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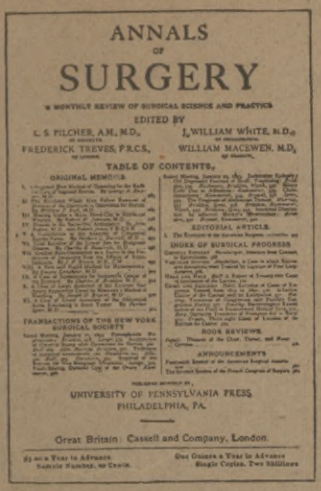

ANNALS
OF
SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

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HYPERTROPHIES AND DEGENERATIONS OF CICATRICES AND CICATRICIAL TISSUE

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OF BOSTON.

PROFESSOR OF SURGERY IN HARVARD UNIVERSITY; SURGEON TO THE MASSACHUSETTS GENERAL HOSPITAL.

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2.

HYPERTROPHIES AND DEGENERATIONS OF CICATRICES AND CICATRICIAL TISSUE.[1]

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THE material by means of which a defect in the integuments is repaired is known as a cicatrix, and consists of a new formation of connective tissue covered by epidermis. In tracing the evolution of this new tissue we find that it is formed from the fixed cells of the connective tissue and from the cells found in the walls of the small bloodvessels. These cells, when in a state of reproductive activity, are known as fibroblasts, and it is from them that the new tissue is formed which firmly holds the edges of the wound in apposition.

The process does not, however, cease with the closure of the wound, for if we watch the cicatrix during the next few weeks we find that the line of union has, in many cases, become much more marked, and that it is the seat of a distinct growth of tissue by means of which it is raised above the level of the surrounding skin. There is an increase in the vascularity of the part, and the bright red color which results gives it an unusual prominence, which threatens, when the scar is situated in exposed regions, to become the cause of an unsightly deformity. The new formation appears, however, to be merely a provisional one: gradually the swelling diminishes, the new tissue shrinks back to the level of the surrounding integument, and the bright color fades away.

If we examine a wound at the end of the first week of the healing process we find remarkably little change in the tissues.

[1] Read before the American Surgical Association, May, 1893.

A line of small round cells, which take the staining fluid readily, serves to indicate the point in the section where the edges of the wound have been brought together, but there is as yet no further change. It is not until the end of the second or third week that the tissue, known as cicatricial tissue, can be found, and the period of full development is really much later than has usually been supposed. In fact, it would not be an exaggeration to say that the process of cicatrization requires a full year for its complete evolution, that is, for that point to be reached at which no further changes are likely to take place.

At the end of a few weeks, however, we are able to see a well-developed cicatricial tissue. This consists of a connective tissue and an epithelial portion. The fibres of the connective tissue are packed together in bundles which interlace one another in various directions. At times the fibres run singly in very small bundles and are so interwoven as to form a felt work. This is in striking contrast to the arrangements of the fibres of the adjacent corium.

The elastic fibres, which are twisted about the bundle of fibres in the normal cutis, are wanting, being rarely replaced when once destroyed.

The interlacing bundles of fibres leave no space for adipose tissue or glands, and give to the cicatrix its characteristic density. Old scar tissue is sclerotic and does not color as readily as the normal cutis, and we see comparatively few cells, but in the early stages of development the cells are numerous, and can be found in clusters here and there, surrounding the bloodvessels which run between the bundles of fibres.

The papillæ are never completely reproduced, and we see at certain points wavy lines of epidermis underneath which loops of vessels lie, but these are not genuine papillæ. A thin layer of epidermis, the lower border of which is represented by a more or less horizontal line, is the usual covering of a scar.

The glands are not entirely destroyed, as many of them lie deep. The ducts of the sweat glands may often be seen on the surface of scars, and hair follicles, with lanugo hairs and sebaceous glands, are occasionally seen. These epithelial structures often play an important part in the epidermization of a cicatrix.

The vessels of a fresh scar are very numerous, particularly the capillaries. If the wound has united by first intention they run horizontally, but if the wound has closed only after a slow process of granulation the vessels, generally speaking, ascend vertically toward the surface, and form there a rich anastomosis, which gives to the scar its characteristic hue. (Winiwarter.[1])

Lymphatics are not usually found and nerves are rarely seen, although Robin describes them, and Jobert attributes the sensitiveness of some scars to rudimentary nerves which form there. The occasional presence of a large nerve fibre may give rise to more serious symptoms. The color of a scar may become a bluish red or violet; it gradually becomes paler and assumes a yellowish tinge, and finally a pure white. More rarely there is a deep yellow or brownish color, or some deeper pigmentation. It may have a mottled appearance, due to the presence here and there of patches of epithelial cells in the granulating surfaces. The presence of grains of powder produces a marked discoloration. Scars rarely disappear entirely, although this occurs not infrequently in scars formed during early childhood. Usually they remain as a fine, white line; or, if the scar has stretched, as it frequently does when there is tension, the line becomes a band. Scars grow in proportion to the rest of the body. Nélaton cites the case of a cicatrix, in an infant, reaching from the wrist to the elbow, which later in life covered the same distance.

William Adams[2] calls attention to this peculiarity of scars, and mentions the case of a child who, at the age of two years, was operated upon for club foot, a scar two inches long being left. When examined at the age of ten years the child was found to have a scar three inches long. A second case was that of a young lady nineteen years of age who, when one year old, had had a deep-seated nævus removed from the neck. The scar immediately after the operation was one and a quarter inches long and three-quarters of an inch wide. At the time the case was seen by Mr. Adams the scar was one and a quarter inches wide and three inches long. In eighteen years it had more than doubled in size.

[1] Deutsche Chirurgie. Lieferung 23.

[2] Trans. Pathological Society, London, 1860, Vol. XI.

Mr. Adams observes that the rate of growth, as demonstrated in these cases, did not appear to be sufficiently known to surgeons, or considered by them when performing operations on children in exposed portions of the body, the opinion being that scars remain stationary or wear out. It is true that the scars of some slight wounds do wear out to a certain extent, but after deep wounds, and when a portion of the skin has been destroyed, the cicatrix appears to be persistent through life, and to grow *pari passu* with the rest of the body, or rather with the portion of the body on which it may be placed. Vaccination scars are undoubtedly often much enlarged by growth.

Paget says:[1] "The scar of a child, when once completely formed, commonly grows as the body does, at the same rate, and according to the same rule: so that a scar which the child might have said was as long as his own fore-finger will still be as long as his fore-finger when he grows to be a man." He adds, however, that there is in youth a tendency toward the healthy state. Hence cicatrices after long endurance and even much increase may, as it is said, wear out, and thickening and induration of parts may give way, and all become pliant and elastic.

The scars formed in early operations, as in case of hare-lip, show greater deformity with the growth of the individual. Minute displacements are magnified by the enlargement of the part, and the tension gives rise to a thickening of the scar tissue which may be permanent. This is the principal deformity in the lip of a young lady which was operated upon when she was a few hours old.

According to Panas, locomotion of scars may take place. A small scar near the eyelid in infancy rose gradually with increase in years, until it was situated close to the roots of the hair.

The so-called false scars or striæ seen in the skin after pregnancy are due, according to Winiwarter, to a displacement of the elastic fibres. Instead of the thick bundles ordinarily seen there is a coarse mesh-work.

[1] Paget, Surgical Pathology, Vol. I, p. 49.

The appearance of scars often betrays their origin, and may in this way serve a valuable medico-legal purpose. The surface of burns is irregular: bridles and depressions are due to the unequal amount of destruction caused by the agent employed.

Suppuration has a decided influence upon the appearance of a scar, as it causes a corresponding loss of substance. Pathological scars are recognized partly from the appearance of the scar itself, and partly from the surrounding conditions. Ulcerations may be present near a scar which may give a hint as to its origin. Depressed cicatrices indicate that the deeper tissues have been involved, and are suggestive of bone disease of long standing.

The linear cicatrix of an incised wound, if left to stretch, may become a broad spindle-shaped scar.

Punctured wounds leave a linear scar parallel to the direction of the line of cleavage of the skin.

The most striking peculiarity of scar tissue is its tendency to contract. This contractile power exerts its influence during the healing process in a beneficial way, distant margins of wounds being brought nearer together, and the covering of the defect by epidermis being greatly facilitated. It is also the cause of the most striking deformities which disease can produce. So irresistible is its power that everything yields before it. Tendons are bound down into hopeless inactivity, nerves are held with an iron grip; the breasts may be so distorted that lactation becomes impossible; limbs are rendered useless, the trunk is bent upon the extremities, and even the solid bone is moulded into fantastic shapes.

What is this hidden power? What peculiar conditions of tissue exist which endow it with such precocious qualities?

Delpech has suggested that the contraction of scar tissue was due to a condition which allied it to muscular tissue. According to Panas we must regard cicatricial tissue as a provisional growth which is intended to preserve union until the edges of the normal skin have been regenerated. The absorp-

tion of this transitory structure is the final stage of the healing process. If the normal tissues are not reproduced only one act in this process is accomplished, and it is this attempt at absorption which brings about the great condensation of the scar tissue.

Looked at from this point of view, we see why it is that hypertrophied cicatrices are produced when the edges of the wound retract from some cause or other. The abundant formation of new tissue is an exaggerated effort on the part of nature to supply the necessary covering for the part. If the cicatricial tissue possessed any specific contractile qualities we should find a subsequent approximation of the edges of the wound, which is not the case. A broad, flat scar is usually the eventual outcome of such conditions. And we find this tissue so yielding to steady pressure that in wounds of the abdominal wall, when accurate adjustment of the edges of the wound has not been effected, the intervening scar tissue yields, and a hernia results.

It is only when there is an extensive loss of substance that the effects of contraction become perceptible. Moreover, this shrinkage begins even before the cicatricial tissue is developed, for we see the approximation of the edges of a large defect during the process of granulation. Contraction is here evidently due to absorption. The contractile power of a scar is, according to Robert Jones, largely dependent upon the amount of granulation tissue which becomes organized: all in excess of local demand adds to its contractile power.

Regarded from a physiological standpoint, scars may be divided into three classes, viz.: Hypertrophied scars, or those due to an excessive formation of cicatrical tissue; contracted scars, or those due to an attempt at absorption of larger cicatricial surfaces, and, finally, the normal scar, which represents the more or less imperceptible tissue which forms the line of union of the well-adjusted edges of a wound.

Scars ordinarily are not painful, for, as we have already seen, nerves are not usually found in them. Scars may, however, become a source of pain by their adherence to structures which are sensitive, as bone or nerve trunks and fibres. Some

observers, as we have seen, have found nerve filaments in the scar tissue, and Follin speaks of neuromatous enlargement of nerves in scars.

Weir Mitchell[1] speaks of cicatrix pressure on nerves as unusual, and mentions, as one of two cases which came under his observation, the presence of a cicatrix close to the sciatic nerve, so that whenever the leg was straightened the man suddenly lost power and suffered pain. Pressure may also be brought about by contractions, which leave the limb in an abnormal position. During the war numberless examples of painful scars, caused by gun-shot wounds, came into the hospitals for relief. It was in a case of this kind that I first saw morphine injected subcutaneously by the late Dr. J. Mason Warren. Mitchell refers to superficial shell wounds causing painful cicatrices due to compression of sensitive cutaneous nerves.

He was unable to find any accounts of the microscopical examination of painful scars, but is inclined to believe that some such alteration exists in the nerves as that described by Danielson and Broeck as occurring in anæsthetic leprosy. The early symptoms seemed to be referred to simple congestion of the neurilemma; the succeeding and latest phenomena are due to a hyperplasia of the connective tissues within and without the nerve sheath.

My attention has recently been called to a series of cases of wounds of the scalp followed by persistent headache in young persons. The pain was relieved in all cases by excision of the cicatrix, after other treatment had been tried without success.

The three cases here reported were referred to me for operation by Dr. C. F. Folsom.

Case I.—C. H., student, aged seventeen. Family history excellent; general health good; was seen by me in October, 1890, with Drs. Folsom and Weir Mitchell, Four years previously he was struck in the head by a horse's hoof, which caused an ugly scalp wound. Was not unconscious. The wound was sewed up without special antiseptic precautions. A year later he began to have headaches, which increased in frequency and intensity until he was

[1] Injuries of Nerves. 1872.

virtually disabled. He could not study or play, and moved about slowly, as otherwise the pain became agonizing.

He appeared, in October, to be in excellent health ; there was no trouble with the eyes.

Near the upper and posterior portion of the left temporal bone there was an irregular cicatrix, tender on pressure, and a little over an inch long.

According to Dr. Folsom's report, the initial point of the paroxysm of pain was in the anterior left temporal region, and the focus of greatest pain and tenderness when the pain was at its height was near the cicatrix, that region being quite tender on pressure. On October 29, 1890, the cicatrix was excised and the bone beneath explored. Two indentations being found in the bone, a button was removed with a one-inch trephine. The dura was reddened and adherent to the adjacent bone. The wound healed by first intention. The greatest care was taken for a year, when the symptoms all disappeared. The patient has remained well since.

The following is Dr. Whitney's report on the bone and cicatrix :

"The bone showed a uniform increase of thickening from one side to the other, and a section showed this to be due entirely to an increase of the diploë, while the inner and outer tables remained constant and normal. On the surface were two slight linear depressions, which were found to penetrate hardly half way through the outer table. There was no change in the bone beneath. The piece of scalp showed a normal cutis beneath which was a dense layer of connective tissue, such as is found in old cicatrices. Lying in this were several relatively large nerve trunks, some of which appeared normal, while others seemed atrophied and associated with an increase of nuclei in the sheaths. The diagnosis would be: Diffuse hyperostosis of the skull ; slight interstitial neuritis."

The relief of pain in this case may be ascribed not only to the removal of scar pressure in the scalp, but to the removal of a source of irritation in the dura, which, as we know, is supplied by the fifth pair, and is an exceedingly sensitive structure.

The next two cases are, perhaps, more perfect examples for the relief to be obtained by the removal of a painful cicatrix.

CASE II.—F. R., eleven years old, of neurotic temperament, and with a nervous family history, was stunned by a fall in 1886, striking on a curbstone. A scalp wound was made over the right frontal region about one inch above the supra-orbital ridge. In 1888 he was thrown from a small cart over a stone fence, and was unconscious for some time. There was at this time a small scalp wound over the superior and posterior portion of the right temporal bone. In the same year, also, he was partially stunned by being thrown from a street car.

Two to three years after the second injury he began to have persistent slight headache, with paroxysms of severe headache. He also had frequent attacks of partial loss of consciousness, somewhat resembling petit mal.

An examination of the eyes gave a negative result. At the request of Drs. V. Y. Bodwitch and Folsom I operated upon him November 23, 1892, excising both cicatrices. The wounds healed by first intention. Relief from headache was gradual. But he has remained well in spite of a blow on each scar received since, with temporary return of headache. Dr. Whitney reports that "An examination of the scar tissue shows quite distinctly a comparatively large nerve fibre, the fibrillæ of which are more or less widely separated by fibrous tissue of the small cicatrix in which they are lying."

The accompanying plate (Fig. 1) shows the appearance of one of the nerves in this cicatrix. The nerve consists of embryonic nerve fibres, and there is considerable cell infiltration around the perineurium. The irregular arrangement of the bundles of connective tissue fibres is well shown. Those which have been divided transversely have been slightly displaced, and give a somewhat disorderly appearance to the centre of the cicatricial tissue.

CASE III.—Miss ——, twenty years old, and of fairly good health, was living on a cattle ranch in 1884, when she was thrown and kicked in the upper and posterior portion of the right temporal bone by a well-shod horse, causing a large irregular scalp wound, which was filled with sand gravel. The wound healed by granulation. There were no cerebral symptoms at the time or later until 1888, when she was thrown from a horse twice, once being dragged about fifty feet. Severe and persistent headache began, becoming much worse at the

catamenial periods. There was also mental confusion. General treatment failing to relieve the headache, Dr. Folsom asked me to excise the scar. The operation was performed in March, 1892. No injury to the bone was found. The wound healed by first intention, and the relief from headache since has been complete.

A microscopical examination of the cicatrix showed that a nerve trunk of considerable size had been involved in the scar tissue. In Fig. 2 a transverse section of the nerve is shown in the deeper layers of the cicatrix. The sheath is thickened, and there is considerable cell infiltration in the neighborhood. We find in these cases not only the existence of pressure, but more or less extensive alterations in the nerve. In Case II the section shows a portion of a nerve which has been divided, but is already in an advanced stage of repair, and quite capable of transmitting painful sensations. Some of the specimens showed an interstitial neuritis, which is evidently the chief source of the pain.

Among the most common of the pathological changes observed in scars is that hypertrophic condition known as keloid (χηλη, a claw).

There is a general tendency among writers at the present time to disregard the distinction between true and false keloid.

True keloid has been considered by most observers as a spontaneous new formation in the corium independent of any pre-existing wound, but there is a growing feeling of late years that keloid tumors spring from cicatrices more frequently than has been supposed, and that some cases of supposed true or spontaneous keloid in reality sprang from minute scars caused by pressure of clothing or friction of folds of skin. Kaposi recognizes both true and false keloid, and also a third variety, which he calls hypertrophied cicatrix. The latter form I have already described as a variety of scar. In addition to these forms a verrucose cicatricial tumor is described by Hawkins, and syphilitic keloid is mentioned by several writers.

The typical true keloid, like that described first by Alibert, is situated over the sternum, and is composed of newly-formed tissue of firm and elastic consistence, sharply defined and raised 2 to 4 mm. above the level of the skin. It extends trans-

versely across the median line of the chest and terminates at either end in one or more prolongations which give it its characteristic appearance and name. Its surface is smooth and shiny, and the color red, like that of a scar, in the single specimen which I have seen during life. It is, however, said at times to be white, pinkish, or even purple. It grows to a certain point and then remains stationary. There is little or no tendency to ulceration. There is usually no history of a pre-existing scar, and the growth to all appearances has developed spontaneously. Keloid is described by different authors as growing in almost any region of the body, but the pure type, such as I have just described, is found on the chest, and as it is an extremely rare form of growth and is highly characteristic in its appearance, it seems to me deserving of a separate classification from other forms of keloid, in spite of the possibility that it may have developed from some lesion that may have passed unnoticed. According to Hebra, it is found once in 2000 cases of skin disease. True keloid rarely disappears. I do not find any well-authenticated reports of the spontaneous disappearance of such a tumor. It is not painful, but may give rise to an itching, prickling sensation, and it is for this reason principally that patients are said to seek relief.

False keloid may develop in almost any part of the body. There appears to be a tendency in scars situated on the chest to form keloid tumors more frequently than elsewhere. Why this is the case is not apparent, but in this region hypertrophies of scars seem to be more frequent than elsewhere. False keloid is also found in the face, both surfaces of the extremities, back of the hand and foot, and external genitals (Crocker). It is found after puncture of the ears, and sometimes develops from leech bites. It is also well known to spring from the scars of acne pustules, and in this case is often multiple. Hutchinson gives a portrait of such a case, where in addition to numerous tumors in the back, there is a growth over the sternum strongly resembling true keloid, which suggested to him the possibility of the development of the latter variety from acne pustules, so frequent in this locality, which have been overlooked. They are said to be found rarely in the mucous membrane. Verneuil reports a case of keloid of the conjunctiva.

De Amicis describes the case of a woman, twenty-seven years of age, who had 318 tumors, and Hebra mentions a family, all the members of which were afflicted with multiple fibroid. Kaposi reports the case of a keloid the size of a fist in a negro who had numerous keloids.

Ziemssen reports the case of an individual who had 105 keloids.

True keloid appears to be a disease of adult life, but false keloid may appear at any age. There seems to be a keloid disposition in certain families and individuals, and the peculiarity of the African race in this respect is, of course, well recognized in this country. False keloid grows to a certain point and remains stationary for many years, and finally flattens somewhat and becomes paler. It may grow at times to an unusual size.

Hayes[1] reports one tumor of this kind weighing eighteen pounds. The patient was a black male, thirty-six years of age. Had first noticed the swelling sixteen years before. It was situated on a line with the eighth dorsal spine. It had begun to grow three years before, and at the time of its removal it covered the entire back. The photograph shows it to be of the papillary variety. It was examined by a pathologist at Johns Hopkins Hospital, who pronounced it a hard fibroma.

It is doubtful whether such a tumor as this should be called a keloid.

False keloid is particularly liable to grow in the scars from burns or caustics, or even blisters.

Hutchinson[2] reports the case of a negro who suffered from an extensive burn of the neck and chest caused by boiling water. The new growth hung like a leather collar over the left shoulder and chest. An interesting feature was observed in this case: The man had about him many other old scars on his arm from bleeding and on his back from cupping. There was also one on his forehead, the result of an injury received not long before the scalding. The cupping marks and those of bleeding were of various dates, but all of

[1] Alabama Med. and Surg. Age, 1891.

[2] Hutchinson's Clinical Illustrations, Pl. 88.

some years' duration. After the scar of the scald had taken on keloid, many of his other old scars began to indurate also; in some the induration was only slight, but in others it was very marked. This occurrence seemed to indicate to Mr. Hutchinson that in some way the keloid patch had shed infective material into the blood which had the power of developing only scar tissue. When seen two years later, the large patch of keloid had grown decidedly thinner and softer.

Microscopically, we find the tumor, both in true and false keloid, to be made up of bundles of fibres running horizontally some little distance beneath the surface of the corium, and arranged parallel to the long axis of the tumor. In old keloid the tissue is extremely dense, and the bundles of fibres are closely packed together. In one case of true keloid which I have examined, the upper third of the corium lay above the tumor, and also the papillæ with their normal covering of epidermis. This is supposed to be one of the distinguishing points between true and false keloid. As there has been no pre-existing scar in true keloid, the upper layers of the skin remain intact.[1]

In another case of true keloid, where the growth projected nearly one-fourth of an inch above the level of the skin, the papillæ had disappeared over the most prominent portion of the tumor. That the absence of the papillæ was probably due to pressure is suggested by the absence, also, of the upper layer of corium, which is usually seen above the keloid. The new formation appeared in this case to have pressed directly upon the papillary layer.

Babes and Winiwarter have also observed the absence of papillæ in true keloid, and attributed it to the same cause.

In the middle of the tumor we find bloodvessels running parallel to the fibres and surrounded by a thin layer of fusiform cells. These vessels can be traced into the bundles of fibres which project into the surrounding tissue. Tracing these vessels still further into the normal tissue, we find a cell growth in the adventitia for some distance beyond the periphery of the growth.

[1] Warren uber Keloid. Sitz b. d. k. Akad. Bd. LVII. Vienna, 1868.

In the case in which I was able to make these observations the changes in the adventitia were best seen in these vessels at each end of the growth beneath the papillæ. Here the walls of the arteries were surrounded by numerous cells, but the veins had no such growth about them.

Cross sections of another specimen of true keloid showed the longitudinal fibres to be separated into bundles by bands running sometimes obliquely upward. These are probably obliterated vessels (Langhans). Crocker examined a keloid of three weeks' standing only. Dilated bloodvessels surrounded by round cells were very numerous near the growth, and around the walls of the vessels of the tumor were found many flattened and fusiform cells.

In false keloid we see the same development of longitudinal fibres running parallel to one another, but above this growth is the cicatricial tissue, which can readily be distinguished from the keloid growth, as the fibres run in various directions. The papillæ are, of course, wanting. Vessels of considerable size run longitudinally through the growth, and their adventitia is occupied by vessels and spindle-shaped cells.

In both true and false keloid the glands of the skin are wanting, although the remains of these glands may be seen occasionally beneath the new formation.

This statement of the minute anatomy of keloid agrees essentially with that made by Langhans, Kaposi, Crocker, Plicque and others.

The development of keloid probably takes place in the following way: A growth of cells first occurs in the adventitia of the arterioles; these later become fusiform cells, and finally fibres. As bundles of fibres form in this way around the arteries, the tissue of the corium is gradually compressed by them, and the different bundles thus uniting form the keloid growth.

Keloid is a fibrous tumor, which in consequence of its development of the vessels, is composed of bundles of fibres running parallel with them in contrast to a simple cicatrix, which consists of fibres which form a network. The tendency to recurrence is evidently due to the implication of the walls of the bloodvessels for some distance beyond the borders of the tumor.

The origin of such a growth from the walls of the smaller arteries, and the presence of many fusiform cells, suggests the possibility of the existence of muscular tissue at some period in the existence of these growths. We have examples elsewhere of fibromyomata, and it is precisely in those races most liable to uterine fibroids that keloid is most frequently found. One authority, as we have already seen, has sought to explain in this way the great contractile power of this form of growth. A more careful study of the origin of keloid might develop the fact that the media of the artery is also involved in the pathological change, and that a growth of myomatous tissue actually does take place.

As an interesting commentary upon this theory I will cite the following case:

Kempf[1] reports the case of a young lady, nineteen years of age, with a spontaneous growth of about two years' standing on the right side of her face over the lower jaw, perfectly smooth and solid, accompanied by flashes of pain. The growth returned one year after removal, and small keloid tumors appeared where the sutures had been inserted. Hypodermic injections of Squibb's extract of ergot dissolved in alcohol were given two or three times a week. After several weeks of this treatment this tumor entirely disappeared.

Myoma of the skin occurs in the form of leiomyoma; that is, a tumor composed of unstriped muscular fibre. According to Winiwarter this form of growth may occur in connection with other tumors, such as sarcoma, keloid and angioma.

It is useless, of course, to speculate upon the cause of this active development of tissue in the skin. Whether the irritant which produces the growth is infective, or simply a defect in the regulation of the formative process, must for the present remain a matter of pure speculation.

I think it advisable to retain the classification of true and false keloid, although it is highly probable that the so-called true keloid develops from a minute scar or blister.

True keloid is nevertheless essentially an independent new formation—a tumor, in fact—and presents certain well-marked

[1] Louisville Medical News, October 12, 1878.

anatomical differences from false keloid, which is clearly a growth springing from and intimately associated with scar tissue.

The diagnosis of keloid is usually not difficult. It may, however, be mistaken for a non-ulcerated gumma, or even a tubercular affection of the skin, which is occasionally accompanied by a firm fibrous growth. Some forms of nævi have a cicatricial appearance. Lymphadenoma in its early stages may resemble keloid, and Virchow points out the sarcomatous nature of certain cases of supposed keloid, and it has been suggested that the frequent recurrence of some tumors of this kind are thus accounted for. Some forms of fibroma have evidently been mistaken for keloid, as, for example, the case of large fibroma of the back already mentioned.

Cancer has been associated with cicatrices by writers ever since Alibert described keloid, and pointed out the close affinity which the disease, which he first called cancroids, was supposed to bear to epithelioma.

It requires only a brief glance through the literature of scars to find that it teems with examples of this form of degeneration.

It is said to occur most frequently in cicatrices which have been produced by cauterization or blistering, although Reid maintains that the nature of the previous injury does not influence the subsequent morbid changes. It appears usually long after the scar was originally acquired, and it is seen most frequently in individuals from forty-five to fifty years of age. Males are said to be more frequently afflicted than females. (Jauzion.) Cancer seems to develop in those scars which have been subjected to long periods of irritation. We find them, therefore, in cicatrices of the limbs which hamper their movements, and which consequently are constantly subjected to undue tension, or in the scars of ulcers, or wounds, or fistulæ.

The disease generally forms when the cicatrix has existed several years; its progress is slow; sometimes a cicatrix ulcerates and heals repeatedly before the ulcer assumes its peculiar character. (Reid.) In a list of twenty cases collected by Smith,

the longest period after the original lesion at which the disease appeared was sixty-one years, the shortest five years. In twelve instances the injury causing the scar was a cut or a laceration of the integuments, and in eight cases a burn or a scald. The affection appears to exhibit two principal forms: the first characterized by the development of one or more warty tumors which increase and spread by the addition of similar growths formed in the neighborhood. This is the so-called papillary form. The second is the ulcerating form, having either a coarsely granulated or fibrous aspect, and spreading by the development of cancerous tissue in the surrounding integument. Both of these types are supposed to have a low degree of malignancy. (Reid.)

Rudolf Volkmann[1] has collected 128 cases of cancer developing from scars, ulcers or fistulæ of the extremities: of these the greater portion formed in scars, particularly those which had a tendency to break down and ulcerate, or in wounds which for some reason had not entirely healed. As this is the history of most ulcers of the lower extremities it is not surprising to find that cancer occurred ninety-five times in the lower extremity, and only thirty-two times in the upper extremity: in other words, the disease is nearly three times as frequent in the lower extremity.

Next in frequency to the ulcerating cicatrix it was found that the secondary contractions following burns, in which the cicatricial tissue was sometimes as thin as paper, became the seat of cancer. But in these cases there was, without exception, a history of frequent breaking down of the scar with suppuration and subsequent healing. In some of the cases reported the cicatrix was due to frost-bite, gangrene, or contused wounds. The cicatrices of syphilis and lupus were also occasionally the seat of cancerous degeneration.

Cancer of the lower extremity developing in ulcers is of a mild type, usually resembling more closely the so-called epithelioma than any other form of carcinoma. Some of them have

[1] Klinische Vorträge, February, 1889.

large epithelial cells and belong to the polymorphous type of epithelioma, while others resemble closely the pure rodent ulcer, or small cell epithelioma, containing chiefly cells such as are found in the deep layers of the rete mucosum.[1] It is on this account that glandular involvement in these cases is comparatively rare. In the 128 cases quoted by Volkmann, only twelve were known to have died of cancer. Sixteen of these died of other diseases, and in fifty-five cases the subsequent history could not be obtained. In no case was a relapse reported later than two years after the operation. In only two cases was metastasis to the internal organs reported, death occurring chiefly from exhaustion. It was found by Volkmann that scars of the leg were the most frequent seat of cancer, and that those of the back of the hand came next in order of frequency.

Jauzion found that cancer developed most often in cicatrices from ulcers of the leg, and then in cases produced by burns, blisters, or cautery, lupus and psoriasis, in the order given. He found occasionally an inflammatory enlargement of the adjacent lymphatic glands, but it is extremely rare to find any infection of them with cancer.

Jauzion reports the case of a cancer developing in a scar produced by the application of a blister to the arm: the disease appeared two years later. A case of cancer in a female, sixty-one years of age, in a scar produced by cautery, employed in the treatment of eczema, the disease appearing six years later; amputation at shoulder with cure. In another case, in a male, fifty years of age, the disease was of eighteen years' duration, and had made its appearance in the scar twelve years after the application of cautery. In a case of an individual, forty-four years of age, cancer had appeared in the cicatrix formed after the cure of tuberculosis of the elbow joint.

Bradley reports a case of cancer developing in a cicatrix of the face where the corner of the mouth was drawn down as if by the scar of a burn.

The following cases which came recently under my observation are good examples of this affection:

[1] Warren, Rodent ulcer, 1872.

H. G., sixty years old. Thirty years ago was badly burned in the back of both legs. The wound of the left leg had never completely healed, small ulcerations developing repeatedly. Six months ago a large ulcer formed in the cicatrix of this extremity behind the internal condyle of the femur, and has continued to increase in size. On examination, extensive cicatrices were found behind both knees. The left leg was flexed on the thigh at an angle of 45 degrees by the contraction of the scar, which was 4 inches broad and extended from the middle of the thigh to just below the middle of the leg. A fungous mass occupied the seat of the ulcer, which was 3 inches long and 1½ inches wide, and had an indurated base. As the patient refused amputation the ulcer was excised, and on examination by Dr. W. F. Whitney it was pronounced to be epidermoid cancer. At the time of her discharge from the hospital a glandular enlargement in the groin was noticed.

T. C., forty-seven years of age, came to the hospital with ulcers on both legs. That on the right was about the size of a silver dollar. On the left leg an extensive ulcer, size of the palm of the hand, existed, involving a portion of the tibia. The surface of the ulcer had a peculiar furry appearance, which formed a brownish scab when allowed to dry, but which could not be removed by poultices.

This ulcer first appeared when he was nine years of age, and that on right shin appeared when he was fourteen years old. Both ulcers had healed and reopened at different times. Had syphilis eight years ago, and scars of old specific ulceration were found at various points. The glands in the groin were not involved. As the patient refused amputation the ulcer was scraped and cauterized. The microscopical examination showed the growth to be epidermoid cancer. As the disease promptly returned the patient finally allowed amputation. Dr. Whitney made the following report on the specimen:

"On the inner side of left leg an ulcer measuring 12 cm. by 7 cm., commencing just above the malleolus, covered with dirty black crusts; bone exposed in centre; section showed the edges thickened with a narrow zone of an opaque white growth. At the upper part of this a new growth was found extending for some distance into the bone, and small centres of disease were found in the spongy bone. Under the microscope appeared large flat epithelial cells. Disease restricted to narrow zone about the edge of the ulcer, and its largest masses were to be found in the bone itself."

The ulcer in the right leg healed promptly with rest in bed.

W. H., forty-seven years of age, consulted me in regard to a scar on his arm near the insertion of the deltoid, which had been giving him trouble for over ten years. "The mole," as he called it, had existed since childhood. On examination a reddened hypertrophied scar was seen about two inches long and one inch wide. Several deep ulcerations existed. The patient postponed operation for nearly a year, during which time no appreciable change took place. On removal of the tumor the ulceration was found to be due to an epithelial growth in the scar tissue. It is now eighteen months since the operation, and there has been no sign of a return. The patient has had syphilis for about three years.

I have had an extensive experience with cancer of the face, but do not remember to have seen the development of many cancers from a distinctly cicatricial tissue.

One of the most typical cases of "Noli me tangere" that I ever saw developed from the cicatrix of a gun-shot injury. The whole side of the face, including the ear, eye, cheek and side of nose, had been eaten away. The disease had lasted nearly thirty years, when the patient died.

It is said, however, to form in lupous ulceration, and in the scars of lupus (Winiwarter), and it is therefore highly probable that a certain portion of cancers in this region find their origin in cicatricial tissue. Heurtaux reports the case of a man, forty years of age, who fell into the fire when he was two months old. He had all his life an extensive scar of the face on the left side. Four years previously it had begun to ulcerate, and at the time of operation there was an ulcer 10 cm. by 8 cm. involving the greater part of the temple and cheek. It was dissected out and found to be superficial. On microscopical examination it was found to be an epithelioma ("lobulé").

Sarcoma may also develop primarily from scars, as shown by Winiwarter, but I do not remember to have seen an example, nor have I happened to have found a reported case. Many of the so-called keloid tumors of unusual size are undoubtedly sarcomatous in nature, and Virchow, as we have seen, attributes the recurrence of such growths to their malignant character.

Taylor reports the case of a sarcoma resembling a keloid. The photograph shows an elongated and irregular shaped keloid growth from which protuberances spring at different points. The history is that of a case of spindle cell sarcoma developing from a wart.

Jacobson[1] reports a case of sarcoma keloidoforme. The patient, a healthy man twenty-seven years old, had on each shoulder a keloid-like tumor. One appeared to form spontaneously and to have the appearance of a true keloid. The other sprang from the scar of an acne pustule, and appeared to be a false keloid. Both tumors, however, proved to be spindle-cell sarcomas. The former had existed three years, the latter five years. After operation the patient was lost sight of.

Calcareous degeneration of a cicatrix is reported by Tunis.[2]

The case was that of a female, thirty-nine years of age. When a child she had sustained a severe burn on the thigh and back. An extensive scar had formed in consequence, and in the centre of this cicatricial tissue an ulcer had formed which was situated over the great trochanter of the right femur. The edges of the ulcer were very hard and leathery, enclosing an area the size of a dollar. A large piece of yellowish white material resembling bone was adherent to the base of the ulcer. The fragment of calcareous material was connected with a stratum of similar substance which stretched down into the deeper parts of the cicatrix. The mass was removed, and the wound was closed by a very extensive plastic operation, and no tendency to a return of the calcification was noticed three months later.

It seemed to the author that this degeneration had been produced by the deficient blood supply brought about by the contraction and pressure of the cicatricial tissues in the blood-vessels. In this case the cicatrix was so extensive that the central portion might have been so feebly vascular as to have been easily deprived entirely of blood.

A more common form of complication in the life history of

[1] Archiv. für klin. Chir., Vol. xxx, 1884.

[2] J. P. Tunis, Univ. Med. Mag., Phila., 1892–93, Vol. cxxii.

scars is suppuration. These cases occur so frequently that there is but little excuse for reporting them. Perhaps the most frequent examples of suppuration are found in scars connected with bone. The reopening of the cicatrix, and the formation of an ulcer or sinus, suggest strongly the recurrence of disease in the bone, but this is by no means always the case. The cause of the suppurative inflammation may be due either to re-infection of the cicatrix, or to the awakening of spores which have long been dormant. The most common form of relapse is due to tuberculosis. An unfavorable state of the health or a severe local strain are usually the exciting causes.

A cachectic servant girl applied for relief from repeated re-opening of cicatrices about an anchylosed hip joint. The thigh was flexed to nearly a right angle. The limb was straightened by osteotomy, and the patient, who was seen several years after, had had no return of the suppuration in the numerous cicatrices about the joint. There had been no disease in the bone since the anchylosis.

A lady, sixty-five years of age, with a history of tuberculosis of the ribs, was operated upon for tuberculosis of the sheaths of the peroneal tendon. An incision, six inches in length, with its angle at the external malleolus, enabled me to dissect off the tubercular mass from the tendon. The wound healed readily at the ends, but a sinus remained at the angle of the wound for several months. This healed rapidly as soon as the joint was placed in a plaster splint. Two years later the wound re-opened at this point after the patient had regained her activity, and a second operation was necessary for the removal of a tuberculous deposit. With fixation of the joint, the wound healed in three weeks. The patient's health during the interval had been excellent.

Cicatrices may re-open, owing to the presence of foreign substances within them.

The use of silk ligatures and buried sutures is now a well-recognized source of the formation of obstinate sinuses. This is true, however, of certain localities only. How often do we hear from silk ligatures used in an amputation of the breast after the wound has once healed?

On the other hand, operations in the abdominal walls or

cavity are often followed by the development of stitch sinus, even though the wound has healed in the most approved aseptic manner. The size of the ligature used in pedicles accounts partly for this difference, but the principal cause is the strain brought to bear upon the cicatrix. The formation of minute stitch abscesses and sinuses in operations for the radical cure of hernia and the shortening of the sound ligaments are familiar examples of this type. Even though the buried suture be thoroughly aseptic, the subsequent strain brought to bear upon the tissues paves the way for a secondary infection.

Abscesses are occasionally reported in keloid growths. Richon[1] mentions the formation of an abscess in the thick tissue of keloid of four years' standing in the lumbar region. The growth was removed and had not returned eighteen months later. An histological examination confirmed the diagnosis of keloid with a central cyst, which contained a lining of endothelium. The cystic character of the cavity may be accounted for by the slow formation of the abscess.

Cicatricial tissue does not appear to suffer any senile changes, which in other tissues has been quaintly characterized by Hutchinson as "Tissue Dotage." By this expression he refers to the power of the senile skin to develop papillomata, freckles and malignant growths, also nævi and hypertrophies of the sebaceous glands. Beyond the distinctly diminished resisting power to carcinoma, there appears to be no degenerative process clearly due to age. In fact, the scar tissue may be said to have grown old prematurely, and, therefore, is susceptible to no further change with advancing years.

A study of the cicatrix which forms between the Thiersch grafts and the subjacent tissue may not be out of place in a paper of this kind.

According to Garré,[2] a layer of exudation material forms in most cases between the graft and the tissues, and glues the surfaces together. This varies greatly in thickness. At first it consists principally of blood clot; cells wander in later, and

[1] Bulletins et Memoires de la Societe de Chirurgie, 1882. Vol. VIII, p. 440.

[2] Beitr. zur klin. Chir., 188–9, IV, 625.

granulation tissue is formed from which the cicatrix is developed. The conditions vary somewhat according to the nature of the tissue on which the graft is placed. The exudation is most abundant when the basis is formed by the cutis or subcutaneous tissues; less so when the deep fibrous layer of granulation tissue or adipose tissue or fascial tissue is used as a base. The exudation is very abundant, however, when muscular tissue forms the bed of the graft.

Grafting can be successfully done on spongy bone, but not on cortical bone.

Most of the vessels of the graft become atrophied. In a few cases the blood is found circulating through their lumen in a few days. The blood supply is, however, furnished chiefly by new vessels. Some of the new vessels grow directly into the old vessels of the graft.

As new cells are formed, after the horny layer of epidermis has been thrown off, the deep cells of the rete begin to multiply and a new epidermis is developed. When the rete mucosum comes in direct contact with the tissues, the cells begin to grow more rapidly.

The layer of granulation tissue forms more rapidly when there has been little or no effusion of blood.

In old ulcers of the leg the grafts are apt to break down with use. This is due to great liability to extravasation of blood in the cicatricial scar tissue, which seems to have a feeble power of resistance. The stasis which this causes interferes with the growth of the epidermal cells, and this layer peels off from its bed in numerous places.

Treatment of Scars.—Every effort should be made to favor as minute a development of scar tissue as possible. The careful adjustment of the edges of a wound is too well recognized an axiom to need repetition here. If buried sutures are to be used, I should strongly advise the use of an animal suture rather than silk, owing to the tendency of the latter substance to work its way sooner or later to the surface at some point. Any one who has studied under the microscope the healing of wounds cannot fail to recognize the great irregularity of the edges of the wound

and the tendency of the epidermis of one lip to bury itself uselessly into the deeper tissues. An unnecessary amount of granulation tissue is formed in such cases, and furnishes material for an hypertrophied cicatrix (a new formation between the edges of the wound). Very superficial stitches should be used more freely than in my experience is customary with surgeons. Packard recommends the making of very oblique superficial incisions, which in his experience leave an imperceptible cicatrix. Such an incision gives to the margin of the skin conditions similar to that which obtain in the Thiersch graft, and theoretically ought to bring the cicatrix, as we have already seen, beneath the surface. The danger of bruising such a tender structure might frequently stand in the way of a satisfactory result.

Lassar[1] claims that disfiguring scars may be avoided when there is a considerable loss of substance if we recognize the fact that the human skin has a greater power of regeneration than has usually been assigned to it. The popular idea that the flesh of certain people heals quickly is not a fanciful one, but is based upon an unusual power of regeneration in the skin which they possess.

When there is a large open wound on the face, the skin forming the edges of the wound pushes forward until the exuberant granulations are reached. From this point a thin layer of epithelial cells grows over the granulation tissue and forms a scar which remains as a permanent disfigurement. This stage of the healing process should, according to Lassar, be prevented, and for this purpose the dressing should be removed every few days and the thin layer of epithelium should be scraped off. The borders of the skin may be refreshed by a knife or a sharp spoon. In this way the normal epidermis and corium will have an opportunity to cover in a much greater surface of the wound, and the cicatrix will often be reduced to an almost imperceptible size. Volkmann has called attention to the fact that those parts of the face in which the skin contains large hair follicles and sebaceous glands have an unusual power of regeneration, as these structures are storehouses of epithelium from which a mass of epider-

[1] Berliner klinische Wochenschrift, 1887, No. 37.

mis is formed which springs up through the granulation tissue and is surrounded by the superficial growth, giving to the newly-formed skin both the functions and appearance of an almost normal structure. It is perhaps due to the greater regeneration of the skin of the face that scars in this region are less liable to stretch.

Robert Jones has also dwelt upon the importance of a systematic checking of the superabundant growth of granulations, as the contractility of cicatrices is largely dependent upon the amount of granulation tissue which becomes organized. He advises that the granulation should be frequently scraped and burned, while the limb (in case the scar is there) should be kept extended. Plastic operations should not be performed for the relief of contractions until the old cicatrices have been stretched. The healthy skin is stretched at the same time, and the contractile element in the scar tissue is destroyed by continued extension. It is this yielding of cicatricial tissue which favors hernia in abdominal scars.

It is important to remember that the skin, and, indeed, other tissue, as muscular fibre or aponeurosis, are capable of regeneration, and that by approximation we favor this process and avoid, as much as possible, the substitution of the less highly-organized cicatricial tissue. I do not believe it to be a good substitute for other tissue in the radical cure of hernia. "Scar tissue is unreliable and should be avoided," ought to become an axiom of modern surgery.

For projecting scars compression has been recommended by various authors. Panas[1] quotes the case of an actress who had scars on her face from smallpox. She wore for the space of six months a mask both day and night. The skin, at the end of the treatment, presented to the feel a polished surface; but when pinched up, points of induration could be felt in it. Compression will often remove the redness as well as the elevation of a scar. The earlier it is done the better. It should be continued for some time after the nodule has disappeared. It must be used at first all night; later on in the treatment, compression for a

[1] Paris, 1863.

few hours at a time will be sufficient. For old scars he advises excision; slight scars can often be removed by actual cautery.

Unna[1] recommends for the treatment of depressed scars of the face friction with sand to prevent the undue accumulation of the horny layer of the epidermis. A case of scars produced by pustular acne was treated successfully in this way. After a few months of this treatment it was found that the depressed scars on the nose were shallower and smaller in diameter, and were scarcely perceptible. In a case of smallpox scarring, in a woman twenty years of age, three months of the friction treatment made the skin smooth. The situation of the previous depressions was marked by less pigmented circular spots.

Unna employs finely powdered marble. He prepares a "pulvis cutifricius" of two kinds. The powder may be used alone or mixed with powdered soap, sulphur or other powders. It should be applied as a lather. The action of the carbonate of lime has probably some beneficial effect. A fine sponge is dipped in the powder and the diseased parts are polished with it, at first slowly, later more rapidly but lightly, more as one would polish a boot. The frictions should be employed for ten to fifteen minutes once or twice a day.

Depressed cicatrices from gunshot injury, disease of the bone or of the glandular structures of the neck are often the cause of considerable deformity. An operation for their relief has been planned and successfully carried out by William Adams.[2] This consists in the subcutaneous division of the scar with a fine tenotomy knife. Two or three punctures may be necessary to liberate extensive scars. The cicatrix should then be carefully everted, and while held in that position two hair-lip pins or finer needles are passed through its base at right angles to one another so as to maintain the cicatrix in its everted or raised form for three days. Adams reports several cases in which the depression had not reappeared several years after the operation.

Pigmentation of the cicatrix may be due to various causes. That produced by the presence of particles of powder is most con-

[1] Unna, Vierteljahr. für Derm. and Syph., Vol. VIII, p. 508.

[2] London, J. and A. Churchill, 1879.

spicuous. These cases should be taken as soon after the injury as possible, and the skin should be scrubbed with a nail brush while the patient is under ether. A number of cases have been most successfully treated in this way by C. B. Porter. In older scars the particles of powder can be removed without further deformity by the punch devised by S. J. Mixter for that purpose.

Unpigmented scars are said by Pashkis to be improved by tattooing with a skin-colored mixture made with sulphate of baryta, yellow ochre and water.

The treatment of true keloid is most discouraging, owing to the persistency with which it returns. The patient usually seeks relief from pain and itching rather than from the deformity. Kaposi recommends the use of mercurial ointment alone or in combination with iodine and glycerine. Quinine and arsenic may be given internally.

Plicque recommends scarification for the relief of pain. The incisions should be made about 1 cm. apart and should cut through the whole thickness of the tumor.

If excision is attempted, the line of the incision should run from 1 to 2 cm. beyond the limits of the disease, and should extend through the cellular tissue to the muscular aponeurosis.

In certain regions it is possible to remove the growth with an ample margin of healthy tissue, as in the lobes of the ears. In such cases recurrence rarely takes place.

I have recently had an opportunity of seeing a young woman on whom I operated six years ago for recurrent keloid of both ears. On one side there was a double tumor, *i. e.*, a growth on each aspect of the lobe; on the other side a single tumor. The ears were bored at the age of fifteen, and the keloid began to develop in a few months. The tumors were removed three years before they were operated upon by me. My operation consisted in excising a large portion of each lobe by a V-shaped incision. There is at present a small, but well-shaped, lobe on each ear, without an appreciable scar.

Compression is recommended by many writers for the cure of false keloid. Unna treated in this way a cicatricial keloid, the result of a burn. A soft mercurial ointment was first applied

and held with circular strips of adhesive plaster. Outside of this dressing collodion was used freely. The dressing was renewed at the end of a week. The keloid gradually disappeared after treatment during two and one-half months.

Iodide of lead ointment was occasionally used instead of the mercurial ointment, A mixture of four parts of acetate of lead with twenty parts of collodion is applied with a brush, and after a few days' treatment the keloid is said to shrink, become paler and cease to pain. The frequency of the application should be gradually diminished.

Compression has been employed by Verneuil by means of an elastic bandage. Vidal has produced great improvement, and even disappearance of the tumor, by deep linear incisions dividing the vessels thoroughly.

As keloid is a connective tissue structure it is possible that an inoculation with the virus of erysipelas might produce absorption of the redundant tissue. Whether such a powerful remedy would be justifiable in a case of non-malignant disease is doubtful. Volkmann reports a case of cicatricial keloid cured by an attack of erysipelas.

A girl nineteen years of age received, three years before, a scald from boiling water on the dorsum of the foot. The wound healed slowly, and three false keloids finally developed. The largest of the three was the size of a Borsdorfer apple. The other two were as thick as the finger, and one of stony hardness. The large tumor was removed, but the parents declined to allow the other two to be excised. Two days after the operation erysipelas broke out and lasted a week. The remaining tumors became gradually softer, and finally were absorbed, and in a few weeks no trace of them could be found. The seat of the tumors was, in fact, somewhat lower than that of the surrounding skin. The tumor which was removed proved, on microscopical examination, to be a typical keloid.[1]

Thiersch grafting may be employed with advantage to broad and flat cicatricial keloids. My experience in this method has been limited to one case, but is suggestive. The patient, a negro

[1] Deutsche Chirurgie, Lief. 5, p. 193.

about twenty-five years of age, had sustained extensive burns about the chin, cheeks and ears, which were covered with enormously hypertrophied keloid tumors. Several plastic operations were performed by Dr. M. H. Richardson, with great success, upon the mouth, which had been nearly closed by the cicatricial contraction. Finally, a large keloid mass was dissected off the chin, and when the base of the wound had granulated Thiersch grafts were applied. A careful observation of this case for several months since this operation shows that thus far the keloid tumor has not returned, although the tissue beneath the grafts is much indurated. The patient has undergone so many operations that he is waiting to regain strength and to watch the result of the grafting experiment before submitting to any further operation for the relief of the tumors which remain. The subject of grafting opens up a fruitful field of research in connection with the surgical treatment of cicatrices, but the limits of this paper do not permit of more than a passing allusion to it.