



**Staff Meeting Bulletin
Hospitals of the » » »
University of Minnesota**

**Acute Poliomyelitis
In Children**

STAFF MEETING BULLETIN
HOSPITALS OF THE . . .
UNIVERSITY OF MINNESOTA

Volume XVIII

Friday, February 14, 1947

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William A. O'Brien, M.D.

I.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
CALENDAR OF EVENTS

February 17 - February 22, 1947

No. 145Monday, February 17

- 9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.
- 9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; Interns' Quarters, U. H.
- 10:00 - 12:00 Neurology Ward Rounds; A. B. Baker and Staff; Station 50, U. H.
- 11:00 - Roentgenology-Medicine Conference; Veterans' Hospital.
- 11:00 - 12:00 Physical Medicine Conference; Present Day Trends in Training in Physical Medicine; Donald J. Erickson; W-200 U. H.
- 12:15 - 1:15 Obstetrics and Gynecology Journal Club; M-435, U. H.
- 12:30 - 1:20 Pathology Seminar; Diffuse Hyperplasia of the Adrenal Gland; Thomas Kenyon; 104 I. A.
- 12:15 - 1:30 Pediatrics Seminar; The Rh factor; Carolyn Adams; 6th Floor Seminar Room; Eustis, U. H.
- 12:00 - 1:00 Physiology Seminar; The Vasomotor Regulation of Body Temperature; Allan Hemingway; 214 M. H.
- 4:00 - School of Public Health Seminar.

Tuesday, February 18

- 9:00 - 9:50 Roentgenology-Pediatrics Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.
- 10:30 - Surgery Reading Conference; John R. Paine; Small Conference Room, Bldg. I, Veterans' Hospital.
- 12:30 - 1:20 Pathology Conference; Autopsies; Pathology Staff; 102 I. A.
- 2:00 - 2:50 Dermatology and Syphilology; H. E. Michelson and Staff; Veterans' Hospital, Bldg. III.
- 3:15 - 4:15 Gynecology Chart Conference; J. L. McKelvey and Staff; Station 54, U.H.
- 3:30 - Clinical Pathological Conference; Veterans Hospital.
- 3:45 - 5:00 Pediatrics Staff Rounds; I. McQuarrie and Staff; W-205, U. H.

4:00 - 4:50 Surgery-Physiology Conference; Newer Aspects of Shock; Samuel A. Corson and Arnold J. Kremen; Eustis Amphitheater, U. H.

5:00 - 5:50 Roentgenology Diagnosis Conference; M-515, U. H.

Wednesday, February 19

8:00 - 8:50 Surgery Journal Club; O. H. Wangensteen and Staff; M-515, U. H.

8:30 - 10:00 Psychiatry and Neurology Seminar; Staff; Station 60 Lounge, U. H.

11:00 - 11:50 Pathology-Medicine-Surgery Conference; Lymphosarcoma; E. T. Bell, C. J. Watson, O. H. Wangensteen and Staff; Todd Amphitheater, U. H.

12:00 - 1:00 Physiological Chemistry Journal Club; Staff; 116 M. H.

4:00 - 6:00 Medicine and Pediatrics Infectious Disease Rounds; W-205, U. H.

Thursday, February 20

8:30 - Surgery Grand Rounds; John R. Paine and Staff; Veterans' Hospital.

9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; Todd Amphitheater, U. H.

10:00 - 12:00 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - Roentgenology-Surgery Conference; Veterans' Hospital.

12:00 - 1:00 Physiological Chemistry Seminar; Viscosimetric Measurement of Depolymeroses; David Glick; 214 M. H.

4:30 - 5:20 Ophthalmology Ward Rounds; Erling Hansen and Staff; E-534, U. H.

4:30 - 5:20 Bacteriology Seminar; 214 M. H.

5:00 - 5:50 Roentgenology Seminar; Necrosuppurative broncho pneumonia; Robert Shapiro; M-515 U. H.

Friday, February 21

9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U.H.

9:00 - 10:00 Pediatric Grand Rounds; I. McQuarrie and Staff; Eustis Amphitheater, U. H.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - Medicine Grand Rounds; Veterans' Hospital.

10:30 - 12:20 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Otolaryngology Department; U. H.

- 11:30 - 1:00 University of Minnesota Hospitals General Staff Meeting; The Distribution of Candida Albicans in the Normal Body in Relation to Moniliasis; C. E. Skinner; New Powell Hall Amphitheater.
- 1:00 - 2:00 Dermatology and Syphilology; Presentation of Selected Cases of the Week; H. E. Michelson and Staff; W-312, U. H.
- 1:00 - Roentgenology-Neurosurgery Conference; H. O. Peterson, W. T. Peyton and Staff; Todd Amphitheater, U. H.

Saturday, February 22 - HOLIDAY

- 7:45 - 8:50 Orthopedics Conference; Wallace H. Cole and Staff; Station 21, U. H.
- 9:00 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.
- 9:00 - 9:50 Surgery-Roentgenology Conference; O. H. Wangensteen, L. G. Rigler, and Staff; Todd Amphitheater, U. H.
- 9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; M-515, U. H.
- 10:00 - 12:00 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
- 10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.

II. ACUTE POLIOMYELITIS IN CHILDREN

Clifford G. Grulee
Theodore C. Panos

Introduction

It is the purpose of this presentation to report the experience of the Pediatric Department in the care of 464 children under sixteen years of age who were admitted to the University Hospitals between the dates of July 1, 1946 and December 31, 1946. The data were compiled from the study of individual clinical records in every case. It should be pointed out that our attention was particularly directed towards the problems arising during the acute phase of the disease, which limited the period of observation to approximately two weeks in most instances. As a consequence a study of convalescence, the evaluation of long-continued therapeutic procedures, and an appraisal of residual involvement were not possible. As a general policy, the detailed description of individual cases was sacrificed in favor of objectivity in recording.

Definition of Terms

Prodromata - first stage or first hump. The occurrence of a non-specific illness lasting approximately two days, and followed by a symptom-free interval of four to seven days.

Central Nervous System Invasion Stage - second stage or second hump. A recurrence of symptoms following the symptom-free interval, with evidences of central nervous system involvement.

Non-Paralytic or Pre-Paralytic Poliomyelitis - A form of the disease in which signs and symptoms of central nervous system invasion are present without spinal or cranial nerve paralysis. Usually there is a pleocytosis of the cerebrospinal fluid.

Paralytic Poliomyelitis - Two types are distinguished; those patients having objective evidence of spinal involvement and referred to as Spinal Poliomyelitis, and those designated as Bulbar Poliomyelitis having cranial nerve palsies, and other evidences of brain stem involvement.

Combinations of these two forms were frequently encountered and were described as Bulbo-spinal.

Polio-Encephalitis - The presence of obvious irrationality, hallucinations, excessive somnolence, extreme irritability, pronounced anxiety and apprehension, or ataxia.

Abortive Poliomyelitis - A term which refers to the presumptive diagnosis of Poliomyelitis during an epidemic, in the presence of a non-specific illness indistinguishable from the prodromata or first stage, and in the absence of a second or invasion stage.

Peripheral Respiratory Failure - Failure of the respiratory mechanism on the basis of paralysis of the intercostal muscles and or diaphragm.

Central Respiratory Failure - Failure of the respiratory mechanism due to involvement of the respiratory centers in the medulla.

Tightness - A descriptive term referring to the restriction of normal extensibility or "stretchability" of a muscle or group of muscles.

Statistical Data

General Statistics

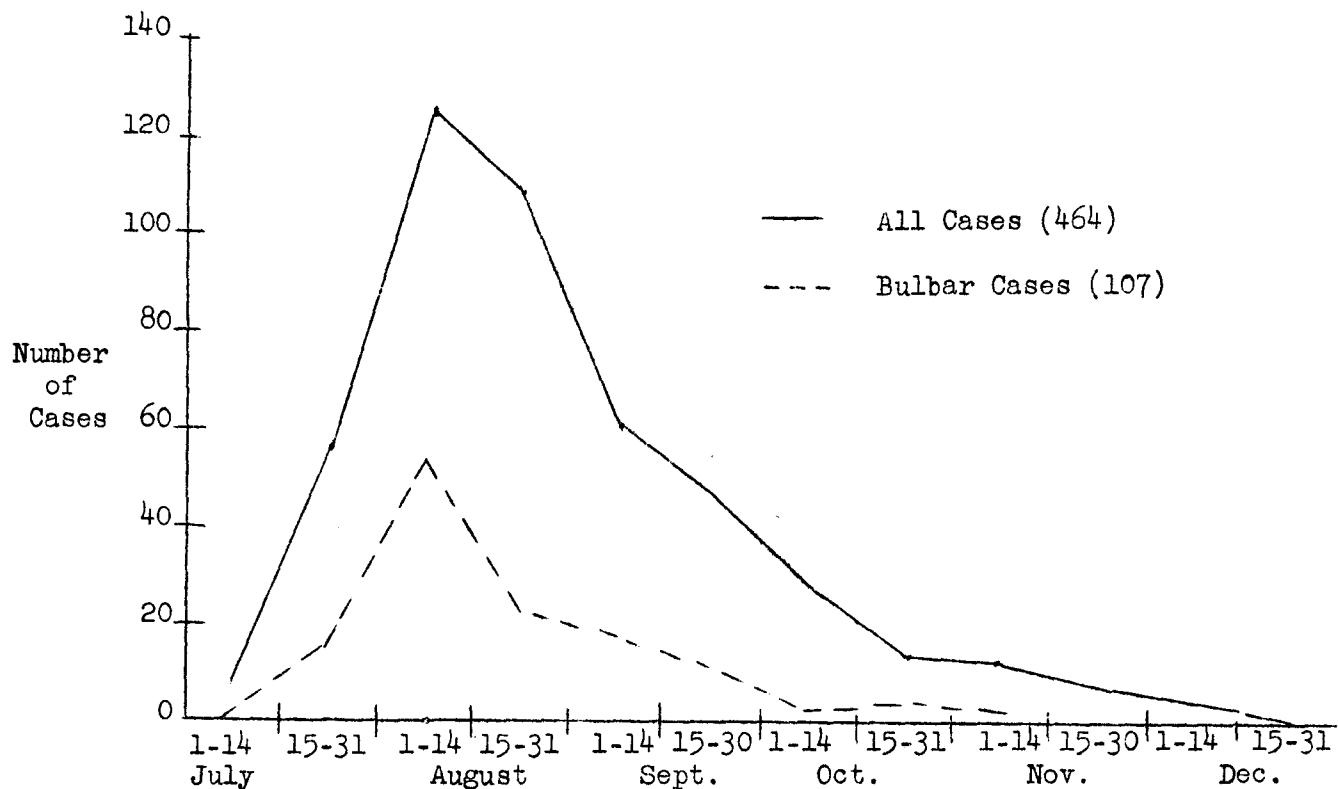
Total number of cases	464
Males	278 (60%)
Females	186 (40%)
Cases with <u>spinal</u> involvement	243 (53%)
<u>Non-paralytic</u> cases	114 (24%)
Cases with <u>bulbar</u> involvement	107 (23%)
Males	71
Females	36
Cases with <u>bulbo-spinal</u> involvement	33
Cases with <u>encephalitic</u> involvement	78
Bulbar	30
Spinal	11
Bulbo-spinal	11
Non-paralytic	26
(Cerebellar signs only, in 2)	
Total Mortality	22
Bulbar deaths	20

Case Incidence

The case incidence of Poliomyelitis as judged by admissions to the University Hospitals followed a typical pattern as compared with other epidemics. This is

demonstrated on graph number 1. It will be noted that the occurrence of bulbar poliomyelitis paralleled the total incidence throughout the epidemic.

Graph Number 1



Sex Incidence

Of the entire group of patients in this study, roughly three fifths were males, and two fifths were females. The apparent predominance of males was more marked in the bulbar group, in which boys comprised seventy-one of one hundred and seven cases. The fact that 17 of the 20 tracheotomized patients and 21 of the 25 patients who were placed in respirators were males cannot be fully interpreted at this time.

Age Incidence

The distribution of cases according to age shows that Poliomyelitis as seen in the recent epidemic predominantly affected children under 8 years of age, 70 per cent (312 cases) having occurred in this age group. Further analysis de-

monstrated that 14 per cent of all cases studied were between 4 months and 2 years of age, and that 39 per cent of the cases in this series occurred in the pre-school child (3 through 5 years of age). Above the 8 year level the case incidence for age remained fairly constant up through the 15th year.

Age Incidence

<u>Age in Years</u>	<u>Number of Patients</u>
4/12-1 1/2	18
2	58
3	32
4	49
5	38
6	47
7	40
8	30
312 cases	

Age Incidence (Cont)

<u>Age in Years</u>	<u>Number of Patients</u>
9	19
10	22
11	14
12	26
13	28
14	22
15	464 cases

Concomitant Illness
in the Family

The occurrence of multiple cases in a single family was rather striking in this epidemic, one hundred and twenty-seven families having been thus affected. The information regarding these cases was derived from three sources:

1. careful family histories; 2. reports of cases hospitalized elsewhere; and
3. experience with sibling groups in this hospital.

Those persons in whom a diagnosis of abortive poliomyelitis was made presented a history of illness indistinguishable from the history of the first stage in the hospitalized sibling and approximately coincident with the latter in time. In the great majority of instances this time relationship was a matter of from one to 10 days, although in a few cases 3 to 4 weeks separated the illnesses. A total of 97 families were found to give a history of one or more than one case of abortive poliomyelitis; in 47 families there was one; in 24 families, two; in 11, four; in one, five; in three, six; and in one family, nine cases. Thirty-six families were found to have a single paralytic case in addition to the hospitalized patient, and four families had three paralytic cases exclusive of the patient. Finally there were ten instances of single cases of both paralytic and abortive types in the same family not including the patient.

Symptoms

Prodromata - A history of prodromal or first stage symptoms was obtainable in 28 per cent (163 cases) of the 464 patients

studied. In the majority of instances these symptoms as recorded were mild, although maximum temperatures recorded in 110 cases averaged 102.1 degrees for 1.97 days. This is to be compared with an average maximum temperature of 101.4 degrees for 4.34 days in the non-bulbar group (non-paralytic and spinal). In general the symptomatology of the first stage was not varied, most of the cases having presented no more than 2 or 3 symptoms. The history of a single symptom, with the exception of a definite febrile episode, was not considered an adequate criterion for the diagnosis of the first stage. Malaise and/or headache were the symptoms most commonly associated with fever.

Headache was described as an incidental complaint of relatively mild degree, in contrast to the severe persistent headache which characterized the central nervous system invasion of the second stage. Signs and symptoms of upper respiratory infection were less conspicuous than might have been expected, pharyngitis having been recorded in forty cases, coryza in eighteen, and tonsillitis in seven. Nausea and vomiting were likewise inconspicuous, but did occur in twenty-two and twenty-six cases respectively. In summary, the signs and symptoms described are quite similar to those that might be expected with the onset of any acute disease of childhood.

Central Nervous System Invasion Stage -

There was no obtainable history of a first stage in three hundred and one patients, the initial signs and symptoms being those of the second stage. In the remaining 163 cases the second stage followed the first after a symptom-free interval of 4.2 days. There was a striking and rather characteristic aspect to the symptomatology of this central nervous system invasion stage. The tendency was towards multiplicity and longer duration of symptoms. Fever was present in 93 per cent of cases, the average maximum being 101.4 degrees in the non-bulbar patients and 103.2 degrees in the bulbar patients with an average duration of 4.34 and 5.30 days respectively.

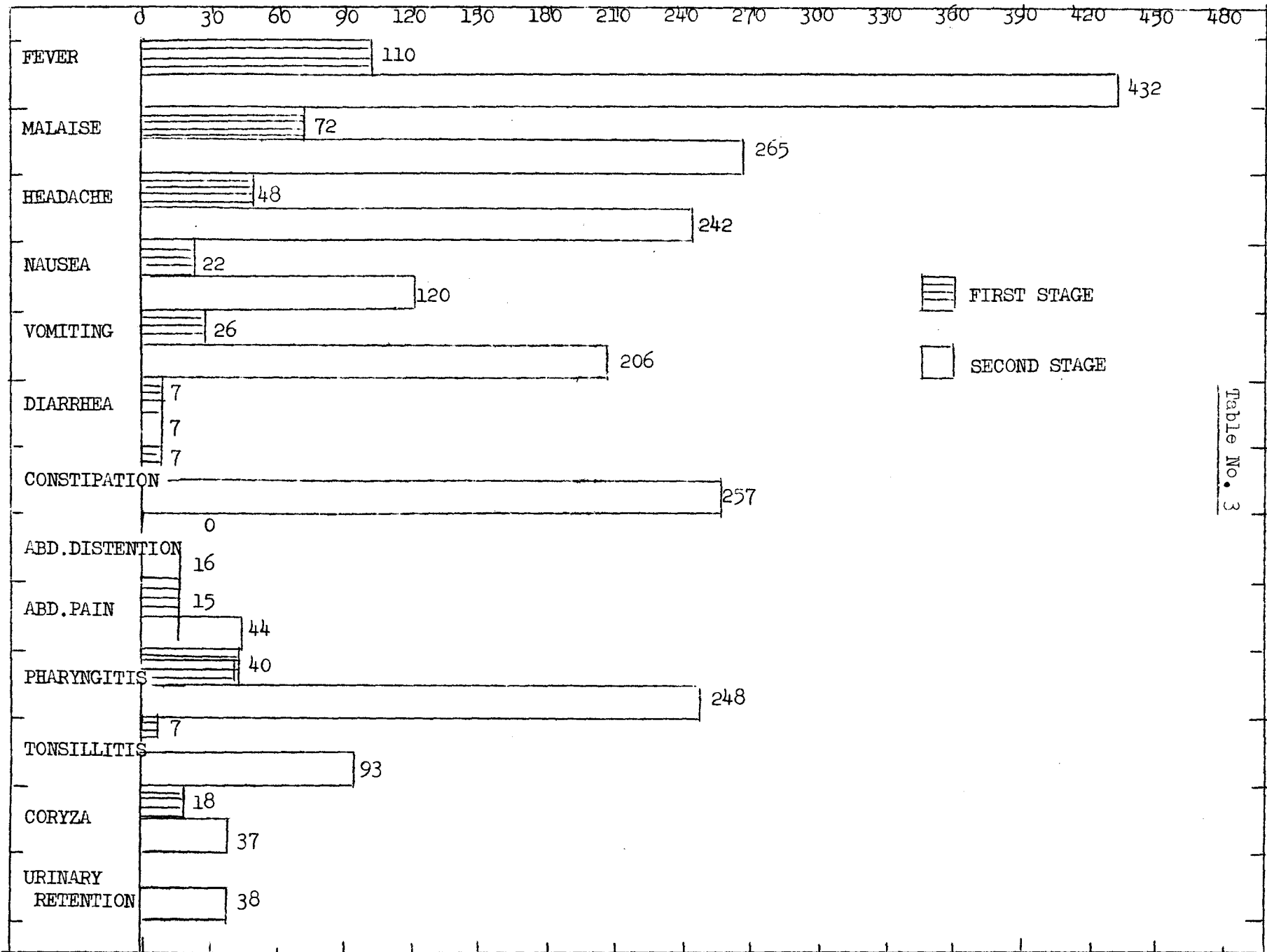


Table No. 3

	Number of Days of Elevated Temperature	Average of Maximum Temperatures
First Stage	1.97	102.1
Symptom-Free Interval	4.2 days	
Second Stage Non-bulbar	4.34	101.4
Bulbar	5.30	103.2

In the order of their occurrence the following symptoms were particularly in evidence; malaise 265 cases, headache (severe and persistent) 242 cases, vomiting (repeated but infrequently projectile) 206 cases, constipation 257 cases, and pharyngitis 248 cases. Pain in the neck and back were extremely common. Also pain in a particular extremity occurred with appreciable frequency, and although there was at times a correlation between this and the subsequent development of paralysis, this association was by no means the rule. Abdominal pain was a conspicuous complaint in approximately 10 per cent of all patients. In fact, in at least three instances a tentative diagnosis of appendicitis had been made by the referring physician. Of note was the surprisingly low incidence of diarrhea in either stage.

The accompanying chart showing the distribution of skeletal paralysis is self-explanatory and represents findings which have been repeatedly demonstrated in other epidemics. Of the 464 patients in this series 243 or approximately 53 per cent were so affected in variable degree.

Distribution of Skeletal Involvement

Right Arm	79
Left Arm	65
Diaphragms	11
Intercostals	28
Right Upper Leg	122
Left Upper Leg	130
Right Lower Leg	115
Left Lower Leg	125

Bulbar Poliomyelitis - The occurrence of bulbar poliomyelitis in this epidemic was remarkable in at least 3 respects: the case incidence was unusually high (23 per cent); arterial hypertension was recognized in a surprisingly high number of patients, and in considering the distribution of bulbar involvement it was found that in all but 11 cases the ninth and tenth cranial nerves were affected. Facial nerve palsy, which in many previous epidemics was most frequently cited occurred in 71 of 107 cases in this series.

Cranial Nerve Involvement

<u>Cranial Nerve Affected</u>	<u>Number of Instances</u>
III	12
V	10
VI	15
VII	71
IX, X	96
XI	40
XII	15

The onset of the second stage of bulbar poliomyelitis as compared to other forms of the disease was marked by a greater multiplicity of such signs and symptoms as severe headache, high fever, repeated vomiting, extreme malaise, pharyngitis, and evidences of encephalitis. The initial complaint referable to bulbar involvement was usually nasal twang to the voice or hoarseness, increased accumulation of mucus in the oropharynx, or difficulty in swallowing. Evidences of involvement of other cranial nerves, especially of the 7th, appeared either concomitantly or after a period of one to 2 days. Manifestations of bulbar involvement were delayed in several instances for periods of 5-15 days after the onset of the second stage. On the other hand, in a considerably larger group, marked bulbar involvement initiated the second stage and progressed rapidly until death presumably from damage to the vital centers, since hyperthermia, striking irregularities of pulse and respirations, elevation or depression of blood pressure with terminal shock, pulmonary

edema, and cardiac stoppage supervened.

Blood pressures were followed in 68 of the 107 bulbar cases. Three sources were consulted in an attempt to establish the norms of blood pressure in the various pediatric age groups. The standards proposed in two of these sources were in close agreement (W.C. Davison, The Compleat Pediatrician, and G. M. Allen, Archives of the Diseases of Childhood, 20:125-128, Sept. 1945), whereas the third (Graham Hines and Page, American Journal of Diseases of Children, 69:203-207, April 1945) gave values which would have led to the conclusion that all recordings reflected hypertension. It is felt that the size of the cuff was sufficiently adjusted to the size of the child's arm to render the readings in this study reliable. A diastolic pressure of ten or more millimeters above the standard for age was adopted as the criterion for hypertension. In each case the highest blood pressure recorded was used in compiling the data. In many instances, this maximum reading did not reflect repeatedly observed low pulse pressures, a point which deserves some emphasis.

Hypertension was present in forty-nine of the sixty-eight bulbar patients studied, and persisted for an average of 3.4 days. Only 41 of 243 spinal and 36 of 114 non-paralytic patients had blood pressure recordings. Of these, 18 and 14 respectively were found to be in the hypertensive range.

Encephalitis - A diagnosis of encephalitis was made in 78 patients or 17 per cent of all cases. Sixty-seven of these were definitely of the commonly described cerebral encephalitic type which is characterized by such findings as irrationality, personality disturbance, hyperexcitability, confusion, extreme listlessness, excessive irritability, somnolence, and diplopia. Dr. A. B. Baker and Dr. J. R. Brown of the neurology staff of this hospital have delineated another form of encephalitis in which anxiety, apprehension, and premonitions of death are the outstanding symptoms. An attempt was made in this study to sort out the patients fitting this category. A total of 21 such cases were found.

Upon further analysis of this group only 10 had definitely ascertainable anxiety, apprehension, or premonitions of death. Three died and 7 survived. In addition there was a group of 11 patients all of whom had a fulminating clinical course ending in death. Since the greater number of these children were in coma or near coma, it was impossible to determine the presence of definite symptomatology. All of them showed pulmonary edema in variable degree, usually extreme, which Dr. Baker has emphasized as a conspicuous feature of this type of encephalitis. This fact, plus the obvious evidence of bulbar encephalitis, seemed to justify the inclusion of these patients in this category.

It was interesting to note that the cerebral type of encephalitis occurred in 26 of the non-bulbar non-paralytic group of patients. It is also interesting that 2 patients demonstrated unmistakable signs of pure cerebellar polio-encephalitis.

Laboratory Findings

Cerebro-spinal Fluid

A total of 454 patients had spinal fluid analysis. The finding reported in previous epidemics that the cell count tends to be low (in the range of 20-200) in poliomyelitis was borne out in the current study. The accompanying table needs little explanation; however, it is particularly interesting that 14 per cent of all patients had cell counts of less than 20 per cubic millimeter, and half of these were below nine. It was impossible to establish any correlation between the total count or differential and the type or severity of the disease. The average value for spinal fluid protein, as computed from 137 individual determinations was 53 mgms. per cent.

Blood Studies

Hemoglobin values did not deviate from expected normal values.

Table Number 7Range of Spinal Fluid Counts

Number of Cases	0-9	10-19	20-50	50-100	100-200	200-300	300-400
Spinal (213)	20	13	52	83	36	21	6
Non-paralytic (145)	10	12	37	27	35	15	6
Bulbar (96)	2	9	20	20	14	2	1
Total (454)	32	34	109	130	85	38	13
Note: The counts of 5 patients were greater than 800, two of which exceeded 1000 (1201 and 1326).							

White Blood Cell Counts - The average of all patients was 10,750 with a range from 26,600 to 3,600. Differential white cell counts were not revealing.

Sedimentation Rate - The average sedimentation rate by the Westergren method was 22 millimeters in 60 minutes.

Management of Acute Poliomyelitis

General Measures - The problems of nutrition and fluid balance in spinal and non-paralytic forms of the disease were essentially similar to those encountered in any acute disease of childhood. Special efforts were made to support optimal mental hygiene. The high incidence of constipation required special attention in the form of frequent enemas and mild laxatives. Urinary retention occurred in 38 cases, in 20 of which catheterization was necessary. Analgesics and sedatives were used as indicated for the control of pain or discomfort without perceptible untoward effects. Isolation technique was carried out for a period of

14 days from the onset of the first symptom.

Specific Measures

Blood and Blood Derivatives - Convalescent serum was not used in this series of patients. Pooled Red Cross plasma was used frequently, particularly in bulbar and severely involved spinal cases. Whole blood transfusions were given as indicated for the correction of anemia. Gamma globulin was administered in approximately 10 cases, but no conclusion could be derived from its use.

Physio-therapy - This aspect of treatment was completely under the direction of the Department of Physical Medicine. Suffice it to say that hot pack applications were routinely applied to all except seriously ill patients, and were almost uniformly effective in reducing the discomfort and pain associated with tightness.

Respirator Cases

There was a total of 25 patients placed in the respirator. Of these 21 were males and 4 females. Seven were pure spinal cases, the remainder being pure bulbar or bulbo-spinal. Two of the pure spinal cases died, one after having been out of the respirator for several weeks, the other after over six months in the respirator. Failure of respirations, whether due to peripheral paralysis or to central involvement or a combination of these provided the indication for placement in the respirator.

The maintenance of nutrition and fluid balance required particular attention in the respirator patient. Those pure spinal cases who had no swallowing difficulty and were not acutely ill were gavaged whenever nutritional requirements were not met by natural appetite. Inasmuch as all the bulbar patients were still very acutely ill when placed in the respirator and all but one had definite difficulty in swallowing with accumulation of large amounts of mucus in the oropharynx, it was felt that gavage feeding would increase the quantity of mucus and consequently augment the already present danger of aspiration. For these reasons, the procedure was avoided. In all cases the administration of fluids was accomplished by the intravenous, subcutaneous, or rectal routes as seemed indicated and most expedient, until normal swallowing became re-established. The nutritional requirements in these patients were met by the use of parenteral protein and carbohydrate mixtures such as casein hydrolysate, plasma, and glucose and saline solutions. Vitamin supplements were supplied either orally or parenterally, depending upon the individual circumstances.

Prophylactic measures against the development of pneumonia included frequent changes in position, repeated suction, and the administration of penicillin. Such measures were considered imperative because of the complete inability to cough in the spinal case resulting from paralysis of the intercostal and abdominal muscles as well as the dia-

phragm, and because of the frequency and danger of aspiration in the bulbar patient.

Another important consideration is the prevention of neck excoriations due to the rhythmic friction of the collar diaphragm. The danger of decubitus ulcers was anticipated by appropriate nursing procedures. In spite of the obvious difficulty in application, hot packs were continued on all but critically ill respirator cases, if there was evidence of tightness.

Each respirator patient required special nursing care. This provision was equally important both from the point of view of maintaining morale and administering to the physical needs of the patient. In addition, play nurses were assigned the responsibility of providing entertainment such as reading, games and so forth. Charitable groups were encouraged to provide radios and movies.

Care and Management of the Bulbar Patient

The proper care and management of the bulbar patient was the primary challenge of the epidemic. Because of the unpredictability of the rate or extent of progression, constant vigilance and repeated examinations were essential. All patients on whom the diagnosis was made were considered seriously ill.

The crucial problem was found to be the prevention of anoxia in these patients. The susceptibility of the brain tissue to the damaging effects of anoxia is common knowledge. Since any bulbar patient by definition has brain stem encephalitis, it would seem logical that the maintenance of a continuous optimal supply of oxygen would assume especial importance. The rationale of therapy was based on the correction or prevention of anoxia which might be due to one or several of the following factors:

1. The effect of an impaired central respiratory mechanism with resultant inadequate oxygenation due to per-

iodic or complete apnea;

2. The effect of an impaired peripheral respiratory mechanism with resultant inadequate oxygenation due to paralysis of the respiratory musculature;
3. The effect of mechanical obstruction of the airway as can be caused by:
 - a. the repeated aspiration of small amounts of mucus with the production of numerous small areas of obstructive atelectasis,
 - b. plugging of large bronchi by mucus or food particles,
 - c. pooling of mucus in the oropharynx with consequent mechanical obstruction of the upper airway, or reflex closure of the glottis.
 - d. vocal cord paralysis with obstruction of the airway. This phenomenon was not observed in this series of cases.
4. Pulmonary edema with consequent decrease in alveolar absorptive surface.

The means at our disposal in the management of these aspects of bulbar poliomyelitis include repeated careful aspiration, the administration of oxygen, tracheotomy, and use of the respirator. The early recognition of anoxia by the use of the oximeter may prove a most valuable adjunct in determining the direction of therapy in bulbar patients. Studies with this instrument were conducted in conjunction with the Department of Physiology and will be reported elsewhere.

Generally any case with bulbar signs was given oxygen prophylactically until such time as progression could be appraised, especially if there were even minimal involvement of the 9th and 10th nerves. Likewise, suction was employed as long as difficulty in handling secretions was manifest whatever circumstances obtained. Penicillin was used prophylactically in all tracheotomy patients and in all others in whom aspiration pneumonia constituted a real threat.

Tracheotomy

A total of 20 patients were subjected to tracheotomy of which 17 were males and 3 females. All of these patients had involvement of the 9th and 10th nerves with dysphagia. In 5 patients, this was the sole bulbar involvement, in 15 cases other cranial nerve lesions were associated, and in 7 spinal involvement occurred. Seventeen of the group presented the findings of encephalitis, 5 of the cerebral type, 6 of the type described by Dr. Baker, and 6 with both types. All patients whose blood pressures were followed (18 cases) showed hypertension.

The decision for tracheotomy was reached only after careful appraisal of all contingent circumstances, and was therefore based on relative rather than absolute factors. For example, 96 of 107 patients had involvement of the 9th and 10th nerves, and 55 of these had definite dysphagia. Thus the mere involvement of the 9th and 10th nerves with or without dysphagia could hardly have constituted a valid indication for tracheotomy. The following signs and symptoms signifying the presence or imminence of anoxia formed the basis for the decision to operate; irregular, shallow, and/or periodically apneic respirations; exhaustion, agitation, restlessness or apprehension; progression of bulbar involvement with increasing dysphagia; and the presence of suffusion, cyanosis and/or retraction.

In order to evaluate the results of tracheotomy, all bulbar cases have been analyzed under four headings; namely, (1) patients who were tracheotomized and were placed in the respirator, (2) tracheotomy patients who were not placed in the respirator, (3) patients who did not have tracheotomy but were placed in the respirator, and finally, (4) patients who were not in the respirator.

First Group - A total of 12 tracheotomized patients were placed in a respirator; of these 5 died. In 4 cases death was directly attributable to central cardio-respiratory failure on the basis of bulbar encephalitis, 3 within 24 hours after admission, and one

after 6 days without improvement following a tracheotomy done on admission. The 5th patient died of uremia 20 days after having been placed in a respirator.

Thus 7 of the tracheotomy patients who were placed in the respirator because of central cardio-respiratory failure survived. Four of the 5 deaths were due to apparently irreversible failure of the vital centers and were benefited by neither tracheotomy nor respirator. The 5th patient who suffered a combination of peripheral and central respiratory failure was definitely benefited by tracheotomy and the respirator but died of renal failure on the 21st hospital day.

Second Group - Eight of the tracheotomized patients were not placed in the respirator and 5 of these died. In each case fulminating bulbar encephalitis with cardio-respiratory failure was unmistakably the cause of death within 24 to 36 hours after admission.

Thus in the 5 fatal cases the extent of bulbar involvement was so great that the increased oxygenation brought about by tracheotomy was ineffectual, and death from cardio-respiratory failure occurred with such rapidity that respirator placement could not be accomplished.

Third Group - Six of the 87 bulbar patients who were not tracheotomized were placed in the respirator. Of these, 5 died, all presumably as a result of central cardio-respiratory failure. Two of the patients died within 24 hours of admission; 2 of the remaining 3 were non-paralytic on admission but developed rapidly progressive bulbar signs on the 4th and 5th hospital days respectively and died 12-24 hours thereafter. In retrospect, the 5th patient should have received the benefit of tracheotomy since death occurred 72 hours after admission and since swallowing difficulty was present upon admission.

Therefore, again in this group it would appear that the time factor did not permit even the consideration of tracheotomy, except for the one case which it is now felt should have had tracheotomy.

Fourth Group - Eighty-one bulbar patients were neither subjected to tracheotomy nor placed in the respirator. There were 7 deaths in this group. Six died less than 24 hours after admission of overwhelming bulbar involvement; the 7th developed sudden and rapidly fatal bulbar signs on the 6th hospital day.

In summary, there was a surviving group of 66 individuals with involvement of the 9th and 10th cranial nerves of whom 35 had definite swallowing difficulty.

Final Summary of Mortality

114 Non-paralytic cases	0 deaths	
243 Spinal cases	0 "	(5 mo. follow-up)
107 Bulbar cases	20 "	
Central cardio-respiratory failure	19 "	
Uremia	1 "	

Conclusions

In view of the fact that all of the deaths in this study occurred among the bulbar group, it seems remarkable that attention heretofore has been primarily focussed on morbidity rate rather than mortality rate. The conviction that the proper management of the bulbar patient should be of prime importance rests on two facts. First, 100 per cent of the deaths in this study occurred in a group which comprised 23 per cent of the total number of patients. Secondly, the surviving bulbar patients, with few exceptions, recover completely. Certain approaches were defined in this epidemic which justify the hope that further investigation of the pathologic physiology will provide even more effective means of combatting the disease.

There can be little doubt as to the effectiveness of tracheotomy in certain bulbar patients, namely in those not characterized clinically by fulminating progression. At the present time it would seem that the course of this ful-

minating type is for the most part unaffected by any or all of the measures discussed, despite the prompt institution of vigorous therapy. This does not suggest, of course, that a nihilistic

approach is in any way justifiable, since a significant number of patients in this category did recover. It does, however, indicate emphatically the inadequacy of our present knowledge.

III. GOSSIP

The Fourteenth Annual Conference of Teachers of Clinical Radiology was held in the Crystal Room, Palmer House, Chicago, February 8, 1947. This group was organized in Kansas City on May 14, 1936 in response to a demand by radiologists who engage in teaching. Conference was discontinued during the war years. Morning session was a round-table discussion on the undergraduate teaching of radiology; in the afternoon teaching of postgraduate residents in radiology. Yours truly spoke on the Selection of Residents in Radiology and Balduin Lucke (Pennsylvania) and Edmund F. Hirsch (St. Luke's, Chicago) discussed Training in Pathology for Radiologists. Doctor Lucke described postmortem Radiology in a fascinating way. He demonstrated the difference between films of the chest during life and after death. He showed radiographs of the spine during life, after death, and when the bone was removed from the body. He also showed gross and microscopics of the same specimen. Doctor Hirsch outlined his training program. Radiologic pathology was an unexplored field until modern radiology developed. I spoke with great pride of the accomplishments of our own group and told them I really felt that Doctor Rigler had done more to help us become better physicians than any other member of our group. U. V. Portmann and Frederick W. O'Brien discussed radiation physics. Their paper provoked a great deal of discussion as many radiologists' primary interests are diagnostic problems and they are rather foggy on atomic energy development. B.R. Kirklin wound up with a discussion of Board requirements. On Sunday morning, the advisory group of specialty boards played to a packed house. Subject for discussion was the basic sciences; Northwestern, Pennsylvania, Washington and Minnesota told of their courses. The Boards in Otolaryngology, Medicine, Obstetrics and Gynecology reported on their requirements. Apparently everyone believes that basic science training is essential for a residency. Method varies with the individual and his opportunity. The Specialty Boards allow a certain number of months for formal training in the basic sciences, irrespective of the number of months taken. They are not concerned with the character

of the course, only the result as displayed on the examination. There was a great deal of discussion about the basic sciences' need, specialty training programs of the Army and Navy and the effects the boards are having on practice. It was a worthwhile morning and many points were clarified. All of the meetings were well attended and interest ran high. In February, the Palmer House is the Center of various activities relating to medical education, medical service, medical law, prepayment plans, etc. The dentists were meeting at the same time at the Stevens Hotel with the Chicago Medical Society as their host. This meeting is larger than the National Meeting of the American Dental Association. American dentistry is the best in the world and Minnesota dentistry is said to be the tops in this country...I visited my old home town where I was born and raised (Fairbury, Illinois), and discovered that many of my schoolmates are beginning to show signs of wear and tear. I went back to the old school building where I attended the grades and the building seemed small and old. I also saw my first grade teacher who is still my favorite instructor. I can recall one of her teaching stunts. She drew a picture of a large house upon the blackboard. We were asked to write names in the house. Her next move was to cover the names in the house with red and white chalk (fire). She rang a bell on her desk, we ran forward and rescued our "name" from the house by writing it down on a free space on the board. Two years ago she retired from the Chicago School System and is now doing part time secretarial work. I went to visit the house where I was born and found the glass in the front door, the fireplace, my old room, the bowl from the bathroom, and the cupboard in their familiar places. On the second shelf in the cupboard my mother used to keep the bottle of blackberry brandy to use when we had diarrhea. The maple trees are larger than ever and two of us could not reach around the trunks. The people living there now tell me the basement fills with water in spring (it always did) and I showed them where I buried our dog years ago (in the middle of their garden)....