

GENERAL STAFF MEETING
UNIVERSITY HOSPITALS
UNIVERSITY OF MINNESOTA

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ABSTRACT:**ACUTE POLIOMYELITIS****Synonyms:** (Ref. 14)

Meningo-Myelo-encephalitis, Acute anterior Poliomyelitis, Infantile Paralysis.

Definition:

Acute, anterior poliomyelitis is an acute, general, systemic, infectious disease which tends to involve the central nervous system, attacking especially the gray matter of the spinal cord, but capable of producing widely scattered lesions throughout the tissues of the brain and cord.

History:

The disease is ancient and probably first described with any degree of accuracy by the English Physician Underwood in 1774. The first systematic study of a large group of cases which finally established the disease as a clinical entity was published by Jacob von Meinel in 1840 in Kolmar, Germany. He undoubtedly recognized that there was a febrile period preceding the onset of paralysis. Since Meinel's time there have been many contributions to the literature.

Etiology: (Ref. 8*, 14)

*The organism is still debatable.

1. Flexner and Naguchi's Virus:

Filterable.

Can be cultivated anaerobically.

Minute globoid or globular organisms, in various arrangements, single, double, chains and masses in bizarre forms.

Stains pale reddish-violet with Niemsa's stain.

Proof of connection of globoid bodies and poliomyelitis not convincing.

Virus highly potent. 1/1000 of a cc aqueous solution of spinal cord of poliomyelitis patient dead will cause disease in monkeys.

Withstands glycerinization, drying and freezing for months.

Heat destroys readily.

Weak solutions of H₂O₂ destroys readily.

Monkeys and certain breeds of rabbits only animals affected.

Animals never contract the disease

from each other.

Produced experimentally by injecting virus into cranial cavity, spinal canal, peritoneum, blood, naso-pharyngeal mucosa as well as under the skin and into large nerves, arrest peristalsis of stomach or duodenum with opium, and introduce virus, get infection, otherwise not.

Naso-pharyngeal mucosa and brain most readily traversed avenues of infection.

Large amounts must be injected into blood. Therefore it is doubtful if infection could take place through skin in man. Most possible - naso-pharynx.

Virus not destroyed in Gastro-intestinal tract. Found in Gastro-Intestinal and nasal discharge.

Convalescent serum in both man and monkeys neutralize virus and prevent infection.

House flies and other insects can carry virus on bodies and could contaminate food - possibility of infection this way is quite remote.

2. Rosenow's Pleomorphic Streptococcus

Found in throat and tonsils of patients with Poliomyelitis.

Pleomorphic.

Size depends on Media it is grown in. Both aerobic and anaerobic.

Passes thru a Berkefeldt filter.

Introduced into nose, spine, brain and blood stream, causes a flaccid paralysis in animals. Lesions are typical for poliomyelitis.

Opsonic index in Poliomyelitis patients is high for this streptococcus.

Convalescent serum of man and monkeys agglutinate this organism specifically.

Rosenow believes Flexner and Naguchi's globoid bodies may be a stage in his streptococcus development.

Their anaerobic property and difficulty in culturing makes this seem improbable however.

Rosenow using aerobic culture of his pleomorphic streptococcus has produced a horse serum which he believes to have neutralizing, protective and curative power against Poliomyelitis virus.

He agrees that intraspinally it increases susceptibility and should be given intravenously or intramuscularly.

Many believe his serum is valueless and his figures are poor.

Pathology: (Ref. 15)

The spinal cord is more markedly involved than the brain in the usual case. The brain and cord may appear normal at autopsy or in marked lesions one may observe softening and hemorrhages, especially in the anterior horns.

Microscopically:

Disseminated lesions in anterior horns (most marked), posterior horns, white matter of cord, in the meninges and scattered in the brain. Marked perivascular and diffuse infiltration, particularly of small lymphocytes and other mononuclear leukocytes and scattered polymorphonuclears. Hemorrhages occur commonly especially in the anterior horns. Nerve cells undergo changes: swelling, loss of processes, chromatolysis, nuclear eccentricities, pyknosis and karyolysis. The infiltrating cells collect around the nerve cell bodies and even invade the cytoplasm of the degenerating cells (neuronphagia). As a rule the inflammation involves scattered levels of the cord.

Epidemiology: (Ref. 1,2,8,9,15)

Occurs sporadically as well as epidemically and is also endemic. Apparently the sporadic cases are those from which epidemics arise under favorable conditions. It is a disease of warmer seasons but of cooler climates. Large majority of the population acquires an immunity in the course of a lifetime. One out of fifty receive an initial exposure each year or one out of six hundred of the population in any given month.

Transmission: Mode of transmission not definitely known. The mass of evidence for direct transmission is overwhelming. Milk, raw fruits and vegetables and insect transmission thought remote.

Quarantine: How long the virus persists in the Nasopharyngeal secretions is not known. The evidence from epidemiological studies though unconvincing, shows that it is present rarely after 2 weeks (may find up to 7 mos.) 3 weeks should be long enough quarantine. Carriers hard to eliminate.

Period of observation: After exposure in epidemics more than half of cases develop disease 3 days after exposure, almost all within a week to 12 days. 2 weeks observation should be sufficient.

Immunity: Susceptibility much less than other communicable diseases. In New York

City 1916 epidemic only 2% of children exposed in same family contracted the disease (Criteria?) Secondary cases in institutions are rare. Active immunity is established by an attack and that the blood contains antivirucidal qualities afterwards.

Infants and young children more susceptible than older children and adults. (?). Explanation - abortive cases or subinfective doses of virus.

In rural districts the diminishing susceptibility with increasing age is less marked than in urban. Active acquired immunity is thought to be quite generalized in adults though not proven. Luther's investigations and Waltham's in the last 2 yrs. show that abortive cases are less frequent than is supposed and this immunity is probably due to subclinical infection. Active immunity may not be an explanation; for it has been found that washings from normal nasal and pharyngeal mucosa possess definite antivirucidal properties -- (Experimental proof). Antiseptics to naso-pharyngeal mucosa of no value, harmful in fact (impair protective powers).

Active Immunization: Killed or attenuated virus of no value in producing immunization.

Passive Immunization: Convalescent serum into blood prevents infection experimentally. Intraspinal - convalescent serum harmful (aseptic meningitis). How long introduced antibodies in blood will last, or dose, is not known.

Incidence - Seasonal:

University Hospital 35 cases in 6437 admissions

Incidence as to Month

January	2 (1?)	July	1
February	0	August	8
March	0	September	6
April	0	October	10
May	1	November	6
June	0	December	1

The greatest percentage of the cases occurred during the months of August, September, October and November.

Aycock's figures are as follows compared with New York and California.

% of Poliomyelitis cases occurring among adults

Registration area of United States (Aycock)	New York City			California	
	1916	1927	1930		

Urban	8.6 (1916)	1.7	16.67	23.57
Rural	19.5 (1910-1913)	10.0	19.88	19.37

U. Hospital series

Age Incidence

	1-5	5-10	10-15	15-25	25-
Cases	9	11	6	8	1
%	25.7	31.4	17.1	22.8	2.8

71.4% below fifteen years of age.

28.6% over fifteen years of age.

San Francisco -1931
60 Adult Cases

Age	Cases
16-20	16
21-25	18
26-30	11
31-35	10
36-40	4
Over 40	1
	<u>60</u>

San Francisco epidemic (1931) of 230 cases, 72 or 26.8% were over 16 years.

A satisfactory epidemiological explanation of age distribution is not readily possible unless the population involved has not been subjected to repeated exposure and thus has less opportunity to develop an adult immunity.

Age distribution of Local Cases of Poliomyelitis in 5 Successive Outbreaks in Syracuse, N.Y., from 1922 to 1929.

1922	- 26.5% 1 yr. and under
	57.1% under 5 yrs.
	89.8% under 15 yrs.
1924	- 13.3% 1 yr. and under
	48.1% under 5
	93.2% under 15
1926	- 3.3% 1 yr. and under
	31.8% under 5
	79.4% under 15

1928	- 4.2% 1 yr. and under
	45.9% under 5
	91.7% under 15
1929	- 23.6% 1 yr. and under
	64.7% under 5
	76.5% under 15

Sex:

U. Hospital Series

Males - 27 (77%): Females - 8 (33%)

Incidence of Poliomyelitis in the two Sexes during the Poliomyelitic Epidemic in Sweden 1911-1913.

Cases with Paresis

Year	Men		Women		Total
	No.	%	No.	%	
1911	1436	54.0	1224	46.0	2660
1912	1595	53.3	1399	46.7	2994
1913	538	55.7	429	44.3	967
	3569	53.9	3052	46.1	6621

Total cases of Poliomyelitis

Year	Men		Women		Total
	No.	%	No.	%	
1911	1929	53.5	1681	46.5	3610
1912	2139	53.1	1890	46.9	4029
1913	654	54.2	553	45.8	1207
	4722	53.6	4124	46.4	8846

As is indicated, males seem to be affected to a greater degree than females. The population in males exceeds that in females but the percentage of deaths and persons afflicted are more than proportional to the population. A possible explanation is that men come in contact with a great number of other men and places and are thereby exposed to the danger of infection during an epidemic. It is noteworthy that the mortality increases after childhood. From the data the author postulates that not only the active contact of males with the outer world but also the manly constitution yields a predisposing moment for hinging about a poliomyelitis infection. This disposition seems to develop principally after puberty.

Sex Distribution in Patients with Poliomyelitis of Local Origin in Syracuse, N.Y. from 1922 to 1929

Year	1922	Male	Female	23
	1924	88	47	
	1926	39	24	
	1928	16	8	
	1929	14	3	

San Francisco - 1931

33 or 55% Males

27 or 45% females

University Hospital SeriesProdromal Symptoms

This problem is one of the most interesting and, at the same time, one of the most baffling of those which at the present time are awaiting our solution. While one would not minimize its importance in the least, nevertheless one feels that it is being relatively overemphasized and that the laity is being unduly alarmed. This is due in part to the spectacularity of some of its manifestations, in part the sentimental appeal of convalescents giving their "life blood" to save the poor, innocent children, but chiefly to the fact that it furnishes striking headlines and interesting copy for the newspapers. No one gets excited over measles and whooping-cough, although the number of deaths from them and their complications is greater than from infantile paralysis. In Massachusetts in 1928 there were reported 41,519 cases of measles with 266 deaths, 8,023 cases of whooping-cough with 208 deaths and 434 cases of infantile paralysis with 64 deaths; in Boston, 8220 cases of measles with 71 deaths, 1910 cases of whooping-cough with 52 deaths and 121 cases of anterior poliomyelitis with 14 deaths. In the cities and towns of this district the story is the same. In Cambridge, with an estimated population of 35,100 children under 15 there were 2082 cases of measles with 11 deaths, 228 cases of whooping-cough with 7 deaths, 11 cases of infantile paralysis with no deaths; in Somerville, 842 cases of measles with 4 deaths, 145 cases of whooping-cough with 3 deaths and 8 cases of infantile paralysis with 1 death. In Waltham, with about 7000 children under 16, there were 316 cases of measles, 109 of whooping-cough and 43 of infantile paralysis. There were 6 deaths from whooping-cough and its complications and 7 from infantile paralysis. In Newton, with approximately 12,000 children below 15-1/2 yrs. 359 of whooping-cough with 1 death and 23 cases of infantile paralysis with 1 death.

	<u>No. of Cases</u>	<u>%</u>
Gastro-intestinal (Nausea and vomiting Anorexia, diarrhea, dysphagia, etc.)	30	85.
Fever (temperature)	16	45.
Headache	14	40.
Backache and stiffness	11	31.
Muscle pains in extremities	11	31.
Stiffness, rigidity of neck	10	29.
Weakness in extremities	8	23.
Upper respiratory	7	20.
Malaise	6	17.
Paralysis 1st symptom	6	17.
Respiratory difficulty	5	14.
Abdominal pain and cramps	5	14.
Fatigue	5	14.
Restlessness	4	11.
Twitching numbness	3	9.
Chills	2	5.
Drowsiness	2	5.
Stupor	1	3.

1 case reports an athletic injury previous to paralysis.

San Francisco 1931
60 cases - Prodromal
Symptoms

	<u>Cases</u>	<u>%</u>
<u>General</u>		
Malaise, fatigue, weakness	26	48.
Chills	6	11.
<u>Respiratory</u>		
Symptoms of cold	7	13.
Pleuritic pains	5	9.
<u>Gastro-intestinal</u>		
Anorexia	1	2.
Nausea	13	24.
Vomiting	17	31.
Diarrhea	2	4.
Constipation	2	4.
<u>Nervous</u>		
Headache	32	59.
Neck pain & stiffness	15	28.
Pain back & extremities	37	68.
Tremulousness	2	4.
Paraesthesias	3	6.
Nervousness & restlessness	6	11.

Symptoms: (Ref. 1, 3, 5, 6, 7, 10, 12, 13, 16)

Prodrome:

Incubation period is 4 to 7 days.

Preparalytic Stage:

Pain in neck, back and extremities, headache, nausea, vomiting, malaise, fatigue and weakness, neck stiffness, symptoms of a "cold", chills, restlessness.

Faber believes the germ of the disease does not reach the central nervous system through the blood stream or lymphatics but directly through the nose without attacking the rest of the body. He offers as proof that the most frequent and characteristic at the onset, were either obviously of a nervous order or strongly suggestive of nervous disturbance and none was incompatible with nervous origin.

These were fever; vomiting; drowsiness; restlessness and irritability; headache; pain or excessive sensitiveness, awareness of bodily disturbance or vague symptoms of discomfort.

Precipitating Causes:

Indiscretions in eating or drinking and vocational (physical and mental) strain. After exertion there was a rapid development of symptoms.

Paralysis: (Ref. 3, 7, 6, 1, 12, 16, 5, 10, 13)

University Series

Number of days between symptoms and paralysis

Same day	0	1	2	3	4	5	6	7	8	9	10
No.)	0	1	2	3	4	5	6	7	8	9	10
Cases	2	3	6	7	5	1	0	3	1	2	2

6 had no primary paralysis, but had signs of involvement, i.e., neck rigidity, etc.

1 no paralysis
1 could not tell
1 - 17 days.

The number of days between symptoms and paralysis showed most of the group had a prodromal stage below 5 days, the largest percentage of the cases from 2 to 4 days. 1 case had a prodromal stage of 17 days. 6 of the cases had no primary paralysis but had signs of spinal involvement, i.e., neck rigidity, muscle pain and weakness, etc.

San Francisco 1931
Paralysis in 44 of Adult Cases

Paralysis of	No. Cases
1 extremity only	9
2 " only	3
3 " only	2
4 " without involvement of trunk muscles	0
extremities & intercostal muscles	4
extremities & intercostal & abdominals	6
extremities & abdominal muscles	8
Bulbar paralysis with paralysis of extremities	9
Bulbar involvement alone	3

Adult Poliomyelitis presents a gloomy Picture

	Cases	%
No paralysis	11	18.
Transient weakness (No paralysis at end of quarantine)	4	7.
Persistent paralysis	29	48.
Death	16	27.

13 cases, or 37%, had bulbar manifestations, such as difficulty in swallowing, talking and facial paralysis.

University Hospital Series
Bulbar Paralysis

5 cases of 13 having bulbar involvement died or 38%. 4 others had fairly extensive paralysis. Therefore 9 of 13, or 69%, of cases with bulbar paralysis had a poor outcome.

Age	Residual Extensive	Bulbar	Resp.	Death
3	+	+	+	Alive
3		+	+	+
9	+			Alive
8		+	+	+
6		+	+	+
7			+	+
3			+	+
15			+	+
8	+	+	+	
14	+		+	
10			+	+
18	+			
2-1/2	+			
16	+		+	
1	Facial & Resp.		+	
8	+	+		
8		+	+	+
18			+	+

Case	Type of Bulbar Paralysis	Residual	Death
1	Larynx	Extensive	(Disch. (Ancker Died
1	Larynx		"
1	Larynx		"
1	Diff. Swallowing (Partial)	None	
1	Pharynx		Died
1	Facial	None recorded	
1	Laryngeal	Extensive	
1	Facial	Slight	
1	Pin point pupils		
1	Resp.	Extensive	Died
1	Facial	Slight	
1	Muscles of deglutination		Died
1	Deglutination	Right upper left lower	

Diagnosis: (Ref. 1,3,4,5,6,7,12)

- Epidemiology:
 - Is there an epidemic?
 - History of exposure
- Symptoms in order of frequency:
Fever, headache, pain in extremities, paraesthesiae, dizziness, nausea and other G. I. symptoms.
- Signs:
Most important meningeal irritation neck stiffness (slight but definite rigidity of lower spine, Kernig sign, differences in tendon and superficial reflexes.

In an epidemic, anyone with slight fever and slight back rigidity has an indication for spinal tap.

Spinal Fluid: (Ref. 4,5,10)

Of the 35 cases, there were 23 that had spinal taps done. The cell counts in these cases showed 11; or 47%, had counts below 50 (average 24). 3 cases with counts between 50 and 100 (average 63), 2 between 1 and 200 (average 185), 3 between 200 and 300 (average 260), and 4 above 300 (average 590). The highest count was 790 cells.

Cytology of spinal fluid is of great diagnostic importance and some authors credit it with prognostic significance.

Spinal fluid of Poliomyelitis resembles, closely, tuberculous meningitis.

Comparing 122 cases of poliomyelitis and 147 cases of the meningitis, it appears that most of poliomyelitis cases show a cell count between 50 and 200, but a fair percentage (19.7%) are below 50. Only a few going over 300 (13%). The highest count was 700 cells. In tuberculous, 9.5% below 50. Largest percentage having counts between 50 and 200 (20-30%). Counts of 200-300 occur in 10-20%. A few cases occur with counts over 500 and the highest count was 800 cells.

Figures of other authors are as follows: (Poliomyelitis):

Abt - the cell count usually not much over 100, though may run over 1000.

Holt - 40-80 to over 1000.

Crothers - 50 to 1000.

MacAusland - 16-20 to 1000 or more.

Lucas - 300 to 400.

14 of the 35 cases, or 40% of all the cases, had affectation of their respiratory muscles (respiratory paralysis) and of these 7 died, or 50% of all our cases with respiration effected died. 8 of these cases put in the Drinker. It is impossible to tell the end results of the cases that were in the Drinker as some of these cases were transferred to other hospitals after their respiratory embarrassment had improved. Since discharge 2 more of the respiratory cases have died, bringing the total deaths of this group up to 9, or 64.2% of respiratory cases admitted here eventually died. Of all the cases showing respiratory paralysis, the spinal fluid cell counts were the highest of the entire group of cases with the exception of 2.

Sphincter Paralysis:

6 cases showed an involvement of the urinary sphincter. Of these 5 recovered the use of the sphincter and 1 died from respiratory paralysis.

Sphincter Involvement
University Hospital Series

No. Days to recover	No.	Recovered use
1 Mo.	1	Recovered use
4 Days	1	" "
2 "	1	" "
1 "	1	" "
4 "	1	" "
	1	Died
	6	5 recovered use 1 died respiratory failure.

New York Board of Health Report
1916 - 15 to 20 to 1000 or more.

Ayer - Made the following statement

"The cellular picture varies with the severity of the infection and also in reference to the time of the puncture. Fluids taken in the early or late pre-paralytic stage show a small number of cells and with the establishment of the paralysis the cells disappear entirely. The number of cells per cu. mm. in average case at 24 hours would be put at 350; a cell count below 100 is very unusual and might be interpreted as occurring in a very mild case or at the end of the preparalytic period. Those below 50 in the presence of high fever are almost significant and would give rise to much doubt as to the existence of the disease.

Ayer's statement is at variance with other authors:

Low cell counts need comment.

Bulbar and cerebral cases without marked clinical involvement of the cord often show low counts (counts 10-40).

In epidemics with low incidence of bulbar cases would vary showing few low counts. On the other hand bulbar signs with extensive involvement of cord, the count may be high. The number of cells is apparently dependent on the location of the pathological process in relation to meninges than on stage of disease. The presence of 10-50 cells with an increase in polymorphnuclears is certainly strongly suggestive of pathology. The cells disappear with recovery from the disease irrespective of onset of paralysis.

	<u>Pre-paralytic</u>	<u>Post-paralytic</u>	
Average day of disease	2.3.	4.	6.
Average cell count	136	119	199

Unless reliance can be placed on accurate spinal fluid studies in Poliomyelitis than Ayer suggests is possible, few cases would be diagnosed until paralysis sets in.

Polymorphonuclears: distinctly lobulated nucleus as in blood as distinguished from single nucleus of lymphocytic cells.

Tbc meningitis only about 10% of cases have predominance of polymorphonuclear cells. Poliomyelitis - 50% of cases with 50% or more polymorphonuclears.

Abt - says generally mono nuclears predominate though at times polymorphonuclears may.

Neal - 400 cases - only 3 in which pmn's predominate.

Holt - Early pmn's may predominate, but soon nearly all cells are lymphocyte

Crothers - Fluid shows marked lymphocytosis.

Wickman - an increase in Pmn's is exceptional.

New York Board of Health - Pmn's predominate in 39%.

MacAusland - early Pmn's predominate and later mononuclears.

Lucas - Mononuclears predominate.

It may be possible that the cell may differ with epidemics. Fresh stains are better than fixed smears, for the cell shrinks and the nucleus is often indistinguishable from that of a lymphocyte (technical error).

In Author's series no marked drop in percent of polymorphonuclears during acute phase of disease. Their opinion, as well as New York Board of Health, and also Neal that number of polymorphonuclears indicate type of pathology and not stage of the disease (contrary to current teaching).

Summary:

In series of 122 cases of poliomyelitis cell count of spinal fluid varied from 10 to 700, with greatest number of cases between 50 and 200; an equal number of cases below 50 and between 200 and 300; a few cases as 700. A high percentage of bulbar cases in series may account for large group with a low cell count. About half of the cases had a polymorphonuclear percentage over 50. This is not in accord with other authors and may be accounted for by variations in different epidemics and technic of staining and studying cells. The percentage of polymorphonuclears during acute phase of disease is independent of day of disease but probably on some other factor.

Mortality and Prognosis: (Ref. 1,3,7)

Wernstedt - Swedish Epidemics
1911-and-1913

The abortive cases of epidemic in-

Infantile paralysis proceed favorably. Only the meningitic type are exceptions.

Cases with paresis may proceed to full recovery, death, or residual paralysis. The outcome varies with the age of the patient and with the epidemic, for it varies in different outbreaks. However, the greatest number of such cases are left with residual paralysis.

If no paralysis is evident up to the 5th day the chances are that paralysis will not enter. After the 10th day the probability of death is very small. Paralysis enters as a rule where sensor or motor appearances of stimulation are seen.

The most unfavorable prognosis is in the cases with respiratory paralysis.

Paralysis of the extremities was fatal in 40% of cases of bilateral arm paralysis. The minimum mortality was in these cases in which only 1 leg was paralyzed, this being fatal in 4% of cases. In general a paralysis of the upper extremities is more unfavorable than 1 of the lower.

Of the different forms of paralysis of the cranial nerve that localized in paralysis of the pharynx is most unfavorable, being fatal in 61% of the cases.

The summarized results of a great number of cases reveal mortality as follows: Nearly every case (97%) with respiratory paralysis.

About 3 of each 5 cases with pharynx paralysis.

Every 2nd person with paralysis of the trunk.

Nearly every 2nd with tongue and speech paralysis.

Every 4th or 5th with arm paralysis.

One of every 6 or 7 with facial, eye or mastoid muscle paralysis.

1 of each 8 with paralysis of the lower extremities.

The mortality is lowest in children 3 years of age. At 10 years it is the same as at infancy (21%).

University Hospital Series

35 cases - 9 died - 26% mortality.

Treatment: Ref. 3,8,10,11,12,13.)

Experimentally no invasion of blood stream. Prodromal symptoms hard to explain in Man (unless - upper respiratory infection causes abnormal naso-pharyngeal mucosa).

Preparalytic stage treatment should be intensive.

Repeated lumbar puncture with spinal drainage has been highly recommended in the treatment of this disease (amount?). Several series of cases in which this has been done show a high percentage of them with minimal paralysis.

Serum intraspinally - aseptic meningitis results. May do serious harm.

Convalescent serum - Neutralizes virus in vivo and invitro.

In several series of cases, those untreated gave almost as good results as those treated.

	<u>Treated</u>		<u>Untreated</u>
	<u>No Paralysis</u>		
Ulrick	86%	:	83%
Peabody	69%	:	69%
	(1916)	:	(1920)

Peabody (Harvard Infantile Paralysis Commission) 1921, writes that the results of use of serum used in 1916 epidemic did not justify use of serum in 1920 epidemic. However in 1927 epidemic this same commission had a 1% mortality in those treated as compared with a general mortality of 14%.

Other statistics show that convalescent serum is of a distinct value. Amount varies with stage of disease. Rosenow's serum not accepted.

Results of Treatment of 104 Poliomyelitis Cases. (Ref. 10)

(Shaw, Tholander & Leinfors)

1. Of the 104 cases, specific therapy was given in 92 cases.
2. Of 53 patients treated before the onset of paralysis, 28 showed no paralysis at any time, 15 showed transient weakness which had disappeared before discharge. 9 showed persistent paralysis and 1 died.
3. The average age of the unparalyzed patients was 9-1/2 years; of the transiently paralyzed, 10 years and of those with definite paralysis, 17 years. Hypothesis is that better results are obtained in the lower age groups.
4. The average spinal fluid cell count was 146 in the unparalyzed group, 119 in the transiently paralyzed, 197 in the persistently paralyzed, and 270 in the single fatality (figures without significance).
5. Serum was given - average 3 days

after onset of symptoms in unparalyzed group, 4 days in transients, and 3 days in those with persistent paralysis.

6. Average amounts of serum per group: 120, 151, 209, 375 cc. (fatal).

7. In the group treated in acute stage after the appearance of demonstrable weakness, of 39 patients, 9 showed transient weakness, 23 had persistent paralysis, and 7 died.

Summary of Results in all Cases

Cases treated before onset of paralysis (53)

	No. of Cases	Avg. Age in Yrs.	Avg. Cell Count	Avg. Day of treatment	Avg. Amt. Serum cc.
No paralysis	28	10.	146	3.	120
Transient weakness	15	10.	119	4.	151
Definite paralysis	9	17.	197	3.	209
Death	1	9.	270	--	375

Cases treated after onset of paralysis (still acute) (39)

Transient weakness	9	7.	67	4.	84
Definite paralysis	23	12.	194	4.	156
Death	7	20.	199	6.	156

Summary of all Cases Total 92

	Total No. Cases	No Permanent Paralysis	Definite Paralysis	Death
Cases treated before onset of paralysis	53	84%	17%	2%
Cases treated after onset of paralysis, still acute	39	23%	59%	18%
Total	92	57%	35%	9%

Conclusion:

The use of highly immune serum will be productive of consistent results and the hyperimmune animal serum offers the greatest promise in this direction.

RESULT OF USE OF CONVALESCENT SERUM

University Series

Days from Symptoms to Onset of Paralysis.	Days after Symptoms that serum was given	Amount	Primary Paralysis	Residual Paralysis	Cell Count Spinal Fluid
7	5 7	20 cc. 20 cc.	Respiratory muscles, arms, and legs, larynx, sphincters	Extensive	5th day 651 (bloody) 7th day 55 (clear)
2	2 3	20 cc. 15 cc.	Extensive paralysis of all four extremities, sphincter	Extensive	2nd day 50 6th day 0
8	6 8	20 cc. 30 cc.	Both arms, respiration, sphincters, larynx	Expired (9th day)	9th day 406
1	1 2	30 cc. 15 cc.	Stiffness of neck, muscle pain	None	2nd day 32
3	11	15 cc.	Weakness both legs abdominal	Lateral abdominal	11th day 0
2	2	20 cc.	Weakness of legs	None	22 days 43 29 days 6
4	4	30 cc.	Weakness right leg	Right hip, flexors right quadriceps	4 day 2
No paralysis	?	30 cc.	No paralysis	No residual	None done
10	16	10 cc.	Rigidity cervical spine	No residual	23rd day 30
9	11 13	30 cc. 10 cc.	Stiffness of back and abdomen, twitching of arms and legs	No residual	11th " 275
3	3	30 cc.	Neck rigidity. Difficulty swallowing	No residual	3rd day 61
3	13	20 cc.	Respiratory muscles, pharynx, upper extrem.	Expired	None done
1	?	20 cc.	None	None	None done
7	4 7	20 cc. (whole bld) 10 cc. serum 20 cc. serum	Respiration, lower extremities, right upper extremities	Expired two days after admission	None done
-	-	-	-	-	Atypical discharge against advice
?	?(adm.)	30 cc.	Abductors and deltoid right arm	?	Unsuccessful
5	6	20 cc. (whole Bld)	Resp. and abdominal	Expired on day adm.	None done

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?	?	18 cc. (before 15 cc. adm.) 18.5 " 2 days later	Lower extremities, facial muscle	No residual recorded	Adm. - 12
10	-	None	Lower extremities respiratory muscles	Expired (14 days) 4 days after onset	11th day 45 12th day 200
2	2	40 cc.	Lower extremities, progressed to complete resp.	Extensive	2nd day 275 (died since discharge)
3	4 5	15 cc. 10 cc. 60 cc. before ad?	Upper and lower resp.	Upper extremities slight in lowers some resp.	2nd day 500 3rd day 300
9 (Dev. in house)	9	20 cc.	Left upper arm and shoulder	Both deltoids, more marked on left	9th day 17 11th " 13 19th " 10
4	2	29 cc.	Right thigh, left face	Inner and outer ham- strings, right, slight, left face	2nd " 29 20 " 22 24 " 13 31 " 7
17		None	General paralysis, res- piratory paralysis	Expired	None done
7	?	20 cc.	Both legs, right arm	Right arm weak, left deltoid, both lower extremities	Adm. 25 3 days later 0
4	?	Adm. 30 cc. 3rd day 20 cc.	Both lower extremities	Both lower extremi- ties, complete	Adm. 70
3	?	Before adm. 20cc. Adm. 10 cc.	Resp. both lower extre- mities, sphincters	Both lower extremi- ties	None done
4	6	10 cc.	Both upper extremities	Left deltoid	6th day 59
1	-	None given	Facial left	Facial left, resp.	None done, transf. to Ancker
2	2	20 cc.	Left leg, right arm	L. leg, R. arm, marked	2 days 7
1	2	30 cc. (intrav)	Resp., arms and chest	Respiration, slight	2 days 708
3	3	30 cc.	Both hands, forearms, r. face	VII N right (slight)	None done
2	2	30 cc.	Muscles of deglut. Resp.	Expired	2 das. 20; 2 da. 40
4	4	30 cc.	Legs, later all 4 extr.	Expired	None done
Same day	-	None	Neck, left eyelid, upper and lower extremities, respiration	Expired	7 day 10

Serum - 31 of the cases received convalescent serum intramuscularly, the average amount being twenty to thirty cc. Four cases received no serum. An attempt to show any value in the use of the serum was a failure.

Summary:

1. Acute poliomyelitis is an acute systemic infection which tends to involve especially the gray matter of the C.N.S.
2. The disease is ancient and was first described in 1774.
3. The causative organism is unknown. Flexner and Naguchi's virus is given greatest credence.
4. Pathologically the chief findings are microscopic degeneration of the anterior horn cells with infiltration of leucocytes in this area.
5. The disease occurs sporadically and in epidemics.
6. The mode of transmission is unknown.
7. Communicability extends usually for about 2 weeks. 3 weeks is sufficient quarantine.
8. After exposure the disease develops within 3 days in over 50% of cases.
9. In same series only 2% of those exposed developed the disease.
10. Immunity is established by an attack.
11. Susceptibility is diminished in direct proportion to age.
12. This is explained on basis of subclinical infections establishing immunity.
13. Convalescent serum prevents infection.
14. Most cases occur during August to November.
15. Only about 20% of cases occur in adults.
16. Males predominate.
17. Gastro-intestinal symptoms occur in 85% of cases. The next most frequent symptoms are fever, headache, muscle pains and stiffness.
18. The prodromal (preparalytic) stage in most cases is under 5 days.
19. In the local series 6 out of 35 showed no paralysis.
20. Of 35 cases (U. series) 14 had respiratory paralysis, 13 bulbar signs, 6 paralysis of sphincters.
21. Spinal fluid studies show the

usual count to be less than 50 and about half have 50% PMN's. The significance of high counts and high PMN proportions is not certain.

22. The most unfavorable prognosis is given in the bulbar and respiratory combined paralysis (98%), and grades downward with the degree of paralysis to 12% in paralysis of the lower extremity.

23. The mortality is lowest at 3 yrs

24. The University mortality is 26%.

25. Treatment should be intensive during the preparalytic stage. Convalescent serum in large doses is to be given intramuscularly.

26. The average amounts used in various groups was 120, 151, 209, 375 cc

27. The use of serum seems definitely to diminish the extent of the paralysis.

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CASE REPORT:Poliomyelitis, Bulbar type.Bilateral Bronchopneumonia.Horseshoe Kidneys.

Path. Randall.

The case is that of a white female, 8 years of age, admitted to University Hospitals 10-4-31 and died 10-8-31 (4 days).

Headache

10-1-31 - Headache and felt feverish.

Stiff neck

10-2-31 - Continued to have headache. Temperature 103. Vomited. In evening complained of neck being stiff.

Dysphagia

10-3-31 - Above symptoms continued. Slept a great deal during day. No appetite since onset of illness. No diarrhea or constipation. Has had no contact with any children who have been ill. Has had difficulty in swallowing for past 2 days.

Admitted to University Hospitals

10-4-31 - Complaints: Headache, 4 days duration. Fever, 4 days duration. Vomiting several times within last 4 days. Slight difficulty in swallowing and slurring of speech.

Past History

General health fair. Measles, mumps, whooping cough, chicken pox and scarlet fever. Since recovery from scarlet fever 4 years ago, has had repeated earaches but no running of ears.

Birth history

Normal full-term pregnancy; instrumental delivery. Breast fed for 12 months. Walked at 13 months. Mother, father, and 3 brothers living and well. No history of tuberculosis, heart or kidney disease. Grandmother died of cancer.

Physical examination

White female, 8 years of age. Face flushed and skin feels hot. Irritable and restless. Head - no gross abnormalities. Eyes - pupils react to light and accommodations; no strabismus. Nose - negative. Tongue - covered with white

furry coat. Teeth - carious. Tonsils - removed. Throat - slightly reddened. Neck - posterior cervical adenopathy. Lungs - no rales or areas of dullness; no abnormal breath sounds. Heart - no murmurs; rate regular. Abdomen - no tenderness or rigidity; no masses; Extremities - no deformities

Reflexes

Patellar negative; biceps, triceps, abdominal, and Babinski's normal. Slight rigidity and pain on flexion of neck. No pain along spine or lumbar region. Impression: 1. Possible poliomyelitis, bulbar type. 2. Diphtheria. Impression of Admitting Officer in Admitting Room: 1. Upper respiratory disease. 2. Pyelocystitis. 3. Prodromal symptoms of infectious disease.

Laboratory

Urine - occasional wbc's. Blood - Hb. 81%, wbc's 15,700, Pmn 81%, L 15%, M 4%. Spinal fluid - clear, colorless, pressure 150, Nonne and Noguchi negative, cells 40. Nose and throat cultures negative on 2 occasions.

Progress

T 103 - 100 - 103 - 101 - 103.2. Pulse 120-140. Respirations 20-30. 9 A.M. - T 100.6. Restless and irritable. Complains of some pain over chest. Seems to have some difficulty with speech. Swallows all right. 8 P.M. - has considerable collection of mucus in throat. Cannot swallow unless sits up. 12 cc. of convalescent serum given into right buttock. Face is flushed.

Worse

10-5-31 - T 100. P 120. R 25. Restless and irritable. Neck rigid. Difficulty in swallowing. Large accumulation of mucus in throat. Slight impairment of speech. Spinal tap - 20 cells. Uses abdominal muscles as accessory to chest. Chloral hydrate gr. x (i). Hypodermoclysis of normal saline. Tube feeding. Suction apparatus, p.r.n. 10:30 P.M. - responds well. Unable to swallow any water but complains of being thirsty.

Paralysis increases

10-6-31 - 5 P.M. T. 101. P. 160. R 60. Delirious and stuporous. Paral-

is of muscles and deglutition of speech. Respiration exceedingly rapid and shallow. Nose and throat culture negative. Codeine sulphate gr. 1/8 (H).

Neurological Consultation

10-7-31 - 9 A.M. - T 103. Respirations rapid and shallow. Somewhat more comfortable today. Can swallow somewhat better. Neurologist saw patient and diagnosed poliomyelitis of bulbar type with cerebral involvement. No chest findings. 5 P.M. - Condition worse. Respirations shallow. Much mucus in throat and seemingly in bronchi. Color bad. Given tepid sponge at intervals for fever, reduced from 103 to 101 at times. 10:50 A.M. Patient takes small sips of water. Chokes when trying to swallow. Restless and irritable. Spinal fluid - negative for bacteria.

Exitus

10-8-31 - Note by Fellow: Typical onset of acute anterior poliomyelitis. 1. Malaise. 2. Headache. 3. Vomiting with anorexia. 4. Fever. 5. Stiffness of neck with developing symptoms of cerebral and bulbar type-- 1. Paralysis of right side of throat, loss of ability to swallow and impairment of speech. 2. Disorientation at times, irrational. 3. Probably some impairment of phrenics, no peripheral paralysis, abdominal reflexes and extremities hyperactive. Spinal fluid increased cell count. Progressed downward and apparently terminal with pneumonia of lower left lobe. Getting weaker. 2 A.M. - Condition is much worse. Gasping at times. 2:25 A.M. patient expired.

Autopsy:

Edema

The body is that of well-developed, fairly well nourished, white female. Puncture wounds in medial sides of both thighs. Some edema around puncture wounds. Slight cyanosis. No jaundice. Each pupil measures 3 mm. in diameter.

The surface of the Peritoneal Cavity is smooth, moist, and glistening. No increase in fluid. The organs are in normal relationship to one another. The Appendix is normal.

Exudate

No increase in fluid in Pleural Cavities. Organs are in normal relationship to one another. Small amount of fibrinous exudate over bases of both lungs, especially left.

Definite decrease in crepitation in left lung. Discolored and reddish-purple in color. Right base is same but to lesser degree. Both lungs are air-containing. The Pericardial Sac is smooth, moist and glistening. No increase in fluid.

Heart weighs 100 grams. No gross pathological change. No deformities.

Pneumonia

Right Lung weighs 300 grams, Left 500 grams. There is definite consolidation and decreased crepitation in both lower lobes and right middle lobe. Cut readily and on section show diffuse infiltration at both bases, especially left. This infiltration which is grayish-pink in color is quite patchy and located in region of the bronchi. There is some tendency to confluence of the patchy areas. There is no air-containing tissue in either lower lobe. The upper lobes are crepitant and air-containing. There is a very definite picture of bilateral bronchopneumonia which is fairly well advanced.

The Spleen weighs 50 grams and is somewhat soft. The capsule is purplish-gray in color and wrinkled, cuts readily and on section scrapes with very little resistance, the malpighian corpuscles and trabeculations are distinct.

Fatty

The Liver weighs 700 grams. The surface is smooth, grayish-brown in color. On section, the lobulations are indistinct and there is a yellowish-gray mottling throughout. This is especially marked in the region of the central vessels where it suggests toxic hepatitis or focal necrosis or fatty infiltration.

The Pancreas, Adrenals, Gall-Bladder and Gastro-Intestinal Tract are negative.

Anomaly

The Kidneys weigh (together) 200 grams. Definitely horseshoe-shaped, connected at lower pole. This connection includes practically both lower poles, measuring about 3 cm. in width. The pelvis and ureters are distended. The ureters encroach over the lower pole, anteriorly.

The Bladder is distended but on section, the mucosa is grayish-white in color and shows no evidence of pathological change.

Head. The scalp and calvarium are normal. The meninges are somewhat injected. The brain is removed but not sectioned and sent to Dr. McKinley's office for complete study.

Diagnoses:

1. Poliomyelitis, bulbar type.
2. Acute bilateral bronchopneumonia.
3. Horseshoe kidney.
4. Puncture wounds in sides of thigh.
5. Acute splenitis.
6. Fatty liver.

III. CASE REPORT

ACUTE POLIOMYELITIS (RESPIRATORY)
Fath. Randall.

The case is that of a white, female, Jewish girl, 8 years, admitted to University Hospitals 11-11-31 and died 11-13-31 (2 days).

Diarrhea (Note this)

11-2-31 - Had diarrhea and slight elevation of temperature (to 99) Stayed out of school.

11-3-31 - Diarrhea persisted, no fever.

11-4-31 - Condition same.

Headache

11-5-31 - Returned to School, complaining of slight headache. Appetite, however, was good. No other pain or symptoms.

11-6-31 - Went to school although she still had a slight headache.

Tired

11-7-31 - Played out-of-doors with other children but still had a slight headache. In the evening, she complained of increasing severity of headache and tiredness. The mother noted that patient had temperature.

Stiff neck, backache

11-8-31 - Temperature 100, headache quite severe. Had no nausea, vomiting, or diarrhea. Headache became worse, physician was called. Had a stiff neck and the physician gave her 20 cc. of serum. In the evening the temperature was 101 and she complained of a severe headache and backache. Ice packs and aspirin gave no relief.

11-9-31 - P.M. - Temperature lower but headache and backache persisted. Not able

to sleep.

Vomits

11-10-31 - Began to vomit and continued through day and evening. In evening physician did a spinal puncture and patient received considerable relief. Began to complain of pain and weakness of left arm and pain in epigastrium.

Paralysis

11-11-31 - Temperature elevated to 104. Splint applied on left wrist and hand, as patient was unable to move wrist. Complained of muscle pains all over body and extremities and of muscle weakness in both arms. In evening, the physician gave patient another 20 cc. of serum. Began to complain of painful and difficult respirations. 6:30 P.M. -

Admitted to University Hospitals.

6:30 P.M. - Patient incontinent.

Complaints: 1. Difficulty in breathing. 2. Muscle pain and tenderness. 3. Paralysis of both arms. Physical examination: (Examiner clerk). Temperature 101, pulse 120, and respirations 36. Appearance is that of an acutely ill girl with difficulty in talking and respirations. Nutrition is good. Inactive. Skin and mucous membranes - no cyanosis nor icterus; skin dry; no edema. Posture - normal, except for left wrist and hand in a splint. Patient won't move on account of pain. Muscular tenderness. Extremities - can move both legs; muscular tenderness of all extremities; cannot move fingers of left hand; wrist drop, Muscular system - flaccid tonus; paralysis both arms.

Reflexes -

positive Kernig's. Lymph nodes - no general glandular enlargement. Head - erect position; rigidity of neck muscles. Eyes - pupils normal; reflexes present; vision good. Ears - hearing good; no mastoid tenderness; no discharge. Nose - sinuses not tender. Mouth - tongue not coated. Teeth - few caries. Throat - membrane and larynx injected; difficulty in speech. Lungs - respiration fast and difficult; rate 36; no increased transmission of vocal sounds; no rales; percussion normal. Heart - P.M.I. 5th intercostal space within midclavicular line; no rubs; no murmurs; rate 120; strong force. Abdomen - negative. Anus and rectum - negative. Mental status and attitude -

right; cooperative. Summary of positive tests; Both arms flaccid, no reflexes. Able to move only fingers of right hand. Severe muscle pain and tenderness of extremities and back of neck. Rigid neck muscles. Pulse fast. Respirations fast. Toxic. Reflexes sluggish or absent. Impression: Acute poliomyelitis. Meningitis.

Laboratory

Blood - Hb. 74%, wbc's 6,600, rbc's 4,650,000, Pmn 78%, L 19%, M 3%. Urine - specific gravity 1.019, no sugar nor albumen, very occasional rbc's, occasional wbc's.

Additional Note

By Intern: A physician in St. Paul gave patient 20 cc. of convalescent serum. The spinal tap showed a high cell count around 1000. She has been treated at home up to this date where she has been slowly developing paralysis of her extremities, especially the upper extremities. Procedure administered by Intern: 1. Bed. 2. Force fluids. 3. Sedatives. 4. Repeat serum. 5. Spinal tap. 6. Good position. 7. Put in respirator if necessary. Spinal tap - 106 cells, lymphocytes predominating in relation of 6 to 1 over Pmn's. Progress - 3:45 P.M. - incontinent. Very tired. Respires profusely. Difficulty in breathing. More marked when talking. Tossing body about and kicking when awake.

Speech Respiratory difficulty

11-12-31 - 12:45 A.M. - chloral hydrate r. x. Irrational at times when awake. 1 A.M. - incontinent. 5 A.M. - irritable and impatient. Semi-solid diet. Complains of difficulty in breathing. Respirations 22. Pulse 104. Respirations 36. Complains of pain. Extremely restless. 8 A.M. appetite good. Has difficulty in talking, apparently her laryngeal muscles have been affected slightly. She seems less restless and irritable today. Temperature 101. Pulse up to 100. Takes fluids well. Deglutition has not been affected. Is having involuntary respirations. This will be watched carefully for any possibility of sphincter involvement. 10 cc. convalescent serum given in left hip.

Respirator

11-13-31 - Respirations weak, rapid and shallow. Patient seems very toxic. Still has difficulty in talking and cannot swallow fluids. Placed in respirator and condition improved. Is resting. Color improved. There is paresis of right side

Temperature 102. Pulse 100. Patient looks very ill. 11 A.M. - Looks somewhat better since being placed in respirator. Color better. She says she does not feel so tired. Takes fluids fairly well. Seems quite drowsy. 3:45 P.M. - Note by fellow: Patient began to twitch and shake, eyeballs rolled back, could not be aroused. She began to regurgitate undigested food. She is very cyanotic although her respirations are not very labored. Temperature 107. Pulse 120, feeble. Given 1 ampule of metrazol, pyramidon gr. v., and tepid sponge.

Exitus

5:45 P.M. Note by Fellow: Subcutaneous started about 150 cc. given. Patient had involuntary urination, much mucous in mouth. Cardiac and respiratory stimulants given. There was a suggestion of pneumonia in right lower lung with decreased breath sounds and some impaired resonance on that side, although difficult to determine in respirator. Prognosis - nil. 6 P.M. - Seen by Chief of Staff at 4:30 P.M. Patient does not respond. Temperature 107-1/2 to 108 (F). Color is poor. Regurgitated material. Pulse rapid and feeble. Respirator changed to 15 rate, pressure to 20 mm., suction used to remove mucus and material from mouth. Cold (ice) applications to head, sponge to body. No fluids by mouth. Hypodermoclysis started of normal saline and 5% glucose, cardiozol, digalen, and adrenalin ordered for patient and given. Oxygen also administered. Patient expired at 6:05 P.M.

Autopsy

The body that of a well-developed and fairly well-nourished white female, measuring 126 cm. in length and weighing approximately 60 lbs. Rigor is not present. Hypostasis is slightly posterior. There is no edema nor jaundice. There is 2+ cyanosis of the finger-tips and lips. The pupils are round, regular, and equal, and measure 5 mm. right and left. No special marks.

The surface of Peritoneal Cavity is smooth, moist, and glistening. No increase in fluid. No enlargement of liver and spleen. Appendix free.

The surfaces of Pleural Cavities are smooth. No increase in fluid. Surface of Pericardial Sac is smooth. No increase

fluid.

The Heart weighs 125 grams. No petechial hemorrhages seen. Musculature is firm. No dilatation, hypertrophy, or congenital defect noted. The myocardium is dark brown in color. Endocardium is smooth. Root of the Aorta and coronaries are negative.

Congestion

The Right Lung weighs 125 grams, Left 115 grams. No petechial hemorrhages on surfaces. Pinkish-gray in color. A few areas, pinpoint in size, of pigmentation.

Lungs are air-containing throughout, crepitate easily, and on section show normal lung tissue throughout. Only very slight congestion at right base. There is no evidence of consolidation nor broncho-pneumonia.

The Spleen weighs 110 grams. The surface is smooth, cuts readily, and on section shows the pulp to be firm, the malpighian corpuscles and trabeculations are distinct.

Congestion

Liver weighs 900 gramd. The surface is smooth. Liver cuts readily and on section shows slight congestion. No petechial hemorrhages, areas of necrosis, or other pathology noted. Lobulations and central vessels are distinct.

The Gall-bladder is smooth and free. The wall is not thickened. The mucosa is smooth and contains dark greenish colored bile.

The Gastro-Intestinal Tract is normal throughout, except that there is considerable lymphoid hyperplasia of the mesenteric nodes.

The Pancreas and Adrenals (2 in number) are normal.

The Right Kidney weighs 110 grams, Left 120 grams. There are no petechial hemorrhages. Capsules strip easily. On section, the cortex and medulla are distinct. The glomeruli are distinct. The pelves are normal.

The Bladder and Genital Organs are normal.

Congestion

Head. The scalp and calvarium are essentially normal. Upon incising the dura, it is noted that the vessels over the cerebral hemispheres are somewhat injected and there is a moderate amount of congestion around the base. The brain is not incised but sent to Dr. McKinley's office for study.

Beccham: "Preparing report of a case of anuria"

Diagnoses:

1. Poliomyelitis.
2. Slight congestion of lungs, liver and brain.
3. Hyperplasia of the mesenteric lymph nodes.

IV. INTERNES

A few years ago the Stands at Minnesota responded as a man to the efforts of one Red Wing - St. Paul product (boy from small town who made good in the cities). A magnetic personality, a big smile, and a remarkable ability to relieve the tension when "psychological rests" were needed characterized his efforts. He will be remembered as one of the few who really won the crowd and made of them his friends.

Time passes - his name now appears on the rolls of those who graduate - his intern days are here and they will soon be over. Today he assumes a new role. The very fine study we have today is by none other than Pediatric Interne Floyd Ammann Thompson (one "Pi" Thompson). He was assisted by B. Figenshau Thorson, P. Woutat, and Miss Michelson. It is a fitting finale for one who has demonstrated real versatility and whose University Education has been truly "living life". Congratulations!

And while we are about it, an incomplete list of other interne projects follows. It looks mighty good - more and more like a real University Hospital. This gives us a real idea for next year!

Borland: "Review of acute and chronic empyema with study of end results."

Edwards: "End results of cholecystectomy and effect of operation on food intolerance"

Paine: "Continuous nasal suction in intestinal obstruction with studies of postoperative convalescence."

Hamilton: "Effect on thyroid of non-iodine halogens."

Fuller: "Gallbladder studies"

Woutat: "Studies in Muscular Dystrophy"

Nielson: "Teaching haematology and clinical microscopy and preparing paper on leukemia."