who died and those who were not improved the primary growth had been apparently checked and healed, but the glandular deposits had continued to progress. Of the 8 cases definitely improved, one patient has been treated by irradiation alone and is apparently free from recurrence over a period of three years and four months; in 3 cases the ulcer has healed, no recurrence can be detected, and microscopical examination of the scars left shows no tumour cells present. In 4 cases healing of the ulcer has followed and the glandular deposits lessened in size in all, completely disappearing to palpation in 2.

There can be no doubt that the primary growth reacts better than do the glandular deposits; this is certainly due to the fact that an intensive cross-fire action can be more easily obtained. Small doses over a prolonged period of time are preferable to large doses acting for a short period. The 5 mg. tubes are probably too large a dose for very prolonged insertion, and a trial is to be made of less powerful needles. The best results are to be expected from growths of the tongue itself, and especially those of the anterior two-thirds; epitheliomata of the floor of the mouth and the pharyngeal portion of the tongue are especially difficult to treat on account of the difficulty of access and also of the danger of necrosis. The warty exuberant type of epithelioma gives a better result than the ulcerative type, which unfortunately is the more common. No anaemia, as shown by a series of blood counts and haemoglobin estimations, has followed even the most massive doses, nor has the cholesterol content of the blood been affected. The greatest care in regulation of the dose, screening, and placing of the needles is essential to prevent radio-necrosis.

It is possible that a combination of lead colloid and radium represents the ideal treatment, since the lead may help to check the glandular deposits while having less effect on the primary growth. An extensive recurrent growth treated on these lines improved considerably. It is to be noted that all the cases treated were past all surgical intervention, and it is probable that earlier cases would react much more favourably than the above figures indicate.

RECTAL CANCER.

The number of cases of rectal cancer admitted to the department was 33. Of these, 26 were suitable for radium therapy and 7 were unsuited (5 were hopelessly advanced and almost moribund; one was operable and the growth was excised; and one was treated by lead owing to liver deposits). Of the 26 patients, 22 were males and 4 females. The average age of the patients was 57. All were advanced and inoperable, in most cases there was extensive infiltration of surrounding structures, especially the bladder, prostate and perirectal cellular tissues.

Microscopical examination of tissue removed showed the presence of adenocarcinoma in 23. In the remaining 3 patients sections were not obtained owing to the inaccessibility of the growth. All these were clinically typical carcinoma, and in none of the three did any improvement occur under radium treatment.

TREATMENT.

All patients were advised to have a preliminary colostomy, for two reasons: first, to allow of exploration of the abdomen, as it is obvious that secondary deposits in liver or peritoneum prohibit any local treatment such as irradiation; and secondly, for the purpose of keeping the growth as clean as possible.

Needles of 5 mg. and occasionally of 10 mg., screened by 0.5 mm. of platinum, were used. In 5 cases the coccyx was excised to allow of implantation of the radium needles directly around a posterior growth. In 16 cases some needles were implanted deeply into the perirectal cellular tissues by puncture of the perineum and ano-coccygeal raphe with a trocar. This procedure requires rigid asepsis and constant dressing if it is not to be followed by perirectal suppuration. This occurred in two cases, resulting in fistulae which never healed. In all cases needles were implanted deeply into the growth from the rectal surface in addition to the two procedures mentioned previously.

Owing to the large mass of these advanced rectal growths and the necessity for getting an intensive cross-fire action a considerable number of needles are inserted, fifteen or twenty 5-mg. needles being required. The rectum tolerates

these large doses well if a preliminary colostomy has been performed and the tubes are not placed too closely together. It has been found advantageous to pack the bowel lumen with rubber tissue to keep the needles embedded in the growth well apart. This also helps to protect the intact mucosa below the growth from the effects of too close proximity to the needles, and also allows of the free discharge of blood and infected fluids from the surface of the growth.

In all, the 26 cases had forty-seven exposures, as follows:

- 1 had 4 exposures, totalling 15,300 mg. hours.
- 5 had 3 exposures, with an average of 14,626 mg. hours in each case.
- 8 had 2 exposures, with an average of 9,375 mg. hours in each case.
- 12 had 1 exposure, with an average of 4,180 mg. hours in each case (treatment is not complete in all these cases).

RESULTS AND REMARKS.

Of the 26 patients in this category, 13 are dead and were not improved in any way, 8 are alive but show no improvement, 5 (19 per cent.) are definitely improved. Of the 5 showing improvement, 2 were irradiated twice and given a total of 9,600 and 8,900 mg. hours respectively; 2 were irradiated on three occasions and given totals of 16,080 and 16,920 mg. hours; one was irradiated on four occasions and given a total of 15,300 mg. hours.

In two of these cases the improvement was most noticeable. In one case, where the growth was very low down and easily accessible, a very complete irradiation was possible from all angles. The growth entirely disappeared, leaving a fine pliable scar, sections of which failed to reveal any tumour cells. The second case was an exuberant warty adenocarcinoma; this also completely disappeared, leaving a fine scar. These two patients have been kept under observation for eighteen months and remain satisfactory. In the three remaining cases the improvement was slight but definite, the growths becoming smaller, harder, and more fibrous as compared with previous sections.

Cancer of the rectum is a much less favourable field for radium therapy than is the tongue. The reason for this is the difficulty of access and still more the intense septic element which, in spite of the most careful preparation of the patient, is almost inevitable. Further, it is difficult, indeed probably impossible, to reach the upper part of the glandular field with any extension of the surgery of access, the glands along the inferior mesenteric artery being quite out of reach. For any satisfactory result, then, the growth must be early, low down, and the glandular field but little involved.

I desire to acknowledge the help of my colleagues Dr. Lamb and Dr. Teall. Dr. Lamb has undertaken all the investigation of pathological material and has also investigated the blood before and after irradiation; Dr. Teall has been of great assistance with advice of a technical character. Without them this work could not have been carried out.

A CASE OF DUPLICATION OR SUBDIVISION OF THE TESTICLE.

BY

G. H. EDINGTON, D.Sc., C.M., F.R.F.P.S.GLAS.,
VISITING SURGEON, WESTERN INFIRMARY, GLASGOW;

With Histological Note by

J. W. S. BLACKLOCK, M.B., Ch.B.GLAS.,
LECTURER IN PATHOLOGICAL HISTOLOGY, UNIVERSITY OF GLASGOW.

DUPLICATION, real or supposed, of the testicle would seem always to have excited considerable interest in both lay and medical circles. There is no doubt that the condition must in early times have been presumed on very insufficient grounds; within recent years even the diagnosis has been made on a slender foundation. It seems a truism to state that authenticity can be established only by histological examination of the abnormal structure. It is now known that the condition does exist: but whether authentic or presumed it must be regarded as of very rare occurrence, and it is for this reason that the following example is recorded.

Clinical History.

The patient, a healthy youth aged 16 years, employed as a telegraph messenger, was sent into the Western Infirmary in March, 1924, with a swelling in the left scrotum. The swelling

was observed on physical examination for entrance to the Royal Navy, but its existence had been long known to the patient, and it had never caused him any trouble.

On examination the right testicle was felt in the scrotum, and apparently was normal. A smooth, rounded, mobile swelling the size of a marble was found in the scrotum above the left testicle. Elements of the cord were felt passing to it, and it was thought to be a displaced globus major, as the normal epididymis could not be demonstrated in the subjacent testicle. At operation the testicle and the abnormal swelling were found occupying a common tunica vaginalis. The lower body, regarded as testicle proper, was ovoid, and measured over 3 cm. in length by 2.3 cm. transversely, and 2.6 cm. antero-posteriorly. The upper body was globular, with a diameter of over 2 cm. It was freely mobile, and only indirectly attached to the lower by a pink strap-like structure several centimetres in length and 0.6 cm. across. The vas deferens was felt arising from near the lower pole of the testicle. The tunica vaginalis extended up along the spermatic cord to well within the inguinal canal, but it did not communicate with the abdominal cavity. The two bodies and intervening strap were covered by serosa on anterior and lateral aspects; the upper body was more completely invested and was pedunculated. The malformed organ being of doubtful utility the tunica and its contents were removed. Recovery was uneventful, and he was discharged on the twenty-first day.

Dissection of Testicle.

When the tunica was laid open and pinned out (Fig. 1) the upper body was seen to be attached to it posteriorly by a pedicle, a little over 2 cm. long, which passed upwards as a vascular plica extending to the upper end of the tunica. Seated on the lower part of this body was a small cup-like structure, 1.75 cm. by 0.75 cm., the expanded upper end of a strap, 4.5 cm. long, 0.6 cm. broad, and 0.4 cm. thick, resembling normal epididymis and passing down to lie behind the lower pole of the ovoid testicle. This strap was attached to the tunica vaginalis posteriorly by a fold like a mesorchium, measuring in its greatest breadth 1.2 cm., and incorporated medially with a vascular plica which extended up from the testicle. The latter body, the long axis of which was directed upwards and forwards, stood well out from the tunica vaginalis, to which it was attached posteriorly for about two-thirds of its length by a reflexion of serosa. From its upper pole a plica extended upwards medial to and blending with the pedicle of the upper body. Its postero-inferior pole showed a cup-like thickening, fully 1 cm. deep, which gave the testicle the appearance of an acorn. The lower end of the epididymal strap seemed to be spread out on the lower pole of the testicle, and from this pole the serosa was reflected in characteristic folds. Medially the serosa was smoothly reflected over the vas deferens and spermatic vessels; laterally it formed a deep gutter-shaped recess, about 2.5 cm. long, behind the lower part of the epididymal strap.

Further dissection (Fig. 2) showed that the epididymal strap passed down behind the testicle and bent sharply upwards and inwards to become the vas deferens. Vasa efferentia were present as stringy connexions between the strap and the lower pole of the testicle. The veins were arranged in two main groups: one from the upper body with addition of a convoluted vessel from the epididymis, the other from the testicle, forming a looped plexus.

Histological Report.

Dr. Blacklock examined portions of the testicle, of the strap, and of the upper body, and he reported as follows:

"*Lower Swelling.*—This is enclosed in a capsule composed of an outer layer of fibrous tissue in which are found numerous vessels, and an inner layer of non-striped muscle in which the vessels are less numerous. Inside these structures composing the capsule typical testicular tissue is present, and here and there evidence of spermatogenesis is found. Many of the gland spaces contain a mucoid secretion. The interstitial tissue and cells appear normal in character and in amount. In some of the sections small ducts corresponding to vasa efferentia are found between the testicle and epididymis.

"*Cord between Upper and Lower Swellings.*—This structure shows in its outer parts fibro-muscular tissue in which are present many small vessels (chiefly veins) and a few nerves. Its central part is composed of typical epididymis tubules lined by columnar ciliated epithelium, collections of spermatozoa being found in some of the lumina. Non-striped muscle is seen whorling around the ducts.

"*Upper Swelling.*—The part projecting furthest into the sac (tunica vaginalis) is composed of testicular tissue in all respects similar to that in the lower swelling, though the evidence of spermatogenesis is not so marked. This part is also surrounded by an outer fibrous layer and an inner non-striped muscular layer, which make it distinct from the outer part, which is composed of typical epididymis tubes. In the epididymis part typical ducts lined by columnar ciliated epithelium are present, and these are surrounded by whorls of non-striped muscular tissue in which are some fine vessels. Between the inner (testicular) and outer (epididymal) parts are found numerous fine ducts lined by a low columnar ciliated epithelium, and corresponding to the normal vasa efferentia."

LITERATURE OF SUPERNUMERARY TESTICLE.

Before commenting on the findings in the above case

I would like to refer briefly to the literature of supernumerary testicle. There is so wide a diversity in the cases published that a consideration of the literature entails a classification of the papers into different groups, ranging from generalizations to the more precise investigations of more recent years.

A. *General.*—Lucas-Championnière,¹ in a clinical lecture delivered at the Hôtel-Dieu, reviewed briefly the subject of numerical anomalies from legendary to scientific times. He found that in proportion as exact scientific observations came to be made the numbers of cases reported tended to diminish. He referred to the legendary belief in the supervirility of individuals thus endowed. In 1911, some eleven years after the publication of this lecture, Conzette² wrote on the subject. He referred to Cruveilhier and Sappey

not having met with a case in fifty years, expressed his opinion as to the rarity of its occurrence, and then went on to discourse upon legendary supervirility, to which, however, he seemed disposed to give credence.

B. *Pseudo-duplication.*—Marsh³ republished in 1911 a case (originally published in 1898) of a boy, aged 3 years, on whom he had operated for congenital inguinal hernia on the left side. At operation two testicles in a common tunica vaginalis were found in the scrotum. The child died after operation, and *post-mortem* dissection showed one vesicula seminalis, situated on the left side, and larger than normal. From it passed a very thick vas to about half an inch from the internal ring, where it divided. The two branches passed down the inguinal canal into the scrotum, one to each testis. The right spermatic artery arose normally, but crossed the middle line and joined the left at the internal ring to form a single vessel, which divided again into two before reaching the external ring, and passed one to each testicle. The condition seems comparable with Lowe's⁴ case. In that case there was no *post-mortem* examination, and it was considered by the Editor of the *British Medical Journal* as an example of true dichotomy of left with non-descent of right testicle. Banks⁵ has recently reported a case similar in some respects. He terms the condition "transverse ectopia" of the right testicle down the left inguinal canal; and Keith, who had an opportunity of examining the specimen, considered it the result of fusion and persistence of the Müllerian ducts. Banks gives four references to cases recorded by other observers.

C. *External Examination without Operation.*—A certain number of observers have recorded cases on the strength of external examination only. Davis,⁶ in 1895, reported a case with three testicles in the left and one in the right scrotum. All were apparently perfect, with sensibility to pressure. Tomory⁷ described (1898) the case of a boy, aged 3½ years, with both testicles in the scrotum, and in addition a rounded insensitive body in the left inguinal canal; the body was larger than a testicle. Fischer,⁸ in 1916, recorded a freely movable swelling in the region of the right external ring. It was possessed of testicular sensibility, and

FIG. 1.—Parts removed, viewed from lateral side with tunica vaginalis laid open. *a*, Spermatic cord; *b*, upper testicular body; *c*, strap-like epididymis; *d*, lower testicular body.

FIG. 2.—Parts viewed from medial side, with tunica vaginalis dissected to show vas deferens and blood vessels. *a*, vas deferens; *b*, strap-like epididymis.

could be pulled down into the scrotum, with a corresponding movement in the normally situated testicle. The subject was 65 years of age, and the scrotum contained two apparently normal testes. Day⁹ reported, in 1918, a case in which there were five alleged testicles in the scrotum, and he reproduced a photograph of the parts. In 1921 Ayer¹⁰ published clinical details of a case of supernumerary body above the left testicle. Testicular sensibility was present, both globus major and globus minor were felt, and a distinct cord traced alongside of the normal as far as the internal ring. A photograph shows the body on the left of the peno-scrotal junction, and of smaller size than the normally situated testicle below.

D. Demonstrated by Operation: No Histological Examination.—Turner,¹¹ in 1900, recorded the case of a child aged 3½ years. On the right side there was an encysted hydrocele of the cord; further down a supernumerary testicle with cord, which blended above with the spermatic cord; and lowest of all the testicle proper with hydrocele of its tunica vaginalis. In 1910 DeFranceschi¹² reported a case of triorchismus in a youth aged 18 years. The supernumerary body lay in the upper part of the left inguinal canal, and its cord blended with that of the normal testicle. The body was removed and showed naked-eye characters of testicular tissue, but it was mislaid before histological examination could be made. Widhalm's case¹³ differed from the above. He reported, in 1911, a case of left-sided double testicle, the right testicle being apparently normal. On the left side were: (1) omentocoele, (2) two cysts of the cord, and (3) hydrocele of the tunica vaginalis. On opening the tunica vaginalis two testicles were found side by side, having a common epididymis and two vasa deferentia. Coudert and Derocque,¹⁴ in 1924, reported an operation on a supposed strangulated left inguinal hernia in an infant aged 7 months. A violet-tinted tumour appeared, resembling strangulated testicle. The cord was dissected and showed two elements, one passing to the strangulated testicle and the other to the normal gland lower down. The supernumerary body, which was strangulated by torsion of its pedicle, was removed. It showed complete macroscopic appearances of a testicle. Histology was not completed at the time of publication (nor has it yet appeared, August, 1927).

E. Operation and Histological Examination.—While the demonstration by operation is a step forward towards establishing the nature of unusual scrotal contents, the authenticity of supernumerary testicle rests on histological examination. Judged by this standard I have found in the literature only eight cases which emerge satisfactorily from the test. In chronological order they are as follows:

(1) 1895. Lane.¹⁵ Youth, aged 17. Cherry-sized body situated above right testicle, and suspended from spermatic cord by a pedicle. Supernumerary body removed and showed microscopically tubules in which spermatogenesis was present.

(2) 1899. Lossen¹⁶ (quoted by Haas, *infra*). In right-sided hydrocele sac of man, aged 28, two bodies, one above the other, each with appearance of testicle and epididymis. Cord showing epididymal tubules united the epididymes. Single vas deferens passed off from lower pole of lower epididymis. Both testes showed spermatogenesis.

(3) 1907. Mariotti.¹⁷ In patient, aged 28, with ostensibly a large left inguinal hernia, two cords were found after opening inguinal canal. The larger cord passed to a normal epididymis, the smaller ended in a bean-sized swelling which, after removal, showed normal reddish testicular tissue supported by fibrous tissue radiating from the tunica albuginea. The fibrous tissue appeared under the microscope to be rich in cells and free from fibroblasts. (Original paper not available; above details from *Zentralbl. f. Chir.*)

(4) 1910. Lerat.¹⁸ Small, nut-sized, ovoid swelling, mobile, in left inguinal canal of a boy, aged 15 years, in whose scrotum were two normally placed testicles, identical in size. The swelling was diagnosed as cyst of cord; but operation showed it to be a testicle in an open processus vaginalis, and attached by epididymis to normal spermatic cord, which traced down to normal testicle, with its own tunica vaginalis. Examination of supernumerary body showed seminiferous tubules, without spermatozooids in tubules or canal of epididymis.

(5) 1922. Haas.¹⁹ In a boy, aged 9 years, with double inguinal hernia, both testicles were in respective inguinal canals. In left canal there was, in addition, a pea-like body with vas deferens distinct from that of testicle proper. Histological examination showed highly atrophic testicle and widely open epididymis. Spermatogenesis is not mentioned, and was presumably absent.

(6) 1923. Jeannin and Delater.²⁰ Left inguinal hernia and painless cyst of cord, in man aged 21 years. Both testicles in scrotum, left smaller than right. Operation showed supposed cyst to be solid, and having consistence and colour of a testicle. Epididymis and vas not identified. Histologically tissue was testicular, with active spermatogenesis.

(7) 1924. Lecène.²¹ Patient, aged 23 years, with congenital right inguinal hernia, and with two normal well-developed testicles in scrotum. On opening hernial sac a body, size of small olive, found hanging by a slender cord from the spermatic cord 5 or 6 cm. above the testicle. Thought to be subserous lipoma; afterwards found to be a small testicle resembling an ectopic organ. Histological examination showed testicular tissue without spermatogenesis.

(8) 1925. Holder.²² Patient, aged 45 years, with two normal testicles in scrotum, had acute gangrenous process in left groin. Supposed inguinal lymph gland excised and found microscopically

to be testicular tissue, with epididymis and vas deferens, and showing active spermatogenesis.

F. Abdominal Supernumerary Testicle.—Oudendal's case,²³ reported in 1922, though hardly coming within the scope of the present paper, is of interest, and may be briefly referred to. It was accidentally discovered during *post-mortem* examination on a subject, age not given, whose external genitals were apparently normal. Within the abdomen was a third testicle, depending by a stalk from the ileum about 30 cm. above the ileo-caecal valve. The body measured 18 by 21 mm., and showed the histological characters of testicular tissue. There was no vas deferens, and spermatogenesis was not observed. The accidental observation of supernumerary testicle in the abdomen was later noted by Nieberle²⁴ in the case of a gelded pig, aged about 9 months, in which nodules were scattered widely over the parietal and visceral peritoneum. Some of the larger nodules were in the mesentery of the large bowel, others were irregularly distributed. Microscopically the nodules showed the characters of testicular tissue, without spermatogenesis.

Remarks on the Literature.

If we confine ourselves to Class E, in which the diagnosis was confirmed by histological examination, we find only 8 cases. Of these, 5 occurred on the left and 3 on the right side. In only 4 was spermatogenesis found; it was absent in 3, and in 1 its occurrence was doubtful. As regards the type of malformation, the pedicle or cord of the supernumerary organ sprang from the spermatic cord in 3 (Lane, Lerat, Lecène); it was presumably attached to the spermatic cord in 2 (Mariotti, Haas); in 1 there was a spread-out epididymis (Lossen); and in 2 the epididymis and vas were not identified.

The occurrence of abdominal supernumerary testicle does not seem to be of clinical interest generally. It is only likely to come under notice if it be the seat of inflammation or neoplasm, and should be kept in mind as a possible finding in the course of a laparotomy.

In addition to the observation by Nieberle (*supra*) in the pig, mention should be made of Gerhartz's²⁵ two examples in frogs. In one the accessory organ discharged its secretion through the duct of the main gland; in the other the accessory had no connexion with the main organ, although the development of the sperm had reached the same stage.

As regards Class D, it is recognized that in some cases the diagnosis cannot be more than presumptive. Presumption may be strengthened by a study of the records of specimens whose authenticity has been proved by histological examination.

Summary.

The specimen here recorded is an example of duplication of the body of the testis. It is to be regarded as an abnormal subdivision or duplication of that part of the intermediate cell mass which gives origin to the body of the testicle. The Wolffian duct has apparently developed normally to form the vas deferens and epididymis, and the epididymis is elongated so as to serve the two separate masses of testicular tissue. Both masses show spermatogenesis—a noteworthy finding, since in a number of cases of duplication the supernumerary organ has been found defective in that respect, a condition of affairs comparable with what often occurs in ectopic testis. The specimen would seem to be similar to that of Lossen (*vide supra*), and one of the less frequent varieties.

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