk of broncho-pneumonia, the method of Clovis Vincent is probably the best. The abscess is localized precisely by ventriculography and then, without any preliminary needling to prove the presence of pus, a large osteoplastic flap is reflected over the site of the lesion. The abscess is then aspirated and when it has been emptied as completely as possible, the bone flap is replaced without the dura being opened. At a later stage, after an interval of weeks, during which further aspiration may be carried out through one of the burr holes if necessary, the flap is raised again and the abscess, now firmly encapsulated, is dissected out intact. With this method Vincent and his assistants have had six recoveries in seven consecutive acute abscesses.

Another method, advocated by King for the treatment of acute abscesses, is a wide exposure of the abscess by piecemeal removal of bone, and excision of the overlying brain. In the days after operation a fungus forms and is controlled by repeated lumbar punctures.

*Drainage of
chronic
abscess*

Chronic recently encapsulated abscesses may be treated by drainage through a small hole in the bone and dura nearest to their most superficial part. Various types of drain have been recommended, but free exposure and drainage rather than the manner of drainage is the important point. If the abscess is subcortical a useful additional procedure is to remove sufficient of the overlying brain to get a good exposure of the capsule and then to marsupialize the abscess capsule by stitching it to the pericranium at the edges of the bone defect.

These operations are all performed through a hole in the skull no larger than 4 to 5 cm. in diameter, and sometimes the exposure of the abscess may be inadequate. Whenever there is difficulty of exposure in the early stages of operation, it is advisable to convert the operation into a much wider osteoplastic exploration, after which the abscess can be treated under direct vision. The risk of spreading meningitis from

this cause is much less than might be expected and, in fact, the results of treatment of encapsulated abscess through an osteoplastic flap are usually satisfactory.

With an abscess of long standing, treatment through an osteoplastic flap is the method of choice. In some chronic abscesses the capsule is so thick that the abscess must be removed intact like a tumour; in others the abscess is loculated to such an extent that thorough drainage is impossible and excision is the only treatment; in yet others there are two or three separate though contiguous chronic abscesses. Excision

Repeated aspiration of an abscess through a small burr hole, without recourse to permanent drainage, has been advocated by some, but it is not to be recommended in most cases. For the rare abscess that contains many living organisms this method, or passing an indwelling rubber catheter into the abscess through a small opening in the skull, is useful as a preliminary to a more extensive operation at a later date.

After-treatment requires great care and should be carried out by the surgeon who drained the abscess. Not the least important part of it is careful and repeated neurological examination to watch the improvement, if any, in functions which were disturbed before the abscess was treated. If the abscess is draining properly, such improvement is to be expected. When an abscess has been satisfactorily treated the cellular and protein content of the lumbar cerebrospinal fluid become normal again; persistent increase of the cells or excess of protein means that all is not yet well. After-treatment

It is necessary to add that so far little success has attended the surgical treatment of brain abscesses secondary to bronchiectasis or chronic empyema. These abscesses are often multiple. Furthermore, they induce a state of drowsiness that is fatal to patients with bronchiectasis, for when such patients become so drowsy that they can no longer cough up the pus in their lungs acute broncho-pneumonia almost invariably follows.

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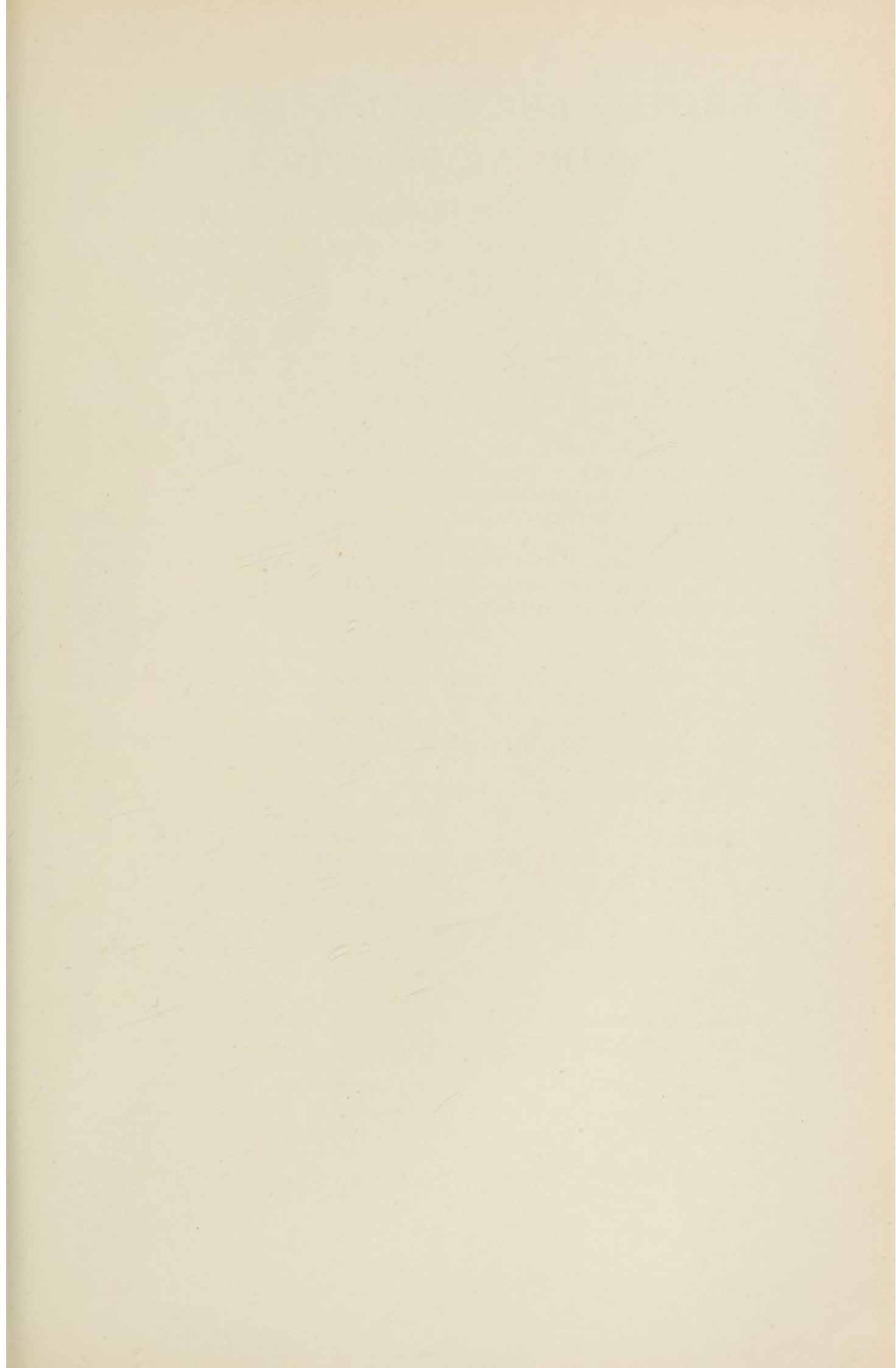
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