laborers returning from the Hawaiian Islands are almost sure to bring it here, and the conditions here are most suitable for its propagation. It is especially true of the middle and southern parts of the state, where the irrigation projects are becoming so extensive and the soil, moisture and temperature are ideal for the propagation of the parasite. These laborers naturally take to agricultural pursuits, which predominate in these districts. This, in connection with already infected mines, gives rise to a decided danger of the infection of a large part of California. I believe that basing estimates on 50 per cent. of Porto Ricans being infected, we have in California, over 20,000 cases of hookworm disease.

DR. REID HUNT, Washington, D. C.: Do you get any encouraging results in disinfecting the excreta? I have done no work myself, but Dr. Stiles seems to have about given up in despair the possibility of finding anything that will destroy ova in excreta. Solutions of phenol (carbolic acid) for weeks had little effect. He found that if feces were collected in a septic tank most of the ova disappeared in two or three months.

DR. E. E. ENDICOTT, Jackson, Cal.: It has never been my experience to see a live worm. They were all dead when they got here. I do not know whether it has been thoroughly demonstrated as to how long the ova would live. They can stand a good deal of heat and a good deal of cold and possibly Dr. Gunn would be better informed on that line than myself.

DR. HERBERT GUNN, San Francisco: On account of the number of patients examined it was impossible to make relative counts. All that was done was a rapid count for eosinophilia, and that was apparent after thirty cells were counted. Ordinarily 100 cells were counted. Thymol I have used in large doses in a patient with marked nephritis of chronic character without any ill effect whatever. I have used the eucalyptus and chloroform mixture quite extensively and never had any ill effects from it. Thymol I have used in clinic work in San Francisco, depending on the patients to carry out directions as to preparation and after treatment. I had one patient who was pretty badly poisoned. I saw another case of poisoning in a hospital and only a moderate dose of thymol had been taken. I think, however, that it has been shown that thymol can be given without much danger when reasonable precautions are taken. At the present time in clinic work and when patients are not to be under observation during treatment, I use eucalyptus and chloroform exclusively. The nausea which frequently results when these drugs are given in castor oil may be avoided if they are administered in capsules. Fifteen minims of eucalyptol and 45 minims of chloroform are put into eight No. 1 capsules. These are sealed with a little water and enclosed in No. 0 capsules, also sealed, and then covered slightly with salol. These are administered at intervals for an hour. I have used this without producing the slightest trouble or irritation. The treatment is, of course, preceded and followed by a laxative. I think Dr. Endicott is perfectly right in regard to the mortality in the mines. I know when I was up there we saw many persons on the streets who presented evidence of grave anemia. In San Francisco I have had two deaths. One was in a Spanish woman who came from Honolulu and who had a hemoglobin of 30 or 40 and general anasarca. Another case I had was in a young Porto Rican boy who had also been in Honolulu and who died of inanition, having been sick a long time. I recently had referred to me in San Francisco a young student who had worked in the mines in Jackson for two months during a vacation. His temperature was 103 F., hemoglobin about 60. The peculiar muddy color was pronounced and he was very sick. He had been unable to keep up with his work at the university for months. The temperature in hookworm disease is quite frequently irregular. I have seen cases in which the temperature ran along so that it was suspected that the patients had malaria or typhoid. Frequently there is a slight fever. One of the cases I saw in the mines had been diagnosed as appendicitis; the symptoms disappeared immediately after treatment. A second case in which this diagnosis was made was seen in San Francisco. The point Dr. Colbert brings out regarding the Mexicans is very important. I had no idea that there were so many coming in and it shows that there should be some examination made on the Mexican border. Such inspection

to be of any value would necessitate the routine examination of the stools or blood, as many of the hookworm carriers present no outward evidence of the disease. Regarding the life of the parasite, ova of the hookworm have remained alive for over a year in the laboratory, and the probabilities are that, under favorable conditions, they would live as long in the mines. As to the life of the parasite in the body, I have had cases in which it was alive for seven or eight years and I believe in estimating whether a case has originated here or outside one should give nine or ten years as being the limit of time. In regard to the material used for destroying the ova, it is claimed that common salt is one of the most efficient for preventing the growth of the ova in the soil.

BRAIN SURGERY *

CASSIUS C. ROGERS, A.M., M.D.
CHICAGO

I wish to consider briefly a series of thirty-five cases of unfavorable intracranial surgical lesions in which I have operated, comparing the results obtained in the cases of patients operated on early with the results obtained in the cases of those operated on late.

The results have not been flattering, but when we consider the duration and seriousness of the malady, the results are perhaps as satisfactory as those obtained in other surgical conditions that have been as long neglected and injudiciously treated.

Attempts are at once made to arrest hemorrhage, evacuate and drain abscesses, remove or drain cysts and remove tumors when located in accessible locations in all cavities except the cranial. Why should this be the exception when so often the hemorrhage, abscess, cyst or tumor can be so easily, correctly and accurately diagnosed and located, especially when it is located in focal areas, and frequently when no focal symptoms are present, the lesions being located in a silent area?

Time should be taken and careful and systematic examination should be made; under no consideration except in emergencies should the skull be opened until all means have been exhausted in the attempt to diagnose and locate the lesions. Skiagraphs of anterior, posterior and lateral views should be taken. The Wassermann and tuberculin tests should always be made as well as a complete blood test and uranalysis. And above all, if the patient is mentally impaired, he should be under close observation until all peculiarities are noted and their meaning fully interpreted. When at last operation is decided on, the site should be located and a large skin and osseous flap reflected, making possible the examination of a large area of the brain.

HEMORRHAGE

Hemorrhage due to trauma or to other causes may be classified under four heads: Intraventricular; intracerebral as in Case 4, Table 1, Series 1; subdural as in Case 8, Table 1, Series 1; supradural as in Case 11, Table 1, Series 1. It is the last two varieties that I wish to consider surgically.

In the subdural, the blood is at once distributed over a large area, being carried by the circulating cerebral spinal fluid. A general irritation is soon produced, perhaps at first it is mild, but later the patient may develop marked and diffuse muscular twitching and violent clonic and tonic movements with symptoms of intracranial pressure. The withdrawal of cerebro-

* Read in the Section on Surgery of the American Medical Association, at the Sixty-Second Annual Session, held at Los Angeles, June, 1911.

spinal fluid by lumbar puncture demonstrates the presence of blood. If the hemorrhage is severe, the symptoms are exaggerated, intracranial pressure is soon produced, and unconsciousness may be the result. In many of these cases the patients are relieved almost instantly and often permanently, by simply relieving intracranial pressure by decompression and by the opening of the dura.

Supradural hemorrhage is more localized and usually at the site of injury. If slight, there may be only local headache; if extensive there may be all the symptoms of intracranial pressure, headache, vomiting, vertigo, slow pulse, slow respirations and at last unconsciousness. In the former condition, if the symptoms are not relieved in a few days, the clot should be evacuated through a large opening in the skull; in the latter condition this should always be done:

First, to prevent infection of the clot, thus preventing the formation of an abscess, and second, to prevent organization and calcification of the clot, thus preventing irritation and adhesions which later produce epilepsy.

Intracranial pressure sufficient to cause headache, cerebral or projectile vomiting (vomiting without nausea, irrespective of the ingestion of food) and choked disk that is not improved in three weeks and relieved after six weeks of internal medication should

Fig. 1.—Hemorrhagic cysts within the brain.

be considered a surgical case and relieved by removing the cause, if located in a site amenable to surgery, or by subtemporal decompression (Cushing's method) if the lesion is in an unfavorable surgical location.

Many conditions such as hemorrhage, edema, avascular gumma, etc., which stubbornly resisted such treatment before the intracranial pressure was relieved will readily yield to internal medicine after decompression.

Following injuries to the head, if the patient is rendered unconscious, regains consciousness in a short time and then again gradually becomes unconscious, and if the respirations are slow, deep and labored, the pulse slow, full and bounding, or weak, the temperature normal or subnormal, I make it a rule to advise operative interference at once, to relieve pressure produced by either hemorrhage or edema and thus to prevent complications and an unfavorable termination, using for the anesthesia, chloroform, and recently, gas (Crile method). Do not procrastinate in these cases; do as little as possible as quickly and thoroughly as possible, to assist the patient past the critical period; later perform a more thorough and complete operation if necessary.

ABSCESSSES

Supradural abscesses originating from acute or chronic suppurative otitis media should be freely drained by removing a plate of skull just above the mastoid and drainage established. Draining through the roof of the mastoid will not give adequate drainage.

Subdural or intracerebral abscesses should be drained by removing a large plate of skull from over the region of the abscess. The dura should be freely opened, and if subdural, the abscess should be drained. If the abscess is intracerebral, the dura should be opened and evacuation of the abscess delayed until adhesions form between the dura and brain, thus preventing diffuse meningitis.

Subdural, supradural and intracerebral abscesses may persist for years and may date back to some slight injury produced many years before and long since forgotten; in some cases, the patients afflicted with them have spent many years in our state institutions for the insane for the want of a correct diagnosis and proper treatment.

CYSTS

Cysts result from many causes but frequently from irritation produced by small hemorrhages. They are

Fig. 2.—Large temporosphenoidal abscess. Series 1, Table 1, Case 8.

frequently subarachnoid as described by Krause.¹ The fluid from the cyst will coagulate, while spinal fluid will not. Cysts may be the result of liquefied glioma.

TUMORS

All varieties of tumors have been found in the brain, malignant and benign. Under all circumstances, the symptoms of headache, dizziness, vertigo, vomiting, impairment of vision, due to intracranial pressure can and should be relieved early by decompression. Constant, persistent, localized headache should demand our most earnest attention and all efforts made to determine the cause, as it is often in the location of the intracranial lesion and can be relieved by relieving tension.

SUMMARY

1. In cases of suspected tumor the patients should not be treated over long periods of time by antisyphilitic remedies.
2. A Wassermann test should always be made and if positive and the gumma is avascular, the tumor will not

1. Krause: *Surgery of the Brain*, p. 53.

SERIES 1.—TABLE 1.—ABSCCESS OF BRAIN.*

In each case family history was negative; vomiting and headache were present. All patients were operated on (trephined and drained abscess), the anesthetic in each case being chloroform.

Case Number	Sex	Age	Nationality	Injury	Duration of Illness	Mental State	Epilepsy	Pulse	Respiration	Temperature	Wassermann†	Operative Findings	Location	Etiology‡	Result	Died After Operation	Cause	Sent by	Hospital	Entered Hospital
1 M. 20	Male	20	Italian	No.	2 years.	Unconscious..	—	60	20	101	0	Abscess.....	T. sphen. lobe	C. S. O. M.....	Died	48 hrs.	Mening.	Dr. Good.....	E. D.	1/16/11
2 M. 23	Male	23	German	No.	9 days.	Cloudy.....	—	72	18	104	0	Abscess.....	T. sphen. lobe	A. S. O. M.....	Cured	.....	.....	Dr. Good.....	E. D.	2/17/11
3 M. 22	Male	22	German	No.	4 years.	Normal.....	+	75	20	102	0	Extradural abscess reg.	Temp. sphen.	C. S. O. M.....	Cured	.....	.....	Self.....	F. W.	12/12/10
4 M. 51	Male	51	American	?	4½ yrs.	Cloudy.....	+	Slow	Slow	Nor.	—	Abscess.....	T. sphen. lobe	A. S. O. M.....	Died	5 days	Mening.	Dr. Schwartz.	F. W.	.....
5 M. 4	Male	4	American	No.	3 mos.	Unconscious..	—	Slow	Slow	100	0	Abscess.....	T. sphen. lobe	A. S. O. M.....	Died	3 days	Mening.	Dr. Good.....	F. W.	6/21/10
6 M. 9	Male	9	French	No.	6 weeks.	Unconscious..	—	Slow	Slow	100	0	Abscess.....	Extr. dur.; T. sphen. reg.	A. S. O. M.....	Cured	.....	.....	Dr. Stoll.....	F. W.	12/13/09
7 M. 9	Male	9	American	No.	2 mos.	Semicomscious	—	Slow	Slow	103	0	Abscess.....	Extr. dur.; T. sphen. reg.	A. S. O. M.....	Cured	.....	.....	Dr. Brode.....	R. B.	2/20/10
8 M. 59	Male	59	German	Yes	21 days.	Unconscious..	—	Slow	Slow	.....	0	Intradural abscess	T. sphen. lobe	Fract. of skull.	Died	47 days	Sepsis..	Dr. Stoll.....	F. W.	12/11/10
9 F. 6	Female	6	American	Yes	6 mos.	Unconscious..	—	Slow	Slow	Nor.	0	Abscess.....	Occ. lobe.....	Fract. of skull.	Died	12 days	Mening.	Dr. Wolfe.....	F. W.	10/28/08
10 F. 14	Female	14	American	?	2 years.	Normal.....	—	.....	.....	.....	—	Nec. of skull; T. B. abscess	Occ. reg.....	Necros. of skull	Cured	.....	.....	Self.....	F. W.	12/28/07
11 F. 47	Female	47	German	Yes	16 years.	Irritable.....	+	104	20	101	—	T. B. abscess	Occ. reg.....	Necros. of skull	Cured	.....	.....	Dr. Weissenh.	F. W.	3/.. /08

* Number of cases, 11; intradural abscess, 8; patients died, 4; extradural abscess, 3; patients died, 0; suppurative otitis media, 7; patients died, 3; fractures of skull, 4; patients died, 1.

† Zero in this and the following table indicates that no Wassermann test was made.

‡ In this column C. S. O. M. means chronic suppurative otitis media; A. S. O. M. means acute suppurative otitis media.

SERIES 2.—TABLE 2.—TUMORS AND CYSTS OF BRAIN.*

In each case headache and vomiting were present; pulse slow, respiration slow, temperature normal. All patients were operated on, the anesthetic in all cases being chloroform.

Case Number	Sex	Age	Nationality	Duration of Illness	Mental State	Epilepsy	Paralysis	Eyes	Operation	Babinski †	Result	Died After Operation	Cause	Hospital	Sent by	Diagnosis	Autopsy	Entered Hospital
1 M. 14			German..	6 mos..	Normal....	+	No	Choked disk	Decompres.	++	Died ...	6 mos.	B. tumor	F. W.	Dr. Seufert..	Tumor cerebell. r. mot. area.	Confirm. diagnos.	4/6/10
2 F. 35			Jewish..	14 years.	Impairment.	+	Left arm and leg.	Impaired vis	Decompres.	+	No imp.	.....	.....	F. W.	Dr. Heym.	Tumor t. sp. reg.	.....	4/10/10
3 F. 18			Amer..	.....	Unconscious	—	.....	Almost blind	Decompres.	+	Died ...	.....	B. tumor	F. W.	Dr. Seufert..	Tumor base of brain.	Refused...	12/18/09
4 F. 32			Amer..	1½ years.	Unconscious	—	Left side	Blind	Decompres. R. temp.	+	Died ...	46 days	Mening.	F. W.	Dr. Brode.	Tumor r. mot. area; gumma.	Confirm. diagnos.	4/13/09
5 M. 51			German..	3 mos..	Semicon....	—	Right side	Impaired vis	Decompres. L. temp.	+	Cured ...	.....	.....	S....	Dr. Campbell	Gumma l. mot. area.	.....	5/4/11
6 F. 16			Amer..	3 years.	Normal....	+	No	Impaired vis	Decompres. L. temp. reg.	++	Improved	.....	.....	F. W.	Dr. Sheets.	Gumma cerebell. Cysts in mot. area.	.....	7/22/10
7 F. 44			Amer..	2½ years.	Normal....	+	Right side partial.	Choked disk.	L. pariet. base flap drain	++	Cured ...	.....	.....	F. W.	Dr. Self.	.....	.....	1/22/08
8 M. 26			Amer..	6 mos..	Irres....	+	Right arm	Poor vision	Occipital decompres.	++	Improved	.....	.....	F. W.	Dr. Orndorff.	Cerebell. cyst; gumma.	.....	2/22/10
9 F. 2½			Amer..	2 years.	Normal....	+	Limbs spastic	Vision good	L. parietal decompres.	++	Improved	.....	.....	M. T. Self.	.....	Subarach. cysts.	.....	12/22/10
10 M. 53			Amer..	2 years.	Irres....	+	Left side	Poor vision	Raised depres. fracture.	++	Died ...	4 days	Nephrit. pneum.	F. W.	Self.	Cyst from old blood-clot.	Confirm. diagnos.	11/10/10
11 F. 8			Amer..	4 mos..	Unconscious	+	Right side	Almost blind	Decompres. motor area.	++	Died ...	4 days	Cerebr. irritat.	F. W.	Self.	Large cyst l. mot. area.	.....	7/9/10

* Number of cases, 11; tumors, 6; patients died, 3; not improved, 1; cured, 1; improved, 3; cysts, 5; patients died, 2; not improved, 0; cured, 1; improved, 2.

† Babinski + one foot, + + both feet.

yield to antisyphilitic treatment until pressure is relieved.²

3. The patient should have the benefit of early operative interference.

4. Intracranial hemorrhage should be evacuated in all cases in which the patient lives long enough to secure a skilled surgeon to relieve pressure, to prevent infection and abscess formation, and to prevent adhesions which will produce epilepsy in future years.

5. Intracranial pressure should be relieved by decompression to relieve and prevent constant and localized headaches, cerebral vomiting and impairment of vision.

6. Antisyphilitic remedies should not be given over long periods of time unless marked improvement is obtained within from three to six weeks.

7. Tuberculosis test should be made in all suspicious cases, in which the presence of tuberculosis is not positively known.

8. Epilepsy seldom develops before eighteen months after injury, and may develop many years later.

REPORTS OF CASES

SERIES 1 (Table 1).—CASE 4.—Mr. W., aged 51, American, clerk, four years previous to entering the Willard Hospital Jan. 6, 1909, had a stroke of paralysis involving the right

Fig. 3.—Chronic syphilitic meningitis. Series 2, Table 2, Case 4.

side. This slowly improved until the patient was able to be up and around and at his work.

A year later he commenced to have temporal headaches on the left side, and for three years sought medical aid without relief. Jan. 7, 1909, I opened the skull in the left temporal region, found a large abscess in the temporal sphenoid lobe and drained it (Figure 1). Patient died on the fifth day from acute meningitis. Autopsy showed cysts of the brain and hemorrhagic areas.

SERIES 1 (Table 1).—CASE 8.—Mr. K., aged 59, German, contractor. Entered the Willard Hospital Dec. 12, 1910. Twenty-one days before entering the hospital while on his way to work he had been struck by a street car and rendered unconscious. He was taken to a hospital and treated. On the twenty-first day there was no sign of return of consciousness. He became very restless and noisy. His pulse was slow, his temperature was 102, and his respirations were slow and deep. He developed paralysis of the left side. He was transferred to the Willard Hospital, where I first saw him.

The diagnosis was fracture of the skull with intracranial hemorrhage. I advised operation. December 12 I opened the skull over the right motor area and found the large subdural hemorrhage (Fig. 2). The dura was opened and a large

blood-clot as well as a large quantity of liquid blood was evacuated. The patient was returned to bed; he was conscious and recognized his family about twenty-four hours after the operation. He remained conscious for one week, when he again complained of severe headaches in the right mastoid and supramastoid region. Two days later I advised a second operation, as the patient again developed delirium. The radical mastoid was done, as well as removing a plate of skull over the mastoid region. An abscess was found in the temporo-sphenoidal lobe and was drained. The patient improved for a few days and then gradually grew worse.

We again opened and explored in the temporal region, draining another abscess. In all, we drained three abscesses in the forty-seven days that the patient was under our care. He died Jan. 27, 1911, forty-seven days after entering the hospital and two days after the last operation, from an abscess in the temporal sphenoidal lobe. Autopsy was held by the coroner physician, Dr. Hunter, who gave the following report: "Patient came to his death from multiple abscesses of the brain, following an injury sixty-eight days previous to his death."

Summary.—Fracture of the vault and base of the skull; patient unconscious twenty-one days before operation; conscious twenty-four hours after operation; unconscious eight days after operation, and unconscious or semi-conscious until death.

SERIES 2 (Table 2).—CASE 4.—Mrs. D., aged 32, housewife, American, mother of four children—healthy, about one and

Fig. 4.—Multiple cysts of the brain, Table 2, Case 11.

one-half years before entering the Willard Hospital (April 13, 1909) complained of headache on the right side. Diagnosis, hysteria. Epilepsy followed. Headache became worse and worse, with cerebral vomiting, unconsciousness, and almost complete blindness. Patient entered Willard Hospital having been unconscious for about two weeks; left hemiplegia. Right motor area was operated on; dura mater was opened; brain bulged; tumor elicited but could not be removed; plate of bone was removed and skin sutured. Large tumor developed. Later skin separated and cerebral fungi formed. Patient gained consciousness; talked naturally and freely; could recognize her friends. She died May 29, forty-six days after the operation. At autopsy, gumma of brain was found with syphilitic meningitis (Fig. 3).

SERIES 2 (Table 2).—CASE 11.—M. P., aged 8, entered hospital July 9, 1910; died July 19. March 1 patient came home from school feeling tired. A physician was called. There was some fever. The diagnosis was grip. Patient stayed home from school three weeks. Three weeks later had vomiting without nausea associated with headache, left parietal region, lasting twenty-four hours. Diagnosis was acute gastritis. Headache and vomiting continued at intervals until June 25, when the patient became unconscious, remaining so for twenty-four hours. Right hemiplegia was present on return of consciousness. July 9 patient entered Willard Hospital with right

2. MacEwen: (Glasgow) Paper read at International Medical Congress, Budapest, 1900, Section VII, Report XIII.

TABLE 3.—FRACTURES OF SKULL WITH INTRACRANIAL HEMORRHAGE

No.	Sex	Age	Nationality	Occupation	Injury	Fracture	Scalp	Paralysis	Mental State	Operation	Duration of Injury	Hospital	Date	Result	Died after operation	Causes of death
1	B	M	47	Irish	Painter	Fell from ladder 7 feet	Lacerated	L. side	Unconscious	Opened skull and dura evacuated clot and drained	7 days	R.B.	1-31, '11	Died	6 days	Pneumonia
2	K	M	55	Irish	Bricklayer	Temp. region, around occip. region, and temp. region of opposite side	Large hematoma	R. side	Unconscious	Opened skull and dura evacuated clot and drained	1 day	F.W.	3-5, '11	Died	6 hrs.	Hemorrhage
3	P	M	40	Ger.	Scaffold fell	Parieto-occipital	Lacerated	None	Conscious	Removed fragments of skull	3 hours	F.W.	9-22, '08	Cured		
4	M	F	39	Am.	Fell from moving car	Occipital region	Lacerated	None	Unconscious	Opened skull, evacuated extra dural clot	3 days	F.W.	10-10, '07	Cured		
5	B	M	31	Am.	Struck by moving car	L. front lobe	Lacerated	None	Unconscious	Opened skull, drained extra dural clot	3 days	F.W.	3-18, '09	Cured		
6	F	M	7	Am.	Fell down stairs	L. motor area	Negative	Constant jerking of all extremities	Unconscious	Opened skull and dura, L. motor area	3 hours	F.W.	7-4, '08	Cured		
7	P	F	40	Am.	None	None	Negative	L. side	Unconscious	Opened skull, R. motor area	8 days	F.W.	10-20, '09	Died	24 hrs.	Cerebral hemorrhage
8	R	F	65	Jew.	Fell on stairs	Parieto-occipital	Swollen	R. side	Unconscious	Opened skull and dura, L. motor area, large clot	8 days	F.W.	1-30, '11	Died	3 days	Cerebral hemorrhage
9	L	M	42	Jew.	Scaffold fell	R. motor area	Lacerated	L. side	Unconscious	Opened skull, R. motor area	7 days	F.W.	4-11, '10	Died	6 hrs.	Cerebral hemorrhage
10	P	F	14	Polish	Jumped from porch 14 feet	R. motor area	Negative	L. side	Epilepsy	R. motor area decompressed	2 years	F.W.	10-5, '08	Epilepsy cured, greatly impr. paral.		
11	B	M	23	Am.	Kicked by horse	R. front eminence	Lacerated	None	Epilepsy	Opened skull, R. front eminence	6 years	F.W.	3-, '08	Cured		
12	C	M	4	Am.	Forceps delivery	R. motor area	Lacerated	L. side	Epilepsy	Opened skull, R. motor area	4 years	F.W.	3-15, '09	Epilepsy cured, paral. greatly improved		
13	W	M	21	Am.	Kicked by horse	L. front	Lacerated	None	Epilepsy	Removed deformed fracture	15 years	F.W.	3-, '09	Died	1 week	Pneumonia

Number of cases, 13; number of deaths, 6; average time of unconsciousness before operation, 8 days. All patients who received surgical interference within 24 hours lived.

hemiplegia, vomiting at intervals, severe headache and Babinski constant both feet. Choked disk was marked. Diagnosis was marked intracranial pressure. I advised decompression to relieve pressure (refused). I sought expert opinions; all disagreed with me. July 10, patient was unconscious four hours; regained consciousness but complained of severe headache. July 11, headache was very severe. Patient improved from July 12 until on July 15, she went into complete coma. She was operated on July 15 under chloroform anesthesia. The child gained consciousness after large cyst was evacuated. Died double pneumonia July 19 (Fig. 4).

NOTE:—Complete histories of all cases are in my possession but are not submitted for publication on account of their length.

I am indebted to Dr. B. H. Orndorff for all laboratory work done.

7 Madison Street.

ANESTHESIA FROM NITROUS OXID-OXYGEN PLUS CARBON DIOXID

WITH SPECIAL REFERENCE TO COMBATING SHOCK *

E. G. MARTIN, M.D.

DETROIT

My purpose in presenting a paper on nitrous oxid-oxygen is to bring out, as forcefully and briefly as possible, its advantages and the added value of rebreathing to combat shock.

Some forty years ago, Dr. Andrews of Chicago discovered that by adding oxygen to nitrous oxid during its administration, the cyanosis was eliminated without impairment to its anesthetic properties. Since that time nitrous oxid has been widely used, but considered mostly as a dental anesthetic and for use in very minor surgical operations; the layman knows it as "laughing gas." During the last few years attention has been called to nitrous oxid anesthesia more seriously, and after extensive use and investigation by some of our leading surgeons—such as Crile, Meyer, Halsted, Kelley, Bevan, and the extended laboratory investigations of Hamburger and Ewing—of the comparative effects of nitrous oxid, ether, and chloroform narcosis on the blood, the American Medical Association reports through its commission on anesthesia that "as a routine anesthetic, nitrous oxid has a peculiar value, . . . and in the hands of highly skilled anesthetists, the method is the best yet devised."

Hamburger and Ewing say as to ether:

The color index shows a rather constant drop, starting immediately after anesthesia and reaching its lowest point on the fifth and sixth days. This would indicate a relative loss of hemoglobin per cell, and again is unlike nitrous oxid results, in which the only sign of a low color index is found immediately after the anesthetic mask is removed, and which is completely gone in two hours.

The volume-index likewise shows an immediate loss, which is most marked in twenty-four hours, and again on the fifth and seventh days. In nitrous oxid readings, the percentage volume remained unchanged throughout.

A demonstrable anemia is produced even after a fifteen-minute anesthesia of ether that does not begin to improve until after the fifth day, and as Coburn¹ says, "such an effect as this which does not begin to improve until after the fifth day must certainly retard convalescence even in favorable cases, and in critical cases may be the determining factor in producing a fatal termination."

It has been recognized for some time that ether increases the toxemia of infection and impedes the functional activity of the leukocytes thus lessening the patient's resistance. We have been advised against administering ether to tuberculous patients, the result often being the establishment of new foci of infection or the lighting up of an old one. Is this due to the irritant properties alone, or is it more reasonable to believe that it is due to the lowered resistance produced? Further, is it not a logical deduction to make, that patients whom we believe to have no infection, and even those in the so-called simple cases for operation, should have the benefit of an anesthetic that causes no such trouble, that does not, like ether, reduce the functional activity of the leukocytes and retard Nature's forces?

C. B. Parker² reports 218 cases of nitrous oxid-oxygen anesthesia, of which nearly all were major operations and the subjects unfavorable for any anesthesia. Among them were patients suffering from organic disease of the heart, kidneys, and lungs, wasting and suppurative conditions, asthma, empyema, diabetes, and alcoholism, the very old and the very young; patients greatly overweight, those who had developed alarming symptoms in previous attempts with ether or chloroform, and those who had experienced the distress of previous etherization. Parker came to the conclusion that nitrous oxid was safer and more agreeable.

Peairs³ says that "nitrous oxid and oxygen is the safest of all anesthetics; post-operative complications are less frequent," and that its more general use should be encouraged.

In the so-called "borderland" cases, those of grave infections and operations on the very ill, the consensus of opinion seems to be that nitrous oxid-oxygen anesthesia gives the chance to live and is often the hinge on which an ebbing life may turn. In the "inevitably fatal" cases, Crile says: "Not a patient showed the rapid march to fatality immediately following the operation, which occasionally follows ether."

It would seem advisable to endorse the report of the Anesthesia Committee at St. Louis in 1910, that gas in the hands of highly skilled anesthetists as a routine anesthetic is the best method yet devised, when such men as George W. Crile of Cleveland use it in from two to twelve operations every day and grow more enthusiastic in its praise as their experience increases. At a recognized medical center such as Johns Hopkins Hospital, it is in general use every day by such men as Howard A. Kelley and is advocated enthusiastically by Gatch, an authority on the subject of rebreathing, as the best and safest anesthetic.

Coburn¹ quotes Dr. Frederick Hewitt, a leading authority of London, as saying: "There is no form of anesthesia at present known which is so devoid of danger as that which results from nitrous oxid when administered with a sufficient percentage of oxygen to prevent all asphyxial complications."

When such reports come from such sources we must, it would seem, refrain from settling down with too much complacency in this regard, if not in justice to the profession, out of duty to the patients. I wish to discuss briefly the newest and what I believe to be the best method of using nitrous oxid-oxygen, namely, by rebreathing.

It has been found that in rebreathing one's own carbon dioxide during the administration of nitrous oxid and oxygen, the patient's general condition improves in every

* Read before the Wayne County Medical Society, April 10, 1911.
1. Coburn, R. C.: The Advantages of Nitrous Oxid-Oxygen Anesthesia, *THE JOURNAL A. M. A.*, Feb. 18, 1911, p. 409.

2. Parker, C. B.: *Cleveland Med. Jour.*, July, 1910.

3. Peairs: *THE JOURNAL A. M. A.*, April 30, 1910, p. 1422.