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ON DIVISION OF THE CICATRICES CONSEQUENT UPON SEVERE BURNS.

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(The subjoined case was mentioned at the Annual Meeting of the Newton Branch of the Provincial Medical and Surgical Association, held at Newton July, 1847.)

Morbid contractions, the result of deep and extensive burns, are among the most unmanageable deformities which the surgeon is called upon to remedy. In instances where the whole thickness of the integument, together with its subjacent cellular expansion, has been destroyed to any considerable extent, and especially if the injury happen to have been inflicted upon parts naturally enjoying great sweep of motion, as about the large joints of the extremities, or the neck, the consequences are frequently of the most disastrous kind, the members or parts being, in many instances, incommoded to a degree rendering them worse than useless, accompanied with physiognomical disfigurement of a description often painful to look upon. Thus, the head may be bowed down, and permanently fixed upon the chest, or towards the right or left shoulder; the jaw may be immoveably depressed, and the lips held apart, subjecting the whole interior of the mouth to constant exposure, while the faculties of articulation and mastication are rendered almost useless; the eyelids may be prevented from closing upon the eye, the arm be bound down upon the side, and the forearm violently flexed towards the shoulder, so as to become little better than a mere incumbrance. It is not without a very humbling sense of the poverty of our scientific resources that one is forced to acknowledge moreover, how completely surgical art has hitherto failed to furnish an efficient means of remedying these unfortunate conditions, whether as regards its unavailing efforts at restoration of the maimed organs to even a moderate degree of usefulness, or towards improving the appearance of the seared and unsightly surfaces which cover them.

In accidents of the class now under consideration, the lost integument is replaced by a structure which necessarily possesses a very low degree of organic force, being, for a great length of time after its formation, little more than a mere protecting web, wanting in the adequate power to sustain the deeper-seated organs within their assigned limits, and deficient also in its capillary development. The natural consequence resulting from this absence of tonic resistance is,

shrinking of the cicatrix, with simultaneous displacement of the subjacent organs, followed by deformity and disorganization to a degree commensurate with the gravity of the accident. These changes in the relation of parts do not usually occur immediately after the infliction of the injury, nor even during the continuance of treatment; they take place most commonly after the reparative process is considered to be complete, and appear to be owing, in some degree, to the abandonment of the curative measures at too early a period. For it generally happens, even in cases where the loss of substance is very considerable, that until the healing process is fairly effected—the parts having, up to this crisis, been kept in a quiescent state, and well protected by the artificial covering employed to promote reparation—no tendency to displacement is perceived; but so soon as the new surface is freely exposed to atmospheric influence, and the subjacent muscles resume their functions, the cicatrix begins materially to alter its dimensions. Its imperfectly-formed cells, unoccupied by adipose deposit, fall together, and speedily become obliterated, and the organizing process going on within it, is, comparatively speaking, arrested; for while its extent of surface is daily diminishing, a corresponding increase takes place in its thickness and density, and the new formation, scantily supplied with nerves and blood-vessels at this early period, soon acquires a textural condition peculiarly unsuceptible of further organic increase. The nature of the structures entering into the composition of the bands of cicatrix, for the removal of which it is the intention of this paper to propose a remedial measure, and the manner in which they assume their abnormal arrangement, may probably be better understood if the reader be first of all briefly reminded of the anatomical disposition of the parts more immediately implicated.

The aponeuroses of the human body form a very important appendage to the organs of locomotion. Long neglected, as Cruveilhier has noticed, by the early anatomists, or alluded to in a very cursory manner as existing in particular parts only, and in portions independent one of another, they were first studied in an especial manner by Bichat, who arranged them under the head of fibrous membranes, of which system they constitute the most considerable portion. Of late years, however, the minute examination of these structures has occupied the attention of several able anatomists, and their importance in a physiological sense, is now duly appreciated.

Regarded in their totality, the fibrous membranes form a perfect model of the body of which they constitute so important an element. Immediately beneath the integument they are everywhere present; they afford a lining to all the great cavities, and a protecting sheath to the organs contained within them, as well as to their prolongations, the vessels, nerves, &c., in their minutest ramifications; they extend processes from the superficial to the deep-seated parts, becoming inserted in an especial manner into the various prominences of the osseous frame, which they also surround in its entire extent. Were it possible to remove every other organ and tissue, leaving only the fibrous membranes *in situ*, the latter would form a perfect skeleton of the whole body, nearly equal in its dimensions with those of the original. Being subject to the same laws which influence other tissues in reference to organic development, as a consequence of healthy functional activity, these structures may be seen to the greatest advantage in vigorous, athletic individuals, and in parts which enjoy great extent of motion, as the extremities. Thus, in one possessing a well-developed muscular system, they are thick, tense, and of a glistening pearly whiteness; but become flabby and attenuated, with loss of their characteristic pearly aspect in feeble subjects, and those who have undergone emaciation by chronic disease. In carnivorous animals they are remarkably strong; the interfascicular septa which, in the young, or in the domesticated of this species, appear but as thin cellular membrane, being in the adult animal, especially if untamed, replaced by a thick pearly-looking structure, manifestly fibrous. This transformation of cellular into fibrous tissue, proves the analogy which exists between the one and the other, in relation to their organization, their vitality, and their uses, (Craveilhier.)

The aponeuroses of different regions form with each other one continuous expansion, although generally described as existing in distinct portions, each of which is denominated according to its form, situation, use, or some other attribute. Their extent, therefore, is commonly regarded as being limited by certain marks, palpable or imaginary, forming the boundaries of different regions, and which, for the purpose of facilitating description, are referred to as indicating the commencement or termination of particular portions of fascia. For instance, that which envelops the upper extremity, called brachial aponeurosis, may be said to commence above at the lower margin of the clavicle, the acromion and spine of the scapula, and the muscular boundaries of the axilla. From these lines of departure, the membrane is expanded, in variable thickness and density, upon the whole circumference of the limb, tightly embracing the muscles and tendons from the shoulder to the points of the fingers, and being firmly implanted in the various osseous prominences about the joints and into the shafts of the cylindrical bones. From the internal surface of this general investment, processes are detached, called intermuscular septa, supplying each muscle with its proper sheath; these again, are seen to furnish other more attenuated projections to surround the component muscular bundles,

each constituent fibre of which is also similarly provided; the subdivision being continued to a degree of microscopical tenuity. Thus it is found, that each ultimate fibrilla of which a muscle is composed, possesses its *sarcolemma*, or proper tubular investment of membranous tissue, not unlike in its nature, probably, to that which is manifestly fibrous.

The general aponeurotic investment just described, is nearly void of elasticity, and is immoveably adapted upon the parts which it surrounds. But between it and the skin is another similar though looser tissue, called the superficial or subcutaneous fascia. This fascia, in which the subcutaneous vessels and nerves are embedded, is connected by its outer aspect to the skin, of the cell-work of which it is a continuation, and by its deep surface, through the medium of innumerable thread-like fibres, to that upon which it rests, but in such a manner as to allow considerable extent of movement of the one upon the other in most parts of the body.

In those injuries classified by Dupuytren, as burns of the fourth degree—namely, where sloughing of the skin and both layers of fascia leaves the surface of the muscles exposed, the organizable matter destined to form the cicatrix or new skin, is furnished by the vessels ramifying upon the intermuscular and interfascicular tissues, with each of which, consequently, it becomes intimately associated; the vascular, nervous, and cellular prolongations of the one being directly continuous with those of the other. It thus appears evident, therefore, that in the kind of contractions now alluded to, simultaneous displacement of the subjacent tissues is physiologically inevitable:—in fact, the cicatrix from the moment it first begins to shrink, drags after it all the portions of interfascicular tissue with which it has become inseparably connected, disturbing at the same time, to greater or less extent, the relations of the muscles themselves. The fibres thus raised forward, soon shew signs of increase both in thickness, and in power of resistance; the result partly of shortening in their linear direction, and partly of actual structural accretion. Each movement of the limb tends to augment the mischief, so that in process of time a thick, firm, unyielding band is found developed within the folds of the meagre integument, consisting of dislocated intermuscular fibres, which it is impossible to replace by any means hitherto known.

The procedure generally recommended for the prevention of these deformities, is to keep the limb or part in an extended posture, until the new skin be sufficiently consolidated to act as an efficient substitute for that which was lost. But this of itself appears to me altogether inadequate to the purpose. The only media which are alone capable of supplying the deficiency,—namely, an ample extent of good skin, and a firm fascial investment beneath it,—are still wanting, and must of necessity remain unsupplied; yet, although the power of reproduction be, physiologically speaking, very limited, there is little doubt that the substitute may be materially improved, both in texture and efficiency, by careful management during its formation. The practice generally adopted of allowing the cicatrix

to be freely exposed immediately after the healing process has been effected is, in my opinion, a great evil, as it effectually hinders all further efforts of the re-organizing function, which would probably proceed to a much greater extent than is usually seen, if the atmosphere were to be so excluded as to prevent for a time the formation of hard cuticle over the new surface, which has the effect of arresting increase of substance, in an outward direction at least, if not throughout the entire structure. In addition to the plan of keeping the part extended in a direction opposed to that of the contracting tendency, my belief is that the whole extent of the cicatrix should also be surrounded by an impermeable tissue, oiled silk for example, in such a manner as completely to exclude the atmosphere, and the new skin ought to be now and then smeared with an unctuous application, having occasionally in combination, as necessity may require, some irritating or stimulating agent, such as turpentine, or an essential oil. These measures ought to be continued, in severe cases, many months after the healing process is considered complete.

But my present purpose is to direct attention more especially to a means of restoring the use of parts disabled by the firm unyielding structures constituting the cicatrices already described, and which, in cases such as the one presently to be noticed, are productive both of serious functional inconvenience, as well as of great disfigurement. The almost uniform want of success which has hitherto attended surgical operations practised with a view to the relief of such deformities, has led medical men to regard them, for the most part, as irremediable cases; the removal or division of the abnormal structures having been generally followed by a state as bad as, or even worse than, that which it was attempted to remedy. Mr. Earle's plan of bringing the edges of the sound skin forcibly together, and securing their union, may possibly succeed in cases where the mischief is limited to a small space; but in extensive injuries, as for example where half the circumference or more of a limb is implicated, such procedure would be impracticable. The favourable issue obtained in the following case, which remains permanently relieved after the lapse of four years, has induced me to submit it to the notice of the profession, believing that the plan adopted in this, may be practised with a reasonable prospect of success in other cases of similar character.

CASE.—E. B.—, daughter of respectable parents, resident in North Cheshire, received a severe burn from accidental ignition of her clothing, in August, 1830, when *eight* years of age. The injury implicated a considerable portion of the left, the front, and the whole right side of the neck, extending from the ear, jaw, and occipital scalp, to the chest and axilla in front, and lower part of the shoulder behind; also the boundaries of the axilla, the whole circumference of the arm at its upper third, and the entire half of the rest of the limb on its anterior aspect, from the last-named part to the hand. The left limb was also severely injured, but to a less extent. Twelve months afterwards, in August, 1831, the surfaces having been for a length of time completely cicatrized, the right

fore-arm was found immovably contracted upon the arm to the degree of an acute angle, in which posture it was maintained by a web of cicatrix extending between the distal extremities of the two portions of the limb, and occupying of course the whole intermediate space. The corresponding limb was similarly fixed, the displacement being, however, less considerable. She presented herself at the last-named date for the purpose of having the position of the limbs restored by operation. The skin of the neck was also deeply furrowed, and the head distorted, but an operation upon these parts was not deemed advisable on the occasion in question. The cicatrices on the arms were accordingly removed, and the limbs maintained in an extended state by means of splints. A thick cord was tied round each limb at the elbow-joint, after a fashion long since recommended. Being at that time engaged in the pursuit of my elementary studies, I had an opportunity of witnessing from time to time the progress of the case. At the end of twenty-one weeks the cure was considered perfect, but in consequence of some degree of contraction being already manifest, the use of splints was ordered to be continued. Had this injunction been fully complied with, the issue would probably have been much more favourable than it proved to be. But once from under the actual surveillance of the surgeon, daily attention to the measures enjoined soon became irksome, even to the anxious parent, and the apparatus was not long afterwards abandoned altogether.

The contraction alluded to as existing at the time when the patient was returned to her friends, although but slight, was, nevertheless, not susceptible of replacement, even by the application of considerable force. But in twelve months after the operation, both limbs were again fixed in nearly the same position as before, and the right one rendered all but useless. Bands of cicatrix had sprung up nearly equal in extent with, and much more resistant than, those which had been removed, and the deformity, which was subsequently further aggravated, remained unrelieved for *twelve* years following.

In May, 1844, the patient, being 22 years of age, presented herself again to my notice. The parts exhibited the appearance represented in the accompanying engraving, made from an original sketch by a talented artist, Mr. G. W. Anthony. At this period the head was dragged downwards towards the right side in a very inconvenient and unsightly manner, the distortion in this part being in reality much greater than the figure appears to represent. The fibrous band subtending the angle at the elbow-joint, was equal in thickness to, and tangibly as firm as, the *Tendo Achillis*. The first operation was performed upon the neck, the incision commencing below the ear, the lower part of which organ was merged in the folds of the cicatrix; it was thence continued below the line of the jaw to a point opposite the middle of the chin. Division of the skin simply appeared to afford no relief whatever to the distortion, there being immediately beneath numbers of bands of a bright fibrous aspect, which effectually prevented the parts from resuming their natural position. These being successively divided with the bistoury upon a grooved probe, and the head raised, other sets presented themselves to view, which, when extended, still produced a tractive effect upon the cicatrix below.

Bundle after bundle was in turn dragged forward and divided, from one extremity of the wound to the other, until caution suggested a cessation. The wound, which appeared dreadfully large, was cleansed and covered with simple dressing; it was quite healed in four weeks.

The relief afforded by the above operation encouraged confident hopes of a successful issue from a like procedure upon the arm; this was accordingly practised on the 8th of June, 1844. The bistoury was plunged through the structure at the angle of flexure, as close upon the joint as safety to the neighbouring parts would admit, and thence carried forwards, emerging at the free edge. But this incision, which might, *a priori*, have been looked upon as all that was necessary, constituted comparatively but a small share of the operation. The divided parts immediately retracted considerably; but when extension was attempted, even but to a limited degree, a number of shining fibrous bands started forwards completely hindering further movement. These were also divided and extension again attempted, when others of similar character were brought into view, occupying an elevated position in front of the joint, and opposing like resistance. In this manner successive groups of fibres had to be separated, layer after layer, before the limb could be brought into a straight line, which was not accomplished until all the deep-seated bands reaching across the joint on each side of the large vessels, and outwards towards the condyles, has been completely divided, including of course the fascial insertion of the biceps

muscle. During the operation the median basilic vein was accidentally wounded; this, it was found necessary to ligature on each side of the puncture, before further steps could be taken.

The wound, which measured eight or nine inches in the long direction, and upwards of four inches transversely, was cleansed and covered with simple dressing and a bandage. A splint was applied to the back part of the limb on the fourth day, but this appeared unnecessary, as there was no difficulty in easily maintaining an extended position; the apparatus was altogether abandoned at the end of three weeks, and never afterwards required. The wound was completely cicatrized in six weeks.

About three months afterwards I divided, in a similar manner, the cicatrices bounding the axilla, on the same side of the body, with nearly equal success.

The accompanying engraving from a sketch made on the 30th of March, 1847, nearly three years after the operation, by the artist above-named, represents the state of the arm at that period, and its appearance now

is even still more favourable, the limb having become more rounded and fleshy.

The successful issue of the operation was undoubtedly attributable, mainly, to the *perfect* division of *all* the fascial fibres traversing the elbow-joint anteriorly from the arm to the fore-arm, or at least *all* that could be exposed with safety.

It is not a little remarkable that the elbow-joint, which had been almost totally unused for twelve years,

appeared in no way injured, as no pain was complained of, nor difficulty experienced, in the attempts that were made to move it. The limb is now plump and well shaped, and apparently as strong and useful as though it had not been materially injured.

OBSERVATIONS ON ANÆSTHETIC AGENTS IN SURGICAL OPERATIONS.

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(Read at the Annual Meeting of the Suffolk Branch of
the Provincial Medical and Surgical Association, held
at Bury St. Edmunds, June 16th, 1848.)

My experience in anæsthetic agents having been confined to æther and chloroform, the following remarks must be understood as applying to them, though the mode of operation of other substances of a similar kind which have been more recently brought into notice is probably much the same. I should likewise state, that my observation has been almost entirely limited to the effects of these agents upon the human body, the experiments on animals which I have seen being few, and not very instructive.

After a brief consideration of the *modus operandi* of æther and chloroform, I will proceed to state also briefly the results of my own experience as to their value in surgical operations.

There can, I think, be little doubt of the anæsthetic properties of these agents being due to a direct effect upon the nervous centres produced by them in consequence of the mixture of their vapour with the blood, which takes place in the lungs much in the same manner as the components of the atmosphere are added in the ordinary process of respiration. Travelling the round of the circulation, and carried into the capillaries of all organs alike, the influence of the vapour is first observed in the nervous centres, which we know from other experiments to be peculiarly susceptible of impressions made in this manner through the medium of the blood.

The complex organ or rather system of organs which we include under the denomination of nervous centres, ministers to a variety of functions. To the intellectual, the sensational or perceptive, and the volitional, by the cerebral hemispheres;—to the special senses and the emotions, probably by the corpora striata, optic thalami, and other ganglia, at the base of brain;—and to the reflex functions by means of certain of these ganglia, by the spinal cord, and by the medulla oblongata, the reflex functions most essential to the continuance of life,—viz., those upon which respiration and deglutition depend, being executed by the latter of those organs. These functions of the nervous centres have been enumerated above in the order of their liability to be interrupted by various agents affecting the whole system. A blow on the head may deprive a man of consciousness, and, as a necessary sequence, of volition; the persistence of a certain amount of sensation being often evinced by his resisting attempts to separate the eyelids, withdrawing his limbs from irritating causes, curling himself up

into a comfortable position in bed, and even crying out lustily when hurt. In all this, being unconscious, he may have no perception of annoyances; in strict language, he may not feel them. A more severe injury is followed by total loss of sensation as well as of volition; the limbs lie motionless wherever they are placed, and the man exhibits no sign of discomfort from any irritation or impression of light or sound. Even some of the reflex functions are suspended, the iris and the sphincters cease to act, but the actions of respiration continue, deglutition is performed, and there may be vomiting. The effect of all this disturbance upon the heart, which is less directly influenced by the nervous centres, varies a good deal; sometimes its pulsations are slow, laboured, or intermitting, at others they are accelerated or continue but little altered. In these cases of cerebral injury, the different parts of the nervous centres are for the time paralysed by the direct effect of the shock or jar upon them; and they suffer in proportion to their delicacy or their susceptibility to such an impression. Happily, the parts which minister to the reflex functions most essential to life are the last to be affected.

In their general outline the symptoms of cerebral injury correspond with those produced by anæsthetic agents, though in the latter case the several portions of the nervous centres are paralysed, not at once by a rude shock, but gradually, one after another, by the application to them of a subtle and evanescent poison, which thus dissects or unravels, as it were, the functions of the brain, removing first one, then another, with a regularity and certainty we were not prepared to expect. Moreover, with both æther and chloroform, a period of excitement sufficiently distinct precedes the depressed or paralysed condition. The first few inhalations are usually productive of some cerebral excitement or wandering, with suffusion of the face and eyes, and acceleration of the heart's action; various sensations are felt, strange sounds, knockings and beatings are perceived, and stars or flashes of light are seen, which increase in rapidity till they are lost in silence and gloom; for these signs of excitement are soon followed by a depression or suspension of the cerebral functions, the loss of consciousness, of perception, and of volition, shewing that the hemispheres of the brain are yielding to the agent. It occasionally happens that volition is lost before perception and consciousness; thus, a gentleman who took chloroform by way of experiment, was aware of the pinchings, and pullings of the hair, which I inflicted on him, but could not move nor express that he was so. I was told that a young woman felt the key applied, and the wrong tooth drawn, without being able to intimate the mistake, or to offer resistance. More frequently common sensation is the first to yield, and the patient may watch the steps of the operation upon his own person, may comment upon them, may hear the scissors snap, or be conscious of the crash caused by the dislodgement of his tooth, without feeling pain.

Usually, sensation or perception, volition, and unconsciousness, are lost together, and an interesting period may now often be observed before the parts of the brain subservient to the emotions are paralysed,