culture in our case was negative. Nevertheless, as suppurative changes are unknown in Hodgkin's disease, apart from secondary infection, the osteomyelitic nature of the infection taking part in the extensive erosion of the vertebral bodies and development of the abscess may be regarded as the correct explanation.

The case here reported is further proof of the extraordinary difficulties that may have to be overcome in order to arrive at the correct diagnosis of Hodgkin's disease.

REFERENCES

- ¹ Hirschfeld, H.: *Handbuch der Krankheiten des Blutes u. der Blutbildungorgane*.
- ² Ziegler, K.: *Die Hodgkinische Krankheit*.
- ³ Hare and Lepper: *Lancet*, February 20th, 1932.
- ⁴ Rolleston, Sir Humphry: Lymphadenoma, *Lancet*, December 12th, 1925.
- ⁵ Carson, H. W.: *Brit. Journ. Surg.*, 1930-1, xviii, 400.

THE PHYSIOLOGICAL AND CLINICAL RESULTS OF DIVISION OF THE VAS DEFERENS*

BY

A. CLIFFORD MORSON, O.B.E., F.R.C.S.

SURGEON TO THE HAMPSTEAD GENERAL HOSPITAL, AND ST. PETER'S
HOSPITAL FOR URINARY DISEASES, ETC.

The vas deferens, or spermatic duct, is the tube which carries the mature spermatozoon from the testicle to the seminal vesicle. It is lined by ciliated epithelium, and the lumen in comparison to the thickness of the wall of this duct is extremely small. The vas deferens has very little contractile power, the reason for which is obvious when it is remembered that the spermatozoon is mobile and is assisted towards its destination by cilia. It is only when it has entered the seminal vesicle that muscular effort is required to urge it further forward on its final journey. There must be some correlation between the vesicles, when they are fully distended with spermatozoa, and the migration of these sperm cells from the seat of their development. The capacity of the seminal vesicle is limited, and thus some control must be exercised over the number of spermatozoa which may travel in any given time along the vas deferens. It is pure surmise how this comes about, but in all likelihood a distended vesicle has an inhibitory effect upon the movements of the cells from the testicle. Coitus has but an indirect relation to these activities.

When the vas deferens is divided or ligated it is necessary to consider the effect upon the testicle, the seminal vesicle, and the prostate gland. As regards the latter, it should be obvious that no change, either physiological or anatomical, will take place, and yet in the days before prostatectomy was introduced it was a common practice to divide both vasa in the belief that the operation would result in a decrease in the size of the enlarged prostate. It is probable that this procedure was intended as a substitute for castration, which was the treatment in vogue during the nineteenth century. The removal of the testicle was discarded on account of the mental complications which it produced, but though it had no effect upon the adenomatous growth of the gland, the latter eventually underwent atrophy, due, of course, to disuse.

Division of the vas deferens *per se* has no effect upon either the function or size of the prostate gland. The quantity of the secretion is unaltered. It thus comes about that the man who has had both vasa divided is unaware of any change in the act of coitus. The quantity of fluid ejaculated is normal, but there are no spermatozoa present. With the knowledge that the vesiculæ seminales merely function as reservoirs for the mature spermatozoa

it is clear that any interference with the flow of cells into these small pouches must lead to their gradual shrinkage and complete atrophy. This is exactly what happens after a dissolution of the continuity of the vasa deferentia. The vesicles, at first palpable through the wall of the rectum, slowly shrivel until they are no longer to be felt by rectal examination.

A much more difficult study is the effect of duct division upon the testicle. There is one definite negative finding—namely, that there is no change in the shape and size of the gland. On the other hand, little is known as to the life history of the spermatozoon when it is imprisoned within the tubules of the epididymis. One can only surmise that the adult cell dies of inanition, unemployed and unwanted. Is the process of development of the sperm cell interfered with by the inability of its mature relatives to escape from the nest and migrate, as nature intends them to? Here again, in another but less important form, is the problem of the unemployed and its effect upon control of the birth of the unwanted. The urge to further formation of spermatozoa must remain, even after division of the vas, so long as sexual desire persists. One can visualize the overcrowding of the tubules of the epididymis with adult cells and the final squeezing out of existence of those that have not reached maturity. The final phase, in all probability, is the testicle's impotence to produce any sperm cells at all.

Such, in brief, are the physiological results of division or ligation of the vasa deferentia. Equally interesting and instructive are the clinical results of this simple surgical procedure.

OPERATIVE TECHNIQUE AND COMPLICATIONS

The operation can be carried out by any medical practitioner with a knowledge of minor surgery, but it must be stressed that this operation, if not performed efficiently, may lead to serious complications.

By far the easiest method of exposing the vas is as follows:

After the skin of the scrotum has been sterilized with iodine, picric acid, or methyl violet the vas is felt for immediately below the external abdominal ring. On the right side it is easily isolated with finger and thumb from the other constituents of the cord, but the left one is not so readily picked out on account of the multiplicity of veins which surround it. As soon as the duct is firmly gripped and fixed an incision is made in the scrotal skin between the operator's finger and thumb. With a pair of toothed forceps the vas is held while the tissues surrounding it are dissected away. It is then cut across and each end crushed between artery forceps. Should the surgeon desire to inject the vesiculæ seminales with an antiseptic or sclerosing solution in order to prevent subsequent vesiculitis the proximal end of the vas must not be crushed until the injection has been made. The procedure is: the proximal end of the cut vas is lightly held with forceps while a blunted hypodermic needle is passed down its lumen. (A sharp-pointed needle is found to catch in the wall of the duct and prevent the flow of fluid along the correct channel.) As soon as the surgeon is satisfied that the needle is in the right position 4 c.cm. of 1 in 10 carbolic acid—or any other antiseptic and sclerosing solution which may be preferred—is injected by means of a glass syringe. By this technique the vesiculæ seminales are sterilized, and, if the correct solution is used, also sclerosed. The divided ends of the vas are now pushed back into the scrotum and the skin wound sutured with catgut.

The complications which may arise from division of the vas are, in the main, the result of errors of technique. Thus, failure to maintain perfect asepsis will lead to scrotal cellulitis and the surrounding of the testicle by a hard mass, which has been mistaken for epididymo-orchitis. Again, particularly on the left side, a vein may be punctured during dissection and the error not recognized. The result is the formation of a scrotal haematoma.

* A post-graduate lecture delivered at the Hampstead General Hospital, November 9th, 1932.

Lastly, a thickened spermatic vein can be divided in mistake for the vas, and when or if orchitis follows, the erring surgeon proclaims the uselessness of duct division as a prophylactic measure!

In those cases where the vas has been divided for the prevention of orchitis, and infection of the seminal vesicles has subsequently occurred, the following signs and symptoms may be observed:

The patient complains of aching in the groin, and has a slight rise of temperature. Palpation of the tissues in the region of the external abdominal ring will reveal a swelling tender on pressure, which may be no larger than a pea or as big as a bantam's egg. The lump is due to the formation of a localized induration of the tissues around the proximal end of the cut vas. So acute was the onset of the symptoms and so sudden the appearance of the swelling at the lower end of the groin in one patient, that the condition was mistaken for a strangulated hernia. These symptoms rarely last longer than a few days unless an abscess forms. When the latter takes place resolution quickly occurs following evacuation of the pus. The transitory constitutional disturbance produced by a small abscess at the point of division of the vas is as nothing compared with pus formation in the testicle. The inflamed vesicle can be felt through the wall of the rectum as a thickened cord projecting upwards and outwards from the upper limit of the prostatic bed. Tenderness is an uncertain sign.

It is clear from the observations which have been made on the mode of spread of infection from the bladder neck and prostatic urethra to the testicle that the effect of division of the vas has determined, once and for all, the channel by means of which bacteria reach the latter. This channel must be either the lumen of the vas or lymphatics within its wall, for the technique of division has consisted solely of breaking the continuity of the duct. Perivascular lymphatics are not interfered with. Proof of the correctness of this observation lies in the fact that infection from the prostatic urethra, the vesicles, or the prostatic bed, following removal of the gland, terminates at the point of division of the vas deferens.

GENERAL INDICATIONS

It is now necessary to consider the indications for this operation as a means of checking the spread of infection to the testicles from the bladder and urethra.

Following removal of the prostate for simple enlargement or any other disease, no technique has yet been devised which prevents some degree of infection in the prostatic bed. So long as this infection exists there is the danger of bacteria spreading from the sump of serum and urine collected in this space, firstly to the seminal vesicles, and thence, via the vas deferens, to the testicle. Thus in all cases of prostatectomy an essential part of the operative technique must be division of the vasa deferentia. The importance to the patient of safeguarding his testicle from infection after he has safely weathered the storm of prostatic disease and the operation of prostatectomy is brought home to the surgeon, who, having failed to divide the vasa, is faced with the problem of treating recurrent attacks of orchitis when he has flattered himself his patient is rid of all his bladder troubles. In urinary tuberculosis when the bladder becomes involved, subsequent complications may be prostatitis, vesiculitis, and urethritis. These organs are affected through the passage of tubercle bacilli in the urine. Once this has occurred there is the further menace of involvement of the external genitalia. It is therefore a wise step, when the prostate and seminal vesicles have been discovered to be tuberculous, to limit the further genital spread of the disease by division of both vasa deferentia. Likewise in genital as opposed to genito-urinary tuberculosis, immediately epididymitis occurs there must be a dissolution of the continuity of the sperm duct to avoid involvement of the accessory sexual organs.

THE ROLE OF MINERALS AND VITAMINS IN GROWTH AND RESISTANCE TO INFECTION *

BY

ALAN BROWN, M.D., F.R.C.P.(C.)

AND

FREDERICK F. TISDALL, M.D., F.R.C.P.(C.)

(From the Department of Paediatrics, University of Toronto,
and the Hospital for Sick Children)

During recent years more and more attention has been devoted by the medical profession to the role of minerals and vitamins in human nutrition. In the present paper we wish to review some of the work which is being done in this field at the Hospital for Sick Children, Toronto. This work has been undertaken, not with the object of discovering methods for the cure of various disease conditions, but in an attempt to determine the value and importance of these dietary factors for normal development and resistance against disease. There are at least ten inorganic elements which are absolutely essential for life—namely, sodium, potassium, calcium, magnesium, phosphorus, chlorine, sulphur, iodine, iron, and copper. From the standpoint of the practising physician we are fortunate in having to watch the supply of only three of these elements, because any reasonable diet will furnish the other seven elements in adequate amounts. The supply of the three elements calcium, iron, and iodine, however, should not be left to chance.

ESSENTIALS IN DIET

Although calcium is the fourth most widely distributed element in the earth's crust, its occurrence in foods is quite limited. Our two chief sources of calcium are milk and leafy vegetables. As regards the child's diet, it may be stated that it is absolutely impossible to furnish an adequate amount of calcium unless liberal amounts of milk are given. This can readily be demonstrated by the following facts. A diet comparable to that found in many uninformed families, composed of rolled oats and bread-and-butter for breakfast, beef, potatoes, carrots, cabbage, and rice for dinner, potatoes, bread-and-butter, and honey or jam for supper, with four ounces of fluid milk to go on the rolled oats and rice, supplies only 0.3 gram of calcium. Yet the average 10-year-old child requires approximately one gram of calcium each day (Rose). The additional 0.7 gram of calcium required can be furnished by one pint of milk per day, or a total milk intake of 24 ounces per day. If all the milk is omitted, the amount of calcium furnished by the remaining portion of the diet is reduced to the absurdly low figure of 0.17 gram. It is thus evident that we depend mostly on milk to supply the large calcium needs of the growing child.

Iron is another mineral element that is not so widely distributed in food that its supply can be left to chance (Sherman). This is particularly true with the small infant, whose diet consists largely of milk and cereal, both of which foods are deficient in iron. Egg yolk, liver, and spinach and other green vegetables are our richest sources of iron in foods. The supply of iodine is probably an easy matter in Great Britain, owing to proximity to the sea. With us, however, in the centre of the North American continent, the iodine content of the water and the food is extremely low. We depend largely on iodized salt to furnish this element.

* Read in the Section of Diseases of Children at the Centenary Meeting of the British Medical Association, London, 1932.