it. Fig. 10, Plate VIII., is from a photograph taken of him three months after operation, and is an excellent representation of his present appearance.

I have little more to advance in favour of this operation; it is safe and simple, and the proof of its efficiency and usefulness is exemplified in the cases just reported. It is applicable in every instance in which, from disease, accident, or other cause, two-thirds, or even a larger portion of the soft parts forming the under lip and chin are defective. It is only to free the connexion of the parts from the body and margin of the jaw-bone, and sufficient substance can be drawn upwards to supply any deficiency. The imaginary lines drawn perpendicularly from the canine teeth to the margin of the jaw comprise between them the parts to be cut, as well as the extent of the incisions; beyond these lines we have the dental holes, with their nerves and vessels, which are avoided by keeping within them; besides, they mark the limit of the ordinary sized lip.

Advanced age does not appear to impede the healing process after this operation; the man of 70 progressed as rapidly as the man of 36. Not so constitutional taint: the operation on the scrofulous boy, Levy, though of the same nature, and on very similar parts, was not complete in its results until the tenth day—a prolonged period of six days, in comparison; but then it was quite complete; and constitutional taint turns out to be no obstacle to the ultimate success of the operation. The foregoing cases comprise all in which I have performed it; and if it is thought worthy of adoption by others in similar cases, I hope it may prove as successful in their hands as it has proved in mine.

ART. X.—*On the Structure and Pathology of the Hernial Sac.*

By THOMAS HAYDEN, F.R.C.S.I., L.K. & Q.C.P.I.,
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HAVING some time since made a series of observations on the structure and properties of the hernial sac, and the alterations it is liable to undergo in the progress of disease, with the view of elucidating some points as yet obscure in the pathology of hernia, I hope the result of the inquiry, though as yet in some respects incomplete, may possess sufficient interest to insure its perusal.

In the ordinary expulsive efforts of the abdominal muscles,

including the diaphragm, I find that a combined force equal to forty-two pounds is brought into action in a man of middle age and ordinary stature; and that, under circumstances of great difficulty, this may be increased to sixty pounds. The means by which this result was arrived at are, shortly, the following:—The broad abdominal muscles, being curved, tend, during contraction, to straighten themselves, and by this movement compress the abdominal viscera; but the contractile portion of them being situated laterally, they act with relation to each other at an obtuse angle, and propel the viscera forwards and inwards. The force of the diaphragm is directed forwards and downwards, whilst that of the levator ani is directed forwards and upwards; thus the united force of all the great expulsor muscles would appear to be concentrated upon the anterior abdominal aponeurosis in the neighbourhood of the umbilicus.

If, therefore, in the recumbent posture, the end of a graduated rule, held perpendicularly, be firmly pressed against the umbilicus with one hand, whilst it is loosely held between two fingers of the other rested upon some neighbouring object, and a voluntary effort of expulsion be made, it will be found that the abdominal wall ascends to a height of an inch and a half, as indicated on the scale. If now weights be substituted for the rule, and the latter be held, as before, resting upon the uppermost of them, we may calculate the force developed by the combined action of the abdominal muscles by observing the height to which they are capable of lifting different weights during forced voluntary contraction. Thus the greatest weight raised an inch and a half may be taken to represent their *minimum* force, whilst the greatest weight which they are capable of raising perceptibly will give their *maximum* force. Of course the standard taken is somewhat arbitrary, and the results, which are liable to variation in different individuals, not strictly accurate; but still I believe they are sufficiently so for the object in view, namely, to afford an approximate estimate of the united contractile force of the abdominal muscles.

It is obvious that every point of the surface of the abdominal cavity, large enough to afford exit to a portion of the movable viscera, must be capable of resisting this force, else hernia will occur. Ordinarily the expulsive force, on the one hand, and the resistant and cohesive property of the walls of the abdomen on the other, are so evenly balanced, that no protrusion can take place; but should derangement of the equilibrium occur, either by the sudden employment of a maximum expulsive force, or by a diminution of the power of resistance in the abdominal walls from interstitial absorption, or impairment of

the ordinary physical properties of the tissues, then hernia will occur; the situation of which will be determined by that of the yielding part, the bulk by its area, the length by the time occupied in the descent, and the composition by several circumstances, viz., the age of the patient, the site of the protrusion, the relative weight and volume of the intestines and omentum, &c.

The structure which first encounters the expulsive force of the abdominal muscles is the peritoneum; the power of resistance, therefore, with which this membrane is endued, the tissue in which that power resides, and the precise nature of the process by which it is overcome, and ultimately abolished, should occupy a prominent place in a systematic inquiry into the pathology of hernia.

In order to determine these points, I instituted the following experiment:—A small glass jar was half filled with rectified spirit, and over its mouth, one inch and three-eighths in diameter, a piece of fresh human peritoneum, cleanly dissected from the superjacent structure, was expanded and firmly tied in such a manner that the membrane depended somewhat into the jar without being immersed in the spirit; a well-adapted cork was now placed in the mouth of the jar, and through an aperture in its centre a closely fitting cylinder of wood was introduced, so as to put the expanded peritoneum on the stretch by one of its extremities, whilst the other projected above the cork to a distance of two inches and a quarter; over the projecting end of the cylinder three india-rubber bands were placed, and thence stretched over the bottom of the jar. A considerable propulsive force was thus brought to bear upon the peritoneum, putting it fully on the stretch, into the jar, whilst the spirit within prevented desiccation. In this state of tension it was left for ten days, from the 18th to the 27th of August, inclusive. When the tension was taken off, and the peritoneum removed, it was found that the membrane had entirely lost the power of reaction, and remained deeply indented where the cylinder had pressed upon it.

In order to determine the degree of pressure borne by the peritoneum, weights were appended to the india-rubber bands stretched over the jar used in the experiment, till they had attained the degree of extension previously reached. By this means I ascertained that that portion of the peritoneum upon which the cylinder had rested, one-fourth of an inch in diameter, had borne a pressure equal to four pounds, eight ounces, during the ten days occupied in the experiment. It will be seen from what has preceded, that this does not represent even the *mini-*

num force developed by the abdominal muscles of a man of ordinary stature, and borne by the peritoneum in the effort of straining. The absolute amount of pressure, however, which is sustained by the hernial sac, is so liable to variation from many causes,—such as difference in muscular development and in the force required for particular efforts, as well as in the number and frequency of such efforts,—that it would be impossible to calculate it even approximately. The result, nevertheless, will show that a pressure very much less than that which the abdominal muscles are constantly exercising in the ordinary efforts of defecation, lifting weights, &c., is amply sufficient to annul the elastic resistance of the peritoneum, if concentrated upon a small portion of it, and continuously applied for a period of ten days.

A portion of the membrane, treated as described, was subjected to microscopic examination with a magnifying power of

FIG. 1.—Portion of human peritoneum that had been ten days subjected to an extending force equal to four pounds eight ounces; magnified 222 D.

222 D.; it will be seen by reference to the accompanying cut (Fig. 1), which accurately represents the appearance presented by the specimen examined, that the elastic fibrous element which enters so largely into the composition of the peritoneum is no longer recognizable by the characteristic curling disposition of its fibres, which appear straightened out in the figure, and as incapable of recovering their normal length and disposition. It will be observed, also, that the membrane has undergone considerable attenuation, as evidenced by the sparse arrangement of its fibres.

These changes will be better appreciated by contrast with Fig. 2, which gives the appearance of a portion of fresh peri-

FIG. 2.—Portion of peritoneum of human subject; magnified 222 D.; treated with acetic acid.

toneum simply treated with acetic acid. In order to ascertain whether the immersion in spirit might not have had the effect of dehydrating the tissue, and thereby of destroying its elasticity, independently of the tension to which it had been subjected, a portion that had been kept in spirit forty-eight hours, but not in a state of tension, was examined, and found to present an appearance in no degree different from that represented in Fig. 2, (See Fig. 3).

FIG. 3.—Portion of human peritoneum, macerated in spirit for forty-eight hours, but not subjected to tension; magnified 222 D.; treated with acetic acid.

Lastly, a portion of an old pendulous hernial sac which had descended quite to the testicle, was examined with the view of ascertaining the condition of its elastic tissue. The appearance presented by the specimen treated with acetic acid is given in Fig. 4. It will be seen that it corresponds pretty closely with that represented in Fig. 1, from the specimen subjected to tension during ten days, with this sole difference, that the latter would appear not to have been so completely as the former deprived of the power of elastic reaction, as shown by the still somewhat tortuous disposition of a few of its fibres.

FIG. 4.—Portion of an old hernial sac, macerated in spirit, and treated with acetic acid; magnified 222 D.

When, however, it is borne in mind that the hernial sac had been in the scrotum, probably for several years, as the subject was old, a sufficient explanation of this difference in degree will readily suggest itself.

That the impairment or loss of elasticity in the sac may exercise much influence in determining the general characteristics, as well as the curability of a hernia, is manifest; thus the degree of descent, and the volume of a hernia, are directly related to, and dependent upon, the yielding of the peritoneum.

The readiness with which the viscera descend on the patient's assuming the erect posture, or on coughing, has likewise immediate reference to it; for whilst the sac is capable of any amount of reaction, as in the earlier stages of hernial protrusion, the descent of the viscera is retarded by it, and the rate of progress downwards regulated by the facility with which it yields to pressure. In cases of old hernia, on the contrary, where, from

long continued pressure, the yellow fibrous tissue of the sac has entirely lost its characteristic property,—its fibres being extended, and no longer capable of resuming their original arrangement on the withdrawal of the extending force,—where, in short, the sac is flaccid and pendulous,—it presents no obstacle to the descent of the viscera, which therefore readily gravitate into the scrotum when the patient assumes the erect posture, or calls the abdominal muscles into strong action. The ease with which reduction may be accomplished in hernia of recent formation must likewise be, in some measure, attributable to the aid afforded by the elastic reaction of the sac, and in the *réduction en bloc* of the French, the return of the sac with its contents, if not due to cohesion between them, is entirely attributable to this cause.

The occurrence of abdominal hernia has been attributed, primarily, by Wharton and Morgagni^a, to the yielding and elongation of the mesentery, by which is implied the permanent extension of its elastic tissue. That such a change must have occurred in large and pendulous herniæ will be readily admitted by any one who has witnessed the distance to which the intestines of a subject not affected with hernia are capable of gravitating, on placing the body in the erect posture, after making a flapsection of the anterior abdominal wall; in ordinary cases they will be found not to reach a lower level than the symphysis pubis. It would thus appear that those distinguished pathologists fully appreciated the great value of resiliency in the mesentery, as a preventive of hernia; but it is not a little surprising that they should have failed to recognize in the cognate structure of the hernial sac the existence of a similar property, which in it plays an equally important part in resisting protrusion of the viscera.

The curability of hernia is no less intimately associated with the elasticity of the sac, than is the history of its formation. By an extension of the well-known physiological dogma, that permanent dislocation of an organ or structure entails upon it impairment or loss of its normal function or properties, we may conclude that, in the history of disease, displacement of a part from its natural position and relations may exercise much influence in modifying its morbid susceptibilities.

If to the modifying influence of this cause, as regards the hernial sac, we add that arising from the loss of its distinctive pro-

^a “Quæramque insuper quomodo nisi laxius fuisset (Mesenterium) cum aliquot tenuium intestinorum ulnis potuisset in amplissimam herniam descendere? Certe enim secundum naturam se habens nequit deorsum adeo provenire.”—*Morgagni de Sedibus et Causis Morborum per Anatomiam indagatis*, Lib. 3, Epist. 43, c. 13.

perty of elasticity, consequent upon long-continued extension, we can readily understand why a membrane so extremely sensitive as the peritoneum is, and so prone to resent even the slightest injury in its normal condition, should tolerate the amount of rough usage involved in the operation for the radical cure of hernia, according to the various plans of Gerdy, Wützer, and Wood, and that more recently devised by Mr. Syme.

The attempt to effect the radical cure of a *recent* hernia by any of these operative procedures, before the sac had undergone the preparatory changes due to the above-mentioned causes, would therefore be hazardous in the extreme, and totally unjustifiable on this ground alone, independently of the obligation which the surgeon owes his patient, of affording him, in the first instance, the chance of alleviation, if not of cure, by the persevering use of a well-adjusted truss.

Mr. Gay would appear to recognize the change produced by long-continued tension in the physical organization of the sac; he has not, however, given the precise rationale of that change, much less afforded demonstrative evidence of its occurrence.

Mr. Gay says—"With its usual investment of the *fascia propria*, the sac does not frequently form a very strong union; but still it becomes so firmly impacted by the surrounding structures, that it is not easy to be dislodged, and returned into the abdominal cavity. This is more especially the case when the sac, or the greatest portion of it, is formed by an *extension* of the original hernial pouch, and not by a *dragging down* of a fresh portion of the peritoneum. Hence, should the surgeon entertain the idea of returning the hernial sac, after emptying it of its contents, the inquiry should be first made, to which of these two processes it is most likely that the production of the sac is due. If to the former, any attempt to dislodge it would be inconsistent, since the pouch would in no way appertain to the abdominal cavity; but if to the latter, its restoration might be justifiable. The circumstances of its formation and development, together with the space of time that might have elapsed between the period of its original descent and that at which the attention of the surgeon is directed to it, would afford material, if not positive, evidence of the *kind* of hernial sac which a given rupture might possess. Thus, in a suddenly formed and small hernia, the sac would be peritoneal, and belong to the abdominal cavity; and if the means are effectively used to prevent its increase in size, it would still remain so. But if its formation be slow, and its increase in bulk be due to the want of proper precautions, the sac in all probability will be a *new structure*,

and have no relation to the abdomen but that of continuity with its peritoneal lining"^a.

I fully concur with Mr. Gay in thinking that the attempt to reduce the hernial sac, under the circumstances stated, would be "inconsistent;" nay more, I believe it would be positively dangerous, if successful,—because such a sac, for the reasons already given, must possess only the most remote affinity to the peritoneum, and would in all probability act as a foreign body in the abdomen.

ART.—XI.—*Some Practical Observations on the timely Use of the Obstetric Forceps.* By EDWARD B. SINCLAIR, A. M., M. D., T. C. D.; Fellow and Censor of the King and Queen's College of Physicians in Ireland; Ex-Assistant Physician to the Dublin Lying-in Hospital, &c.

THERE can be little doubt but that after the secret (which the Chamberlens so long and so ungenerously guarded) came to light, the practice of obstetrics underwent a complete revolution.

No greater blessing was ever accorded to parturient woman than the midwifery forceps: discovered and used by the Chamberlens, in 1647, retained a secret by its originators, and lying dormant over a period of eighty years, it has now for upwards of one hundred (as from time to time its use became more and more general, and its form better adapted for its end), been the means of saving more human life than any other surgical invention for a similar period.

One would suppose that, after so long an experience of this instrument, the professional mind ought to be sufficiently certain as to the indications for its use, and the period of labour at which it should be had recourse to. Not so, however; amongst obstetricians of the present day, these topics still form subjects for warm controversy; though recently, I am happy to say, we of the Irish school are beginning to have more rational and more uniform views on these questions than heretofore.

It has been said by a high authority, that, "in every case of midwifery, the chief object to be attained by the practitioner should be, the preservation of the *lives* of both mother and child committed to his care;" and this has formed the basis of treatment in all cases of labour. Now, though I thoroughly concur in the above rule, yet I do not consider it without fault;

^a On Femoral Rupture, its Anatomy, Pathology, and Surgery, by John Gay. London: 1848.