Tuberculous Meningitis

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C O U R T E S Y O F C I T I Z E N S A I D S O C I E T Y

I. ABSTRACT

TUBERCULOUS MENINGITIS

Carolyn Adams.

Incidence

Tuberculous meningitis is second in frequency only to meningococcus meningitis. At Babies Hospital in New York, excluding meningococcus meningitis, 70% of acute cases of meningitis were found to be tuberculous.

Blacklock of the Royal Hospital for Sick Children at Glasgow reports 2,400 consecutive autopsies among which were 396 cases of meningitis, 232 or 58.6% were tuberculous.

Also from Glasgow Department of Health, figures indicate that the death rate from tuberculous meningitis is falling in proportion to the fall in death rate from all tuberculosis.

The figures from the Minnesota State Department of Health for the period 1928-1934 show a total of 1,235 cases of all kinds of meningitis. Of these, 50% are meningococcic meningitis and 29% tuberculous meningitis.

At the University of Minnesota Hospitals, there have been 16 cases of tuberculous meningitis of which 13 were proven. This includes all age groups in the 7-year period since 1928.

Season

Holt and McIntosh in their textbook state that deaths from Tuberculous meningitis are more common in the winter and spring months. The peak in 400 deaths from this disease in New York City was in March, lowest in August.

Glasgow reports show the peak in May, lowest in October.

Of the 13 cases here, the greatest number were in July (6).

Age

Rare in the first 6 months, peak at the end of the first year.

Glasgow	90% under 15 years	
	65% under 5 years	
University of Minnesota Hospitals	69% under 15 years	- 9 cases
	46% under 5 years	- 6 "
	30% under 1 year	- 4 "

Youngest of our cases, 1 year; oldest, 33 years. Hilliard Holmes reported 29 cases in adults and found the average age to be 26 years.

Pathology

Rich and McCordoch state that tuberculous meningitis is "characterized by its exudative inflammatory nature and a tendency to widespread necrosis of the inflammatory exudate and of contiguous meningeal tissues."

Exudate most extensive over base of brain and may extend into fissure of Sylvius on both sides.

Owing to location of exudate and duration of disease, the foramina through which cerebral spinal fluid escapes may become blocked and dilation of cerebral ventricles may occur.

Formerly, it was believed that tuberculous meningitis was due to direct hematogenous dissemination. Recent work by Rich and McCordoch points to a primary location of tubercles in brain, meninges or contiguous bone which later became caseous and rupture into meningeal space, causing tuberculous meningitis. They report 82 cases, in 77% of which a focus was found in one of these 3 locations. McGregor, Kirkpatrick and Craig have recently published an article in which this view is substantiated. They report finding the focus in brain, meninges or bone in 25 out of 27 cases.

Symptoms and Signs

Onset usually gradual with irritability and drowsiness. Older children and adults may complain of headache but infants as a rule are only irritable and restless.

These symptoms usually last a few days

and are followed by stiffness of neck and occasionally of the extremities. Hyperesthesia may be present. Vomiting accompanied by constipation at this stage may lead to extreme dehydration.

Third stage usually is one of extreme drowsiness or coma. (Most of our patients come in this stage.) During this phase, there may be automatic twitchings, transient paralyses or actual convulsions. Eyes may not respond to light. Strabismus or nystagmus may be present. Ophthalmoscopic examination may show choked discs. Tubercles in choroid may be visible.

Death takes place usually in coma or continuous convulsions. Temperature throughout disease usually is not above 101° but there frequently is terminal rise. Respirations are irregular. Entire duration is not over 3 weeks.

Symptomatology in adults similar. In Holmes' series of 29 adults, symptoms were as follows:

Mental signs	24 cases
Eye signs	18 "
Pain or stiff neck	18 "
Headache	12 "
Vomiting	8 "
Backache	5 "
Constipation	4 "

Duration in his series averaged 14½ days.

Our 13 cases, including both children and adults, show:

Stiff neck	9 cases
Drowsiness or coma	8 "
Vomiting	7 "
Headache	6 "
Convulsions	6 "
Irritability	3 "
Constipation	1 "

Duration could not be estimated since onset in most cases is gradual and indefinite.

Laboratory

Blood: may show no abnormality. Terminally, white blood cells rise with a polynucleosis. In 1916, Morgan stated that in 169 cases (2 months to 4½ years of age) the average leucocyte count was 20,900 with 72.6% polymorphonuclears. Our 13 cases from 1 to 33 years show an average of 10,616 leucocytes with 69% polymorphonuclears. Approximately the same average was present in the group 1 to 5 years.

Spinal fluid: shows

1. Normal or elevated pressure.
2. Clear or ground glass appearance.
3. Web formation on standing in incubator.
4. 100 to 1,000 cells, predominately mononuclears.
5. Protein 100 to 1,000 mgms. per 100 cc.
6. Sugar 0 to 40 mgms. per 100 cc. Blood sugar usually increased so that spinal fluid sugar relatively very low (10 to 35%)
7. Chlorides 500 to 600.
8. Colloidal gold curve - meningitic type.
9. Bacteria- tubercle bacillus may be found in film.
10. Syndrome of xanthrochromic fluid which coagulates spontaneously (Froin syndrome) may be present due to block at base of brain.

Josephine Hemenway in 1911 reported 138 cases of tuberculous meningitis in which the bacilli were found in 135 cases. She points out that 40 to 60 cc. of fluid are needed. In Holmes' cases, out of 23 examined, 22 were found positive. Clark of Dundee Royal Infirmary demonstrated organisms in 50% of cases.

Our material:

Organism found in 2 out of 13 cases but guinea pig positive in 4 other cases.

Cells ranged from 5 to 600.
% mononuclears from 40 to 99
In 11 out of 13, protein was elevated.
Sugar 10 to 42.
Chlorides 385 to 782.

Diagnosis

Can usually be made from history plus laboratory findings but at times this may be difficult.

Syphilitic meningitis may be ruled out only by the Wassermann and chloride determination.

Epidemic encephalitis may simulate closely except that sugar is either normal or elevated and chlorides are normal.

Anterior poliomyelitis differentiated by muscle group paralysis, sugar and chlorides of spinal fluid.

Lymphocytic choriomeningitis is often diagnosed tuberculous meningitis when first seen, however, sugar and chlorides are repeatedly normal. Usually goes on to complete recovery. Blood of recovered patients protects mice against Armstrong's virus.

Diagnosis of tuberculous meningitis can be made absolutely only if:

a. Bacillus is found on smear of spinal fluid.
b. Guinea pig shows tuberculous lesions.
c. Postmortem examination.

Treatment

Usually considered as symptomatic only. Wallgren's recent article states that rigorous treatment of the primary complex will lessen incidence of meningitis. This has been disputed.

Prognosis

Said to be uniformly fatal. Cramer and Bichel found 45 cases in the literature which were proven to be tuberculous meningitis but which recovered. Kelly reports a case proven by guinea pig innoculation and finding of the organisms which was well 2½ years later but had residual spasticity and gross tremor of the upper arm.

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II. CASE REPORT

___ , 5 years of age, admitted 6-27-34 and expired 7-9-34 (12 days).

Onset

6-19-34 - Restless at night. Face flushed.

6-20-34 - Anorexia, headache, stiff neck.

6-21-34 - Vomited once.

6-22-34 - Vomited 3 times. Soreness of entire body.

6-23-34 - Vomited all feedings.

Drowsy

6-24-34 - Pain in abdomen. Drowsy.

Admitted

6-25-34 - Family history: Father had 2 attacks of pleurisy in past 6 months, also had cough; 2 sisters had died in last 2 months of "whooping cough" with pneumonia, one had a terminal meningitis.

Physical examination

Stiff neck; absent biceps and patellar reflexes, abdominals sluggish, positive Babinski on right, Kernig questionable. Irritable. Some muscle tenderness. Not extremely ill.

7-1-34 - Semicomatose. Pupils do not react. Tuberculin test 4+.

Decline

7-3-34 - Does not respond to ordinary stimuli.

7-6-34 - Comatose. Breathing irregular. Tache cerebrale. Temperature to 102°.

7-7-34 - Temperature to 103.4

7-9-34 - Terminal rise in temperature to 106°. Respirations irregular. Expired.

X-ray examination of chest on admission - probable primary tuberculous focus of right lung - active stage. Mother's chest at time of child's admission - pulmonary tuberculosis, moderately advanced nodular type, bilateral.

Laboratory

Urine - negative.

Blood - hemoglobin 81%, white blood cells 6,050, polymorphonuclears 77%, lymphocytes 21%, eosinophils 5% (on admission).

7-5-34 - white blood cells 16,500, polymorphonuclears 78%, lymphocytes 20%, eosinophils 2%.

Wassermann - negative.

Spinal fluid: cells 310 on admission; other examinations, 40 and 150, 50 to 100% mononuclears.

Nonne negative. Pandy positive.

Wassermann negative.

Sugar 12 to 27 mgms. per 100cc.

Chlorides 640 on admission, 351 on 6-30-34.

No tubercle bacilli found in web.

Guinea pig showed tuberculous lesions.

Autopsy

Body is poorly nourished, well developed, white male, 5 years of age, measuring 34 inches in length and weighing about 40 lbs. Rigor and hypostasis are present. No edema, cyanosis or jaundice. Pupils are equal, each measuring about 4 mm. in diameter. Diaphragm on right is at 5th rib, 4th interspace on left. No special marks.

Peritoneal Cavity, Pleural Cavities and Pericardial Sac show no adhesions or excess fluid. Appendix is free and lies over brim or pelvis.

Heart weighs 80 grams. Musculature is

firm. No valvular defects or congenital anomalies. Root of aorta is smooth and shows no atheromatous plaques.

Right Lung weighs 170 grams, Left 120. Right lung presents an area in the upper lobe near the hilus which is firm and cuts with increased resistance. On cut section, it appears fibrotic. No caseous material is found in this area. Left lung shows no nodules and there are no signs of consolidation or atelectasis.

Spleen weighs 25 grams and shows normal trabeculations. Pulp is soft. There are a few miliary tubercles in the substance of the spleen on cut section.

Liver weighs 560 grams. Lobules appear normal. Cut section shows scattered miliary tubercles in the substance.

Gall-Bladder contains about 5 cc. of thick bile. Smooth mucosa. Bile ducts show no congenital anomalies and are patent.

Gastro-Intestinal Tract: No ulcerations, polypi or diverticuli. Normal mucosa.

Pancreas weighs about 10 grams, contains no cysts or nodules.

Adrenals weigh about 5 grams together and no tubercles are found. No softening present.

Right Kidney weighs 50 grams, Left 55. Capsules strip easily. Smooth surfaces. Cortices and medullae appear normal. No tubercles found.

Bladder contains about 3 or 4 oz. of urine. Normal mucosa. No diverticuli present. No signs of cystitis.

Genital Organs and Organs of Neck - not examined.

Aorta is smooth and shows no atheromatous plaques.

Lymph Nodes of mesentery and mediastinum show moderate hyperplasia. Cut section shows no tubercles in these nodes.

Head: Scalp and calvarium show no abnormalities. On removing brain, around base, there is noted a small amount of purulent exudate. Many miliary tubercles are studded over the meninges at the base and over the cortex along the fissures of Rolondo. On sectioning the brain, in the sulci of the left hemisphere in the region of the fissure of Rolondo, a small caseous tubercle, measuring about 5 or 6 mm. in diameter, is present which appears to have ruptured through the meninges. No other such caseous tubercles are noted on further sectioning of the brain. Ventricles appear to be of normal size. No obstruction of aqueduct of Sylvius.

Diagnosis

1. Tuberculosis of right lung, primary.
2. Tuberculous meningitis.
3. Tuberculous otitis media, left.
4. Miliary tuberculosis of spleen and liver.

III. MOVIE

Title: Contact

Released by: Hennepin County Tuberculosis Asso.

IV. LAST WEEK

Date: November 7, 1935

Place: Recreation Room, Nurses' Hall

Time: 12:15 - 1:10

Program: Research Theories
Cardiospasm

Present: 105

Discussion: Clarence Dennis
L. G. Rigler
N. L. Leven
Lawrence Boeis
R. Koucky

Gertrude Gunn,
Librarian

V. Gossip

Movie goers saw the sequel to our cariospasm meeting in a current newsreel in a downtown theater. A rather self-satisfied individual drinks an enormous quantity of water, tops it off with a jug of kerosine. A small pile of rubbish is lighted, and he makes his contribution by regurgitating a steady stream of kerosine into the fire followed by a deluge of water which promply puts out the fire... Carolyn Gaston Adams, our contributer today, was born in Tacoma, Washington. She followed her newspaper family to Spokane, Fargo, St. Paul, Minneapolis, and Brooklyn. A graduate of Barnard College, she took Medicine at Columbia, her internship at Minnesota. When she arrived with her intern husband, the Adams' family were the first newly wed internes at Minnesota Both are interested in Pediatrics and they are continuing their training at this hospital and Abbott respectively. Dr. Adams with her poise, charm, graciousness of manner, and fine spirit of medical comradeship is a splendid example of the ideal type of woman physician. We predict that the Adams will go far-together...Proud Papa Wallace Parks Ritchie, took a gracefull bow last week when the birth of the fourth generation of medical Ritchies was announced. The way he sprang to his feet was remindful of the way he used to get up in response to the plaudits of the crowd when he was known as "Paralyzing puncher Ritchie" and not "Proud Papa". A graduate of St. Paul's Academy, Yale, and Johns Hopkins, he is still remembered in the East for his boxing ability and as an official in Eastern tournaments. While his interest in the sport has somewhat waned, he had a class of Summit socialites last year...One of ourmembers remarked that he thought the time was ripe for one, Leo George Rigler, our radiologic strategist, to again tell the rest of us how to use his Department. Our friend remarked that when he hears Dr. Rigler and his associates explain how they are able to anticipate disease changes in given cases, well he becomes rather ashamed of the fact that he is the one who tells the Department what he wants done...The movie shown today was developed by the Hennepin County Tuberculosis Association and the University of Minnesota through its Department of Visual Education and Music.

The National Tuberculosis Association, the largest and most powerful of the nonofficial health agencies, has no connection with the American Red Cross as so many people imagine. Its organization is national with state and county units. Any phase of anti-tuberculosis work is a matter of concern and interest to its governing body. Of all of its state units none is better organized or more efficient than the Minnesota Public Health Association. The Hennepin County unit, one of the ace groups in Minnesota and the United States, also has unique record of accomplishment. It has never gone before the public to request an endorsement of any particular project. Its affairs have been governed by a group of men and women who have changed their objective from time to time, always keeping abreast of worth while progress in the field. In the final analysis it represents a community effort in which men and women in the ordinary walks of life have delegated to the Board of Directors their sanction and their pennies for this work. There are so many firsts in the achievement list that it would grow long and tiresome. To mention a few: This movie today, free weekly tuberculin service to all practicing physicians, boarding homes and reeducation of ex-sanatation patients., a staff of educators, including expert scenario writers and others too numerous to mention. When you are asked to accept your seals, remember that no high pressure is ever used to make you respond. Truly this is a unique accomplishment...Everyone wonders what Coach Bernie Bierman does between halves. As a teacher he simply calls his boys to order and gives them a chalk talk according to those who know.) A fact that they are able to respond brands both Professor Bierman and his students as an outstanding group...Fred Carter, Superintendent of Ancker Hospital, St. Paul, leaves at the end of this month to take over the Superintendency of Christ Hospital, Cincinnatti, after fifteen years in the Twin Cities. Ancker Hospital has had only a few Superintendents. Dr. Ancker started, according to popular legend, with a horse, wagon, a bed, a patient and a Superintendent of Nurses. Fred Carter is one of the real hospital administrators of this country. He has never lost interest

in the medical side of his training, always ran a good hospital, demonstrated his honesty and ability to judge human nature by publishing a signed statement in St. Paul newspapers on the same day an anesthetic death occured. He made more friends than most men in a position like this because he was always just Fred Carter...

Every year we devote one meeting to some phase of the tuberculosis problem. This is it today. Minnesota is one of the most tuberculosis minded states in the Union. Do you know that the present world wide interest in tuberculin testing started with a small survey at Worthington, Minn., by Dr. Slaper.