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LATERAL SINUS THROMBOSIS

by
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LATERAL SINUS THROMBOSIS

In reviewing the history of the operation of entering the skull, it is interesting to note in passing, that trephines are regarded as the first operation ever performed.

Ballance (3) reviews brain surgery from the time of the Neanderthal man, who lived approximately 60,000 years ago, down through the centuries to present time. There is evidence that the Neanderthal man actually did skull surgery. This practice, and that of brain surgery, has risen, fallen, and been re-established intermittently throughout the ages.

Rudolph Virchow (45) published his work on thrombosis and embolism before he was 26, clearing up the "age long riddle of pyemia (30)". As do many of the modern authors, he separates the thrombosis into primary and secondary types. In summarizing the reviews presented at that time for the cause of thrombosis, he gave four examples:

1. Blood clotting as a result of compression.
2. Blood clotting as a result of harmful or irritating substance transmitted from adjoining structures which sets up inflammation in the vessel.
4. Blood clotting as a result of occlusion by a compact mass impacting the vessels.

It is pointed out by Dusch (24) that just prior to his time, clots had been regarded as an exudation upon the inner surface of inflamed veins. Later it was ascertained that
they were true clots of blood, and the notion that coagulation of blood in the veins as the immediate consequence of phlebitis, which was supported by Cruveilhier, prevailed generally.

It was proven at autopsy, in this period, that there was no inflammation present in the walls of the veins and that the clot was ante-mortem because of the "laminated structure, its firmness and dryness, its colour, its richness in fibrin, and the circumstances that it completely filled the sinus and was adherent to its walls."

Virchow has based the cause of coagulation of blood on two circumstances:

1. The retardation and interruption of the blood in the vessels.
2. Contact with the constituents of the atmosphere.

It was noticed also that the thrombus grew in size. This resulted from blood coming into contact with clots already formed, or with rough surfaces and foreign bodies which find their way into vessels, as obtained in the process of crystallization. Various clotting times had also been observed; some extremely short, but "caution should be used before the assumption is made that this is the cause of the formation of thrombi."

Virchow had pointed out the fact that there were three localities in the body which, from their anatomical character and position, especially favor a retardation of the
motion of the blood and consequently its coagulation during life; namely, the veins of the lower extremities, the veins of the true pelvis, the sinuses of the brain, and "of the latter more particularly the longitudinal and lateral sinuses." In the sinuses it is the "dilatations of calibre and projecting partitions in the walls which are said to favor coagulation." The form of the sinuses is also cited as a contributory cause of thrombi formation. The structure of these sinuses, which will be pointed out more clearly in discussing the anatomy, is quite different from the round form of other portions of the venous system. The triangular shape of the sinuses offers greater resistance to the flow of blood, thus retarding it. A further circumstance which tends to reduce the rate of flow is the angle at which contributaries discharge blood into the sinuses; particularly, the longitudinal sinus, (this occurs at right or even obtuse angles). Then, if pathological conditions supervene which tend to reduce the general circulation, the retardation will become more considerable, and a state of things produced favorable to coagulation. Besides these conditions, the sinuses are shown to be rigid tubes, which, when the blood volume is reduced, decrease the rate of flow.

Dusch collected 57 cases of thrombi formation in the sinuses. Of these it was shown that 20 were complications of otitis media. In each of these cases, thrombosis existed in
the side affected with caries, and in many cases was confined to the lateral sinus, although generally extended down into the jugular vein and sometimes observed in the subclavian vein. Those found in the superior petrosal sinus are not regarded as having extended from the lateral sinus but result from the same condition that caused the thrombus in this (lateral) sinus.

In reviewing these cases, Dusch allows that there might be a different explanation offered for thrombosis than already suggested. Because the thrombosis and phlebitis of the sinuses stand in casual connection with the inflammations existing within their radius vessels, and both the course of events during life and the post-mortem appearances favor the view that the affections of the sinuses occurred later, in the point of time, than the inflammations of the parts about them, it might be regarded that the thrombosis in the sinuses is a consequence of inflammation of their walls, i.e., as a secondary condition.

This theory is merely mentioned and it is considered that other reasons presented are more "admissable because the theory that the coagulation of the blood as a consequence of inflammation of the coats of the vessels is founded upon very unreliable data."

Dusch emphasizes the following:
Thrombosis by prolongation is a result of:

1. Process of inflammation (otitis interna most frequent).
2. Injuries of the bones of the skull.
3. Effusion of blood into the substance of the brain or its membrane.

Thrombosis originating primarily in the sinuses is a result of:

1. Influences which retard the current of blood, both of local and general causes.
2. Disease of the walls of the sinus.

Virchow (45) has considered the thrombosis as the primary condition and that any infection that developed at the site of the thrombus as secondary. This conception, the so-called "marantic origin of thrombi", held the field for a long time (9).

Welch, (67), as will be noted later, shows that the usual order is just the reverse of this theory, - infection occurs first, followed later by the thrombosis.

Boyd (9) observes that thrombosis is a protective mechanism, that without it we would bleed to death but that at times its effects are "unfortunate and undesirable as is often the case with the defense mechanisms of the imperfect body with which we still have to put up."

In observing the lumen of the descending portion of the lateral sinus (Sigmoid Sinus) opposite the middle ear, it is noticed to be an irregular oval with its greatest convexity
outward, the sinus seeming to tunnel between the layers of dura. Obliteration of the sinus by an encircling ligature is difficult because it is fixed at two points of dural surface that cannot be approximated. At the knee (bend) the sinus assumes a pear-shape, the inner wall still flush with the contiguous dural surfaces of the cerebellum and cerebrum. (25),(6),(7)

The superior petrosal sinus enters at an angle, emptying into the inner wall at its posterior margin. After passing the knee, the horizontal portion of the lateral sinus is triangular in shape, with three fixed points. Because of these three points of attachment, the tentorium cerebelli having been interposed between the other two points of attachment, it is difficult to obliterate a transverse sinus without hemorrhage for the reason that, upon tightening the ligature, dural tears result.

Page (35) is of the opinion of Mr. Ballance (4), that the two lateral sinuses do not communicate posteriorly, but rather, the lateral sinus is a continuation of the superior sagittal sinus or the superior longitudinal sinus, whereas the left lateral sinus is a continuation of the straight sinus. Both believe this description not to be invariable but that it is generally found to be true is not disputed.

Cunningham (19) in his description of the anatomy of the sinuses, shows that the above arrangement is sometimes
reversed and further states, that not infrequently is there a direct communication between the two lateral sinuses. He also describes the confluens sinus into which the superior sagittal and the straight sinuses flow and from which the two lateral sinuses take their origin.

Lillie, (42) in describing the sinuses, gives the percentage of the three main types. 50% of the skulls show the right lateral sinus as a continuation of the superior longitudinal sinus and the left lateral sinus as a continuation of the straight sinus. 30% unite around an islet of connective tissue, the superior and straight sinuses dividing into two branches and giving one branch each to the two lateral sinuses, and the remaining 20% uniting the four sinuses in a common reservoir, the confluens sinus.

Furstenberg (29) reviewing anomalies of the sinuses, concluded that though rarely encountered, their occurrence as the seat of infection results in confusion in diagnosis and method of treatment.

Those described are: The double lateral sinus, an absent lateral sinus and the sigmoid takes its origin from a large superior petrosal sinus, a constricted jugular bulb and the emissary vein carrying the bulk of the blood, a blind sac ending of the sigmoid sinus with the emissary vein enlarged and a patent petro-squamosal sinus, a portion of the lateral
sinus outside the skull beneath the pericranium, lateral sinus with lakes, and last, a persistent petro-squamosal sinus. These are mentioned in passing because, although they are infrequent, they must be kept in mind.

The blood pressure in the sinuses is but a few millimeters of mercury, and in the sigmoid or descending portion of the lateral sinus, is negative during each inspiration. The volume of blood, despite the low pressure, is great. The fact that the blood pressure is low allows for control of hemorrhage following an injury to the sinus, by merely bridging the gap. The gloved finger, a piece of cotton, or the "postage-stamp" method controls the hemorrhage without stopping the flow of blood through the lumen."(25) The "postage-stamp" method of controlling hemorrhage from the sinus consists of placing a piece of fascia lata over the rent, the fascia adhering to the injured sinus.

There occurs, through the cranial vault, extension of organisms from the "pneumatic sinuses." (32, 41) These sinuses, frontal, ethmoidal, mastoid, and sphenoid are often involved as secondary infections from the nose and throat. This may result in an osteomyelitis and spread to the meninges, or involve the dural sinuses with a subsequent extension to the brain. The most frequent cause of this is a secondary mastoiditis following an otitis media. (See diagram for spread of infection of page 10)
The study of early and recent authorities on lateral sinus thrombosis reveals that there has been a decided change in the understanding of the cause of this disease. First the marantic theory held sway, and later it was believed that infection was the primary cause of the thrombus formation. Geza de Tokats (61) summarized thrombus under three headings:

1. The slowing of the circulation.
2. The changes in blood composition.
3. The changes in the vessel wall.

The mechanism of the thrombus formation, as explained by Howell, is a complex process, not yet thoroughly understood, which converts soluble fibrinogen into insoluble fibrin. His theory, the nucleus of which follows, is most widely accepted.

Thromboplastin is produced as a result of cellular injury and neutralizes antithrombin. This latter substance and prothrombin are in balance as a neutral substance, but prothrombin is released when the thromboplastin unites with the antithrombin, and in the presence of calcium which is present in the blood, forms thrombin. Thrombin, in turn, acts on fibrinogen to form fibrin, or the clot.

Though it has long been known, Sonneschein points out that the most frequent cause of lateral sinus thrombosis is complication of mastoid involvement and otitis media. It is believed that diseases of childhood such as measles, scarlet fever, diphtheria, influenza, and pneumococcus infections, are forerunners of ear and mastoid diseases.
Scheme of the Primary Focus, the Initial Pathways of Extension, the Subsequent Process of the Infection, and the Resultant Intracranial Infections. (Turner & Reynolds)
In discussing thrombosis of the lateral sinus, it is important to note that there are two types, one an infective thrombus with its resulting septic signs and symptoms, and the other the non-infective thrombus, referred to by older authors as the marantic thrombus, however, more recently, referred to as a retrograde thrombus.

According to earlier papers, the first observation in a lateral sinus thrombus suspect, was a purulent otitis media and mastoiditis with swelling, tenderness, or both in the region of the mastoid emissary vein. This latter sign is somewhat older. Although an inconstant sign, swelling and tenderness along the jugular vein was early recognized as indicative of sinus thrombosis. It was not known whether this was due to regional lymphadenopathy or to an actual inflammation of the vein. Also, distention of the external jugular vein was noticed when a thrombus occluded the internal jugular. (13,60,60,59,64,51)

The infection usually extends from an acute or chronic otitis media and the mastoid is generally found to be diseased, although the infection may pass directly to the sinuses through the small vessels of the temporal bone with macroscopic change. Any of the sinuses may be involved but the lateral and sigmoid are most frequently found to be thrombosed. Less often are the superior and inferior petrosal sinuses or the cavernous sinus affected. The jugular vein may be involved by direct extension of the thrombus from any of these sinuses, this
occurring not infrequently in cases of lateral sinus thrombosis. (6,32,14,52,31,39,44)

Most of the early cases reviewed were evidenced by the late, severe stages of the disease and were generally terminated in death. It is not until after the time of Zaufal, who in 1884 described the classical operation for lateral sinus thrombosis, that reports show any signs of improvements in the symptoms of patients. (64,31,63,68,48,27,16,28,10,35,62,46,49)

In doing mastoidectomies, it was not unusual to find a destruction of the inner table with pus bathing the sinus wall. Even a phlebitis of the sinus might be present, the inflammation involving more than one coat of the vein. Yet it was observed that only when the intima is disturbed does clotting occur. (8) Particularly in young persons, the infection at times passes directly through the floor of the tympanum to the adjacent bulb of the juglar vein, thus causing direct infection around the vein. The clot may extend down into the vein, even below the clavicle. When the latter occurs the superficial veins of the face become dilated.

There are opposing views on the theory of extension of the clot from one lateral sinus to the other. Anatomy generally supports those who disbelieve spread by extension. Others prove spread by extension, citing case histories. Many believe that there is too little emphasis stressed on the latter fact.
It might be pointed out, however, that a thrombus found in the opposite sinus need not have been an extension. In many cases it can be attributed to the general condition of the patient. (54,4,19,42,29,36)

The most reliable symptom of lateral sinus thrombosis is the temperature, and this is not constant. In typical cases it is of the intermittent or remittent type, changing suddenly within a few hours, from normal or near normal to 104° or 107° suddenly dropping down to even a subnormal temperature. This may occur several times within a few hours, or but only once or twice during the twenty-four. A temperature that shows an elevation of not more than one or two degrees, but with a persistent irregularity, and the usual evening rise is another type. Tobey believes this type occurs during the formation of a mural thrombus. A third type of temperature with elevations of 2 to 3 degrees from a minimal of 100°, lasts for several days and returns to normal, and then recurs in a few days. This is probably due to the breaking down and absorption of the thrombus. Also, it is not uncommon to find a normal temperature with a lateral sinus thrombosis, evidenced at a mastoidectomy. (42,8,65)

The abnormal temperature often continues for some days after the ligation and removal of the thrombus, and the
sepsis which has already occurred, must be combatted with fluids, transfusions, and stimulants.

Though chills are significant and common in adults, their absence is of little diagnostic importance. Even a slight chilly sensation should be noted. The chill is followed by perspiration. The true rigor occurs in less than 50% of the cases but most of the patients will complain of the chilly sensation accompanied by sweating. (42,14,65)

Cultures are a controversial topic, some believing them to be of importance and others regarding them insignificant in the diagnosis of thrombosis. Blood cultures may be returned positive with an acute upper respiratory infection. However, with the other signs and symptoms of lateral sinus thrombosis present, a positive blood culture is significant. The technician determines the most suitable time to take the culture, but most agree that it should be obtained shortly before the high rise in temperature.

Blood counts are of value, there generally being a leucocytosis ranging around 16,000 with the polymorphonuclear leucocytes in preponderence, usually about 85%. It is of importance to bear in mind that other pyogenic infections cause a leucocytosis and give the same elevation. Other diseases such as pneumonia, scarlet fever, typhoid, malaria, and erysipelas, may also obscure the diagnosis. If there is a leucopenia it is indicative that the patient's resistance
is low and, if it is much higher than 16,000, it is suggestive of meningeal or other complications. (54,42,65)

Optic neuritis is reported in a varying number of cases, according to the author, ranging from 8% to 50%. It may be of value when used in conjunction with other symptoms of thrombosis, as a diagnostic aid but its significance is not great because it occurs with meningitis, brain abscess, and other conditions as well. Nystagmus may be in both directions or it may be rotatory. Sixth nerve paralysis is not uncommon, it is due to edema, secondary to the stasis produced by the thrombus. At times there is involvement of the ninth, tenth, and eleventh cranial nerves. Some patients evidenced aphasia and Jacksonian convulsions. (54,32,13,65)

The presence of a headache is not sufficiently characteristic to carry any weight in diagnosis, but if the pain is exceedingly severe it may be the result of extensive or local meningitis. When the headache is present, it is seldom described as pain, but rather a dull sensation of pain which the patient is unable to localize. It is accompanied by a feeling of drowsiness from which he is easily aroused, but back into which he relapses immediately, suggestive of typhoid fever. At times the patient may describe the condition as a throbbing sensation. It is known that the circulation of the brain is that of a closed box. At a certain phase of the respiration, the brain is filled, and the sinuses act as buffers, taking
up the pulsations so there is no throbbing, so, depending on the degree of thrombosis, whether it is mural or ocluding, the full sensation or the throbbing may be experienced. (61,65,43)

The cerebrospinal fluid pressure is found to be high, and if meningitis is present, the cell count is increased and organisms are found. The presence of blood in the cerebrospinal fluid is indicative of the rupture of a cortical vein and the subarachnoid hemorrhage. The thrombus causes a marked venous pressure increase and thus, a higher capillary pressure in the brain, from which result small and large intracerebral hemorrhages with softening. Late in the course of thrombosis, then, focal signs appear.

Of diagnostic value, in determining the presence of a thrombosis and the side on which it is located, is the Tobey-Ayer test which elicits the Queckenstedt sign in a modified form. This test consists of attaching a manometer to the needle after a spinal puncture has been made, and noting the original pressure, which is normally between six and nine millimeters of mercury. Compression on both jugular veins causes the fluid to rise rapidly in the manometer. Pressure over one vein will likewise cause the fluid to rise if the vein is patent. If thrombosis occludes it, there is no response or a differential response. This test is used with equally good results on children and adults alike, providing the
test is performed correctly. In children an anaesthesia is used, in order to overcome some of the difficulties in keeping them still. Avertin is preferably used as it does not cause an elevation of the blood pressure or intracranial pressure as does ether. (41, 65, 66, 53, 67)

This test is not in itself, diagnostic of lateral sinus thrombosis, but used in conjunction with other signs and symptoms, it is an aid in confirmation of the diagnosis. Also as previously mentioned, it is used to ascertain on which side the thrombus is located in bilateral mastoiditis.

Although a metastasis generally occurs late in the course of events it is occasionally found very early. If the infected thrombus is broken at all, there is danger of its being spread through the system via the blood stream to set up pyemia and multiple abscesses. The most frequent results are a pneumonia, abscess or gangrene of the lungs, an arthritis or peri-arthritis, abscess in the subcutaneous connective tissue, or nephritis. Diffuse meningitis or brain abscess may be caused by continuity. (42, 34, 17)

The spleen may become involved, it may be swollen, and later the faces may show the effects of sepsis, the yellowish tinge of the conjunctiva, the dry, sallow skin, and the heavily coated tongue.
Roentgen-ray plates are often of aid in diagnosis in doubtful cases. Several cases have been reported in which the ear findings were negligible, the mastoid macroscopically negative, but an X-ray revealing its involvement. It must be pointed out and emphasized, however, that if a rentgenogram shows but little change in the mastoid cells, it is not evidence that a pathologic process cannot exist. (42,27,17)

It is not an infrequent occurrence to do an operation when doubt is not dispelled by any of the procedures outlined. If there is an absence of pulsation and a doughy sensation upon palpation, the indications are that a clot is present within the sinus. If the exposed lateral sinus vein wall looks normal, and yet pulsates, it is thrombosed below that point. It may be necessary to incise the sinus for diagnosis and removal of the thrombus. This latter method will be discussed in the treatment (41).

Aspiration is believed to be of slight value because of the loss of the normal color and yellow or gray discoloration. Some authors are vigorous in denouncing this procedure as a diagnostic aid. (14) Kopetzky (41) states that "it can not be warned against too much." If there is no thrombus present when the needle is introduced into the sinus, there will certainly be one afterwards due to the trauma imposed upon the intima in carrying out the procedure.
In discussing the differential diagnosis of a brain abscess, Sir Charles S. Ballance (5) mentions embolism, hemorrhage, and thrombosis. In a brain abscess due to an ear infection, the symptoms "are gradual and they may not reach their acme for 2 to 3 weeks. In embolism the onset is usually instantaneous. In hemorrhage the patient may be a sufferer from chronic heart disease; the onset is usually rapid and arterial pressure in excess. In thrombosis the manifestations of the symptoms is more gradual extend over a few hours or days."

The most frequent complication simulating the symptomatology of lateral sinus infection is a localized central pneumonia, especially so in children. Another is acute septic endocarditis, and in children again, acute otitis of the other ear may be overlooked, and acute pyelitis, and pyelonephritis in adults, may give the symptoms of septicemia. Erysipelas, malaria, acute tonsillitis, rheumatic fever, and typhoid fever may confuse the diagnosis. (65)

Cavernous sinus thrombosis, (55) which also will give the picture of sepsis, is characterized by exopthalmos, chemosis, edema of the eye-lids and optic disc, and sometimes paralysis of the motor oculi, abducens, and trochlear nerves. These ocular symptoms become bilateral within a short time because the infection passes through the circular sinus to the other side. (56)
The outcome of this disease, cavernous sinus thrombosis, is almost invariably fatal and the only hope of saving the individual's life is drainage by means of a radicle operation. Several approaches have been used for this purpose. One is through the petrous portion of the temporal bone but this leaves the patient deaf and with a facial paralysis. Some employ the approach used in dissecting the Gasserian ganglion, but here, too, not a few important structures are injured and others endangered. To date, the best approach used is that through the nostril, reaching the sphenoidal sinus and then opening the davernous sinus. Another effective operation is that of entering the sphenoids from the maxillary sinus and from this angle, enter the cavernous sinus. Structures of importance are not encountered and danger of meningitis is minimized. The orbital approach is used only if the focus of infection is located in the eye or in the orbit. (8,11,13)

A high percentage of fatalities(40%) caused by intracranial complications of ear diseases are due to infective sinus thrombosis, but the prognosis may be regarded as favorable if operated on early, that is, before the clot has become extensive.

The treatment of lateral sinus thrombosis is considered, in the main, to be surgical. Although cases have
been reported as having recovered without operation, such cases are rare and not safe to expect. Some persons advocate and report success with antiscarlatinal serum but it is too early to prognosticate as to its true worth. (34,26)

It was Zaufal who, in 1884, advocated and first performed the classical operation for lateral sinus thrombosis. This consisted of ligation of the jugular vein and exposure and incision of the lateral sinus. Since that time, and until the last ten years (when some dissention has been aroused) it had been considered an essential phase of the operation on the lateral sinus because in so doing, the channel (the jugular vein) through which septic material is being passed, is blocked. This is erroneous because the material may be passed through anastomoses or collateral circulation, to the general circulatory system. About the same time large venous sinuses were sutured after being ruptured as a result of an accident. (58,37,20,57)

Treatment does not consist of immediate ligature of the internal jugular vein, as is advocated by some, but rather uncovering the lateral sinus first and noting if there is a thrombus present. If a thrombus is evident, incise and remove this clot, and if bleeding occurs from both ends, the wound is packed. If there is no bleeding from the upper end, incise until free bleeding is obtained, and pack. The gauze,
in packing, is inserted between the bone and the sinus. Vaseline gauze is given preference over iodiform gauze because it is free from meshes, is easily removed, and does not result in an allergic reaction as the iodiform type. If there is no bleeding from the inferior end, ligate the internal jugular vein. (21)

Others believe that when the thrombus is located, it is best to ligate the jugular vein to prevent any of the clot that might be separated during the manipulation from easy access to the general circulation. This procedure of ligating the vein does not greatly lengthen the operation unless it is collapsed, cord-like, or covered with many large lymph nodes. (14, 68)

Many case histories were reviewed from various papers and most of them substantiated ligation of the jugular vein followed by removal of the clot. Then a comparatively short time ago the conception of treatment began to change and the efficiency of the above-mentioned procedure was held in doubt. As one of the more recent authors said, that until the anatomy and pathology is understood, treatment is subject to change.

C. Miles Atkinson desired the result of what would come of abandoning the idea of ligating the jugular vein. First he would expose the sinus to the limits of the pathologic
process in the wall and determine if a thrombus was present, if not, and if there was no general infection, he would do no more. However, if a thrombus was found and there was necrosis, and evidence before operation of a general infection, the sinus would be opened and obliterated without ligation of the jugular vein. This vein was not operated on unless signs of general infection continued or unless there were local signs of the jugular being involved. (2)

Ligation of the jugular vein is of most value when thrombosis has extended to the jugular bulb. Some maintain that infection of the lateral sinus has a marked tendency towards spontaneous cure if the infected tissue is removed and free drainage supplied, without ligation of the jugular. This feeling is gaining a vast number of supporters. (42,41,8,65,43,21,12)

Juers (38) believes that the ligation of the "internal jugular vein is a procedure of little value in the management of optic sepsis unless there is thrombosis of the vein itself." He believes, though, that infected thrombosis should be a sign of jugular ligation. (21)

A better approach to the problem is the prophylactic care that might be given a patient, the early and adequate approach to the primary infection or to the epidural abscess which forms before the sinus thrombosis. (32)
The marantic thrombus, the non-infective clot, forms and after it forms becomes organized and finally canalized. The most severe danger being emboli which may be dispersed in the blood stream. This thrombus may become infected, and very easily so if there is a bacteremia. Treatment for this, if it is infected is identical to the infected thrombus already discussed. (32)

Hartman (34) advocates a medical regime to build up a patient before operation, especially in children:

I. Preserve Normal Metabolism
   A. Water and Acid-Base Balance
   B. Blood Sugar Level and Glycogen Stores

II. Preserve Adequate Blood Circulation
   A. Plasma Volume
   B. Red Blood Cell Volume

III. Confer Immune Bodies Passively

IV. Decrease Extent or Virulence of Infection
   A. Drainage of Metastatic Foci
   B. Chemotherapy

He gives intravenous Ringer's and Dextrose solutions and repeated blood transfusions of small amounts of blood, from immunized donors if possible, although he does not put much faith in the therapeutic capacity of the immunized blood, "it is disappointing." Strongly advocated, is his belief in the benefits of sulfanilamide treatment, particularly when symptoms of sepsis and focal infections are presented. The dosage used is three-tenths of a gram per kilogram of body weight per day, and reach a peak of 16 milligrams per cent

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in the blood.

His is a controversial subject, because when evidence of metastatic lesions are noticed, it is believed by most authorities that an immediate operation is the only procedure. (42,41,65,43,12)

In summary, the diagnosis of lateral sinus thrombosis is made from septic attacks, and four or five attacks of chills. High temperature may be observed in order to ascertain this diagnosis without danger to the patient. (42,41,65,43,35)

Because the symptoms are vague and associated with so many other diseases, early diagnosis is difficult. However, general malaise, pain in the ear or deep-seated and not infrequent headaches are early signs. Herpes will sometimes give a clue, they are present frequently in lateral sinus thrombosis. The late symptoms are not so difficult. (50)

The operation consists in laying the sinus bare very extensively, handling the vessel carefully, avoiding all possible trauma and removing all infected area, the wall of the sinus, or the inside of the lumen if necessary.

Ligation of the jugular is reserved and performed only in extensive infection, a jugular thrombus, or in very old cases with extensive metastatic abscesses. (42)(43)(35)

Primary operation of the jugular vein is indicated
when a patient who has sepsis of otitic origin is encountered late in the disease. (42)

Ligation of the jugular vein, however, is still a debatable issue, but many authorities agree now that it is not essential as Zaufal first described. The accepted opinion at present is that ligation should be performed only if there is definite infection in the vein that cannot be adequately drained. It should be accompanied by resection. (42,41,65,23,35)

The post-operative management of the septic individual is important, and, according to Maxwell (47) a routine must be followed:

1. Force fluids four or five litres per day. If the patient cannot take them by mouth, give intravenous injection of 5% dextrose.

2. High calori-high vitamin liquid diet.

3. Reduced iron in doses of 5 gram three times a day.

4. Repeated small transfusions of whole blood (200 cc every third day during sepsis from different donors)

5. Sulfanilamide, in cases of hemolytic streptococcic infections, is beneficial.

This should be given orally if possible. However, if the administration is necessary by vein, it should be in a 5% solution in 5% dextrose. To build up the blood level and maintain it, it must be given in adequate dosage, especially at
first. The blood level content of sulfanilamide should be up to ten milligrams per 100 cc of blood for adequate treatment.

In following a routine such as this the chances of recovery of a septic patient are greatly increased.
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