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## Varicose veins

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T H E S I S

On

V A R I C O S E V E I N S

By

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April 10, 1931

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## I. INTRODUCTION

Of all the subjects in medicine, "varicose veins" was chosen by the author as proper for a thesis report because of its common occurrence and because of its practical appeal.

Fully <sup>?</sup>30% of the population suffer with varicose veins of the extremity, and 10% of these develop ulcerative complications. Any surgeon of the day is well acquainted with the amount of prolonged discomfort and suffering either condition, especially the latter, may produce. However, many are the cases of varices that are neglected even during the present era, because the medical profession, as a whole, regard this condition too lightly.

The development of the injection treatment with sclerosing solutions was done by Sicard of the Necker Hospital, Paris. This, in the author's opinion, is one of the most important developments in modern medicine. The sclerosing methods have not only proved satisfactory in the treatment of all conditions of varices, but it is also being used as a means of treating hydrocele and hernia. Concerning the latter, Wysz of Zurich reports that Steffer gets a total of 90% permanent cures in all hernias including inguinal, femoral and ventral hernia. (1)

The writer attempted the treating of varices with 25% sodium salicylate, and hemorrhoids with quinine and urea. The work was done under the instruction of Dr. M. C. Petersen, of the State Hospital, St. Peter, Minnesota. Results obtained were very satisfactory, both as a means of curing the symptoms and causing the varix to disappear.

## II. DEFINITION.

McPheeters in the introduction of his text on Varicose Veins (4) gives the following concise description;

"The word "varicose" is derived from the Latin "varicosus" meaning dilated, and when applied to veins, means knot-like, cylindrical, or sac-shaped enlargements of the lumen of the vein in the course of its distribution."

"The word "varix" or "varicose" may be applied to arteries or to veins in any portion of the body; however, due to common usage they have come to be associated only with the condition of varicose or dilated veins of the lower extremities. At times it is difficult to draw a line distinguishing between these phlebectasias on the one hand and the angiomas on the other".

III. ANATOMY.

To H. McPheeters, present day authority on varicose veins, the writer is indebted for the following discussion as well as many to follow. )4)

"The venous system of the lower leg consists of the superficial and deep portions. The deep veins of the lower leg are those situated deeply among the tissues, muscles and bones, and collect the blood from the deeper tissues about the foot and ankle, carrying it upward, and then become the popliteal vein at the lower edge of the popliteal space. This vein continues as the popliteal until it enters Hunter's Canal, where it is called the femoral. It is then called the femoral vein until it passes under Poupart's ligament, at which place it becomes the external iliac, and later at the brim of the true pelvis unites with the internal iliac to form the common iliac vein."

"The superficial venous system of the lower leg consists of the greater, long, or saphenous magna, and the short, lesser, or saphenous parva. The long saphenous forms over the inner side of the foot and ankle, passes upward just internal to the edge of the tibia, past the internal condyle of the femur, then along the inner side of the lower thigh, and on upward, joining the femoral vein of the deep system through the ostial window, two inches below Poupart's ligament."

"The short saphenous collects the blood from the back and external border of the foot and the back of the calf. It joins the popliteal vein in the upper edge of the popliteal space. Both these systems are extensively connected one with the other by collateral anastomosing veins. They make an extensive network over the whole lower leg, resting in the superficial fossa."

"The superficial veins are in turn connected with the deep veins both in the lower leg and thigh by communicating veins. In most of the cadaver specimens there were two communicating branches in the middle and lower thigh,

though in some there were none. In the lower leg, however, the communicating branches were very frequent and scattered. All these veins, both the superficial and the deep, as well as the communicating branches, are supplied with valves with their cusps facing upward and inward, which tends to prevent the reflux of blood and to maintain the blood column above them. As a rule the valves in the vein are supplied and placed in relation to the opening of a tributary vein. Usually they are distal to it."

"The valves usually are of the bicuspid type, though many unicuspid valves and occasional tricuspid groups are seen. 73% of the valves in the femoral vein are bicuspid, as are also most of those in the deep veins of the lower leg."

"Along the main trunk of the saphenous magna both in the thigh and lower leg, there are often found small, normal veins lying close to and often parallel with a varicosed vein. This anatomical fact explains the occurrence, often seen in practice, that we may carefully excise or sclerose a vein, and yet in a year or so, find another vein present in the same location."

Microscopic anatomy of the normal vein shows the layers of cuboidal epithelium lining the inner wall of the vein with the elastica interna just beneath it. Below that is seen the media with large amounts of muscle tissue interspersed with fibrous tissue. The media forms the large part of the vein wall. Elastic fibers are also scattered throughout these layers. Beneath this layer of the vein wall which consists almost entirely of fibrous elements and only a small amount of muscle tissue. The muscle fibres run both longitudinally and circularly, while the elastic connective tissue fibres run longitudinally, circularly and obliquely. Through the media and adventitia may be seen the vasa vasorum of the vein wall.

#### IV. EMBRYOLOGY

There has been a great amount of literature written upon the embryology of the venous system. However, until the recent work of Dr. O. Kampmeier and Carroll La Fleauer Berch, (3), there has been no work done upon the embryology of the valves of the saphenous system. It is to this piece of original work that the writer is indebted for the following information.

The valves are first seen in the three and a half month embryo. They develop at first in the upper saphenous magna as a thickening of the endothelium with a ridge like formation of the vein wall. These ridges are placed opposite each other transverse to its long axis. At first there is merely a circular ridge of endothelium in the vein wall; however, there soon appears a proliferation of mesothelium causing a thinning of the wall at the base of the ridge. Next the base of the ridge forms downward as though forced by the pressure of the fluid. This forms the cusps of the valves as well as closes the valve cusps. All valves have been formed by the end of the fifth month.

The valves are usually found distal or below the opening of a tributary. The number varies; usually, however, there are four to six valve sets in the saphenous magna above the knee. Valves are also found below the knee in both saphenous magna and parva, but they vary in number.



#### IV. PHYSIOLOGY

The following is a general understanding of the physiology of the saphenous system.

The normal function of the deep and superficial veins of the extremity is to carry the blood upwards toward the heart. Since the force imported<sup>a</sup> to the blood by the heart is practically lost in friction against the capillary walls before reaching the venous system, other factors must be of importance in carrying out the normal function.

The veins are supported by muscle fascia and skin. The deeper veins are surrounded by muscle, which by a massaging action causes the blood to be moved forward and backward, the latter being prevented by the valves. These veins are well supported and very seldom become varicosed. The superficial veins are embeded in fatty tissue and receive practically all their support from the overlying skin. When the tonicity of the skin is lost with age, these veins become inefficient, allowing stagnation of pools of blood and the development of varicosities.

The aspiratory action of the pelvic veins as described by Bernstein and Hallian are also helpful in the exoulsion of blood from the lower extremities. (3 & 4).

## VI. PATHOLOGICAL PHYSIOLOGY

There has been a number of experiments made upon the direction of flow in the varicose extremity. The following is a brief summary of the various experimenter's work.

"Gentzer of Geneva injected strontium bromide solution and by radiographic studies showed that in varicose veins the injected liquid follows a course opposite to the usual direction of the blood flow".

Sicard, Gangier, and Forestier injected iodized oil into varicose veins under the fluoroscope and found the blood flow, if not reversed, was at least much slower and that the liquid injected into the superficial venous system showed little tendency to reach the deep network if the injection was made in a recumbent patient.

"Magnus injected iodized oil under the fluoroscope and noted that the substance tended to flow toward the heart when the patient was standing. He decided that it was much better to have the patient ambulant after treatment because of this reason". (6)

These results were confirmed by H. O. McPheeters. He injected lipidol and used the fluoroscope. He arrived at the conclusion that "the venous flow in varicose veins was toward the periphery, returning to the general circulation through the communicating veins of the deep system". (7)

Bernstein arrived at the same conclusion through extensive operative work in the surgical treatment of varicose veins. He gives the following as his final conclusions.

1. "In the early cases of varicose veins of the legs, the valves in the saphenous may be competent and there is no reverse flow. In these there is merely a stagnation of blood. This demonstrates the Trendelenburg "nil"".

2. In the moderately advanced cases, the valves have become deficient and the Trendelenburg test is positive, with the blood flowing downward in the superficial saphenous and into the deep veins, through the communicating veins, the valves of which are still normal.
3. In the advanced cases, the valves in the communicating veins are also destroyed and thus a Trendelenburg is developed. (7)

This explains how valvular incompetency in the great saphenous (Trendelenburg positive) plus the valvular deficiency in the communicating veins (Trendelenburg negative) gives the condition known as Trendelenburg double. In this condition there is a reverse flow from both the superficial and deep system of veins causing a stagnation of blood in the dependent extremity and following edema of tissues. (7)

*Trendelenburg  
not well  
introduced or  
explained*

## VII. PATHOLOGY

The following is the pathology of varicose veins as given by numerous writers.

In the early stages of varicosities there is a general hypertrophy of all the contractile elements. This is soon followed by dilatation of the vein and later by a gradual progressive atrophy of the same elements. In the fully developed varix both elastic and muscle tissue show evidences of extreme atrophy. The vein wall has become thinner and is frequently entirely fibrotic. There may also be a change in the intima of the vessel wall in the form of proliferation which produces nodular elevations not dissimilar to those seen in arteriosclerosis. The varicosity of long standing may become calcified and even ossified. The inflammation of the varicose vein is generally regarded as secondary and in reality is superimposed upon the pathology.

### VIII. ETIOLOGY

The exact etiology of varicose veins is not a settled question. Many theories have been advanced and no one is applicable to the entire group. For the present it must be assumed that a number of factors are directly responsible for the pathological development.

It is usually assumed that women are more frequently attacked by the disease than men, due to the influence of pregnancy. In a report on a series of cases, Dr. G. De Tokats states; "59% were females and 41% were males. It must be remembered, however, that we saw a group of young women, with beginning varicosities, seeking advice for cosmetic reasons at a stage when men would not consult a physician". (3). This work shows that more men than is generally thought, suffer with the condition.

Age plays an important part in the development of varices. In Bernstein's report, 75% of varicose veins occurred before the 30th year. (4). However, patients range in age from nine months to seventy-seven years. (4)

It is generally known that heredity is an outstanding factor in the development of varices. Different authors vary as the percentage having a hereditary factor. Some place it at 8%, some 10%, while Nicholson in his work came to the conclusion that "55% of cases of varices give a history of heredity". (9) He places the hereditary factor at approximately 75%.

Occupations necessitating long continued standing on the feet such as barbers, clerks, etc., predispose to the formation of this pathological development. In these cases, the pumping effect of the muscular contraction is lost and instead there is a continuous back pressure of the venous column. This was discussed in the section on physiology of the normal venous system of the extremity.

While the etiological factors are quite definite, the proposed theories are not applicable to all cases. Von Meisen has noted the curious fact that a very large percentage of flatfoot, varicocele and enteroptosis

are coincident with that of leg varices and expresses the opinion that the abnormal circulatory condition lies in the weakened connective tissue of the vein wall and its surroundings.

McPheeters, Nohl, Heese, Schaak and Reazi believe that infection and infectious fevers plus a chematoxic effect on the muscles of the vein wall, play an important role as an etiologic factor in varices of the extremity. (4)

Nohl believes that an inflammatory process can explain all the pathology with a primary inflammatory condition and congestion and later the sclerosing results and the formation of the fibro-scleratic wall. It is logical that as the venous flow becomes stagnated it would be most slowed up just above the valves and that if infection was present in the blood stream it would be more prone to infect and involve the vein wall locally at the point of greatest stagnation. Microscopic sections through this stretched and distended area show the pathological results of an inflammatory condition. This also would be an explanation why the valves in the veins are so often destroyed and it would be evidence that at times there is a primary destruction of the valves of the vein before injury is made to the vein wall itself. This then agrees with the idea of Delbet, Magnus, Hasebroeck and many other investigators that an incompetency of the valves is the first thing to develop and that the pathology in the vein wall, inflammatory or otherwise, develops secondary to this condition. (4)

The association of the endocrine system with the development of varicose veins has been brought out by some authors. Sicard and Gaugier, possibly the outstanding advocates of this theory, are of the opinion that the varix (excluding that due to pressure and infection) is endocrine in origin - a special hormone circulating in the blood acting on the sympathetic

which regulates the caliber of the vein. When the internal secretion of the endocrine glands is defective or vitiated, varicosity results; in their opinion, the genital glands (testicles and ovary) and hypophysis cerebri are those chiefly concerned, and a course of treatment with extracts of these glands is suggested following injection. (10)

IX. SYMPTOMS

The following descriptive article on symptoms was written by Lewis

A. Conner:

"The onset is usually slow and insidious and often occurs before the occurrence of the sub-cutaneous varicosities. At first there are only some ill-defined discomfort of feeling of tension in the leg and calf. The limb feels heavy after walking or standing, or at the end of the day, and there may be some formication or itching. The symptoms usually subside promptly upon rest in the recumbent position. In well advanced cases, the feeling of weight and the dull ache in the leg may be very troublesome and may seriously interfere with prolonged walking and standing. Occasionally the pain may take on a distinct neuralgic character."

"The appearance of the leg in well developed cases is very characteristic. Over the affected region the dilated veins show as serpentine, bluish cords winding in every direction beneath the elevated and often thinned and atrophic skin. Here and there circumscribed protusions of deeper color mark the position of the true varices or aneurysmal pouches. These venous swellings are soft, elastic and compressible, except when the lumen contains a thrombus. If the main trunk of the large saphenous is involved, it may show as a permanent tortuous cord as large as a finger, coursing along the inner aspect of the thigh and often presenting an ampulla dilatation at the saphenous opening above the ostial window." (11)

*Too much  
question  
than should  
be written in  
your own  
rather than copied*



## X DIAGNOSIS and DIFFERENTIAL DIAGNOSIS

The following discourse was obtained from H. O. McPheeter's text on Varicose Veins;(4)

"In considering a differential diagnosis of varicose veins we would think of thrombo-angiitis - obliterans, intermittent claudication, Reynaud's disease, diabetic neuritis, indurated erythema of Bazin, Morton's disease, the pains associated with flat feet and the rheumatic pains about the knee and ankle. The varicose veins which are compensatory and which develop following a deep thrombo-phlebitis must be differentiated from those varicose veins usually met with".

Since pain is one of the outstanding symptoms of varicose veins, it is necessary to differentiate this condition from rheumatism, true sciatica, tabetic pains of the lower leg, polyneuritic pains, pains of osteitis and periostitis, developing following a coincident bruise of the tibia on the periostitis following the congestion of an associated varix which is very common. The menopausal arthritis, which occurs usually in fleshy individuals, must be considered.

At the time of taking the history, it is very important to obtain information of a possible previous thrombo-phlebitis. If such a condition has ever been present, the amount of destruction to the circulation should be ascertained. This is of importance and will decide your further management of the case.

## XI. COMPLICATIONS

The most frequent complication of varicose veins is the development of an infectious thrombo-phlebitis. This occurs in the superficial group of veins, the saphenous magna and parva, and in the deep group of veins of the lower leg.

The stagnation of blood in the varices makes an ideal site for the location of an infectious process. The source of infection may be any foci in the body, as it may arise from excoriations of the skin over the area. The condition may be found in the superficial or deep system, either one or both, one predisposing to the development in the other. It frequently occurs in women about four days post-partum, hence the name "milk leg".

The condition is very painful, prone to spread and usually very slow to recover. Extended cases produce a marked destruction of the lymphatic circulation of the leg, particularly the lymphatic circulation of the superficial fascia. This causes a varying amount of edema which may persist or clear up rapidly.

Rupture of the varicose vein either externally or internally, may result in dangerous or fatal hemorrhage. This is usually the result of some form of trauma.

The impairment in the circulation in the skin overlying the varices may produce a dermatitis and later on an eczema. The eczema is usually extensive and of the moist, oozing type.

Finally, the most severe complication of this condition is the Ulcer Cruis or Varicose Ulcer. This will be discussed under a special head in the Miscellaneous group.

## XII. TREATMENT

The treatment of varicose veins is of vital interest because of the favorable results that can be obtained if proper therapeutic measures are instituted and because of the severe and painful complications that may arise if treatment is neglected. The following discussion will be divided into the principles, general, operative and injection methods of treatment, with the latter obtaining a majority of the discussion.

A. Principles of Treatment;

Biinnie says "The principles of treatment of varicose veins is the transference of the circulation from the superficial to the deep veins, but before attempting to do this, it must be shown that there is neither thrombosis of the deep veins nor marked obstruction to the return of blood through them".

With the testing of the deep veins is generally associated the Trendelenburg test. This is made as follows; "The patient's leg is well elevated, after which the varices empty. Next, the proximal end of the great saphenous vein below Poupart's ligament is compressed and the patient is asked to stand up. If the vein remains empty but fills up with a gush of blood from above when the compression is relieved, the test is positive for valvular incompetence of the great saphenous vein. If the veins fill up suddenly on standing before compression is relieved, and the veins become still more prominent, the test is doubly positive for incompetence of both the saphenous and anastomotic valves. Finally, if after elevation and compression, the veins fill up slowly from below on standing and do not dilate more after relieving the pressure, the test is negative and the valves are competent".

The surgeon is, of course, interested in the deep venous circulation but it is not necessary to make the Trendelenburg test.

If the varicosed extremity shows no signs of edema or swelling around the ankle, one can be sure that the deep venous circulation is functioning because the circulation in the dilated superficial system is reversed in the upright position and does not function. "Mayo in doubtful cases, applies an elastic support to the limb for a week; if this gives comfort, it is fairly evident that the deep vessels are capable of doing their duty". (13)

B. General and Palliative;

If evidence shows that the condition is due to some endocrine disturbance, it would be advisable to give extracts of the glands.

If the wearing of tight shoes, tight gaiters, or the patient's occupation appear<sup>s</sup> to be a factor, it would be advisable to remove and adjust, as best possible, these conditions.

Conditions producing a continued and repeated increase of abdominal pressure should be treated. These conditions are usually bronchitis, brochiect<sup>a</sup>osis, or a tumor growth in the pelvic region.

Palliative measures such as the wearing of bandages, rubber stockings or splinting of the varicosed extremity give remarkable temporary relief. The latter procedure is known to have given permanent cures when applied for a period of two to three weeks. This result is due to the increase in strength of the vein wall.(15)

C. The Operative Treatment.

*Until* Within recent years the only method of treating varicose veins was by operation. The surgical procedures were rather crude and the results obtained were very discouraging. After other surgical measures proved of little worth, Dr. Mayo introduced his operation in 1906. A short time later, Dr. Babcock introduced his operation which proved to be a modification of the Mayo method. These methods gave favorable results and brought surgery to its highest degree of efficiency in the treatment of varicose veins.

*Bone Brantley  
Walter*

The operative procedures are best grouped under the main heads of Excision, Incision and Ligation;

1. Operation by Excision.

- (a) Trendelenburg was one of the early workers in the operative field. His operation consists<sup>ed</sup> essentially of excision, between sutures of an inch or two of the saphenous vein at the upper part of the thigh. (12)
- (b) Mayo devised a dissector with accompanying forceps to facilitate excision of varicose veins through ~~the~~ small skin incisions. He stripped the vein of its branches, then pulled out the vein completely and bandaged the leg to stop the profuse bleeding of tributaries. (15)
- (c) Babcock modified the Mayo operation by inserting a probe into the vein. On both ends of the probe is an acorn tip. After the probe is put into the vein and pushed either up or down, a second skin incision is made at the site of the acorn. The vein is cut and tied firmly to the end of the probe. The probe is then withdrawn, bringing out the vein inverted upon itself. (17)

2. Operations by Incision. (12)

- (a) Circular Incision; Schede has advocated complete circular incision, dividing all tissues down to the deep fascia in the upper third of the leg, double ligating each vein as it is cut. Von Wenzel adds a similar circular incision at the lower and middle third of the thigh.
- (b) Spinal Incision; Reinofleisch and Freidal ligated the saphenous in the thigh; marked a spinal with five to eight turns around the leg; deepened this by incision to the deep fascia; catching and ligating the cut vessels; packing the wound to hold the edges of the spinal apart and force it to heal by granulation and epidermization.

(b) cont'd.

This leaves a deep gutter in the leg. When ulcers exist they include them between spirals. Kayser and Geinitz reported favorable results with this operation.

3. Treatment by Suture; <sup>(12)</sup>

(a) Delbet, in 1906, carried by suture and re-implantation of the saphenous vein into the femoral 10-12 cm. below the original entrance. His object was to cure varices by relieving them of the weight of the superimposed blood column through the interposition of one or more sets of competent valves.

(b) Hesse and Shaak worked on the same principle as Delbet.

(c) Jerger advocated end to end implantation with end and end to side anastomosis approximately <sup>in</sup> the endothelial surfaces very exactly.

(d) Katzenstein, reasoning that the varicosities of the saphenous system are due to lack of muscular support, originated a procedure in which he frees the internal saphenous as widely as possible, lays it on the sartorius muscle, and builds a muscular canal for it by suturing the latter around it.

The incision methods left unsightly scars, were exposed to infection and ulcer formation. The suturing methods did not give good curative results. Although Mayo's operation was a marked advancement over the other methods, it was unsuccessful in a large number of cases because the communicating vessels would dilate and give a recurrence <sup>e</sup> of the varices.

Some results given by surgeons are as follows;

Miller reports 79% cures by Trendelenburg operation in the Trendelenburg clinic.

Mathas quotes Goerlich as having 1,425 cases and had 65-80% cures with ligation of the saphenous.

C. cont'd.

Jeannel reports a total of 56% cures in 697 cases, using the Trendelenburg operation. (18)

The mortality rate from pulmonary embolus in operative procedures is 53%.

D. The Injection Treatment.

The development of the injection treatment of varicose veins to its present efficiency is regarded as one of the most remarkable of advances in modern medicine. Although injection treatment by chemical obliteration has been in vogue sporadically for some seventy-five years, it was developed and popularized in 1916 by Sicard of Paris. The previous attempts had failed because the technic was faulty or the solutions used dangerous.

1. History.

The following historical account was given by Douthwaite in his text on the Injection Treatment of Varicose veins. (19)

"The earliest attempts to obliterate varicose veins by injection of chemicals appear to date back to 1853 when Chassaignac used iron perchloride in three minim doses. The results, although often satisfactory, were so frequently complicated by severe inflammation of the surrounding tissues that the method fell into disrepute."

"In 1875 Valette used, with great success, a solution of iodine and tannic acid. The treatment entailed, however, a fortnights recumbency."

"Tavel, in 1904, employed a 5% solution of phenol with some measure of success; he combined ligature of the veins to be injected. As is, however, so often the case, the pioneer work was greeted with but little enthusiasm, and the credit of popularizing this valuable new treatment amongst the medical

### History (cont'd)

fraternity on the Continent be given unstintingly to the Frenchworkers in this field. Pre-eminently the names of Sicard, Gaugier, and Genevrier, stand out in this connection the first two workers having concentrated on sodium salts of which they now favor the salicylate, while Genevrier brought to our notice the remarkable obliterating power of quinine solutions".

"Sicard in 1917, used solutions of sodium carbonate, found that although this substance brought about the obliteration of the lumen of the veins when injected into them, yet it was unsuitable for general use on account of its caustic action on the soft tissues. Experimenting further, he discovered that sodium salicylate proved to be an effective though less irritating compound, and has since this time used it in treating most of his cases".

"Dalton in 1928 reports great success with the use of pure liquid carbolic acid".

#### Injection Treatment.

Of other substances which have been used for injecting varicose veins, mention may be made of sodium citrate employed by Troisier, biniodide of Mercury by Montoellier, glucose by Nobl, and iodine in the form of Pregls solution, by Brady".

#### 2. Contraindications.

The following contraindications for the injection treatment of varicose veins represents the general opinion of most workers in this field. (20)

- (1) Thrombophlebitis. "A good history is of importance and if not diagnostic will give a good lead. The physical signs of this condition, except in the acute stage, are not



(1) Thrombophlebitis (cont'd)

clear cut and only too often not helpful. This is particularly true when there is edema associated with small dilated veins which are really compensatory and not true varices."

(2) Obstruction; to the deep veins and peripheral arterial disease.

(3) Infection; cellulitis or lymph-angitis is often present in the zone surrounding the ulcer. Either the ulcer should be treated first until healing is complete, or if injections are made, the operation should go some distance from the ulcer.

(4) "Elderly patients, and patients enfeebled by acute or chronic diseases, or who are physically or nervously exhausted. This is especially true when the lowered vitality is due to chronic diseases, or who are physically or nervously exhausted. This is especially true when the lowered vitality is due to chronic involvement of a vital organ, as in cirrhosis of the liver, nephritis, myocarditis, cerebral arteriosclerosis, hypertension, etc. A well compensated heart lesion is not a contra-<sup>ic</sup>indication, but the injection should be made carefully to avoid any vasomotor reaction which might prove of serious import."

(5) Arterio-venous fistula; this condition is rarely met with, and when it is, is easily recognized.

(6) There is some controversy as to the injection of varices in pregnancy. McPheeters considers it proper to inject varicosities in the first seven months of pregnancy. He claims that much relief can be obtained from a simple injection procedure.<sup>(4)</sup> Numerous authors, including Sicard and Burton, are opposed to this procedure during pregnancy. They regard the pregnancy as an "intra abdominal tumor". (10)

3. Indications for Injection Treatment.

The indications for the injection treatment of varicose veins differ with men about the country. McPheeters states that "All varicose veins should be treated by the injection method unless <sup>there</sup> some definite positive contraindication, inasmuch as the danger entailed is so slight". (13) He gives the following as generally accepted indications;

- a. Varices which are so large and painful that they partially or totally disable the patient.
- b. Varices which have developed the complications of ulcer, eczema or pruritus.
- c. Varices causing rheumatic pains about the joints.
- d. Painful and large varices of pregnancy should be treated before the sixth month.
- e. Painful varices about the vulva respond very well to injection treatment.
- f. Varices of the cardio-vascular and cardio-renal cases must be decided upon individually as to prospects of treatment. Mild cases of cardiac decompensation are sometimes <sup>treated</sup> by the injection treatment and are considered an indication.
- g. Injection for cosmetic purposes is an indication to be decided upon by the patient; however, results are very good!

(13)

4. The Solutions;

All the varicose solutions used in the injection treatment of varicose veins are best grouped according to the classification of Seibert and Wreszynski. (21) The grouping is on a pharmacological basis.

4. The Solutions (cont'd)

Group 1. The salts which absorb water; sodium chloride, calcium chloride, sodium salicylate and sodium citrate.

Group 2. The halogens; Tincture of iodine, Lugol's solutions, Pregl's iodine solution.

Group 3. The alkalies, which have very strong cauterizing effects; sodium carbonate solution.

Group 4; The heavy metals; corrosive sublimate, iron perchloride, mercuric iodide.

Group 5. The organic cauterizing agents; alcohol, dextrose, glucose, colorose (or invert sugar solution, Eli Lilly) and invertose (invert sugar solution, plain), quinine and urethane.

The following discussion of the solutions is obtained from the work by Dr. Levi (22) and H.O. McPheeters (4).

The sodium chloride and sodium salicylate are the only solutions of group one that are being used at present. The former used in a 20% solution is desirable because of its exact results, and its safety against systemic reactions. The latter is probably the most used solution of the present day. It is used in 15%, 25% and 35% strengths as well as in solution with tritocaine for anesthetic effect. The results are very exact. The objection to these two solutions, however, is the painful cramp produced upon injection of the substance.

The halogens of group two and the caustics of group three have been discarded because of severity of reaction and inefficient results.

The heavy metals of group four are not used generally, at present. The mercury preparations produce good results but there

4. The Solutions (cont'd)

is danger of poisoning. A few surgeons use Metaphen and a few use sodium morrhuate 5% which gives very good results.

The solutions considered in group five are the ones most extensively used at present. The alcohol gives good results but is very painful and also a blood coagulant. The sugar solutions are very effective in their results, produce less cramp and a minimum amount of periarteritis. The invert sugars were introduced because of making a thinner solution, thus allowing the use of a smaller needle, the large needle used being one of the disadvantages of glucose administration. The sugar solutions do not produce the firm clot of salt solution and sodium salicylate.

Genevriar's solution of quinine and urethane causes no cramp comes on some four hours later. This passes rapidly. The solution is effective in small amounts and there are no undesirable systemic results. The quinine is the active element, which destroys the endothelium of the vein and the urethane acts as an anesthetic. There is a tendency toward violent reaction causing the vein to become red and tender. Some women have experienced disturbance of menstruation by the action of this solution. Because of the thinness of the solution there is a tendency toward extra venous leakage.

Contrary to general opinion - J.A.M.A. (23) states that there is no solution known that is being used in the injection treatment of varicose veins, that will not produce a slough if injected outside the vein. The sugar solutions and quinine solutions produce the least amount of slough.

4. The Solutions (cont'd)

The sodium chloride and sodium salicylate produce severe sloughs on being injected outside the vein.

5. Technic

It is impossible to give any exact technic for the injection of varicose veins, because, as the literature shows, this varies with the particular surgeon and the particular solution being used. Some use a number of tourniquets (4) others state that tourniquets are contra-indicated because of the reverse flow of the blood (14). Others use gauze bandages and special types of vein occluders (24). After all, the object of the procedure is to bring the sclerosing agent into contact with the varicosed wall of the vein; just how this is accomplished does not matter if the end results are satisfactory.

The following is a good account of the injection technic as described by J.M.Moca of the University of Chicago. (25):

"The technic is simple. It consists merely of an intravenous injection which presents only the difficulty of being preformed frequently on tortuous, shifting, and sometimes very thin walled veins. One must be absolutely certain that the needle is within the lumen of the vein. The patient may be either in a sitting or in a recumbent position. It is not necessary to use a tourniquet. The injection should always be carried out slowly, watching carefully for signs of extravasation of the fluid. Should this occur, one injects immediately 5-10 cc of physiologic sodium chloride solution subcutaneously, to dilate the irritant fluid in the tissues". This treatment varies

5. Techninc (cont'd)

slightly, depending on the sclerosing agent used. If glucose, should be used, one injects 5 to 10 cc of a 50% solution two to three times weekly. Glucose, however, is not a very rapid sclerosing agent, but because it is relatively non-toxic and produces such little reaction in the event of the solution getting outside the vein, it is used by many men.

Sodium chloride, if selected, is used 20% strength, 5-10 cc being injected twice weekly. While it is a good sclerosing solution, it so often produces so severe a cramp like pain below the site of injection, lasting for several minutes, that patients frequently refuse to continue the treatment.

"Sodium salicylate (our preference) 20% strength, injecting 5 cc at the first sitting, and 10-15 cc at subsequent sittings. One injection often suffices to obliterate 5 to 10 cm. of the vein. If the 20% sodium salicylate does not produce the proper reaction, this occurs infrequently, the same solution in 30% strength may be used. Upon concluding the injection, it is best to bandage the limb with cotton elastic bandage which may be left on for 48 hours. This pressure causes a collapse of the vein at the site of the injection and often the walls become adherent<sup>30</sup> that the vein does not refill. The number of injections must be decided entirely by the case involved, usually one or two suffice for the smaller veins, three to six for the large veins.

## 6. Complications

The complications of the injection treatment are best discussed under the local reactions, general reactions, and pulmonary embolus.

### (1) Local Reaction.

The local reaction is invariably a cramp like pain in the leg, coming on about one minute after the solution enters the vein, spreading diffusely distal to the site of injection, and lasting three to five minutes. A burning sensation at the site of injection should indicate perivenous injection. This should be treated at once either by the method previously described by J. Moca, or by "massage and hot applications" as described by C. C. Burton.(20)

"Some twenty-four to forty-eight hours after the introduction of the solution, the vein may show an inflammatory reaction in the region of the injected vein, characterized by a firm, slightly red, swollen, tender area. These symptoms usually subside in two to four days, but occasionally may last a week. This is due to the chemical irritation of the solution. Small discolored areas at the site of injection are due to faulty injection or a reflux of solution through the puncture site." (23)

The varicose vein slough is a very undesirable complication of the injection treatment. It is caused by the solution getting into perivenous tissue. This may be due to faulty technic or may result from a leakage through the site of injection into the vein, or from a seepage through the vein wall. The condition produced is treated early by chlorinated soda washes, but if the condition is of long standing, excision is necessary. Early excision is dangerous because

## 6. Complications (cont'd)

of spread through the lymphatics. (23)

### (2) General Reactions.

The general symptoms which are most common are those of a general disturbance such as sweating, dizziness, palpitation, and fainting. The emotional factor is the most common cause.

### (3) Pulmonary Embolus.

Pulmonary embolus is the only serious complication of the injection treatment of varicose veins. Fortunately, this complication is rarely developed. This has been the subject of much discussion, chiefly because of the apparent possibility and the clinical absence of this condition.

H. O. McPheeters states; "The very thought of injecting directly into the blood stream a destructive solution with the intention of getting a thrombus formation, which is always considered the parent of an embolus, seems unscientific, and certainly non-surgical. This, however, is what is done in the injection treatment of varicose veins by the use of sclerosing solutions" (1). However, McPheeters and Rice have a record of only four cases of pulmonary embolus in 53,000 treated cases. (4)

Bernheim of Baltimore, working on the subject of fatal emboli, as the result of thrombosis, comes to the conclusion that most of the fatal postoperative emboli arise not from the long veins of the extremity, but from the thrombi lodged in the short concealed veins of the pelvis. He states that "he has never known of a fatal pulmonary embolus to arise from the saphenous vein" (26)



(3) Pulmonary embolus (cont'd)

The following is a discussion by the French school upon the subject of "venit<sup>is</sup>", the condition produced by sclerosing and solutions,/"phlebitis" the infectious condition in relation to pulmonary embolus.

The former is localized, is associated with the formation of a very adherent clot, gives rise neither to pain or edema of the limb, and leaves an atrophied cord. In the latter, there is often extension from the superficial network to the deep venous system causing edema of the limb, the clot is often loose, pain is nearly always present, and atrophy does not occur. That Phlebitis may give rise to embolus venit<sup>is</sup> practically never occurs.

The work done to establish the belief that the circulation in the varicose extremity is toward the periphery, also <sup>helps</sup> proves to explain the practically clinical absence of pulmonary emboli. The thrombus, if formed into an embol<sup>us</sup>, would be carried to the smaller venules and there become lodged.

7. Value of Treatment.

The injection treatment is much advanced over the operative methods. The results are also much better as shown by the following reports.

(1) Recurrence.

Sicard with 15,000 patients and 120,000 injections, has a recurrence of 6%. (22)

Authentic operative results show a recurrence of 30%. (22)

(2) Chemical Gangerene (22)

Injection method, Payne, 13 in 1,500 cases.

Higgins, 12 in 200 cases.

7. Value of Treatment (cont'd)

(3) Mortality.

The following is the result of a questionnaire to 1,000 of the leading surgeons in the country, the work being done by McPheeters.

Death from pulmonary embolus following operation 0.53, and following injection treatment 0.00754 or 70 times as great for operative procedures. (27)

One should obtain almost 100% cures by the injection treatment if the case is followed and all recurrences injected early. (4)

### XIII. MISCELLANEOUS

In this group the writer has placed ulcer cruris, hemorrhoids, varicocele and esophageal varices. The first two conditions will be most often seen, so a majority of the discussion will be on those subjects. The latter two conditions will be only briefly reviewed.

#### A. Ulcer Cruris.

To Dr. Stoner (23) the writer is indebted for the following;

"The varicose ulcer or ulcer cruris is the most severe complication of varicose veins, and is considered one of the most painful and disabling conditions that affect an extremity. Writers have estimated that 30% of the population are affected with varicose veins, and fully 10% of these have ulcerating complications".

"The constant symptom of the ulcer is pain, varying in degree independent of size of ulcer, but varying as to location of lesion. This is intensified by the standing posture and by any constriction."

"The etiology is usually some form of trauma, superimposed on a varicose vein. A slight bruise scarcely noticeable at the time may be the beginning of a chronic ulcer. However, a phlebitis, localized, with a thinning out of vein wall, and overlying integument, may blow out, as it were, producing a sudden hemorrhage, more or less alarming to the patient, but easily controlled by pressure, leaving, however, in its wake a well defined varicose ulcer".

Pathology: "The ulcer forms as a result of gangrene of the overlying integument. The stagnation of blood, serum soaked tissues, thin walled veins, makes an ideal place for infection. The ulcer may involve only the superficial skin layers, or it may slough through the entire integument. These deep ulcerations frequently involve a very larger area sometimes extending more than half way around the circumference of the leg.

"The bacterial flora consists practically always of strep or staph. *spell out*

The rapidity of the healing time of an ulcer bears no relation whatsoever to the type of bacteria found in the ulcer. In no case has the gas bacillus been found."

"The skin about the ulcer may be thinned, reddened or assume a dirty violet color. The surrounding area may be tender to the touch."

"The diagnosis of varicose ulcer should offer no great difficulty. It must be differentiated from syphilitic, tuberculous, trophic and malignant ulcerations. An ulcer with varicose veins may be anyone of these conditions. The Wasserman and Kahn test should be made. It is well established that ulcer *rarely* if ever precedes or acts as a causative factor in producing varicose veins".

McPheeters follows the method of Rodoloho Kloop in the Clinic of Berlin in treating his cases of Ulcer Cruis. He also includes the large rubber sponge and supportive bandage as advised by Professor Nobl. (29) His results compare favorably with the best workers in the country. An outline of his treatment follows;

1. Be sure of your diagnosis and complications as nephritis, diabetes if present.
2. Apply gauze and sponge to ulcer.
3. Several layers of fluffed gauze are put over the ulcer to adsorb the discharge.
4. A good grade rubber sponge extending more than one inch beyond the edge of the ulcer is placed over it.
5. This is bound down firmly with 4inch gauze, extending from the knee downward.
6. The patient must walk for at least an hour.
7. When the granulations become flattened out and the secretions controlled, and the tissue appearance becomes normal, the rubber sponge can be eliminated, but the pressure with the

7. (cont'd)

compression bandage must be continued throughout the entire course of treatment, and for a long time after the ulcer is healed.

8. At the proper time, skin grafting will shorten the time of healing. This is done after the offending veins are injected and complete elimination of the lymphangitis and extensive tissue infection about the ulcer.

There are numerous other methods of treatment, but since the introduction of the injection treatment of varicose veins, the older methods have been cast aside. However, De Takats reports good results by using a combination of a paste board boot and injection of varices with sugar solutions. (30

B. Hemorrhoids

For the following discussion of hemorrhoids the writer is indebted to Vernon C. David. (31)

"This condition is due to varicosity of the veins of the plexus which is situated immediately above and below the mucocutaneous junction of the rectum. The veins are principally those from the superior and inferior hemorrhoidal vessels, both sets anastomosing freely, though the superior group make up for the most part of the internal hemorrhoids, while the inferior hemorrhoidal veins are usually found under the skin of the anus, and form the external hemorrhoids".

1. Etiology.

"The etiology of hemorrhoids has to do with factors causing stasis in the hemorrhoidal veins, which anatomically are without valves to prevent back pressure. The most common causes are constipation

B. Hemorrhoids (cont'd)

and diarrhea. In women, childbearing and tumors of the pelvic organs play an important role. Obstruction of the portal circulation, as cirrhosis of the liver, or decompensation of the heart, with liver swelling, causes numerous varicose veins to appear in the hemorrhoidal plexus. Lesions such as prostatic enlargement, bladder stone or urethral stricture, play a considerable role in increasing intra-abdominal pressure and causing stasis of blood in the hemorrhoidal veins."

"Irregular habits of elimination favor the development of hemorrhoids. Chronic bronchitis and attacks of vomiting also favor great increase of venous engorgement of the hemorrhoidal plexus."

2. Pathology.

"Hemorrhoids involve the plexus <sup>e</sup>centring at the mucocutaneous line of the anus and are made up of dilated anastomosing vessels of the inferior and superior hemorrhoidal veins. Internal and external hemorrhoids are differentiated by the fact that the former lie immediately above the mucocutaneous junction, are covered with mucous membrane, and consist largely of veins of the superior hemorrhoidal vessels".

External hemorrhoids lie immediately below the mucocutaneous junction. They are covered with skin and made up chiefly of inferior hemorrhoidal veins.

Internal hemorrhoids are multiple and form sessile tumors, varying in size from a pea to an English walnut. When the varicose veins are well developed, the mucosal covering becomes thin and the slightest trauma to their surface causes bleeding.

The larger internal hemorrhoids prolapse through the

sphincter muscle and protrude. If left long in this position, thrombosis of the veins may occur, or ulceration of the mucosa covering the vein ensues, and not infrequently, gangrene of the hemorrhoids takes place. Infection of these strangulated necrotic masses may lead to severe constitutional symptoms and liver abscess. Internal hemorrhoids present for a long time may develop enough fibrous tissue to stop the bleeding.

External hemorrhoids usually occur suddenly, due to thrombosis in one or more of the veins surrounding the anus. There is edema into the loose tissue. If not removed surgically, the clot organizes recedes, forming a loose tag which is usually called an external hemorrhoid.

Increased abdominal pressure may cause a slow development of external hemorrhoids. These are especially prone to thrombosis. When the thrombus is large and next to the skin, pressure necrosis of the skin may result with extrusion of part of the thrombus. The blood clot may become infected with abscess formation; this is not a common occurrence.

### 3. Symptoms.

- a. Occasional bleeding of bright red blood.
- b. Later, bleeding and protusion at almost every stool.
- c. Still later, bleeding and protusion not only at stool but at any time the patient is on his feet or strains.

Actual pain is absent unless complications are present. These are thrombosis of veins under the skin; ulceration of surface, persistent diarrhea, superficial diffuse ulceration of constantly protruding internal hemorrhoids. None of these are commonly present, so the pain may be due to some other factor as ulcer, abscess, tumor, etc.

B. Hemorrhoids (cont'd)

4. Diagnosis.

The history of painless bleeding and protusion at stool is characteristic of internal hemorrhoids.

A sudden painful swelling at the anus is usually due to a thrombosed external hemorrhoid.

Carcinoma of the rectum is almost always associated with passage of blood or clots.

When ulcer is present there is a burning sensation after bowel movement. Usually this is associated with a chronic fissure but may be an ulcerated prolapsed internal hemorrhoid.

5. Treatment

(a) Internal.

The operation on the internal pile, its removal by clavo and cautery, is the most efficient method of treating this condition. Ambulatory treatment consisting of injection of the vein with quinine and urea gives good results in some cases but there is a tendency for recurrence.

The Whitehead operation, or excision of the pile-bearing area, is used in very extensive hemorrhoidal condition.

(b) External.

The external hemorrhoids are treated by incision for the thrombotic and incision for the hypertrophic type.

C. Varicocele

For the following discussion, the writer is indebted to Francis R. Hagner;

"The condition characterized by dilatation, elongation, and tortuosity of the veins of the pampiniform plexus. It is generally limited to the spermatic vein, though the differential and cremasteric veins.



C. Varicocele (cont'd)

veins may also be involved. The spermatic vein has its origin at the posterior border of the testis as a thick network of eight to ten vessels (the pampiniform plexus) most of which lie in front of the cord. These veins pass up through the inguinal canal into one trunk in the abdominal cavity, the vein on the right side passing to the vena cava and then on the left side to the renal vein. About 95% of all varicoceles occur on the left side. Many theories have been proposed to account for this left sided predominance. Some writers believe that the condition is related to the right angled junction of the vein, with the renal vein, or to the fact that the left spermatic vein is longer than the right and has no valves."

"To other writers, this explanation does not seem to account for the occurrence of varicocele in the young, and its comparative absence in the old. The most probable explanation is that it is a functional disorder caused by chronic passive congestion during the period of greatest activity of the sex glands. This would account for its frequent disappearance after marriage and for its absence in the old men whose sexual functions are in obedience."

"Varicocele is symptomatic, is caused by abdominal tumor, or growth of left kidney causing obstruction of spermatic vein by pressure. This is rare, however. Any varicocele developing in men past fifty years of age should immediately lead one to think of neoplasm". (22)

D. Esophageal.

Throughout the esophagus there is a free venous anastomosis. It has been stated above, that the return of venous blood from the esophagus may go through the superior vena cava, or the portal system. Therefore, if there is an obstruction to any of these

D. Esophageal (cont'd)

systems, the blood may use this anastomosis or the esophageal wall as a means of returning through some other system which is not obstructed. The result is a marked dilatation of the veins of the esophagus, usually those about the lower end."

"The most common cause for dilation of these veins is cirrhosis of the liver. These dilated veins will not cause symptoms, except that they are liable to rupture with resulting hemorrhage. Rupture is sometimes spontaneous without apparent cause, or may result from sharp particles of food, or from the passage of the stomach tube. The blood is usually vomited but may pass into the stomach and only be detected as a tarry stool".(23)

XIV SUMMARY

Patients suffering with varicose veins can now be effectively treated by the injection of obliterating agents. The older operative procedures are now in discard and the medical profession can offer a better prognosis. One of the outstanding points making this treating desirable is that the patient is ambulant during the entire period and also is subjected to a minimum amount of pain.

With the early treatment of varices, there will be a decrease in the number of cases of ulcer cruris. This will mean more to the doctor or patient who has watched or suffered with this severe complication.

Varicosities of the inferior hemorrhoidal and spermatic vessels likewise respond favorably to this injection method.

BIBLIOGRAPHY

- (1) H. O. Mc Pheeters "Varicose Veins" Journal-Lancet  
49: 243-247 1929
- (2) Kampmeir and Carrol La Fleur Berch  
"The Origin and Development of the  
Venous Valves with Particular Reference to the Saphenous  
District" The American Journal of Anatomy  
38: 451 1926-27
- (3) Macleod "Physiology and Biochemistry in Modern Medicine"  
Text 427-428 1926
- (4) H. O. Mc Pheeters "varicose Veins" Text 1929 *Bibliography*
- (5) J. M. Moca "Chemical Obliteration of Varicose Veins"  
Illinois Medical Journal 56: 191-192  
March 1929
- (6) F. P. Strickler "Varicose Veins" Kentucky Medical Journal  
28: 140-143 March 1930
- (7) Mc Pheeters and Rice "Surgery Gynecology and Obstetrics"  
49: 29-33 July 1929
- (8) G. De Takats "Treatment of Varicose Veins and Ulcers"
- (9) B.B. Nicholson "Varicose Veins; Etiology and Treatment"  
Archives of Surgery 15: 355-57 1928
- (10) P. K. Murphy "Sicard and Gaugier Method of Treating Varicose  
Veins" British Medical Journal 1: 145-48  
1929
- (11) Lewis A. Conner "Varicose Veins"  
Nelson's Looseleaf Medicine 4 Pg. 609

- (12) Johnson's Therapeutics Vol. 1 "Operative Therapeutics"  
 617.9  
 J63 Pg. 320
- (13) H. O. Mc Pheeters "Indications for Injection Treatment of  
 Varicose Veins" Text Varicose Veins  
*Published*  
 1929
- (14) T. O. Smith "Varicose Veins" Canadian Medical Journal  
 22: 627-35 May 1930
- (15) D. H. Stewart "Splinting of Varicose Veins"  
 Medical Journal and Record  
 22: 627-35 1930
- (16) C. Mayo Surgery Gynecology and Obstetrics 11  
 Pg. 385 1906
- (17) Babcock Surgery, Text Book of Pg. 416 1929 *W.H.D.*
- (18) Jeannel "Varicosities" Illinois Med. Journal 56: 114-116  
 Aug. 1929
- (19) Douthwaite "Varicose Veins" Text 1929
- (20) C. C. Burton "Injection Treatment-Complications Following"  
 U. S. Veterans Bureau Med. Bulletin 6: 854-857 1930
- (21) F. M. Sherman "Injection Treatment of Varicose Veins"  
 Kentucky Medical Journal 28: 282-91  
 June 1930
- (22) D. Levi "Relative Value of Solutions"  
 Lancet 2: 16-18 July 1930
- (23) "Varicose Vein Slough"  
 J. A. M. A. 95: 787-89 Sept. 1930
- (24) W. J. Potts "Chemical Obliteration-Improved Technic"  
 Annals of Surgery 92: 475-477 Sept. 1930
- (25) J. M. Moca "Chemical Obliteration of Varicose Veins"  
 Illinois Medical Journal 56: 191-92  
 Mch. 1929
- (26) J. N. Baker "Combined Method of Injection Treatment"

(26) cont'd

South Medical Journal 23: 742-47 Aug. 1930

(27) Mc Pheeters "Operative versus Injection Treatment"  
Surgery Gynecology and Obstetrics"

48: 819-822 June 1929

(28) A. P. Stoner "Varicose Ulcer"

J. Missouri Medical Association

27: 161-66 April 1930

(29) Mc Pheeters "Etiology, Pathogenesis and Treatment of Varicose  
Ulcer" Surgery Gynecology and obstetrics

Oct. 1928 Pg. 469-77

(30) C. C. Burton "Complications following Injection Treatment"

U. S. Veterand Bureau Medical Bulletin

6: 854-85 Oct. 1930

(31) Vernon C. David "Surgery of the Rectum and Anus"

Dean Lewis Practise of Surgerye Vol. 8 Pg. 60

(32) C. Frothingham "Diseases of the Esophagus"

Oxford Medicine Pg. 15-16

(33) F. R. Hagner "Surgery of the Scrotum Testes and Groin"

Oxford Medicine