AUTOPLASTIC SUTURE IN HERNIA, AND OTHER DIASTASES.—PRELIMINARY REPORT.*

L. L. MCARTHUR, M.D.

CHICAGO.

Without entering into a discussion of the relative merits of suture materials possible or desirable, all of which can be found in our text-books, it shall be the aim of this brief and preliminary communication to show the feasibility as well as the desirability in certain situations of utilizing the patient's own living tissues as the resisting medium to future hernia. While at work with an inguinal hernial operation the idea occurred to me that it would be feasible to utilize a strip of the tendinous portion of the external oblique, which, possessing fibers in the adult from 5 to 6½ inches in length, would have sufficient strength to act as a substitute for the absorbable kangaroo sutures. Experiments on dogs and operations on the human being have proven to me the feasibility of the procedure; it remains for the future to determine the actual value of the suggestion.

Mentioning in passing the more pertinent of the autoplasmic hernial procedures that have been recommended by various surgeons, in order that they shall not be confused with the present suggestion. This in nowise is intended (as are all the other methods) as an obturator to the inguinal canal. I would recall McEwen's treatment of the sac, as a pad at the internal ring, or Wölfler's autoplasty with the lower segment of the rectus muscle loosened from its sheath and drawn out to the position of the canal, or Poulet's dissection out of the tendinous insertion of the adductor magnus and grafting it upward into the canal, or Graham's similar treatment of the upper end of the Sartorius. Autopsies held long afterwards have demonstrated the complete absorption of the McEwen treated sac; while atrophy of the muscular structures utilized as obturators to the canal has been observed. The only suggestion similar to mine with which I am familiar is that which was made by Vulliet in cases of nephropexy, he being driven to this expedient when all other methods of suture, absorbable or non-absorbable, had given occasional failures. You will recall that in that position he recommended the dissecting out of a portion of the tendon of the longissimus dorsi, leaving its lower end attached. With this he perforated the capsule of the kidney, bringing the free end then into the wound for fixation. With such a living suture it was possible for him to have a permanent suspensory ligament. His recommendation has not met with the recognition it perhaps deserved, because, 1, in that situation it required an extra three and one-half inch incision above the usual wound, exposing the tendon at the transverse process of the first lumbar vertebra. 2. Simpler, equally successful, procedures came into use. In the case of inguinal hernia, however, the tissues lie immediately at hand; the skin incision need be lengthened but an inch to one and one-half inches, when the living tendons with their fixed bony insertion below can be separated in any desired size. It thus becomes an easy matter to utilize them for the suture of any hernial procedure; requiring, however, a running instead of an interrupted stitch.

Technique.—Any of the accepted operations, the Bassini, or the Andrews-Girard, operation can utilize this

material without great variation in the technique. The skin and fat having been cut, exposing the external ring, the latter is prolonged upwards, the line of separation paralleling exactly the tendinous fibers of the external oblique muscle to its commencing muscular insertion. This divides the aponeurosis of the external oblique into an external and an internal flap, the cut edges of which can easily be raised from their contact with the internal oblique. The sac having been treated as the operator may

Fig. 1.—Schematic representation of two strips of tendon of external oblique, ready for suture; canal represented as opened; sac ligated and dropped back.

prefer (Duplay-Cazin) a bundle of those white fibers which enter into the formation of the internal pillar of the ring are then split off from the edge of the internal flap of the external oblique quite up to their insertion in the muscle belly, where they are cut loose from the muscle but left attached to the spine of the pubis. This strip should vary in width from one-eighth to four-sixteenths inch, according to the development

* Read at the Fifty-second Annual Meeting of the American Medical Association, in the Section on Surgery and Anatomy, and approved for publication by the Executive Committee of the Section: Drs. W. J. Mayo, H. O. Walker, and A. J. Ochsner.

of the tendinous fibers, which in children and women are not so strong as in the male adult. In case a Bassini is done, a similar strip is taken from the outer flap, the lower end of which strip terminates in the fibers of the external pillar of the ring. At this stage the opening presents the appearance of a shoe ready to be laced up. The operation is then completed according to the choice of the operator, a Bassini or an Andrews imbrication or a Girard, using these strips as

stitch is so applied as to give the desired lumen to the new external abdominal ring, using the one terminating in the internal pillar for the first suture, the remaining one for the superficial layer of buried stitches. The end of the suture strip can be fixed by making a simple knot in it; but one or two stitches through and back as the tailor fixes his thread, will also serve the purpose. The treatment of the cord can be by either method that suits the operator's fancy—Bassini or An-

Fig. 2a.—Schematic representation of suture with "T. S." tendon strip for deep layer: inner flap to inner aspect of Poupart's ligament. Artist has included inner flap of external oblique tendon as in Andrews'.

suture material for a running stitch. As an easy means of handling, and for the purpose of avoiding infecting the graft suture, a strand of No. 3 silk is tied (with a single knot) tightly to the free end, this silk threaded in the ordinary needle, and the tendon graft drawn through the tissues to be united, one for the deep row of stitches, the other for the superficial layer. The first

Fig. 2b.—Similar representation of suture with "T. S." outer flap to anterior surface of inner flap, when using Andrews' Edge-to-edge with Bassini.

draws. The skin and fatty layer can likewise be closed with the suture most in vogue with the person operating. The writer's practice usually has been with interrupted silkwormgut stitches, no drainage, and sealing with

iodoform collodion. While I have had a large number of hernial operations in the past, since commencing this method of suture I have had twelve¹ cases in which to try it, in all of which a perfect primary union was obtained, with an unusually satisfactory convalescence, the temperature not rising as it usually does during the absorption of the animal sutures, with in these few cases less than usual of the indurated boggy area surrounding the wound. Some of my colleagues have likewise tried the operation, making in all seventeen cases of which I have personal knowledge.

Realizing, as I do, how nearly perfect our absorbable suture material has now become, I should not have the temerity to present this paper did I not believe it to possess undoubted additional merits, viz.: 1, the obtaining of a living suture; 2, lessened chance of failure through avoidance of introduction of dead or foreign tissue; 3, the incorporation in the resisting cicatrix of organized white fibrous tissue; 4, the applicability of the same procedure to other situations.

By similar experiments with aponeurosis of external oblique of the dog, I am able to demonstrate that the tissue heals *in situ*, is not absorbed, does not slough, and I present microscopic specimens thereof in verification. Animal ligatures dissolving in one to two weeks no longer exert a retaining influence, while these grafts living, as white fibrous tissue largely does by imbibition, remain permanent. Indeed, the well-known heteroplastic tendon grafting for loss of portions of tendinous structures should teach that this graft should likewise.

It will at this date be generally accepted as true, I think, that failure of cure in hernial operations by any of the recognized methods is practically always due to associated infection, for the Bassini, the Andrews or the Girard unassociated with infection can be said to be practically always successful. Inasmuch as these accidental infections are usually traceable to the buried sutures, if by any means we can eliminate their use, we lessen chances of failures. In the case of non-absorbable sutures like silk or silver wire, it is not an uncommon experience to have a primary union and yet a year or longer afterwards to have a patient return with the auto-infection of a stitch successfully buried that length of time and requiring removal.

Whatever the method of operation, McEwen, Bassini, Andrews or Girard, the success of the operation is dependent upon the formation of a cicatricial connective tissue between the apposed surfaces retaining them where placed. McBurney's demonstration of the occasional unreliability of this cicatricial material as a resisting medium in hernia teaches us that occasionally we must expect failures because of this very yielding of connective tissue. Could we, however, by any means incorporate in such a cicatrix such white inelastic tissue as these tendons present, especially when interwoven as a running suture is, then we can certainly feel more confident of its permanency and unyielding character.

In very young children, and some women, the tendon of the external oblique is sometimes so poorly developed that I am convinced that this method of suture will not be applicable to every case, and have refrained from trying it under these circumstances. As to the tensile strength of strips of tendon of sufficient size for use as suture material, this can be said, that they withstand a tensile strain of from 11 to 24 pounds without breaking.

Sufficient time has not elapsed since any of my operations to state that the method is any more successful than with animal sutures. It is logical to conclude however, that if the identical technique is followed, using these living strips as is followed with aseptic animal tendons, and a primary union with normal convalescence is obtained, that if they die and be absorbed, they accomplish all that the foreign material does, while if they live (as experiment proves) it remains to offer permanent resistance to future stretching.

Experiments are now in progress by means of which, after the lapse of sufficient time, I shall study the histological changes, if any, which grafts of this nature may undergo, and hope to have the honor of presenting to this Section the findings.

DISCUSSION.

DR. C. A. POWERS, Denver—We all know how useful and popular is the modern operation for the radical cure of inguinal hernia, and every addition to our technic is welcome. Dr. McArthur has presented this simple matter in a very plain and modest way, and I personally believe that it is very well worthy of trial. I shall make use of it for I think it promises to be an addition to our methods.

DR. D. N. EISENDRATH, Chicago—I do not know whether the Doctor has had any children among those whom he has operated on. I tried it in a child and was surprised to find, in a boy of 10, the tensile strength of the aponeurosis of the external oblique, which suffices to close the hernial canal. The only trouble I had at that time was the method of closing the suture, which was afterwards explained to me by the Doctor as the splitting of the tendon and then separating the two ends to tie them together. That was the chief difficulty. Everyone is surprised at the great annoyance of having suppuration, and in these cases it is certainly a great addition to our technic, where we have animal tissue.

DR. J. R. EASTMAN, Indianapolis—With regard to the suture strip that Dr. McArthur splits off I would like to ask how it happens to be so much longer than the wound in the aponeurosis of the external oblique. I wish to ask further if he has encountered cases in which the aponeurosis was so thin and delicate that the edge was split off where he has applied this tissue as ligature material. The autoplasmic suture has considerable breadth and must involve some splitting of the aponeurosis of the external oblique, as it is introduced to close the wound. It appears that there would be some danger in this direction, and I would be glad if the Doctor could throw some light upon this phase of the matter.

DR. G. F. SHIMONEK, Milwaukee—It seems to me that since these autoplasmic sutures represent a tissue which, histologically, is rather of low vitality, as all white fibrous tissues are, their existence must be very greatly limited. In order to oppose the adjoining edges it is necessary to put these sutures on the stretch, thus devitalizing them more or less completely; the result will be a complete absorption of the sutures, probably in as short a time as it takes to absorb plain catgut. Having had no experience with this method I can only say that I imagine it inferior to silkwormgut, kangaroo tendon or formalized pyoktanin catgut, because those tissues upon which the permanency of our results, in hernia, depends, are composed of fibrous tissue which requires to be held much longer in close approximation than do structures of higher vitality.

DR. McARTHUR, in reply—The strips have been exaggerated in length in the drawings. One knows the length from the anterior spine up to the external oblique belly. It is a good length, in some, as I said, even six inches. The strips again are represented as flat. That is a representation which is not found as soon as they are loosened. When they are loosened they roll up as catgut does, and therefore pull through as does catgut and do not make a long stitch wound in the edge of the external oblique any more than the catgut or any suture material does. The edge I have not found to tear out more than it does in using any other suture material. I recall one

1. The number has since increased to twenty.

case in which it did tear out. I want to report a case that was operated on by this method, in which a death occurred on the fourth day from a total suppression of urine. I want to report it, because it presented that rather rare type of hernia—necessitating a prolonged operation—because I did not recognize for some time I had to deal with what is spoken of as the “sacless hernia” (*hernie par glissement*), made possible by the fact that in certain cases the anterior aspect of the colon is only partially covered by peritoneum; a large portion of its outer posterior aspect is uncovered by peritoneum. This sometimes slips down and presents in a hernial ring. When you cut down on the mass, you look in vain for a peritoneal covering; still you feel the gurgling within, find the contents of the bowel and know that you are close to it—you find no peritoneum; or until you pull it down, you do not find any peritoneum. It was so in this case, a man 62 years of age, who was a peddler, urging that he be operated on, because he had to jump down from his wagon and could not keep this hernia up with the truss. I concluded to operate, and he died, without any doubt from a too prolonged anesthesia for a man of his years; the total suppression of urine proved it, I think. It was not possible to get a postmortem. It was, however, possible in the night for my house surgeon to cut out the segment which had been sewed, showing the tendon *in situ*; microscopical sections of which are being made.

THE COSMETIC AND VISUAL RESULTS IN SQUINT.*

J. MORRISON RAY, M.D.
LOUISVILLE, KY.

Since Donders first promulgated the statement that strabismus convergens always depends upon hypermetropia, to the present time, the study of the etiological factor or factors concerned, has been one of ever-increasing interest; yet much still remains unknown and unsettled in our knowledge of this complex condition. A step was taken forward when it was proven beyond question that there must be a something besides hypermetropia to determine a squint. Schweigger, Stilling, Hansen-Grut, Wahlfors and others have attacked the subject, but no one theory explains all the features sometimes encountered.

The early age at which squint usually shows itself adds much to the difficulties of our gaining knowledge of the pre-existing conditions. The best way to approach the subject is by a careful study of cases. In doing this we often encounter phenomena that can not be explained by any of the ideas yet advanced.

Leaving to others a discussion of the theories underlying squint, I have chosen to address myself to a practical consideration of the visual as well as the cosmetic effect gained by the different methods of treatment. In order to do this I have selected 100 cases of convergent strabismus that have been under my personal care in private practice during the past four years. I have excluded all cases where a visible diseased condition such as corneal, lens or vitreous opacities of fundus changes were present. Each case has been under observation for several months, and a careful test of the vision made when possible; and the refraction determined either by subjective or objective tests under the influence of a cycloplegic (usually atropia).

The ideal result from the treatment of squint would be that which, while bringing about parallelism of the visual lines, would at the same time improve the vision in the defective eye, and produce binocular single vision

in all portions of the field of fixation. Were these ends obtainable in all cases the chapter on squint could be closed. The studies and writings of Javal, Priestley Smith and others have aroused a fresh interest in the question of improving the vision in the amblyopic eye and lessening the squint by the so-called educative treatment.

Of the 100 cases selected for this study, 76 were cases of monolateral squint, in all of which the squinting eye was defective in visual acuteness; 24 were cases of alternating squint, in which the visual acuteness was practically the same in each eye. Of the 76 cases of monolateral squint, in 21 cases, or 27 per cent., who were old enough to answer to the subjective test, improvement in the acuteness of vision in the amblyopic eye was obtained by correction of the refraction. In these cases the vision was first tested, then a cycloplegic was instilled, and the correction ascertained both by objective and subjective tests. After adaptation of the correcting lens, which was as near as possible a complete correction, a test was again made with the pupil in its normal condition. The following results in the 21 cases were shown: 1 case was improved from excentric fixation to 14/200; 1 from 18/200 to 20/200; 4 from 20/200 to 20/100; 2 from 20/200 to 20/70; 1 from 20/200 to 20/50; 1 from 20/200 to 20/30; 2 from 20/100 to 20/70; 3 from 20/100 to 20/50; 1 from 20/70 to 20/50; 3 from 20/50 to 20/40; 1 from 20/50 to 20/30, and 1 from 20/40 to 20/30.

The amount of hypermetropia present was as follows: 2 cases with 1 D.; 3 with 2 D.; 7 with 3 D.; 5 with 4 D.; 2 with 5 D.; 1 with 6 D., and 1 with 4 D. of simple hypermetropic astigmatism. In 6 cases astigmatism of from 1 to 3 D. was combined with the hypermetropia.

The improvement obtained in these cases was always apparent shortly after the lenses were adjusted, and is, I believe, a result of the lessened eye strain due to the formation of a more distinct image on the retina brought about by an accurate correction of the refraction error, and not to direct improvement in the perceptive powers of the retina. This same improvement is often noted in one-sided amblyopia without squint where the hypermetropia and astigmatism have been corrected.

More recent writers seemingly having taken the cue from the authorities noted, have gone even farther, and now we almost daily read of cases of squint with high amblyopia and excentric fixation in which a correction of the defect in refraction and exclusion of the fixing eye has brought the vision of the defective one up to the normal standard of acuteness. Senn, in a recent article in “*Wochenschrift für Therapie und Hygiene des Auges*,” reports ten cases in each of which the amblyopic eye improved under forced use, while in two of these the good eye deteriorated as a result of the exclusion. That isolated cases of marked improvement in amblyopia are encountered can not be denied. The reported cases of Johnson, Javal and others are conclusive, but in my experience I have not observed such results. One case where the amblyopic eye was forced to do the work of the former fixing eye has been under observation: A boy 16 years of age presented a squint of the right eye with amblyopia. A corneal ulcer produced a large central opacity on the left or fixing eye; the right then became the useful eye, and while under observation for six months the vision did not change from 20/70.

All will admit that when a squint is corrected, of scarcely less importance than improvement in the acuteness of vision in the amblyopic eye, is the attainment of

* Read at the Fifty-second Annual Meeting of the American Medical Association, in the Section on Ophthalmology, and approved for publication by the Executive Committee of the Section: Drs. J. A. Lippincott, Casey A. Wood and H. V. Würdemann.