2 p.m.—There is now an interest in food, and the animal is eating well.

2.35 p.m.—The condition is now almost normal again, and the animal is washing itself. It is still more active than the controls.

(b) *Large Doses*.—Ten mg. were injected subcutaneously into a 16-gram mouse. Death took place in fifty minutes in a manner similar to that already described for dilaudid.

Eukodol

(a) *Small Doses*.—A subcutaneous injection of 0.25 mg. was given to a 16-gram mouse.

10.40 a.m.—Drug injected.

10.55 a.m.—Respiration slower and deeper. There is a markedly increased activity. The mouse walks or runs continuously around the cage with its ears and tail stiff and erect.

11.10 a.m.—The condition has not changed beyond a pronounced increase in the reflexes.

11.40 a.m.—Food placed in the cage. The mouse immediately investigated it and ate a fair amount. Analgesia is present, as measured by nipping the tail.

12.10 p.m.—Condition as before.

12.45 p.m.—Condition appears normal again.

The effects produced by a subcutaneous injection of 5 mg. eukodol are almost entirely of a depressant character—apathy, stupor, and analgesia. The acute reflexes are heightened, but firm pressure, such as nipping the tail, which would be very painful in normal animals, elicits no response. There is a peculiar clumsiness and lack of co-ordination in the voluntary movements. The animal stands only with difficulty, walks unsteadily, and often drags its hind limbs in a manner not unlike the "hyenoid walk" described for morphine by Claude Bernard. The respiration is markedly slowed, and the tail erected. Complete recovery takes place later without any untoward symptoms. The effects produced in the mouse by dilaudid and dicodid are almost identical. Small doses of either of these drugs produce marked slowing of the respiration, and analgesia. Larger amounts increase the spinal reflexes, in addition. The toxicity of dicodid is very much less than that of dilaudid. Very large amounts of eukodol are tolerated by mice without any lethal effects. The stiff erection of the tail produced by these drugs has been described by Straub, as taking place in mice after the hypodermic injection of morphine or its esters. Rassers¹⁰ described the same effect with other convulsants, but generally only with large doses. Van Leersum¹¹ believes this to be due to intense tenesmus of the anal and bladder sphincters, originating in the medulla and transmitted through the pelvic nerves, while Heinekamp¹² refers it to stimulation of the spinal cord.

DISCUSSION

It has been shown that the pharmacological actions of dilaudid, dicodid, and eukodol are very similar to those of morphine. Dilaudid approximates very closely to morphine, but is much more toxic; smaller amounts of dilaudid than of morphine are needed to depress the respiratory centre. Dicodid, on the other hand, seems to lie midway between morphine and codeine. Dilaudid has a well-marked action on the gastro-intestinal tract. It stimulates the movements of the intestine and stomach as well as those of the pyloric and ileo-colic sphincters. This action on the gastro-intestinal tract resembles that of heroin. Dicodid increases the movements of the intestine and the ileo-colic sphincter, but has little effect on the stomach and the pyloric sphincter. Both of these drugs increase spinal reflexes and general muscle tone. They slow the respiration and increase the amplitude by depressing the respiratory centre in the medulla; they have little or no action on the bronchioles. Eukodol differs from the others in many ways. It has a much feebler action on the movements of the alimentary tract,

and does not increase spinal reflexes. It has, however, a profound effect upon respiration, which is as marked as that produced by either dilaudid or morphine. Considering that this drug is manufactured from thebaine one might have expected some signs of it being a convulsant, but none were found. On the contrary, it produced depression of the respiratory centre and a marked diminution of pain sense. It has no effect on the bronchioles. It is interesting to note that any or all of these drugs when injected into mice produce a stiffening and an erection of the tail similar to that caused by morphine.

SUMMARY

1. Dilaudid, dicodid, and eukodol have an action on the respiration which is similar to that produced by morphine. They have little or no effect upon the bronchioles.

2. These drugs produce marked analgesia.

3. Dilaudid and dicodid have a marked action upon the tone and movements of the alimentary canal. This effect is very much less marked with eukodol.

4. Small doses of dilaudid or dicodid render the vagal centres in the medulla more sensitive; larger doses depress. Eukodol depresses the centre, even in small doses.

5. Toxic doses of dilaudid or dicodid increase the reflex excitability of the cord. Eukodol does not alter these reflexes.

6. The toxicity of dilaudid and eukodol is much greater than that of dicodid. Anaesthetized cats can withstand enormous doses of these drugs provided that they are administered after a smaller therapeutic dose. An initial large dose causes death from respiratory failure.

7. These drugs have only a negligible action on the cardio-vascular system. Dilaudid causes some slight slowing of the heart, which is central in origin.

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THE TREATMENT OF ACUTE OTITIS MEDIA IN ACUTE FEBRILE CONDITIONS*

BY

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We may assume that practically all cases of acute otitis media arising in acute febrile conditions develop as the result of a spread of infection from the nasopharynx along the Eustachian tube to the middle-ear cleft. This is particularly prone to occur in young children who have enlarged adenoids and tonsils when they develop a common "cold in the head," or suffer from any of the acute infectious fevers. It is estimated that the common "cold in the head" and influenza are responsible for more cases of acute otitis media than all the other infectious fevers combined. The percentage of middle-ear infections in influenza varies greatly in different epidemics. This is true also of all the infectious fevers, but probably about 10 per cent. of scarlet fever and measles patients

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develop an acute otitis media, about 5 per cent. of diphtheria patients, and a much smaller percentage of mumps, typhoid, and whooping-cough patients.

THE SPECIFIC FEVERS

1. Scarlet fever is very prone to give rise to an acute otitis media, either in the early stage of the disease or during convalescence. A sudden rise of temperature during convalescence should immediately direct attention to the ear as a probable cause of the pyrexia. The infection is liable to be fulminating and virulent, and to pass rapidly and deeply into the tissues, causing an early perforation, or even destruction of the drum membrane or a panotitis with labyrinthine involvement. Early paracentesis is called for to relieve pain, to lower the temperature, to afford free drainage of the pus which so rapidly forms, and to diminish the marked liability of spread to the mastoid and labyrinth.

2. Measles resembles scarlet fever in inducing an otitis media which may be virulent and rapid in its onset, and which may early spread to the deeper parts of the middle ear, causing mastoiditis and deafness. The membrana tympani quickly becomes red, swollen, bulging, and flesh-like; perforation rapidly ensues, and extensive destruction of the drumhead occurs. Both in scarlet fever and in measles there is an inherent tendency in the acute otitis media to develop into the chronic suppurative otitis media, and to require mastoid operation, even though an efficient myringotomy may have been performed and early and careful conservative treatment may have been instituted and maintained throughout.

3. Diphtheria is less frequently complicated by acute otitis media than either scarlet fever or measles. When antidiphtheria serum is administered in the early stages of the disease otitis media seldom intervenes. When, however, the middle ear becomes infected with the Klebs-Loeffler bacillus the otitis media may be most intractable and resist all treatment, so that a mastoidectomy may become necessary. In view of the fact that the discharge induced by the diphtheria bacillus is alkaline, it has been suggested that treatment with an acid, such as boric or citric acid, will be beneficial.

4. Influenza otitis media is characterized by a haemorrhagic exudate into the middle-ear cleft. In many epidemics the infection shows a marked tendency to spread to the mastoid very early, and it is not infrequently complicated by meningitis, which runs a very fulminating course and ends quickly in death. Haemorrhagic bullae are sometimes formed on the membrana tympani and on the walls of the deeper part of the external auditory meatus.

5. The acute otitis media occurring in cases of typhoid, pneumonia, whooping-cough, and mumps shows no special features. It may be of the nature of an acute catarrh of the mucous membrane of the middle ear, which may resolve spontaneously, or be evacuated by spontaneous rupture or by paracentesis of the tympanic membrane; or the inflammation may have passed on into the suppurative stage, and have produced the typical acute purulent otitis media and mastoiditis, which may be complicated by subsequent labyrinthitis or facial paralysis, or by intracranial sequelae such as meningitis, lateral sinus thrombosis, temporo-sphenoidal abscess, and cerebellar abscess, or by septicaemia.

BACTERIOLOGY OF ACUTE OTITIS MEDIA

Streptococcus haemolyticus is the most commonly found organism in the early stage of acute otitis media. The pneumococcus is also often present, particularly in cases of influenzal otitis media, and in pneumonia. *Staphylococcus aureus* and *albus* are frequently to be

found in the discharge after a few days, but they may be absent in the initial stage. *Pyocyaneus* and diphtheria bacilli are also sometimes to be found in the discharge, and a mixed bag of other organisms.

My colleague Dr. J. H. Pollock investigated the bacteriology of the discharge in fifty-three cases of acute otitis media occurring in Cork Street Fever Hospital. He found after a few weeks that *Staphylococcus aureus* was present in thirty-one cases and streptococci in only five, although many of the cases of acute otitis occurred in scarlet fever patients. Diphtheria bacilli were found in fourteen cases. Dr. Pollock drew attention to the fact that they were often present in cases of measles and scarlet fever as a coinfection.

He found that autogenous vaccines were of considerable help in clearing up the otitis media if it persisted for more than a month.

TREATMENT

This will naturally resolve itself into: (a) general treatment and (b) local treatment. The former will consist of treatment of the specific fever—for example, anti-scarlet-fever serum in scarlet fever patients, and antidiphtheria serum in diphtheria patients, with rest in bed in a warm, but not overheated, room, and protection from changes of temperature which might increase the nasopharyngitis. A purge should be administered, and the patient should be put on light diet in the febrile condition.

Local treatment will fall into three categories: (1) abortive; (2) conservative, including myringotomy; and (3) operative—mastoid operation.

Non-operative treatment is undertaken if the drum-head, though red, is not bulging. Drops of warm glycerin of carbolic should be instilled into the ear. A diaphoretic mixture or aspirin should be given to induce sweating and to relieve pain. A hot-water bag should be applied to the ear, or an antiphlogistine poultice may be applied over the mastoid and over the ear. If the membrane begins to bulge no time should be lost in relieving the tension and pain by myringotomy. Hearing is better preserved by early myringotomy than by allowing the membrane to rupture. I have ceased to employ leeches to the mastoid or to use the ice-bag.

Indications for Myringotomy

In the early stages of acute catarrhal otitis media myringotomy is not often required. Surgical treatment becomes necessary when the drumhead is red and bulging. It is even more imperative when pain and tenderness over the mastoid are well marked. Paracentesis of the membrana tympani should not, in my opinion, be delayed, particularly if severe pain persists and the temperature remains high. A free oblique incision through the posterior portion of the drum membrane is made under nitrous oxide anaesthesia. I emphasize the necessity for a free incision in order to ensure adequate drainage and to obviate too early closure. The incision is best made in a vertical or oblique direction from below upwards and parallel with the handle of the malleus through the posterior portion of the membrane, or through the most bulging portion of the membrane. A carefully made incision of the membrana tympani will almost invariably heal with complete restoration of hearing when the discharge ceases, whereas a perforation resulting from spontaneous rupture, consequent upon pressure necrosis and destruction of part of the membrane, is less likely to close.

The subsequent treatment resolves itself into the adoption of a "wet" or "dry" technique, according to the circumstances of the case and the environment and social position of the patient. For ordinary routine practice in hospital and in the out-patient department I favour irrigation of the ear with a solution of boric acid or bicarbonate of soda several times a day, according to the amount of the discharge. This should be followed by

the instillation of a saturated solution of boric acid in alcohol (boric acid grains xxx, spirit. vini rect. 3 i, aquae 3 i) for ten minutes, the patient's head being inclined to the opposite shoulder. This should be repeated several times a day when the discharge is profuse, and less frequently as the discharge diminishes. The technique of "dry" treatment consists in applying the end of a narrow wick of iodoform gauze to the perforation, the other end projecting through the external auditory meatus. In this way the pus is drawn off by capillary traction.

Some otologists recommend the use of hydrogen peroxide drops for clearing the pus from the external meatus, prior to using the boric alcohol drops. On theoretical grounds this treatment is anathematized by other otologists on the assumption that the pus may be driven into the mastoid cells, the bacteria-laden discharge sitting loosely, so to speak, on the surface of the bubbles of oxygen as the peroxide is disintegrated in the tympanic cavity. A somewhat similar charge might be levelled, with equal cogency, against the use of the syringe, for surely the pus is conveyed by syringing through the perforation in the membrana tympani into the tympanic cavity. It is sometimes found that the fluid escapes into the nasopharynx along the Eustachian tube, and if it can pass so readily into the Eustachian tube, which communicates with the tympanic cavity anteriorly, it can pass almost as easily into the mastoid antrum posteriorly. To my mind these are purely hypothetical objections; in actual practice such spread of the infection is not likely to occur, but I would like to hear the opinions and experience of subsequent speakers on this point.

Politzerization and Inflation

In order to restore the hearing after an attack of acute otitis media, politzerization, or inflation through the catheter, may be carried out, but this should not be resorted to during the acute stages of the inflammatory process, and certainly not before perforation of the drum membrane has occurred spontaneously or by paracentesis, as I feel that infection may be carried to the mastoid antrum and to air cells which may not be infected already. Acute otitis media is very liable to periodical recurrence, particularly when the patient is suffering from large adenoids and tonsils. If, therefore, the attack is prolonged and the discharge does not cease, the offending adenoids and tonsils should be removed, particular attention being paid to lateral extensions of adenoids, which occupy the fossae of Rosenmüller behind the Eustachian tubes. Other pathological conditions in the nose, such as polypi, deviated nasal septum, and sinus suppuration should also be effectively dealt with to obviate a return of the acute otitis media.

ACUTE PURULENT OTITIS MEDIA

It is not known what determines the type of middle-ear infection which ensues from infection with a given organism. Indeed, the acute purulent otitis media is probably only a later stage of the acute catarrhal otitis media which has not resolved. This is borne out by the well-established observation that on paracentesis of the drumhead in a case of acute catarrhal otitis media the discharge at first may be purely serous, and in twenty-four hours may be profusely purulent. It is probable that in all cases of acute otitis media the mastoid antrum is involved to a greater or lesser degree. It is certainly unlikely that when the tympanic cavity is full of catarrhal or purulent fluid some will not escape into the mastoid antrum through the aditus. Whether the mastoid antrum and air cells then merely act as an overflow reservoir, or become infected and give rise to a typical mastoiditis,

will depend upon the virulence of the infecting organism and the immunity of the patient and the local resistance of the mastoid.

In the acute purulent otitis media the pus is specially prone to travel back into the mastoid antrum. It may be several days before the tympanic cavity is distended and the drum membrane bulges outward. Moreover, paracentesis of the membrane may not afford the immediate relief which occurs in the case of acute catarrhal otitis media. Myringotomy must be performed in the very earliest stage of acute purulent otitis media. In spite of all our efforts to afford ample drainage of the tympanic cavity by myringotomy, and notwithstanding careful attention to the details of disinfecting the middle ear by syringing and antiseptic drops, the mastoid only too frequently becomes involved in the suppurative process. Indeed, the mastoid in all likelihood is infected in all cases of acute otitis media to some extent, but in many cases it may be drained effectively through the aditus, as the inflammation subsides, without operation on the mastoid.

INDICATIONS FOR MASTOIDOTOMY AND MASTOIDECTOMY

As we have seen, the mastoid is often involved early in cases of influenza, scarlet fever, and measles where the organism is virulent and the patient's immunity is lowered. When there is a free discharge through a perforation of the membrana tympani, but severe pain persists and the temperature does not subside—particularly if there is marked tenderness to pressure over the mastoid antrum or tip, accompanied by oedema, redness, and swelling over the mastoid, together with a bulging of the postero-superior wall of the meatus in close proximity to the drum—we may with safety conclude that the mastoid is not being adequately drained, and must therefore be opened.

These are the cases of manifest mastoiditis which cry out for operation, but there are many in which the indications for operation are not so apparent and obvious. Thus we not infrequently find some pain and mastoid tenderness in early acute otitis media which are rapidly relieved by timely paracentesis and conservative measures. The patient is not acutely ill, and the temperature gradually subsides with the provision of adequate drainage by myringotomy. If, however, there is any doubt in the mind of the surgeon it is far safer to operate than to allow the patient to run the grave risk of intracranial complications by ill-judged procrastination.

SIMPLE MASTOID OPERATION

In most cases of mastoiditis complicating acute suppurative otitis media, some form of simple mastoid operation will suffice. The radical mastoid operation will be unnecessary, except in those comparatively rare virulent cases in which rapid necrosis of the labyrinth or of the tegmen tympani takes place and intracranial complications have already intervened.

Many variations in the technique of the original Schwartze operation have been introduced by different otologists. In fact, we may almost say "Quot homines, tot sententiae." The essential fundamental principles to be aimed at, however, are free drainage and the removal of all necrotic bone. It behoves us, therefore, thoroughly to open up the mastoid antrum, and to extend the operation to include all infected mastoid cells right down to the tip cell, which will frequently be found to be filled with pus, even though the intervening cells may appear to be comparatively healthy. If the bone below the middle cranial fossa is infected it must be removed to expose the dura. The same applies to the bone over the lateral sinus, where more infected cells may be found.

Cells at the root of the zygoma, above and superficial to the mastoid antrum must also be attacked, and in like manner must the post-facial cells which lie behind the descending portion of the facial nerve be exenterated. Neumann's advice is: "Be radical in the conservative mastoid operation."

If we are entirely satisfied that all infected cells have been completely freed of pus and granulations we can now allow the cavity to fill with blood clot and suture up the mastoid wound without drainage, or a small silkworm-gut drain may be inserted into the lower end of the wound for twenty-four hours. In this way primary healing will take place in those cases in which the patient's general resistance has not been too severely sapped by a virulent infective fever. Most surgeons, however, prefer to act on the principle of "safety first"; they leave the mastoid incision partly open and drained by tube or gauze wicks.

The adaptation of Heath's conservative mastoid operation, in which the mastoid incision is completely sutured and the cavity drained with a tube through the posterior wall of the external auditory meatus after removal of much of the posterior bony wall of the meatus, commends itself to some otologists.

If there has been any exposure of the dura of the middle fossa or lateral sinus by the disease, and the dura is covered with granulations, and particularly if the patient is suffering acutely from toxæmia of the infection, it is certainly preferable to leave the wound widely open and to afford adequate drainage by tube or gauze wicks inserted in parallel strands and not packed tightly in the cavity. It is a safe procedure to treat the bony cavity

with bipp, which also has the added virtue of facilitating the removal of the gauze wicks and diminishing the pain of the early dressings. The tube or gauze wicks may be changed in three days, and thereafter daily or every second day. As the discharge becomes serous they may be dispensed with and the cavity allowed to close. In this way healing will be complete in about three or four weeks, and the hearing power in most cases will be restored to normal and the perforation of the drum will be closed. This should be the ideal aimed at; and if properly and honestly aimed at it will be achieved.

SUMMARY

In the early stage of acute otitis media abortive measures, such as rest in bed, administration of a purge, steam inhalations of friar's balsam, drops of warm glycerin of carbolic, a rubber hot-water bag to the ear, may suffice to bring about resolution and cure. If this is ineffective the drum membrane should be freely incised and adequate drainage of the tympanic cavity and of the mastoid antrum, via the aditus, afforded. This may bring about a restitution to normal of an infected mastoid. If temperature persists in spite of adequate drainage, and mastoid pain and tenderness increase, and the patient is obviously not improving, mastoidotomy becomes imperative, and should not be unduly delayed. By adopting such a definite course we may hope to avert the onset of the more serious complications of otitis media—namely, meningitis, lateral sinus thrombosis, cerebral and cerebellar abscess, facial paralysis, labyrinthitis, and deafness, the treatment of which is outside the scope of this paper.

Memoranda

MEDICAL, SURGICAL, OBSTETRICAL

PERFORATED GASTRIC AND DUODENAL ULCER

A SURVEY OF FIFTY CONSECUTIVE CASES

During the period 1927 to 1931, I operated on fifty cases of perforated ulcer of the stomach and duodenum, and from a survey of these some interesting features emerge. These are recorded as under:

Sex.—Of the fifty cases all were males. In 1906 the late Professor Caird¹ of Edinburgh published a series of twenty-five consecutive cases of operation for perforated gastric and duodenal ulcer, and of these fifteen were females and ten males. Hamilton Bailey² in ninety-three cases had only nine females with perforated ulcer.

Age.—The average age was 39½ years, the eldest being 67 and the youngest 16.

Previous Symptoms.—Thirty-seven of the patients had suffered from previous attacks of stomach trouble, and the other thirteen denied any prior gastric symptoms.

Previous Treatment.—Out of the total number thirty-two had been treated by dieting and medicine, and twenty-four had been told that they had a gastric or duodenal ulcer.

Situation and Type of Ulcer.—In all cases the ulcer was chronic in type, and was situated on the anterior aspect of the stomach or duodenum. The situation of the ulcer in the fifty cases was: proximal to the circular vein of Mayo, 11; first part of the duodenum, 39.

Time between Perforation and Operation.—The number of hours perforated worked out at an average of nine. Fifty-one hours was the longest period perforated, and there were eleven cases in which the man was operated on within four hours of perforating. Details are shown in Table I.

TABLE I

No. of Hours Perforated	No. of Cases	No. of Deaths
3-12	41	2
13-24	5	0
25-51	4	2
Total	50	4

Type of Operation and Mortality.—The cases have been divided into three groups, according to the type of operation performed, and the mortality rate for each group is shown in Table II.

TABLE II

Group	Type of Operation	No. of Cases	Deaths	Mortality per cent.
1	Closure of ulcer with drainage of abdominal cavity	32	2	6.2
2	Closure of ulcer without drainage	5	0	nil
3	Closure of ulcer with drainage and gastro-jejunostomy	13	2	15.3
Total		50	4	8

This gives a general mortality of 8 per cent. for the fifty cases.

Fatal Cases.—These are shown in Table III.

TABLE III

No.	Age	Hours Ill	Operation	Site of Ulcer	Day of Death
1	29	6	Closure of ulcer and gastro-jejunostomy	Duodenal	8th
2	58	48	Closure of ulcer	Duodenal	3rd
3	38	14	Closure of ulcer and gastro-jejunostomy	Duodenal	10th
4	46	25	Closure of ulcer	Gastric	2nd