similar operations, and Emmet's work in 1880 was of the same character. But no one gave definite teaching as to how to cure prolapse. The multitudes of variations and modifications that were introduced show that in general results were not good. Indeed, the opinion that up to 1899 there was no satisfactory surgical treatment for prolapse is upheld by Dr. R. H. Paramore.¹² There is no more thorough student of the literature of prolapse than this author, whom I thank for much information and many references. Another indication of the partial failure of vaginal operations is the great popularity which was gained, in spite of their inefficiency, by various abdominal suspension operations.

But, though the results of plastic vaginal surgery were not uniformly good, still most surgeons could say that many of their cases were successful, and certain operators secured permanent cure in nearly every case. Donald,¹³ for example, began operating in Manchester in 1888, and has always been so successful with a wide anterior colporrhaphy, amputation of the cervix, and a very efficient posterior colporrhaphy, that he has never thought it desirable to use any abdominal suspension or other method. My own personal experience dates from 1895, and the results were good from the first. But when amputation of the cervix was omitted recurrence was occasionally noted, and some cases failed to stand the test of pregnancy and labour. I have never used suspension or other methods, nor have I seen them employed in the Manchester Royal Infirmary or St. Mary's Hospital.

RATIONALE OF VAGINAL OPERATIONS.

Why did plastic vaginal operations succeed in some hands and in some cases while they still failed to satisfy the majority of surgeons? The objects of narrowing the vagina, shortening the uterus, and restoring the integrity of the perineum were generally attained. Why did the prolapse so frequently recur? Such questions disturbed our minds for long, and they were only answered in the light of new information gained by surgical experience and anatomical research as to the normal supports of the pelvic viscera. The rationale of prolapse and its treatment was only explained when it was realized that the uterus, vagina, and bladder are not so much suspended from above or propped up from below as they are attached by their sides, where they receive their blood supply, and held in their normal position by the subperitoneal tissue which intervenes between the organs and the more fixed lateral structures in the pelvic floor. This had been described by various anatomists, including Elliot Smith, Cameron, and Derry, when I¹⁴ brought the subject before the Royal Society of Medicine in 1907; but some little time elapsed before this teaching was generally accepted. But with this information we can see how vaginal operations work, for the removal of a wide portion of the vaginal wall exposes the lateral tissue or paracolpos. When the wound is sutured, unstripped muscle and connective tissue that formerly lay far apart at the sides of the vagina are brought together in the mid-plane of the pelvis. This lengthens the course of the structures and so tightens them up, thus restoring efficiency to the attachments of the vagina and bladder. Again, high amputation of the cervix exposes the parametrium and allows its right and left portions to be brought together in the middle line in front of the stump of the cervix. In other words, anterior colporrhaphy works not so much by narrowing the vagina as by exposing the paracolpos; and amputation of the cervix works not so much by shortening the uterus as by freely exposing the parametrium. In this light it is clear that those of us who gained success when these operations were still empirical must have operated in such a manner as to secure good union of lateral tissues in the mid-plane of the pelvis.

Consequent Changes in Technique.

How could these operations be simplified and standardized so as to place uniform success within the grasp of any competent surgeon? At the Edinburgh Obstetrical Society in 1907¹⁵ I advocated the extension of the anterior colporrhaphy wound far into the lateral fornices with the object of securing better exposure of the paracolpos than is given by the ordinary colporrhaphy wound, together with

exposure of the under surface of the parametrium. This modification was followed by improvement in my own results; but I soon realized the importance of high amputation of the cervix to secure efficient exposure of the parametrium. In 1910 I saw the way to a great simplification, and began to excise a large portion of the anterior vaginal wall together with the cervix in one piece. The incision begins half an inch above the urethral orifice, passes wide of the cervix on either side, and ends behind it. This leaves a quadrilateral wound narrow below, wide above, with the stump of the cervix near its posterior angle. The bladder, freely separated from the cervix, is well out of the way. The parametrium is much better exposed than is the case when the amputation and the colporrhaphy are done one after the other. Beginning in the mid-line behind, the vaginal wall is sutured to the cut edge of the cervical canal until the stump of the cervix is surrounded and covered in. The rest of the wound is closed from side to side by interrupted sutures which take a good bite of the paracolpos together with the edge of the vaginal wall. As this is done the cervix passes upwards and backwards, and the uterus is left in anteversion. This combination of anterior colporrhaphy and amputation of the cervix in a single operation was published in 1913¹⁶ and in 1915. It has proved during the last fifteen years to be simple, safe, and efficient.¹⁷ It is generally followed by perineorrhaphy, colpo-perineorrhaphy being used whenever rectocele is present. Dr. Lacey's¹⁸ inquiry into ultimate results was published after the Birmingham congress had discussed them in 1921. He found that 97 per cent. of my cases in 1914-15-16 were permanently cured. Thirty children had been born to twenty-four of the patients. One of them who had had three children required further operative treatment; this patient's cervix was not removed at the first operation, or the result might have been better.

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THE OPERATIVE TREATMENT OF HERNIA IN INFANTS AND YOUNG CHILDREN.*

BY

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THE remarks which follow deal with a consecutive series of operations for inguinal hernia in infants and young children. Most of these were performed in the out-patient department of the Belfast Hospital for Sick Children, and a comparison is made of the results of these operations and those performed in the wards and in private practice during the same period.

When the British Medical Association held its Annual Meeting in Belfast in 1909 the late Mr. J. H. Nicoll of Glasgow advocated the treatment of hernia in children by operation in the out-patient department. The late Mr. Robert Campbell of Belfast, who was at that time a recognized authority on the surgical affections of children,

* Read at a meeting of the Ulster Branch of the British Medical Association, January 21st, 1926.

and especially interested in hernia, had already done pioneer work in this direction, and had advocated early operation in an address read before the Ulster Medical Society in 1903. Mr. Campbell, about the time of the meeting referred to, had begun to perform these operations in the out-patient department, and had so infected his colleagues with his enthusiasm that it soon became the established custom in Belfast. This gave rise at first to some criticism among the governors of the Children's Hospital, but all objections were finally overcome, and a well equipped out-patient theatre was soon provided for these and similar operations by an enlightened and appreciative board of management. I have in my possession a paper in manuscript written by Mr. Campbell and duly presented at a meeting of the Ulster Medical Society during the session 1905-6, in which he gives an account of 305 operations for the radical cure of hernia in children, with no deaths and only two cases of suppuration. Mr. Campbell's subsequent records have not been published, but I understand that the total of these operations reached something in the neighbourhood of 1,500, with only one death.

My own earlier work in this direction began about the year 1909 and was carried on for many years entirely in the out-patient department without a single death. Notes suitable for statistical purposes, however, were taken in the last 300 cases only, and include those operated on in the wards and in private practice, as well as those operated on in the out-patient department. The present article, then, concerns a consecutive series of 300 children in which the radical cure of inguinal hernia was carried out. The notes, which are very brief, record the age and sex of the patient, the side affected, the general characters of the hernial sac, its contents, if any, and whether or not it communicated with the tunica vaginalis testis. The total number of separate operations was 326.

Sex.—There was a large preponderance of boys (265 males to 35 females).

Side Affected.—The hernia was confined to the right side in 186 cases, to the left in 78, and was present on both sides in 36.

Characters of the Sac.—The sac varied in type from a pear-shaped, flat, opaque structure, with a well defined rounded lower border lying high up in the cord, and difficult to imagine as ever having had any connexion with the tunica vaginalis, to a thin membrane, often of great tenuity, descending to the scrotum, where it was closely applied to, but not firmly adherent to, the tunica vaginalis, and from which it could be separated by gauze dissection, assisted, perhaps, by a few touches of the knife. (See Figs. 2, 3, and 4.) In some of the cases little white polypoid projections were found on the inner surface of the sac near the neck, and various thickenings were occasionally found in the walls, the nature of which was not determined.

Relation of the Sac to the Tunica Vaginalis Testis.—Counting a double hernia as two, 298 male hernial sacs were investigated, and in 22 only was there a communication with the tunica vaginalis testis—that is, in a little over 7 per cent. In three of the cases of double hernia the sac was continuous with the tunica vaginalis on one side, and in each case the right. In a fourth case the sac was continuous with the tunica vaginalis on both sides.

There does not seem to be much point in retaining the term "infantile" as applied to inguinal hernia. The

varieties of infantile hernia, as described in textbooks, depend on the presence of a large tunica vaginalis and the various ways in which it may be invaginated by the descent of a hernia. More important, from an anatomical point of view, is whether or not the hernial sac is continuous with the tunica vaginalis testis.

It might be instructive to digress for a moment to consider what is known as encysted hydrocele of the cord. This condition is, I believe, nothing more or less than a pear-shaped hernial sac that has become obliterated at its upper end and whose fundus has become distended with fluid. (See Figs. 2b, 3c, and 4d.) If these cases are carefully dissected, it will be found that the lower end is rounded and quite easily separated from the surrounding structures. I have not seen an encysted hydrocele of the cord that could be said to resemble a dilatation of the central part of an otherwise obliterated tube reaching from the internal ring to the tunica vaginalis. The upper end terminates in a band or cord which looks like the neck of a hernial sac, and the lower border is always well defined and shows no prolongation resembling the remains of an obliterated tube. Further, in a certain proportion of cases this sac descends as far as the testis and invests the tunica vaginalis, giving rise to a condition closely resembling an ordinary hydrocele. (See Fig. 4d.) In such cases, by

careful dissection the sac may be separated from the tunica vaginalis, leaving the latter intact. An encysted hydrocele may be present on one side and a hernia on the other. The sacs are similar, except that one contains fluid while the other contains abdominal contents.

Strangulation.—There were two cases of strangulation in this series. One of these occurred in a boy, aged 6 weeks. He had been vomiting for a week, finally bringing up foul-smelling stuff. The sac contained small intestine, which was dark in colour, but viable. After carefully freeing the neck of the sac it was possible

to reduce the bowel without incising the hernial ring.

Contents of the Sac.—Only very rarely was operation undertaken while the hernia was "down." The invariable practice was to reduce the hernia, if possible, and keep it reduced, thus avoiding one of the most annoying accidents that may happen. If a hernia comes down and escapes through a rent in the sac during the operation the difficulties of the latter are much increased, especially if the child is straining. The opening in the abdominal wall is very small, and, the guide into it being torn, it may be impossible to return the prolapsed bowel. In one case in which the appendix and caecum were adherent to the sac I found, after separating the adhesions, that it was impossible, without damaging the bowel or slitting up the hernial ring, to effect reduction. The difficulty was got over by opening the abdomen through a McBurney's incision and gently drawing the caecum through the hernial opening from within. The appendix was removed, and the operation completed in the usual way. I have seen the appendix alone in the sac, and have found no difficulty in removing it as it lay, pulling it down just sufficiently to enable the stump to be satisfactorily dealt with. In a few cases omentum was found, and in one adhesions had to be divided before reduction could be effected. The Fallopian tube was present in several cases, and in one or two the ovary presented. The most usual viscus, however, was the small intestine.

In two cases a small diverticulum of the bladder was found adherent to the sac and might easily have been tied off with it. Fortunately the condition was recognized and

FIG. 1.—Unusual form of congenital hernial sac; communicating with tunica vaginalis testis (7 per cent. of cases in present series).

FIG. 1a.—Congenital hydrocele in which the hernial sac may become obliterated at its upper end, and distended with fluid.

FIGS. 2, 3, AND 4.—Various degrees of extent of the usual type of hernial sac (93 per cent. of cases in present series).

FIGS. 2b, 3c, AND 4d.—Showing how a hernial sac may become obliterated at its neck, and distended with fluid to form an "encysted hydrocele of the cord."

FIGS. 5a AND 5b show two types of "infantile" hernia.

the bladder wall was not included in the ligature. In addition to these there were a few cases in which, on pulling down the sac so as to make sure of ligaturing the neck high up the bladder was dragged upon. The muscular wall of the latter was recognized and carefully separated from the sac before the ligature was applied.

The Operation Performed.

The operation carried out in these children is of the simplest type. An incision about an inch long is made over the upper end of the sac, the cord is isolated, and the index finger of the left hand is passed under it so as to spread out the component parts. With light touches of a sharp knife the successive coverings are divided longitudinally and reflected till the sac is reached. The latter can then be separated by blunt dissection with gauze and forceps until the neck is freed as high up as possible, taking great care to avoid injury to the delicate vas. The neck of the sac is then transfixed with a small round needle, tied off with fine catgut, and allowed to retract. In some of the earlier cases the sac was invaginated and brought out through a separate opening in the external oblique, fixed to the aponeurosis, and the projecting portion cut off, but this method was soon abandoned in favour of the more simple procedure. In female children it is impossible in most cases to separate the round ligament from the sac, and this structure is therefore included in the ligature occluding the neck of the sac. In all cases, male and female, it is a wise precaution, just before ligaturing the neck, to open the sac, so as to exclude the possibility of the presence of abdominal contents. The inguinal canal is not interfered with in any way, and only in a very few cases of this series were sutures placed in the pillars of the external ring. After tying any bleeding vessels—and it is surprising how seldom it is necessary to ligature a single branch—the skin wound is closed with a subcuticular silkworm-gut suture, the ends of which are tied over a pad of gauze, which is left in position until the wound is quite dry. The suture is then cut about an eighth of an inch from the point where it enters the skin at either end of the wound, and a collodion dressing applied. At the end of a week the dressing is stripped off and one end of the suture is grasped with forceps and pulled upon so as to remove the stitch. Another collodion dressing may then be applied, but, as a rule, all that is necessary is a little dusting powder. Cases operated on in the out-patient department are taken home as soon as they have recovered from the anaesthetic, and are brought back for inspection in two or three days' time, when further instructions as to attendance are given.

The operation may take a few minutes only to perform, but, if the sac is very thin and extends down towards the tunica vaginalis, careful dissection requires a somewhat longer time. The test of clean, accurate work is the absence of swelling of the testicle on the affected side after the lapse of a few days. Much handling of the cord invariably leads to swelling of the testicle, which may take ten days or longer to subside.

Preparation of the Patient.—In the out-patient department a leaflet is given to the mother or other responsible person, containing directions as to an aperient, bathing of the patient on the morning of the operation, and feeding, but these instructions are frequently neglected, and a dirty child who vomits solid food and defaecates on the operation table is often the result. The preparation of the skin by soap and water, ether, and an antiseptic (mercury biniodide, iodine, or picric acid in spirit) is carried out while the child is being anaesthetized. In the early days the operation was often performed without the services of an assistant. Without elaborate preparations and with the simplest technique the results have amply justified early operation, and particularly the surgery of the out-patient department.

Anaesthetic.—As to the anaesthetic, we used in the early days to give chloroform, but this has now been abandoned in favour of open or warm ether. More elaborate preparations are carried out in the wards, where the child is given glucose for several days, and a small dose of atropine just before operation.

While in the out-patient department I had hand-towels

made with a slit, about three inches in length, in the centre. One of these diminutive abdominal towels is clipped to the skin so that the slit exposes the operation area. This effects a considerable saving in towels, and has proved quite satisfactory.

Statistics.

I have notes of 184 children operated on for inguinal hernia in the out-patient department. The total number of operations was 209. This is accounted for by the fact that 32 of the patients had a double hernia, and in only 7 of these were both sides dealt with at the same time. In 25 patients, therefore, two separate operations, with an interval of several weeks between them, were carried out, as this was considered safer in out-patient work. The ages of these children were as follows:

Under 3 months ...	...	...	...	77
Between 3 months and 1 year ...	...	...	...	48
Between 1 and 2 years ...	...	...	...	31
Between 2 and 12 years ...	...	...	...	28

Some degree of sepsis took place in 5 cases—that is, just under 2.4 per cent. Sepsis was understood to mean anything from a stitch abscess to opening up of the wound. There were no deaths, though in one case, a child 1 month old, tracheotomy was performed for laryngeal spasm. One case was a strangulated hernia. Most of the others were reducible.

The private cases and those treated in the wards number 116. Four had double herniae, and of these 3 had both sides dealt with at the same operation. This gives a total of 117 separate operations. The ages of the children were as follows:

Under 3 months ...	...	...	...	7
Between 3 months and 1 year ...	...	...	...	18
Between 1 and 2 years ...	...	...	...	14
Between 2 and 12 years ...	...	...	...	77

Some degree of sepsis occurred in 3 cases—that is, just under 2.6 per cent. There were no deaths.

It will be seen that most of the very young children were operated on in the out-patient department—125 under 1 year, as compared with 36 in the wards and in private practice. Young children are easily carried to and fro, and are better with their mothers. These two series taken together give a grand total of 326 separate operations, with 8 cases showing some degree of sepsis (2.4 per cent.) and no deaths. There were 3 cases of recurrence, of which one was in a child operated on in the out-patient department.

These statistics prove conclusively that operations for hernia in infants and young children are as safely conducted in the out-patient department as in the wards; in fact, from the figures quoted, the balance, if anything, is slightly in favour of the out-patient department.

Two great advantages are gained by operating in the out-patient department:

1. The child, if being nursed by its mother, does not suffer the inconvenience and risk of being weaned. It would be impossible in this district to have the mother in the vicinity so as to be able to attend at the hospital at stated times to nurse her child.

2. The range of usefulness of the hospital is enormously increased, the beds which would otherwise be occupied by cases of hernia being available for other patients. This is a great advantage in a small children's hospital like ours.

Conclusion.

I hope that the effect of this contribution will not be to leave the impression that the operation of herniotomy in a child should be considered a trivial affair, devoid of difficulty and danger. Nothing could be further from the truth. The more experienced the surgeon, the more he realizes that the difficulties may be very great indeed, especially with a very thin sac in a straining child. One sees occasionally, alas! a sac torn to shreds and a vas irreparably damaged by clumsy surgery. The operation is, indeed, one that demands careful and delicate manipulation, each structure being recognized as it is exposed. Given these conditions, there is no more satisfactory operation in the whole range of surgery.

I am indebted to Dr. R. H. Hunter for the accompanying drawings.