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CLINICAL AND PATHOLOGICAL REPORT OF A CASE OF CAVERNOUS LYMPHANGIOMA OF THE SUBCUTANEOUS TISSUE OF THE FOREARM.

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CLINICAL AND PATHOLOGICAL REPORT OF A CASE OF CAVERNOUS LYMPHANGIOMA OF THE SUBCUTANEOUS TISSUE OF THE FOREARM.

Clinical and Pathological Report of a Case of Cavernous Lymphangioma of the Subcutaneous Tissue of the Forearm (under the care of Professor Chiene). By Harold J. Stiles, M.B.

In January 1892 Professor Chiene operated for the third time upon a congenital tumour of the arm of a little girl, æt. 8. As the parts removed presented a very unusual appearance, they were sent to me at the surgical laboratory for microscopic investigation. The tumour proved to be a well-marked example of a cavernous lymphangioma of the subcutaneous fatty tissue. The rarity of the condition has prompted me to give a short account of the clinical and pathological features of the case.

Present condition (January 1893, a year after the last operation).—KATIE S., æt. 9, well-developed and healthy-looking. The right upper extremity presents (Plate IX.), in the regions of the lower third of the forearm, the wrist, and the thumb, a swelling, producing a configuration not usually met with in surgical affections of this neighbourhood. The maximum swelling is opposite the wrist, and involves the entire circumference, which measures $6\frac{1}{4}$ in., as compared with $4\frac{1}{2}$ in. on the sound side. The swelling, well defined below, but tending to fade away above, and more marked on the radial side, involves the lower third of the forearm, and both aspects of the metacarpal bone of the thumb, while the palm is entirely unaffected.

The skin of the affected region (except for the cicatrices of the three operations) is normal, both to sight and touch; the sweat glands, however, appear to be more active than those of the skin elsewhere. There are no such vesicles as exist in the more superficial and cutaneous affection, known as

lymphangioma circumscripta. On palpation, the swelling appears to be confined to the subcutaneous tissues, and is of a soft, inelastic, doughy consistence, giving one the idea of being dependent merely upon an overgrowth of the subcutaneous fat. Except for some induration in the neighbourhood of the cicatrices, the consistence is uniform. The skin possesses its normal thickness and elasticity, and on pinching up the part there is no indication of the lobulation met with in a fatty tumour. There is no pitting on pressure, and neither elevation nor compression reduce in any way the size of the swelling, nor is there any enlargement of the supratrochlear or the axillary glands. The movements of the wrist and hand are as free, and the muscles producing them as well-developed and powerful, as those of the opposite limb. Measurements of the adjacent sound parts of the affected limb, when compared with corresponding parts of the opposite limb, show a slight increase in the latter, but no more than is to be accounted for by the greater use to which it has been subjected. Subjective symptoms are not prominent, and do not appear to cause much inconvenience. Pains shooting down the fingers are complained of when the swelling is much manipulated, or the parts much used. The fingers are more susceptible to cold than normal. She wears no bandage or covering of any kind to the parts. Father and mother both alive and healthy; one brother and one sister, both healthy, and younger than the patient; a fourth child died of whooping-cough. None of the other children present any congenital conditions.

The *previous history* of the case is shortly as follows:—A few days after birth a "big fat lump on the wrist and back of the hand" was noticed. It "just grew as the child grew," but does not appear to have given rise to pain, or to have interfered in any way with the usefulness of the limb; no further notice, therefore, was taken of it, until the child was $4\frac{1}{2}$ years old, when her mother brought her to hospital for treatment.

On account of the extensive and somewhat diffuse nature of the tumour, it was thought advisable to try the effect of elastic pressure before proceeding to more radical measures.

As, however, no effect was produced on the size of the tumour by this means, a T-shaped incision was made (March 1888) over the most prominent part of the swelling at the back of the wrist, and a large portion of the growth removed, piece by piece, until its limits were partly reached, no attempt being made to remove the whole of it at the one operation. The wound healed without trouble. Two years later she sought advice a second time, the tumour having in the interval become more prominent and painful. On this occasion Professor Chiene again recommended pressure, which was carried out in the out-patient department for six weeks, but again without material benefit. A second operation was therefore performed, and that part of the tumour occupying the lower portion of the forearm was removed, as far as possible, by an incision over the posterior and outer aspect of the limb. The operation was performed by the "bloodless" method. The condition was regarded as a peculiar blood-vascular tumour of the subcutaneous fat.

The third operation was performed in January 1892, the tumour having become more prominent still further up the forearm. An incision, beginning 3 in. above the wrist, was extended upwards along the anterior and outer aspect of the forearm for 4 in., and the tumour tissue removed until the normal fat was reached. The patient was discharged on the twenty-fifth day with the wound healed.

Pathological report.—The parts removed at this the last operation consist of several pieces, forming collectively a mass about the size of the ball of the thumb. On section, the tissue to the naked eye possesses a fibro-lipomatous structure, rendered porous and spongy by the presence of innumerable small openings and fissures. The openings vary in size from somewhat larger than a pin's head to minute pores just visible to the naked eye; they are of very various shapes, collapsed or patent, and exude on pressure a clear, serous fluid. In some places the fibrous, and in others the fatty element predominates. Well-developed blood-vessels may be seen here and there in the fibrous portions. The tumour itself, although not encapsuled, is fairly well defined from the surrounding fat.

Microscopical examination.—Sections were prepared from the more spongy as well as from the more compact parts, also from a piece consisting of the edge and adjacent normal subcutaneous fat. The pieces were embedded in the usual way in paraffin, stained with Ehrlich's hæmatoxylin, and with acid fuchsin and methyl-orange as contrast-stains.

All the pieces showed essentially the same structure, the only differences being the size and arrangement of the spaces. The general plan and structure of the tumour are well seen under the low power (Plate X.). Smooth-walled cavernous spaces of manifold shapes and sizes are surrounded and separated by a fibro-areolar and adipose connective tissue framework. The cavernous spaces are circular, oval, elongated, angular, or more or less irregular and diverticulated, varying in size from 1 to 3 or 4 mm. in diameter. They are for the most part patent and distended, except in the more fibrous parts, where they are somewhat compressed. They are lined with endothelium. Filling their interior, more or less completely, is a partly granular and partly fibrillar lymph coagulum, forming a sort of net-work. Entangled in these coagula are a variable number of small, round, nucleated cells, either uniformly scattered or aggregated into small groups. One or more large narrow-necked diverticula are often given off from the larger spaces; these, however, are in reality due to the fusion of two or more spaces, and the above diverticulated appearance depends upon the manner in which they happen to have been caught in the section. Narrow and elongated spaces may sometimes be seen opening into larger spaces. It is evident, therefore, that we have to do with a series of communicating cavities and channels, and not with small isolated cysts.

With the high power (Plate XI.) the endothelial lining of the spaces is very distinctly seen, and a careful examination of their contents establishes conclusively the lymphatic nature of the tumour. The cells which are entangled amongst the granules and interlacing fibrillæ of the coagula are of two kinds—(1) Small round cells with very little protoplasm surrounding the nucleus, which stains very deeply, and measures 3–4 μ in diameter. These are evidently young

uninucleated leucocytes (lymphoid cells). (2) Round cells with larger (6 μ) and less deeply-stained nuclei, surrounded by a relatively greater amount of granular protoplasm. At first sight it was doubtful whether these latter cells were to be regarded as large fully-developed leucocytes, or as derivatives of the endothelial cells lining the spaces. Careful examination, however, showed that they were similar to the large leucocytes which are so frequently found lying free in the sinuses of a lymphatic gland. Although the majority of the nuclei are spherical, many are distinctly horseshoe-shaped, and some are even fragmented. As further proof of their leucocyte nature, it may be mentioned that transitional types between the two varieties of cells are present. In none of the cavernous spaces can any red blood-corpuscles be detected. In order to meet the possible objection that the absence of red blood-corpuscles in the cavernous spaces might be accounted for by the " bloodless " method of operation, it is right to state that red corpuscles were found more or less filling the vessels in the stroma.

The stroma shares about equally with the spaces in forming the bulk of the tumour. It consists of a mixture of fibrous, areolar, and adipose tissue ; the latter, however, predominating, more especially in the neighbourhood of the larger spaces, where it forms the sole supporting tissue ; where the spaces are small the stroma is more fibrous. The fat cells in the tumour are for the most part smaller than those in the normal subcutaneous tissue surrounding it. The processes which project into the large diverticulated spaces often carry blood-vessels with them, and these latter may, according to the manner in which they are cut, give the appearance of lying free in the space, which might then be erroneously regarded as a very much dilated perivascular lymphatic vessel. The fibrous tissue of the stroma is of the coarse wavy type found normally in the subcutaneous tissue, intermixed, however, with a greater or less amount of young and œdematous tissue. There is no exaggerated connective tissue cell proliferation, but the leucocytes are everywhere more abundant than normal, and here and there aggregated into foci of varying size and density. In many of the smaller endothelial-lined

spaces and (lymph ?) capillaries they are so numerous as to present the appearance of thrombi. That these spaces are lymph capillaries is rendered more than probable by their relation to the blood-vessels, which is that of perivascular lymphatics. The leucocytes which are found free in the stroma, as well as those forming thrombic-like masses in the small lymphatics, are of the small uninucleated or migratory variety.

The feature, however, which especially characterises the stroma, and which distinguishes it from ordinary subcutaneous tissue, is the presence of well-developed *plain muscular fibres*, which not only surround many of the cavernous spaces, but are also scattered throughout all parts of the tumour. The differential staining has rendered the muscle fibres easily distinguishable from the connective tissue. Their arrangement is worthy of careful study, as it helps to throw some light upon the nature and origin of this rare form of tumour. When not specially related to the cavernous spaces they are scattered irregularly and in small bunches amongst the denser and more fibrous parts of the stroma. The part played by the muscular fibres in forming the walls of the cavernous spaces is a very variable one, and in no way depends upon the size of the spaces. The walls of some of the spaces possess a structure very closely resembling what one sees in the axillary or mediastinal lymphatic trunks; that is to say, outside the endothelium a coat of variable thickness, made up of a mixture of muscular and fibrous tissue in about equal proportions. The muscular fibres are collected into small bundles, some, especially the internal, running circularly, whilst those placed externally are more widely separated, and run for the most part longitudinally. Frequently, however, the two sets of fibres are mingled. Valves such as are present in the main lymphatic trunks do not appear to exist in the tumour. In contrast to the above—which may be looked upon as the highest degree of development reached by the walls of the spaces or channels—there are an equal number of spaces, both large and small, whose walls consist simply of a layer of endothelium placed directly upon the adipose or fibrous tissue of the stroma. Between these two extreme types, all tran-

sitions are met with, viz. spaces surrounded by a thin layer of circular fibres extending completely, or sometimes only partly, around the circumference; by small bundles of longitudinal fibres, placed more or less closely together; or, lastly, by fibrous tissue or fat, in which only a few isolated bundles occur. The spaces containing little or no muscular tissue in their walls are widely distended, whilst those with well-developed muscular walls are more or less contracted and zig-zag in outline. In the fibrous tissue surrounding the larger spaces are small lymphatics similar to those met with in ordinary subcutaneous tissue.

The blood-vessels in the tumour are not larger or more numerous than normal, so that there is no evidence of any hæmangiomatous element such as has been described as occurring occasionally in lymphangiomata. The larger blood-vessels, that is those with well-developed muscular walls, show a distinct thickening of the internal elastic lamina, and a slight thickening of the sub-endothelial layer —changes no doubt due to a certain amount of impediment to the circulation through the tumour. Nerves apparently normal in structure are seen here and there in the larger connective-tissue bands.

The origin and mode of growth of lymphangiomata appears to have been the subject of an amount of investigation and discussion somewhat out of proportion to the results which have been gained. Wegner (4), in his valuable monograph upon lymphangiomata, distinguishes three modes of origin— (1) Dilatation and hypertrophy of pre-existing lymphatics, giving rise to what is now generally spoken of as lymphangiectasis, or to a condition analogous to varix of veins. The cause is believed to be some local obstruction to the lymphatic circulation, but the nature of the obstruction cannot always be demonstrated anatomically. (2) Formation of new lymphatic vessels from endothelial proliferation in the form of solid processes, which become channelled and join the neighbouring pre-existing lymphatics (homoplastic neoplasia). (3) A secondary formation of new lymphatics and lymph spaces in newly-formed granulation tissue (heteroplastic neoplasia). Wegner believed the first to be the most frequent mode of origin. The

interest of the above distinctions, from a genetic and pathological point of view is, no doubt, considerable; at the same time it must be admitted that an attempt to make them the basis of a practical and clinical classification results, to a great extent, in failure. Winiwarter (9), in a case operated on by Billroth, found all three modes of origin. The case was one of congenital macroglossia, combined with multiple cystic hygroma of the neck. In the connective tissue between the muscles of the floor of the mouth were a number of round and slit-like lymph spaces, sufficiently large to be detected with the naked eye; these were directly continuous, both with the cavernous spaces of the tongue and the cysts in the neck. The walls of the lymph spaces consisted of fibrous tissue lined with a distinct layer of endothelium. Between the spaces were nodules of newly-formed lymphoid tissue, inside which were small spaces, and all transitions from these to small cysts. A somewhat similar case has been recorded by Whitehead.

According to Rindfleisch (10) the lymph containing spaces may arise from dilatation due to the contraction which accompanies the transformation of the granulation tissue into fibrous tissue. Such a process is, as Schmidt rightly observes, as difficult to understand as it is to demonstrate. Most authorities, including Virchow (1), Billroth (2), Winiwarter (3), Langhans (5), Nasse (6), Schmidt (7), and Beyer (8), admit that the third process described by Wegner plays a part in the growth of lymphangiomata. The exact mode in which this heteroplastic lymphatic neoplasia occurs has not been demonstrated with the clearness which one would desire, as may be gathered from the descriptions which follow. Nasse describes the process as occurring in the midst of the lymphoid collections, in which fine clefts, lined by flattened cells, with flat oval nuclei, make their appearance, and can in many cases be traced to communicate with the larger lymph spaces. In the two cases examined by Schmidt the cell masses consisted of strings of flattened connective tissue cells, arranged in rows with lymphoid cells between them, and he believes that these latter form the lining of the future newly-formed lymph spaces, the spaces themselves being formed by the washing away of the lymphoid cells.

More recently Beyer has attributed the origin of the cavernous forms of lymphangiomata to a cell infiltration, spreading from the perivascular spaces and adventitia of the vessels into the surrounding fat and cellular tissue, the pre-existing cells of which (especially the fat cells) become destroyed, so that spaces and cavities arise, which by their enlargement open eventually into the pre-existing lymphatics, and occasionally into the blood-vessels, accounting, in the latter case, for the mixed lymph and blood-vascular tumours occasionally met with. The homoplastic new formation of lymphatics is even more difficult to demonstrate, and appears to have been less frequently observed than the heteroplastic; judging, however, from the analagous process, as it occurs in blood-vessels, one would be inclined to regard the former as the more frequent and important. In 3 of the 18 cases examined by Nasse, he found the endothelial cells of the smallest lymphatics to be more closely placed than those of the larger vessels into which they opened, and infers from this that an endothelial proliferation has occurred.

It is true that in the tumour I have described there is a well-marked follicular, perivascular, and diffuse leucocyte infiltration into various parts of the stroma. In many of these lymphoid collections, appearances may be seen similar to those described by Nasse and Schmidt; nevertheless, they do not afford sufficient evidence to warrant the conclusion that these lymphoid nodules represent new foci in which either a hetero- or homo-plastic formation of lymphatics takes place. Many of the strings of flattened cells are sections of the walls of the capillary blood-vessels. The fact that the cells lining the smaller lymphatics are placed closer together than those lining the larger spaces into which they open, is no proof of endothelial proliferation, as the appearance might equally well be accounted for by supposing the latter to have been the result of dilatation. We have already seen that the cavernous spaces contain many uninucleated or migratory leucocytes, and that in the infiltrated tissue outside them are dilated, but otherwise normal looking, lymphatics, completely filled with the same variety of leucocytes. It is probable, therefore, that these lymphoid areas, in which a new formation

of lymphatics is supposed to occur, are nothing more than portions of the stroma which have become infiltrated with collections of leucocytes migrated from the cavernous spaces and lymphatics in their neighbourhood. There are no appearances leading one to believe that this leucocyte infiltration gives rise to the formation of lymph-containing spaces by a process of tissue destruction and rarefaction, such as has been described by Beyer. After all, it seems to me that the heteroplastic and homoplastic processes of lymphatic formation are in reality so closely allied that to differentiate them is to make a distinction without a difference.

In spite of the above observations, it must be confessed that the exact genesis and mode of growth of lymphangiomata are not fully understood. By most pathologists the term lymphangiectasis is applied to those conditions in which there is merely a dilatation and hypertrophy of pre-existing lymphatics, the term lymphangioma being reserved for the true neoplasms in which the lymph-vascular structures are supposed to be of new formation. Under lymphangiectasis may be included lymphatic varix, which, though usually a local condition, may also, as for instance in the interesting cases described by Mr. Sydney Jones ([11]), be associated with a general lymphangiectactic condition of the limb. On account of the richness of the lymphatic anastomoses, and of their open communication with the tissue spaces, a local lymphatic obstruction seldom produces lymphangiectasis. The condition is, as a rule, produced by an extensive lymphatic obstruction, caused by a general lymphangitis, which, becoming chronic, leads to lymphangitis obliterans of the main vessels of the part. In a case of lymphangiectasis, with solid œdema of the leg, which the writer recently had an opportunity of examining microscopically, the inner coat of the main arteries was greatly thickened but not degenerated; the calibre of the large superficial veins was reduced to half their normal size by thickening of the internal coat. The condition of the main lymphatic trunks accompanying the above veins was still more interesting; many of them were completely obliterated as the result of chronic lymphangitis. The smaller lymphatics and lymph spaces were everywhere distinctly dilated, but there did not

appear to be any evidence of a new formation of lymphatics. The true lymphangiomata are no doubt always congenital. They are either cavernous or cystic, the latter often resulting from the former by a more cystic dilatation of the spaces, and a breaking down of the intervening trabeculæ. All transitions, therefore, are met with between the typical cavernous and cystic varieties. The most familiar examples of the cystic variety are the congenital hygromata of the neck.

Of the 18 cases detailed by Nasse, 3 are described as cavernous lymphangiomata of the subcutaneous tissue. Their naked-eye and microscopic structure appear to be similar to our own case; no mention, however, is made of the presence of non-striped muscular fibres. The walls of the cavernous spaces are stated to consist of endothelial cells alone, or with the addition of connective tissue containing spindle-shaped nuclei. It is possible that these nuclei belong really to non-striped muscle fibres, the presence of which may readily be overlooked unless a differential staining method be employed. Under the name *angiomyoma*, Ziegler ([15]) describes and figures a tumour of the skin and subcutaneous tissue, the growth consisting largely of non-striped muscle derived from the muscular walls of thickened and pathologically new-formed blood-vessels. In our own tumour the amount of non-striped muscle is not sufficient to warrant the term *myoma*. The presence of muscular tissue in our own case is not without significance, as it enables us to differentiate the condition from simple lymphangiectasis. We have strong grounds, therefore, for regarding it as a tumour, which in its origin, growth, and structure is closely analogous to a subcutaneous venous angioma. All that can be said regarding its nature is, that it consists of a congenital overgrowth, and dilatation of lymphatics, with proliferation of the muscular fibres of their walls, depending upon "an excess and want of due restraint of that developmental force by which the several organs and structures acquire and maintain their proper dimensions and relations to one another" [Sir George Murray Humphry ([12])]. Of the cause of the developmental disturbance we know nothing. The manner in which the lymphatic overgrowth takes place in lymphangiomata is, as we

have seen, very imperfectly understood. This, however, is not to be wondered at, when we consider how imperfect is our knowledge of the normal development of the lymphatic system. Moreover, the anatomical relationship of the lymphatics to the tissues and tissue spaces is so intimate, the transition from the one to the other so gradual, and the development of a lymph space into a lymphatic capillary no doubt so readily brought about, that it is difficult to say how far the growth depends upon a true neoplastic overgrowth of lymphatics, and how far upon mere dilatation and hypertrophy of developing and pre-existing lymphatics. The growth of the tumour after birth is, as a rule, so slow that histological examination reveals but little of its nature.

I have only to refer to the condition known as macroglossia to illustrate the difficulties presented by the study of the pathology of those tumours. Most authors, following Virchow, regard this affection as a congenital lymphangiectasis, whilst others again regard it as a true cavernous lymphangioma. The case described by Mr. A. E. Barker ([13]) in the *Pathological Society's Transactions* was looked upon as *lymphangiectasis;* whilst Mr. Hutchinson, junior ([14]), in the same volume, describes, under the name *lymphatic nævus,* a case in which he believed a new formation of lymphatics to have taken place. The combination of macroglossia, with cystic hygroma of the neck, has already been referred to.

A few words may be added regarding the diagnosis and treatment of this case. The condition has to be distinguished more especially from subcutaneous venous angioma and from lipoma, and even after these have been disposed of the diagnosis would no doubt not be arrived at without the clinical experience of a previous case of a more or less similar nature. From subcutaneous venous angioma it is to be distinguished by the absence of any bluish coloration of the skin, by the want of any worm-like feel, and by the negative effect of elevation or pressure. The absence of pulsation puts out of account an arterial erectile tumour. It is to be distinguished from a lipoma by its situation, extent, diffuse character, ill-defined edge; by the absence of linear furrowing and lobular bulging; by its intimate connection with

the skin, and lack of mobility, and, above all, by its history.

As to treatment the choice lies between—(1) Compression, (2) Injection of irritants, (3) Electrolysis, (4) Excision.

1. Compression while of use as a palliative, and in combination with other means, could not alone be expected to effect a cure.

2. The injection of iodine or other irritants would not be suitable for such an extensive tumour, and in a smaller and more circumscribed growth excision would be far preferable.

3. Electrolysis.—In speaking of the treatment of lymphangiomata, Winiwarter states that "of the means which are used in the treatment of blood-vascular growths, we cannot employ those which act by coagulating the blood, since the lymph does not coagulate." Clinical records, as well as physiological facts, would indicate that the above statement is not to be accepted without reservation. No doubt in the cystic lymphangiomata the fluid is more of the nature of a secretion, and contains too little albumen to form a clot. The same cannot be said of the simple and cavernous forms. The question of coagulation is, however, of no practical importance, as Mr. Duncan—in whose hands the treatment of blood-vascular tumours by electrolysis has been so successful—attributes the cure not to coagulation but to cicatrisation, following the cauterising action which is produced along the track of the needles. In electrolysis, therefore, we possess a most valuable addition to the treatment of certain forms of lymphangiomata. In many cases it would certainly appear to be the best means of dealing with those portions of the growth which had not been removed by the knife.

4. Excision.—In a tumour of such extent, complete excision at one operation would not be desirable. The method, therefore, which was employed in this case, viz., excision of different parts at different operations, seems to be the most satisfactory means of dealing with such cases, and as already indicated, an attempt at completing the cure might be made either by electrolysis or the injection of irritants, preferably the former. It is important to secure, if possible, primary union of the wound, otherwise a lymph tissue would be liable to form,

and a second operation would no doubt be required in order to get complete and permanent healing. The indications for the wound treatment, therefore, are, plenty of sutures, accurate apposition, no drainage tube, and a fair amount of pressure.

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DESCRIPTION OF PLATES IX., X., AND XI.

PLATE IX.

Subcutaneous cavernous lymphangioma. Katie S., æt. 9.

The drawing shows the appearance of the parts a year after the third operation. The tumour forms a well-marked swelling of the lower third of the forearm and of the ball of the thumb. The cicatrix resulting from the third operation is seen along the middle third of the forearm, which presents here an almost normal configuration.

PLATE X.

Subcutaneous cavernous lymphangioma (× 50).

a. Cavernous lymph sinuses containing fibrinous lymph coagula and leucocytes.

b. Small lymph sinuses filled with leucocytes.

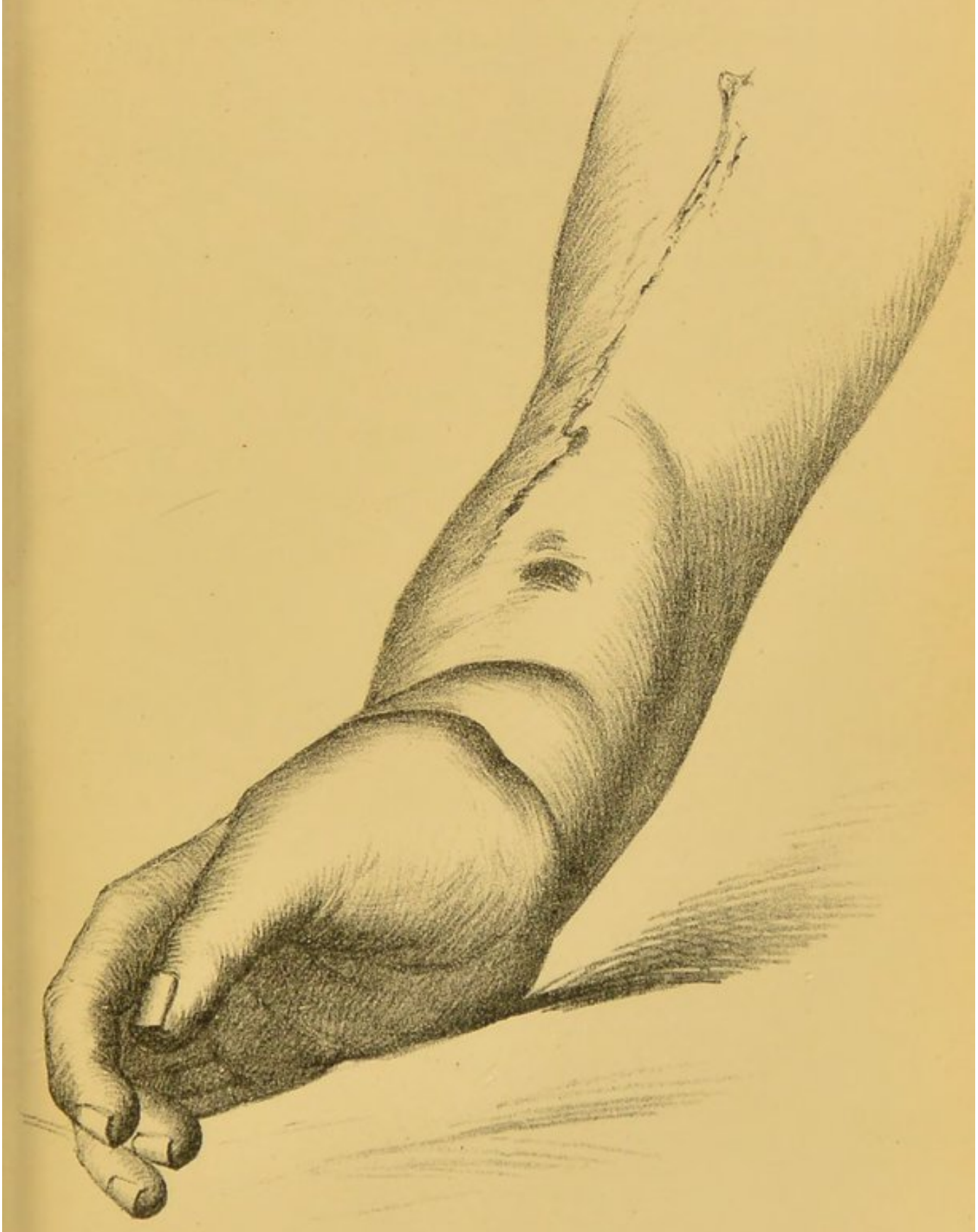
c. Masses of leucocytes infiltrating the fibrous tissue framework.
d. Non-striped muscular fibres.
e. Fat-cells infiltrated with leucocytes.
f. Band of fibrous tissue, separating the tumour from the normal subcutaneous fat (*g*).

Stained with hæmatoxylin, rubine, and orange.

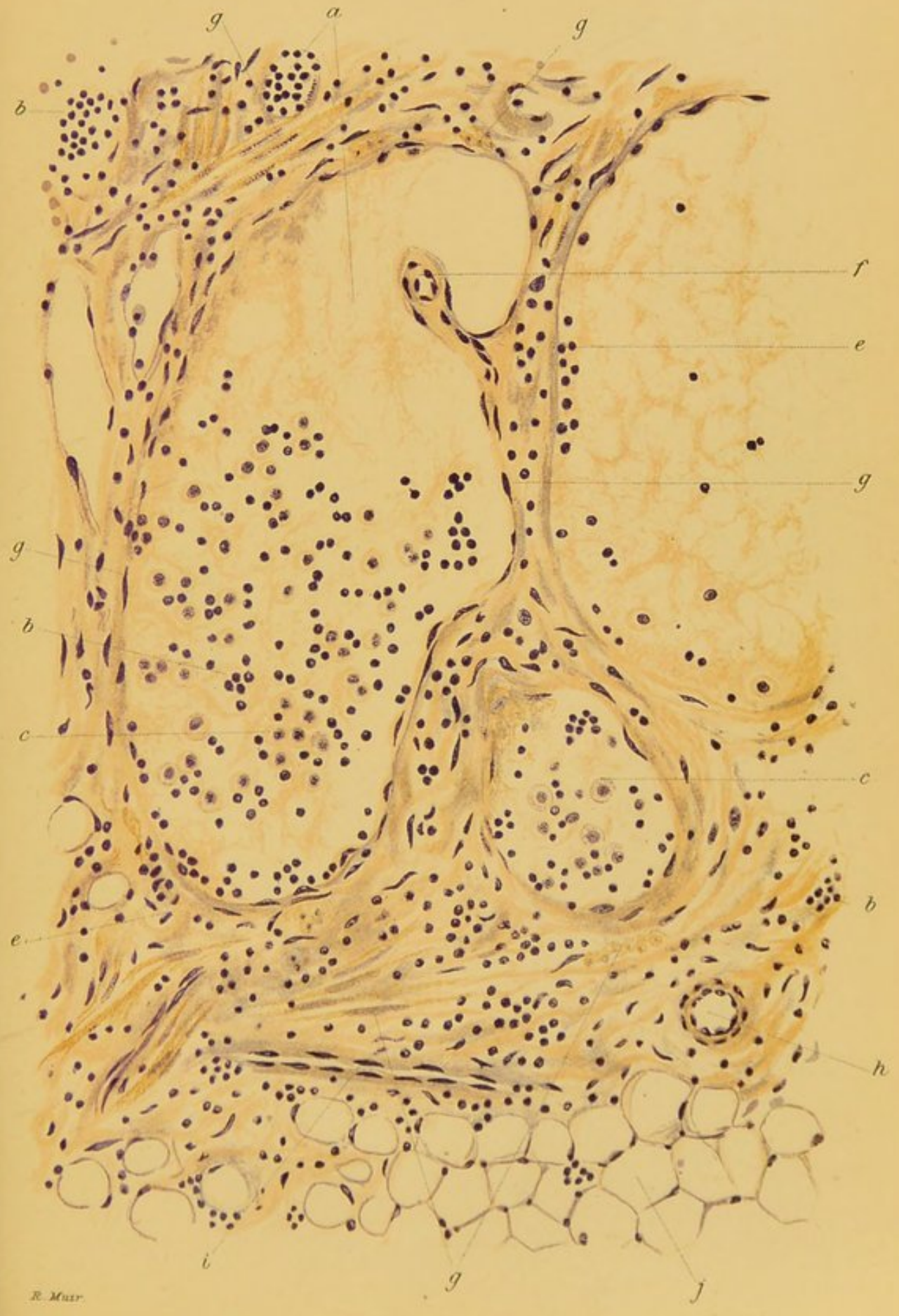
PLATE XI.

Subcutaneous cavernous lymphangioma (× 300).

a. Cavernous lymph sinuses containing fibrinous lymph coagula and leucocytes.
b. Small leucocytes (lymphoid variety).
c. Large fully-developed leucocytes.
d. Endothelial cells lining sinuses.
e. Fibrous-tissue framework containing many leucocytes.
f. Trabecular process containing a small blood-vessel.
g. Small bundles of non-striped muscular fibres cut, some longitudinally, others transversely.
h. Arteriole.
i. Capillary blood-vessel.
j. Fat.



R. Muir



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