

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

Vitallium in Surgery

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

Volume XI

Friday, February 23, 1940

Number 18

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Published for the General Staff Meeting each week
during the school year, October to May, inclusive.

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William A. O'Brien, M.D.

I. LAST WEEK

Date: February 16, 1940

Place: Recreation Room
Powell Hall

Time: 12:15 to 1:15 P.M.

Program: Movie: "Inside Nazi Germany" - - -

The Use of Fluids in Pediatrics
John A. Anderson
Mildred R. ZieglerGertrude Gunn
Record Librarian
- - - - -Discussion
Arild E. Hansen

Present: 152

Corrections: "Use of Fluids in Pediatrics"
Staff Bull. Vol. XI, No. 17,
P. 241.Rate of injectionSubcutaneously: 60-80 cc. per kilo per
24 hours can usually be
given without distending
the skin markedly.Intravenously: Altschule, Rourke, and
Gilligan have shown that
in normal adults 5% glucose and 0.9%
saline can be given at a rate of 15 cc.
per minute without significantly affect-
ing the blood pressure, velocity of blood
flow, or blood volume. At a rate of
20-25 cc. per minute there was an in-
crease in cardiac output, velocity of
blood flow and blood volume. These
changes occurred after 500 to 1500 cc.
had been given, but would invariably re-
turn to normal after 15 minutes. With
larger than 25 cc. per minute the increase
in velocity of blood flow was less than
expected from cardiac output. There was
thought to be an increase in the pulmon-
ary blood volume.The rate for the intravenous admini-
stration of such fluids to infants and
children should certainly not exceed
the following:Normal 5 - 10 cc. per minute
Dehydrated 10 - 15 cc. per minute
Debilitated -
toxic or
febrile 5 cc. per minute or
less
Incipient shock 10 - 20 cc. per minute
After hydration 3 - 6 cc. per kgm
per hourII. MOVIETitle: "How to Sub-Let"Released by: A Robert Benchley
Short
- - - - -III. ANNOUNCEMENTS1. CENTER FOR CONTINUATION STUDYMedical Social Service - February 29-
March 1, 2, 1940.

Guest Faculty

Edith M. Baker - Principal Consultant
in Medical Social Work, United States
Department of Labor, Children's
Bureau, Washington, D. C.Grace Beals Ferguson, Professor,
Division of Social Administration,
University of Iowa.Ruth E. Lewis, Assistant Professor of
Medical Social Work,George Warren Brown, Department of
Social Work, Washington University,
Chairman, Education Committee, American
Association of Medical Social Workers,
St. Louis.
- - - - -

2. SIGMA XI LECTUREX-rays of the Diagnosis and Treatment of Disease,

Friday, February 23. Leo G. Rigler,
Professor and Head of Radiology.

Music 7:45

Lecture 8:15

- - - - -

3. ALPHA OMEGA ALPHA LECTURE

Dr. Richard E. Scammon will speak on
the "Plague in London" - Room 210,
Minnesota Union, Tuesday, February 27
at 8:15 p.m.

- - - - -

4. WANTED

Physicians for Panama Canal
Zone. There is need for additional
medical service in connection with the
construction of the new locks. The job
will last at least four years. Duties
will be to care for health of employees
and to give aid in case of accident.
Candidate must pass civil service exam-
ination. Initial pay is \$4,000 a year.
Maintenance may be secured in government
houses for \$15 - \$30 a month. Mess or
commissary privileges are available for
meals.

There are several well-equipped staff
hospitals in the canal zone where pa-
tients are referred for care, if neces-
sary. Further information may be ob-
tained by writing to Chief Health Officer,
Balboa Heights, Canal Zone.

There are several Minnesota graduates
in the service. The Canal Zone is
10 miles wide and 50 miles long; it is
a piece of land leased from Panama. Some
of the larger cities of Panama are partly
in the Canal Zone.

Although both the army and navy are
represented, the operation of the zone
is separate. The average temperature
is 85°. The towns are well-built and in
every respect are above average in
health. Negroes live in separate towns.
Tropical fruits are available through-
out the year. In the hills one finds
lakes and streams teeming with trout.
The rainy season is short. The roads
are good and although a car is not
needed, it is very handy when the rains
come. A trip to New York on an official
boat is \$30. All the comforts of home
can be obtained including short wave
radio reception from the United States.

The above information is supplied by
Gilbert M. Stevenson, Minnesota '28,
Dispensary, Gamboa Canal Zone District,
Panama Canal.

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5. MARRIED

Merlin Martin, night oper-
ator, and Harold Hanson, February 3.

Congratulations!

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IV. THE USE OF VITALLIUM
IN BONE AND JOINT SURGERY

W. H. Cole
H. B. Hall

In 1775, Icart used iron wire to approximate the ends of a fracture. It was not until 1829 that any experimental work was done to test the reaction of tissues to metals. Levert implanted gold, silver, lead, and platinum into dogs and found that platinum was the least irritating. With the advent of antiseptic surgery by Lister, the open reduction of fractures received a great stimulus. Soon surgeons were using screws, rivets, and wire for the internal fixation of fractures. In 1905, Lane introduced the metal plate and screws, after first using screws alone in 1892 for internal fixation of fractures. He vigorously championed the use of metal plates and screws, with the result that many surgeons fell into line with Lane. However, as with any new spectacular, and yet at times worthwhile procedure, it was attempted by some who were not qualified. Also, many

cases were plated which were not suitable candidates for internal fixation. Soon reports were published of failures and even tragedies which, of course, immediately brought considerable opposition to the use of metals for internal fixation of even suitable cases. Scattered reports of the use of metals for fixation of fractures appeared in the literature for the next decade. In 1924, Zierold published a detailed report on the reaction of bone of experimental animals to various metals. His paper did much to stimulate new interest and revive experimental work. Zierold found that stellite, an alloy of cobalt, chromium, and tungsten, was the least irritating to bone, and also showed the least change as far as the metal itself is concerned. Soon, several stainless steels made their appearance and once again, new interest was manifested in the use of metals for the internal fixation of fractures.

This chart shows the composition of some of the better alloys which have been used in bone work during the past 20 years.

- - - - -

<u>Metal</u>	<u>Stellite</u>	<u>NickelFree</u> <u>Rustless</u> <u>Steel</u>	<u>HighNickel</u> <u>Rustless</u> <u>Steel</u>	<u>Low Nickel</u> <u>Rustless</u> <u>Steel</u>	<u>Vanadium</u> <u>Steel</u>	<u>Vitallium</u>
Chromium	35%	15%	8%	18%	.8-1.0%	30%
Cobalt	58					65
Nickel			22	9	98+	
Iron	3	80	65	70		
Molybdenum		.5				5
Manganese		.4		.4		+
Tungsten	4					
Carbon	+	+	+	+		
Silicon		.3	1.5			+
Phosphorus		+	+		.04	
Sulfur		.5			.045	
Vanadium					.15-.18	
Copper			1.0			

Let it be said now that beginning with aseptic surgery the open reduction of fractures and the use of metals for internal fixation was a reliable and safe procedure in suitable cases which were operated upon by adequately trained sur-

geons. The metals played a minor role in the pitfalls that were encountered. It was the poor selection of cases and the inadequately trained surgeons as a rule which produced the tragedies.

In 1930, the American College of Surgeons appointed a committee with Philip D. Wilson as chairman, to select a stainless steel to be used in the manufacture of standard Lane plates and screws. This group enlisted the help of the U. S. Bureau of Standards to aid them in their selection. Vanadium steel was chosen. However, in 1936, Jones and Liebeman, in a series of well controlled experiments were able to show that Vanadium steel was not as satisfactory a metal as several other rustless steels. The alloy that these workers found to be best was a high nickel low chromium steel. The physiologic response of the bone to the metals and the corrosion response of the metals to the bone and body fluids were at a minimum. In the same year Venable, Stuck, and Beach while searching for an ideal non-irritating metal had suggested to them by a dentist, an alloy composed of cobalt, chromium, and molybdenum. This alloy is called vitallium. It is closely related to stellite, the alloy which Zierold found to be the least irritating in his experiments. However, Venable and his associates approached the problem from an entirely new angle. All other workers had been concerned only with the physiologic response of the tissues to the metals. These men **not** only were interested in this response but also were concerned with the electrolytic action which occurs when dissimilar metals and body tissues and fluids are brought into contact with each other. Venable and his co-workers were the first to investigate carefully the electrolytic action that develops between bone and metal. It must be remembered that if a pure metal is used no electrolytic action can take place but as soon as dissimilar metals are used electrolytic action does occur. All materials used, of course, are a mixture of several different metals. By ingenious and carefully planned experiments, Venable has shown that electrolysis occurs whenever two dissimilar metals are placed inside the body except for the alloy vitallium. (Dentists have been confronted with this problem for some time.)

In 1929, vitallium was first cast as an alloy and two years later it was used in denture work. Since then dentists have been gradually using it more and more.

Zierold, in 1934, first used it in bone work. but was not impressed by it. Then in 1936, Venable began his experimental work and soon surgeons added this new alloy to their ever growing list of rustless metals. Venable has shown that vitallium is electrically neutral. It is the most "silent" of all the alloys which have been used in the human body. It is not affected by body tissues, nor does the alloy affect the body substance. Vitallium is not susceptible to corrosion. Its strength and durability when fashioned in accordance with standard engineering principles are equal to similar appliances made of any other alloy. Vitallium does not interfere with bone regeneration. There is neither a production of too much callus nor less than the normal amount. In the past when metal was placed in the body, the surgeon usually planned to remove it at a later date. All indications point to the probability that subsequent operations for the removal of the vitallium appliance will be unnecessary.

The most serious objection to other metals utilized for internal fixation of fractures has been their electrolytic action upon the bone as manifested by a local area of tissue necrosis with absorption of bone about the screws and plate. The consequent loosening of the screws lessened the stability of the internal fixation and the devitalized tissue favored bacterial growth. One can never be certain when metals are used for internal fixation if they will remain electrically neutral or if immediate or delayed electrolytic action is going to occur. With what seems to be conclusive proof by Venable, vitallium may be placed in the body with the assurance that electrolysis will never take place. Until facts are brought forth proving that vitallium does not remain electrically neutral it seems that surgeons have an alloy which can be used in almost innumerable ways.

A general outline will be introduced showing the use of vitallium in fractures and reconstructive orthopedic surgery in present day practice. Campbell and Speed divide acute fractures into two groups in which internal fixation may be indi-

cated.

In the first group are placed fractures of necessity. This group includes those fractures in which experience has shown that satisfactory position of the fragments cannot be obtained or maintained by manipulation or skeletal traction, and those in which treatment by these methods has failed to achieve a sufficient approximation of the fragments adequate to prevent serious disability or deformity.

Into the second group are placed fractures of election. In this group, although sufficient anatomic position has been or can be obtained by closed reduction to afford a good functional result, the degree of offset usually results in some deformity, a slow union, and a slight permanent impairment of function. Formerly, this condition would have been preferable to the dangers attendant upon open reduction and internal fixation. The slight danger incident to internal fixation with vitallium and the probability of obtaining a better functional result with a shorter period of disability, justifies a more aggressive attitude toward this type of fracture.

There is a third group of acute fractures in which the question arises as to whether internal fixation or skeletal traction should be employed. The choice here will depend upon the experience of the surgeon, the surgical facilities available, the general condition of the patient, and the local condition. Skeletal traction obviates the danger of wound infection and involves less surgery. It does not insure anatomic approximation in the restoration of the position of fragments. Also, longer periods of immobilization and hospitalization are required for skeletal traction. In the presence of infected skin lacerations or brush burns adjacent to the operative field, however, there is danger of operative infection, and accuracy of reduction should be sacrificed in favor of the safer method of skeletal traction.

Internal fixation may be used in cases of delayed union or malunion. In delayed union with mal-position, freshening of the ends of the fragments, accurate re-

duction and adequate fixation by means of vitallium are usually sufficient to secure union. Fixation by a plate prevents recurrence of the displacement which is not uncommon when union is delayed. Elimination of all motion between the fragments favors earlier union. Vitallium plates may be used as a means of fixation in malunited fractures after correction of the deformity, provided the quality of the bone is good and normal callus production may be expected. If the ends of the bones are sclerotic and of poor quality, and if callus formation will probably be slow or inadequate, an autogenous bone graft is preferable. It affords not only fixation but also a stimulus to osteogenesis which is necessary in this type of case. Vitallium screws, however, are ideal to hold the graft in place.

In ununited fractures, two fundamental requirements must be met to insure the highest percentage of successful results: (1) accurate reduction and secure fixation; (2) stimulation of osteogenesis.

In many ununited fractures the ends of the fragments are sclerotic, the blood supply poor, and there are often other conditions unfavorable for the formation of callus. Every possible stimulus for the formation of new bone should be provided. For this reason it seems that the use of vitallium plates should not replace bone grafts in typical non-unions. However, vitallium screws to hold the graft in place are a great improvement over the use of autogenous bone screws, os purum screws, ivory screws or other metallic screws. The adoption of vitallium screws simplifies the operative procedure and provides prolonged stable fixation for the grafts.

When ferrous alloy plates were placed in acute compound fractures, the incidence of infection along with loosening of the screws and loss of position was relatively high. This has been the paramount reason internal fixation of compound fractures has been approached with some hesitancy. Reduction of a compound fracture is easier and safer the earlier it is done. Accurate and stable fixation favor union. Obliteration of dead

space about the ends of the fragments lessens the chance of infection. Lane during the first world war used metal plates and screws to stabilize the ends of compound fractures so as to put the injured limb at rest and later he removed the plates. Vitallium seems to fill this need better than other alloys as there is minimal bone and soft tissue reaction to this metal and no electrolytic action. With the introduction of sulfanilamide crystals directly into the fracture site as described by Jensen and his co-workers, it appears that nearly all compound fractures will heal by primary intention. Twenty years ago Orr introduced his method of treatment of compound fractures. Again vitallium might be used for internal fixation in suitable cases treated by this method. Even in those cases which require Dakinization, vitallium may be used as it will not be affected by Dakin's solution or by necrotic body tissue. Neither will it aid the infection already present in gathering new impetus.

Vitallium has no known bacteriocidal or bacteriostatic power and the use of this alloy for internal fixation in potentially infected fractures only serves to promote rest and stable fixation so that the possibility of infection will be held to a minimum and these fractures which tend toward delayed union will be held secure and in this way prevent malunion.

As to the use of vitallium in the obviously infected compound fracture, there is little evidence as to its use in aiding or delaying the healing of tissue. If stabilization of a fracture can be accomplished by application of a plate and screws or screws alone with only a minimal amount of operative trauma, it seems that its use should be given a trial as a non union might be prevented and most probably a malunion would be averted.

In the field of reconstructive bone surgery, vitallium has truly given new hope. Smith-Peterson in 1939 reported a series of 29 arthroplasties of the hip in which he used a vitallium cup molded to fit the head of the femur and also to fit into the acetabulum. He has found that a fibrocartilage which approaches hyaline cartilage in character forms when an inert

mold is interposed between two cancellous bone surfaces. A true synovial lining was found to have reformed about the capsule. Five patients in the University of Minnesota Hospitals have been submitted to six of these operations. One young lady who had developed an ankylosis of both hip joints following an attack of arthritis is now able to flex each hip about 70° which means she can sit down, walk, and get around in a fairly satisfactory fashion. Another patient, a young male medical student, suffered a traumatic dislocation of his left hip 4 years ago. Cystic degeneration of the head of the femur followed in several years and at the time of operation the patient had a very painful hip with marked limitation of motion. Four months after surgery, this patient has about three-fourths normal range of painless motion. He can perform most of the actions of a person living a restricted life.

Other reconstructive devices have been developed such as molds for knees, and shoulder joints. It seems that many undeveloped fields in reconstructive surgery will be explored. Even flat vitallium plates have been made to cover skull defects. This procedure seems quite logical and practical. One surgeon had made a vitallium mold of a head and neck of the femur and fitted it in place where the normal one had been destroyed. A physician recently had a patient who had lost a testicle by surgery. A vitallium mold was fashioned into the shape of a testicle and it was used to replace the missing one. The patient's mental outlook is greatly improved.

One final word should be added. Vitallium is an important addition to the therapeutic armamentarium of surgeons. However, it is not a cure-all but if vitallium is used wisely it has and will continue to aid in the solution of some of the more difficult problems in the fields of bone, joint and plastic surgery.

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V. GOSSIP

The following are newsworthy this week. Allan Roy Dafeo, Callander, Ontario, who visited the University of Minnesota while in Minneapolis to take part in the Tribune Press Conference. Dr. Dafeo spoke at a faculty luncheon arranged by Head Obstetrician, John L. McKelvey. This quaint little man with a slight speech impediment shows no blocks in telling the story of the quintuplets. In frank and vivid style, we all lived again that night when the quintuplets arrived. His troubles with those who would have him endorse products and the parents and relatives of his famous patients were briefly related. He charmed all by his simplicity and frankness. His plea for better care for premature and newborn babies was a suitable benediction for the three-day course at the Center for Continuation Study held the previous week. It is difficult to imagine that so much fame could come to one man and at the same time leave him so untouched in his relations with his fellow men. Every place he went, including a trip to see the crippled children was made brighter by his presence... ..Thomas Turlay Mackie, assistant professor of medicine, Columbia University and president of the Tropical Medicine Association in this country was also here last week. He brought to us a concept of gastroenterology which was decidedly new and interesting. He spoke on Amebic Dysentery, Ulcerative Colitis, and Deficiency States as related to gastrointestinal disturbances. No teacher within recent memory has ever made such a uniformly good impression. He addressed our faculty, the physicians at the Continuation Center and the medical students, and all were charmed by his informal, effective teaching method....Walter Freeman, neuropsychiatrist, Washington, D.C. was here last week to address the Minnesota Neurological Society and visit his good friends in the Division of Neuropsychiatry. While here he gave a clinic for the junior medics, and also attended a faculty luncheon. Dr. Freeman is interested in the development of neuropsychiatry throughout the U.S. and was very frank in his praise of the progress we are making at Minnesota. Chevalier Lawrence Jackson, son of famed bronchoscopist Chevalier Jackson, spoke at the Center for Continuation Study on Monday, Feb. 19. He is following in his famous father's footsteps in disseminating knowledge concerning disease and foreign bodies in the respiratory tract. He and his father are modern prototypes of teachers in the early days of medicine who went from center to center to teach for a short time in each institution. The Jacksons' fame is worldwide and well it might be when you hear in their modest way of their accomplishments....Dean M. Lierle, Iowa's head of otolaryngology was here on Tuesday. A native of Iowa, he shares an unusual distinction with his predecessor in that they are both named "Dean"..... Philip Meltzer of Tufts and George E. Shambaugh, Jr. of Chicago were visitors on Thursday and today the campus is host to Albert C. Furstenberg, dean of the Medical School, University of Michigan and professor of otolaryngology, who is also teaching at the Center. He is being entertained at a special faculty luncheon this noon. Over the weekend, I had the good fortune to visit with Edward Leo Tuohy of Duluth. It does not seem possible that 20 years have elapsed since I first met him, so little has been the change in this man who graduated from Minnesota in 1905. His interests change with the needs of the times. His ability to keep ahead of the field has made him a good leader for he has a sincere group of followers. Many who imagine that his activities are confined to medicine will be surprised to know they extend to all phases of social progress. His saving grace has always been his sense of humor. An afternoon passes rapidly when rare Hibernianisms are intermingled with sage philosophical utterances. He believes our profession should actively interest itself in geriatrics. The growing number of older people, the declining number of younger people, the low birth rate, and effective control of infectious and contagious diseases all point the way to new medical problems. He wishes that all physicians would make arrangements with their patients to have their diseases handled for the natural duration of the process. He feels that this long time planning will result in more effective care. Dr. Tuohy lives in modest, baronial splendor in the high tax district of Duluth, perched on the side of a canyon, high above the waters of Lake Superior. May his influence be felt for many years to come.....