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

Congenital Atresia of Esophagus

Volume XVI | Friday, January 12, 1945 | Number 11

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

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INDEX

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William A. O'Brien, M.D.

I.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
CALENDAR OF EVENTS
January 15 - 20 , 1945

No. 54 Visitors Welcome

Monday, January 15, 1945

9:00 - 10:00 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.

9:00 - 11:00 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; Interns Quarters, U. H.

12:30 - 1:30 Pathology Seminar; Aberrant Thyroid and Tumors; A. N. Ries; 104 I.A.

Tuesday, January 16

9:00 - 10:00 Roentgenology Pediatrics Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.

11:00 - 12:00 Urology Conference; C. D. Creevy and Staff; Main 515, U. H.

12:30 - 1:30 Pathology Conference; Autopsies; Pathology Staff; 104 I. A.

12:30 - 1:30 Physiology-Pharmacology Seminar; Hypothalamic-Cortical Relationship; Peter Murphy, 214 M. H.

4:00 - 5:00 Physiological Pathology of Surgical Diseases; Physiology and Surgery Staffs; Todd Amphitheater, U. H.

4:30 - 5:30 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; Station 54, U. H.

4:00 - 5:00 Pediatrics Grand Rounds; I. McQuarrie and Staff; W-205 U. H.

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

5:00 - 6:00 Roentgen Diagnosis Conference; A. T. Stenstrom, L. P. Anderson, 515 U.H.

8:00 - Minnesota Pathological Society; The Rickettsial Diseases; Henry Pinkerton; 15 MeS.

Wednesday, January 17

9:00 - 11:00 Neuropsychiatry Seminar; J. C. McKinley and Staff; Station 60, Lounge, U. H.

11:00 - 12:00 Pathology-Medicine-Surgery Conference; Chronic Cor Pulmonale; E. T. Bell, C. J. Watson, O. H. Wangensteen and Staff; Todd Amphitheater, U.H.

12:30 - 1:30 Pediatrics Seminar; The Value of Psychological Methods in Pediatrics; Dr. Wolf; W-205 U. H.

12:30 - 1:30 Physiological Chemistry Literature Review; Staff; 116 M. H.

4:30 - 5:30 Neurophysiology Seminar; Pain and Activity of the Motor Cortex; Josef Brozek, 214 M. H.

9:00 - 10:00 Medicine Case Presentation; C. J. Watson and Staff; Todd Amphitheater, U. H.

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

4:30 - 5:30 Roentgenology Seminar; Reviews of Recent Radiological Literature; Staff; M-515 U. H.

4:30 - 5:30 Bacteriology Seminar; Relation of Diet to Antibody Formation; F. Adams, 214 M. H.

8:00 - E. P. Lyon lecture; The Amino Acid Requirements of Man; W. C. Rose; 15 MeS.

Friday, January 19

9:00 - 10:00 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U.H.

10:00 - 12:00 Medicine Ward Rounds; C. J. Watson and Staff; E-214 U. H.

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

11:45 - 1:15 University of Minnesota Hospitals General Staff Meetings; Restriction of Activity in Coronary Thrombosis; G. N. Aagaard; Powell Hall Recreation Room

1:30 - 2:30 Medicine Case Presentation; C. J. Watson and Staff; Eustis Amphitheater, U. H.

1:00 - 2:30 Dermatology and Syphilology; Presentation of selected cases of the week; Henry E. Michelson and Staff; W-306 U. H.

1:30 - 3:00 Roentgenology-Neurosurgery Conference; H. O. Peterson, W. T. Peyton and Staff; Todd Amphitheater, U. H.

Saturday, January 20

8:00 - 9:00 Surgery Journal Club; O. H. Wangensteen and Staff, M-515 U. H.

9:00 - 10:00 Pediatrics Grand Rounds; I. McQuarrie and Staff, W-205 U. H.

9:15 - 10:30 Surgery-Roentgenology Conference; O. H. Wangensteen, L. G. Rigler and Staff, Todd Amphitheater, U. H.

9:00 - 10:00 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.

11:30 - 12:30 Anatomy Seminar; The Theory of the Synapse; B. Campbell; 226 I. A.

II. CONGENITAL ATRESIA AND CONGENITAL TRACHEOESOPHAGEAL FISTULA

N. Logan Leven
Bernard Lannin

Thomas Gibson in 1696 observed a case of congenital atresia of the esophagus with a tracheo-esophageal fistula, noting the typical feeding difficulties and accurately describing the postmortem findings. Mackenzie, Griffith and Lavenson, Cautley, Plass, Phelps and Rosenthal have carefully reviewed the literature and collected all recorded cases of congenital anomalies of the esophagus. In 1931 Rosenthal collected 255 cases of congenital atresia of the esophagus. In 1933 O'Hare reported 281 cases and in 1941 Ashley collected 314 cases. Ladd in 1944 added 72 cases, bringing the total to nearly 400 cases.

In the literature are various classifications of congenital anomalies of the esophagus. Six such anomalies have been described.

1. Simple atresia of the esophagus.
2. Obstruction of esophagus due to a membrane.
3. Upper segment of esophagus ends in a fistulous tract entering the trachea just above its bifurcation and the lower segment begins again as a blind pouch.
4. Tracheo-esophageal fistula with no atresia of the esophagus.
5. Both upper and lower segments of esophagus end in fistulous tracts entering the trachea.
6. Congenital atresia of the esophagus with tracheoesophageal fistula, the usual anomaly found in the esophagus.

In this most common type of atresia of the esophagus the upper segment terminates blindly just above the bifurcation of the trachea, while the lower segment has a fistulous communication with the trachea usually about 0.5 to 1.0 cm. above the bifurcation or more rarely with the bronchus. The upper culdesac is usually hypertrophied and dilated and has an average length of 3 to 4 cm. The lower segment of the esophagus at the cardiac end is usually of normal size but often diminishes in caliber toward its tracheal opening.

The symptomatology associated with this anomaly is so characteristic that it should be readily recognized. At birth the child appears to be well nourished and usually well developed but has difficulty with large amounts of frothy mucus filling mouth and pharynx, and drooling from the side of the mouth. When fed, the child eagerly takes the breast and after a few swallows stops, ceases to breathe, becomes cyanotic, and regurgitates frothy mucus and feeding through the nose and the mouth. The child appears as if it would drown, but after a period of lifeless relaxation usually recovers and repeats this episode with each subsequent feeding. These infants rapidly lose weight due to starvation and dehydration and often develop an aspiration pneumonia. The diagnosis of atresia of the esophagus is readily made on the typical history, obstruction to the passage of a catheter at 10 to 12 cm. from the alveolar margins, and roentgenologic visualization of the blind pouch with instillation of lipiodol or by esophagoscopic examination. The presence of air in the stomach in cases of atresia of the esophagus indicates a fistulous communication with the lungs whereas, the absence of air in the stomach would indicate a simple atresia of the esophagus without a tracheoesophageal fistula.

A series of 21 cases of congenital atresia and congenital tracheoesophageal fistula has been collected from the records of the University Hospitals and the Department of Pathology of the University of Minnesota for the 22 year period 1916 to 1938 inclusive. Twenty additional cases have been seen at the University Hospitals from 1939 to 1944 inclusive.

Three types of anomalies of the esophagus were found in this series:

1. Simple atresia of the esophagus (3 cases),
2. Tracheoesophageal fistula with no esophageal atresia (2 cases),
3. the common type of atresia of the esophagus with associated tracheoesophageal (36 cases).

The problems of treatment presented by each of these groups differ and will be discussed separately.

1. Simple atresia of the esophagus.

The obstruction in these cases may vary from a membranous diaphragm across the lumen of the esophagus to a partial or nearly total absence of the esophagus. In the former case, merely rupturing the membrane with the tip of an esophagoscope has been sufficient to effect a cure. In the latter case the problem is two-fold: 1. feeding; 2. care of the blind pouch of the upper eophageal segment. Gastrostomy should be sufficient for the purpose of feeding and should be done as soon as possible. The distance between the blind ends of the upper and lower segments of the esophagus is often too great to consider anastomosis of these segments. Exteriorization of the upper blind pouch of the esophagus, to form a cervical esophagostomy, should be done as a second stage procedure. An antethoracic esophagoplasty will later be necessary to establish continuity of the gastrointestinal tract.

In the three cases of simple atresia of the esophagus in this series the upper segment of esophagus ended as a blind pouch at the level of the second thoracic vertebra and the blind end of the lower segment extended 2 cm. upwards from the cardia of the stomach. There was no connection between the two segments.

The first case was admitted at six days of age and died three days later. The autopsy showed a thrombophlebitis of the umbilical vein, b. coli peritonitis, meningitis and endocarditis as well as congenital atresia of the esophagus.

The second case, died of peritonitis 3 days after gastrostomy, at the age of 7 days. An x-ray was taken on the operating table with a radio-opaque ureteral catheter passed beyond the pylorus at operation prior to inserting the gastrostomy tube. Apparently the ureteral catheter perforated the jejunal wall and this tragedy was not suspected at the time of operation.

The third case is alive and well at 9 months of age. A gastrostomy was made at 3 days of age and the upper segment of the esophagus was exteriorized as a cervical esophagostomy at 25 days of age.

Simple atresia of the esophagus is very rare but should be the most satisfactory to treat since there is no associated tracheoesophageal fistula.

2. Tracheoesophageal fistula with no esophageal atresia.

This rare type of tracheoesophageal fistula presents the usual symptom associated with any fistula between the esophagus and trachea, namely, coughing and choking after swallowing liquids. Since the fistulous tract may be small and the symptoms inconstant, the diagnosis may be difficult to make before autopsy.

If the diagnosis of tracheoesophageal fistula can be established, feeding by gavage may suffice to minimize the danger of aspiration into the air passages. Surgical correction of such a fistula could then be accomplished by exposure and ligation of the fistulous communication through a posterior extrapleural approach.

The two cases of tracheoesophageal fistula in this series presented different pictures.

In the first case, the esophagus was kinked on itself near the point of fistula so that an upper segment simulated the blind pouch seen in the common type of congenital atresia of the esophagus with tracheoesophageal fistula. However the lumen of the esophagus was patent throughout the entire length but greatly reduced in size at the point of fistula just above the bifurcation of the trachea. In this case a gastrostomy had been done because of a diagnosis of atresia of the esophagus. The baby died at 55 days of age.

In the second case the clinical diagnosis of tracheoesophageal fistula was suggested but not verified. For the first

4 months of life this patient had characteristic episodes of choking after swallowing. His condition improved but at 27 months of age he died after an attack of vomiting followed by severe respiratory difficulty. At autopsy the fistula appeared as a horizontal fissure which was closed in its natural state by folds of mucosa but which permitted passage of a 2 mm probe. From both the tracheal and esophageal aspects fistula appeared only as a dimple. Acute and chronic aspiration pneumonia was present. The survival to 27 months of age in this case was undoubtedly due to the small size of the fistula.

3. Congenital atresia of the esophagus with tracheoesophageal fistula.

This type of atresia of the esophagus is the most common, occurring in 80 to 90% of cases. The problem in these cases is three-fold: (1) feeding, (2) management of the fistulous communication of the lower segment of the esophagus with the trachea; and (3) care of the blind pouch of the upper esophageal segment. The various operations which have been suggested and attempted will be discussed briefly.

Gastrostomy has been the most frequent procedure used in these cases for the purpose of feeding. This alone has been insufficient because it does not answer the most important problem of regurgitation of stomach contents through the fistula into the trachea. To lessen this danger, passage of the gastrostomy catheter beyond the pylorus and well down into the jejunum has been suggested. In one case in this series in which this was the only treatment used, the patient survived 54 days. Jejunostomy has, likewise, been ineffectual in these cases.

Ligation of the esophagus at the cardia plus gastrostomy leaves a blind pouch of esophagus in which secretions will collect and empty into the trachea.

Transection of the upper end of the stomach, abdominal esophagostomy and distal gastrostomy have been unsuccessful. Exteriorization of the cardiac end of the esophagus and stomach plus gastrostomy has resulted in ulceration of the exteriorized segment. In both of these procedures considerable difficulty presents in the management of the wound due to drainage of secretions from the gastric end of the esophageal stump.

Several methods of direct attack on the fistula have been attempted.

Endotracheal stenosis of the fistula by chemicals has been suggested. In one case of this series which is alive and well, the fistulous communication of the esophagus to the trachea was identified through a bronchoscope and was coagulated by an electrode passed into the fistula. This did not result in an effective stenosis.

Lannan and associates ligated and divided the fistulous communication to the trachea through a right sided extrapleural approach, bringing out the distal esophagus as a dorsal esophagostomy and placing a catheter in this for feeding. In some cases proximal esophagostomy was added primarily or secondarily to prevent the overflow of secretion from the blind proximal end of the esophagus. This group of cases demonstrated that dorsal esophagostomy is not a desirable procedure since the blood supply of the mobilized distal segment of esophagus is definitely impaired. Simple ligation of the fistula at the trachea and gastrostomy should prove to be safer.

Early exteriorization of the blind pouch of the upper esophageal segment to prevent aspiration of secretions is of primary importance to prevent aspiration of saliva from the blind pouch of the upper segment.

The major disadvantage of ligation of the fistula at the trachea and cervical esophagostomy is the necessity of some form of permanent exterior esophagus.

The operation of direct anastomosis of upper blind pouch to lower segment of esophagus after division and ligation of the fistula to the trachea would be the ideal solution to the threefold problem presented by these cases. It closes the tracheo-esophageal fistula, takes care

of salivary secretions, provides for feeding and restores the esophagus more nearly to normal than any other plan of operation.

The discrepancy in size of the two esophageal segment and the distance between the segments make this operation often difficult if not impossible.

Since 1939 Ladd and his associates have operated on 34 patients. Of these patients 6 have had primary anastomosis of the esophagus and 2 are living. Twenty-eight patients had the 3 stage operation of obliteration of the esophageal fistula, gastrostomy and cervical esophagostomy; 9 of these are living.

Since 1939 Haight has operated on 24 of 28 patients seen at the University Hospital at Ann Arbor. A primary anastomosis of the esophageal segments was done in 16 of the 24 cases. Six of these patients were living, the oldest being the first successful case of primary end to end anastomosis recorded in this type of anomaly.

Humphrey has 3 patients living after the multiple stage operation and one patient alive after primary anastomosis of the esophageal segments.

Daniel of Vanderbilt also has one living patient after anastomosis of the esophagus.

Our cases of anomalies of the esophagus are divided into two groups. In the first group are 21 cases collected from the records of the University Hospitals and the Department of Pathology of the University of Minnesota from 1916 to 1938 inclusive. In the second group are 20 cases which have been seen at the University Hospitals from 1939 to 1944 inclusive.

Group I cases

Table I

Type of anomaly	Number of Cases
Simple atresia	1
Tracheoesophageal fistula with no esophageal atresia	2
of the esophagus with tracheoesophageal fistula	18
Total cases	21

Table II

Cases of Atresia of esophagus with tracheoesophageal fistula

Number		Average survival period
No operation	8	6.8 days
Operation	10	25 days

Table III

Types of operations	Number	Average survival period
Simple gastrostomy	5	6 days
Exteriorization or division of cardiac end of stomach		44 days (maximum 98 days)

Study of these cases demonstrates: 1) that simple gastrostomy is of no value alone, 2) A type of treatment which takes care of the tracheoesophageal fistula has been shown to prolong the life of these cases, 3) the method used to take care of the tracheoesophageal fistula in 5 cases was unsatisfactory.

In 1939, a more direct attack on the fistula was planned, and carried out successfully. This patient was the first with congenital atresia and tracheoesophageal fistula that has survived.

It is of extreme interest that Ladd came to the same conclusions about

methods of attacking this problem and adopted principles identical with ours. While our case is the oldest living patient, his oldest living patient is but a day younger than ours. It was 2 years after our operation that I learned of Ladd's case.

The procedure used in the first successful case will be briefly outlined. After a preliminary gastrostomy, an extrapleural ligation of the communication of the lower segment to the trachea is carried out. The proximal blind pouch of esophagus is exteriorized to make a cervical esophagostomy. This plan necessitates construction of an antethoracic esophagus to re-establish the continuity of the gastro-intestinal tract. Ladd has successfully carried this out in 2 cases.

Group II Cases

Year	1939	1940	1941	1942	1943	1944	Total
Number of patients	2	1	3	3	6	5	20
No. operations performed	1					1	2
Gastrostomy		1a	3			1a	5
Ligation of fistula	1			3	6		10
End to end anastomosis						3	3
Living	1				3d	1a	5
Dead	1	1a	3b	3c	3e	4f	15

a. Cases of simple atresia without fistula into trachea.
b. One case showed cerebral sclerosis and was a Mongol
c. One case lived 27 months. Death was due to perforation of stomach wall by gastrostomy tube. One case had congenital atresia of the duodenum also.
d. Two cases re-established continuity of fistulous tract and fistula was religated.
e. In one case the exteriorized upper segment was not opened immediately and death was due to aspiration. Death in another case was due to perforation of stomach by the gastrostomy tube which had been drawn back out of the duodenum into the stomach.
f. The 3 cases of primary anastomosis of the esophagus lived, 7, 37 and 88 days. The first case developed a generalized edema on the third postoperative day and died. The second case developed an external esophageal fistula. A gastrostomy was made but hypoproteinemia developed with edema and death occurred at 37 days. The third case had an imperforate anus with a rectovaginal fistula. Swallowing of lipiodal demonstrated no fistula but at autopsy re-establishment of the tracheo-esophageal fistula was demonstrated.

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In two cases in this second group no operation was performed. One patient died the day after admission and the other patient died 3 minutes after reaching the hospital. In both cases extensive bronchopneumonia was present.

Comment:

Bronchopneumonia has been the most common cause of death in these cases.

A second cause of death is edema due

to overhydration. Parenteral fluids must be limited to less than the amount that could be taken by a normal baby. A definite danger of development of pulmonary edema exists if much saline is given. Such edema developed in two cases following plasma infusions.

The sequence of operations is important. Because of a successful result in early cases in this series where early ligation of the fistulous tract and exteriorization of the upper blind pouch were considered elective procedures, this plan was adopted after losing several cases in which only gastrostomy had been done. I learned that early treatment of the fistula was emergent and occasionally early treatment of the upper blind pouch may be of primary importance. This pouch when exteriorized should be opened at once.

Re-establishment of the tracheoesophageal fistula occurred in 2 cases, 4 weeks after the operation of extrapleural ligation of the fistulous tract, when ligatures eroded through into the lumen of the esophagus. In both cases the operation was again performed dividing the esophagus. This should be done at the initial operation.

Primary anastomosis of the esophageal segments is the ideal operation, but cannot be done in all cases. The risk of this operation is greater than that of the multiple stage operation.

Summary

A series of 41 cases of congenital atresia and congenital tracheoesophageal fistula is reported.

The problems presented by these cases are reviewed and the various operations which have been attempted are discussed.

Five living cases are reported in this series.

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1. Haight, Cameron, and Tousley, H. A. Congenital Atresia of the Esophagus with Tracheoesophageal Fistula: Extrapleural Ligation of Fistula and End-to-End Anastomosis of Esophageal Segments. Surg.,Gynec.,Obst.,76,672-688, '43.

2. Haight, Cameron: Congenital Atresia of the Esophagus with Tracheoesophageal Fistula; Reconstruction of Esophageal Continuity by Primary Anastomosis. Am.Surg.,120, 623-655, '44.

3. Ladd, William E. The Surgical Treatment of Esophageal Atresia and Tracheoesophageal Fistulas. New Eng. J.Med.,230, 625-637, '44.

4. Leven, N. L. Congenital Atresia of the Esophagus with Tracheoesophageal Fistula. J. Thoracic Surg., 6, 30-39, '36.

5. Leven, N. L. Congenital Atresia of the Esophagus with Tracheoesophageal Fistula; Report of Successful Extrapleural Ligation of Fistulous Communication and Cervical Esophagostomy. J.Thoracic Surg.,10, 648-657, '41.

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III. GOSSIP

The following letter was received from Lt. Colonel John Paine:

"Christmas has come and gone. Sixteen parcels from the University have reached us to my knowledge. The flags were in one and have received the admiration of everyone. We certainly feel dressed up. Army regulations forbid our keeping the University banner in the foyer of the hospital where I was in hopes both it and the flag might be displayed permanently, so we will have to put them some other place. Both are being kept in the officers-nurses club. Please give to all concerned my own personal thanks and for the unit as a whole. Everyone has said "France and Germany O.K. as long as they didn't send C-B-I". We will take them with us however wherever it is and try and bring them safely back. They are truly beautiful. Articles in the other boxes are being used in various ways. Some of the food I think is going to be on the table this afternoon at Miss Flynn's wedding reception. She married a Captain Lolly, ex-para-trooper, now in the Transport Command of the Air Forces. He is a nice boy and she was a beautiful bride. The wedding was at our chapel at 10:00 in the morning.

The patients spent a week or more lavishly decorating the hospital with radar chaff, red flannel bandages, and colored paper so we were quite festive. The Red Cross got over 100 fir trees for us so this year for a change we can say we really had a Christmas. It never quite comes up to expectations when you are away from home, but everyone did their best. Most of the wards had parties of one kind or another, and there was a dance for our own personnel Saturday night and a delicious dinner at noon on Christmas Day.

All the Air Corps generals were here for 2 hours. Christmas morning visiting the patients and then getting big hearted have presented the nurses and officers here a week's tour of Egypt and Palestine for seven people each month in a B-17. I am going on the first trip about the middle of January with our new Colonel. Darned right I'm thrilled. All of us are well and the weather is perfect. Goldner, Kremen and Haserick are up at the front as a surgical team but Haserick slipped into town over Christmas and reported all going well and everyone fairly comfortable.

Carl Sandt will be home next on a 30-day leave. French and Plankers and Hay have been permanently transferred to that evacuation Hospital they have been working at since October 15. I have no idea when I'll be home, in fact I have no idea when the war will be over, have you?

Sincerely,

John"

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Leonard S. Arling, M.D., announces the opening of The Northwest Industrial Clinic, 3101 University Avenue Southeast, Minneapolis 14, Minnesota. Practice limited to Surgery and Diagnostic Services of Industries.

Listen to Wesley W. Spink tonight at 10:30 on WTCN. Will be interviewed by Milton Cross on Penicillin.

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