morning. I ordered stock vaccine—30 million of the *Streptococcus puerperalis*. When I saw her the next morning her temperature had begun to go down; she was delirious, trying to get out of bed, picking at the bedclothes, dry and almost black tongue, sordes on her lips, pulse that I could hardly count and very feeble, uterus big and tender, abdomen slightly distended and tender, no tear in the perineum. I took swabs of the interior of the uterus. Dr. Mackey reported an infection of a *Streptococcus puerperalis* and *Bacillus coli*. During that day her temperature fell to 101°, but went up again the next day to 104.8°, and she had two rigors. Her temperature remained up until the third day after admission, when she had a dose of her own vaccine, 4 minims, containing 20 million streptococci and 100 million *Bacillus coli*. Her temperature came down rapidly to normal, and has never risen again. Although it was some days before she became quite clear in her mind and before her tongue became clean and moist, she had a second dose of her own vaccine four days later of 25 million streptococci and 120 million *Bacillus coli*. Her temperature remained normal, but on May 5th I noticed a small swelling at the back of the right buttock. The next day I found that this was larger and fluctuating, and under a local anaesthetic I opened it and let out about 1 oz. of pus, there being no rise of temperature; and by this time the patient, who had had altogether four doses of her own vaccine, was expressing herself as feeling very well and anxious to get up. Under ordinary circumstances I would certainly have said when I first saw her that this patient had not a chance of recovery.

Showing the advantage of treatment by the patient's own vaccine as compared with stock vaccine, there is the case of

CASE XIV.

Mrs. T., aged 36. Confined by a midwife; fairly profuse post-partum haemorrhage; on second, third, and fourth days had rigors; on the fifth she was seen by Dr. Barber and by myself; temperature 103.6°; in acute septic condition. Admitted to the hospital the next day, and the usual treatment was followed out. Dr. Mackey's report showed that infection was due to *Bacillus coli*, but chiefly to a Gram-negative bacillus in tiny colonies smaller than the streptococcal colonies, which I think I am right in saying that Dr. Mackey said he had never seen before. Her temperature was irregular for the first nine days after admission, but usually varying from 101° to 103°. After the second dose of her own vaccine on the ninth day, containing 60 million *Bacillus coli* and 15 million of the other bacillus, her temperature came down steadily, and, although it subsequently rose twice to 101, her recovery was continuous and complete.

CASE XV.

A second case, also showing the advantage of her own vaccine, was that of Mrs. P., who was admitted on the fourteenth day after her confinement with all the symptoms of puerperal fever. Cultures showed streptococcus and a few colonies of *Staphylococcus aureus*. On admission she had a bad cough, there were crepitations behind the left apex, and the sputum was crowded with the same streptococci. She had one dose of her own vaccine, containing 20 million streptococci and 200 million staphylococci; her temperature came down to normal and never rose again.

In addition to this treatment by vaccines, none of the ordinary methods of treatment should, if indicated, be neglected; intrauterine douching with dilute antiseptics, iodoform pencils in the vagina if the discharge is offensive, tonics, careful attention to the bowels, and, when necessary, stimulants.

As I have said, I chose the subject because I thought it was one of interest to the majority of medical men. I may say now that I chose it also because I was anxious to impress upon you the possible advantage that your patients may derive from your knowledge of this vaccine treatment. I may have formed my conclusions too hastily, and you may say that they are not warranted by the number of cases investigated. I can only say now that I am going on with these investigations, and further results will be published when they are ready. I chose this subject, too, because it has always seemed to me that the death of a woman in childbirth from puerperal fever is a matter of reproach to the medical profession, and any possible advantage in treatment that may be derived from investigations into all aspects of the disease should be, and will be, I am sure, heartily welcomed by the profession.

Before I close I would appeal to the Central Midwives Board to extend the duration of the course of training for midwives to at least six months. At present it is four months, and, when one thinks of what has to be learnt, this time hardly seems long enough. I would appeal to the doctors to notify their cases immediately, so that the really poor may get institutional treatment as early as possible. I would congratulate the Faculty of Medicine here on the near approach of the time when their students will receive part of their instruction in midwifery in a maternity hospital.

I would express my consciousness of the inadequacies of my lecture; any little merit that there may be in it I owe almost entirely to our bacteriologist, Dr. Mackey. To him I give my deepest thanks. I have also to thank, and I do it with pleasure, my colleagues on the staffs of the Women's and Maternity Hospitals.

THE ETIOLOGY OF TORSION OF THE TESTIS.

By R. W. MURRAY, F.R.C.S.,

SURGEON, NORTHERN HOSPITAL, LIVERPOOL.

My attention has been directed lately to torsion of the testicle, and without making by any means an exhaustive inquiry, I have endeavoured to learn what I could regarding the etiology of this remarkable complaint.

The liability of an undescended testicle to become suddenly and acutely inflamed was well known to surgeons of old, and, though often unaccounted for, was usually attributed to a blow or a strain.

The chief interest then, as now, was in distinguishing between an inflamed inguinal testicle and a piece of strangulated gut. Percival Pott mentions the case of a young man in whom inflammation of an undescended testicle caused symptoms closely resembling those of a hernia strangulated. The local tenderness was extreme, spread to the abdomen, and was associated with vomiting. It was noticed that the testicle on this side was not in the scrotum. Fomentations were applied and the patient recovered without an operation.

Sir Astley Cooper, in his work, *The Testis*, and Samuel Cooper, in his *Surgical Dictionary*, 1823, both draw attention to the fact that there may be considerable difficulty in distinguishing between an inflamed testicle in the inguinal canal and a strangulated knuckle of bowel. However, the older surgeons had little opportunity of studying the pathology of the living, for until well beyond the middle of the nineteenth century operative interference was confined to minor cases or to those of extreme emergency. Even when strangulation of the bowel occurred operation was invariably postponed until all other measures for obtaining relief had been tried and failed; and as thrombosis due to torsion of the cord, even when unrelieved, very rarely ends fatally, there was in those days no opportunity of determining the cause of the trouble. However, with the dawn of antiseptic surgery more light was thrown upon many obscure problems, for there was much less hesitation in making an exploratory incision. Still, many years passed before it was proved that torsion of the cord or testis was the essential cause of spontaneous inguinal orchitis. Mr. Jacobson, in his admirable article on diseases of the male organs of generation in Holmes's *System of Surgery*, describes the case of a lad 19 years of age, in whom inflammation of an inguinal testis produced symptoms simulating those of strangulated hernia.

The lad came to Mr. Jacobson's out-patient clinic in November, 1879, and was admitted with a view to operation. An incision over the swelling disclosed a gangrenous testicle, and an adjacent black, cyst-like mass was found to be epididymis, with above this the reddish, pulpy, oedematous cord. The cord was divided after being ligatured, and the affected parts removed.

In this case the symptoms had originated without any apparent cause, and in the light of our present knowledge there can be no doubt, though no mention was made of the fact, that it was an instance of thrombosis and gangrene following upon torsion of the cord.

So far as I have been able to ascertain, the first surgeon to describe torsion of the testicle was Professor C. Nicoladini. In the *Archiv für klinische Chirurgie*, 1885, he relates the two following cases:

A man, 62 years of age, was operated upon by Professor Nicoladini in June, 1882, on account of a painful swelling of the right side of the scrotum. The swelling was of recent origin and could not be accounted for. The right side of the scrotum was considerably swollen. It was oedematous, painful, and fluctuated. It was thought suppuration had occurred. On making an incision bloodstained fluid escaped, followed by a testicle and epididymis, which were of a dark plum colour, and at first sight thought to be a piece of strangulated intestine. Further examination showed that this extreme congestion was due to the spermatic cord, being twisted like a screw through more than 180 degrees, thus causing thrombosis of the

vessels beyond. The body of the testicle was one-third of the normal size.

The other case was that of a lad 16 years old. He was first seen by Professor Nicoladini on December 28th, 1883, on account of recurring attacks of pain in a testicle retained in the right inguinal region. The pain was occasionally so acute as to cause vomiting. Rest in bed and ice applied locally would relieve the pain, but he wished to be cured permanently. On January 11th, 1884, an operation was performed. Bloodstained fluid was found in the tunica vaginalis, the testis and epididymis were deeply congested and necrotic, due to a twist of the cord through 180 degrees. The testicle was connected with the epididymis by a long mesorchium. Both testis and epididymis were removed.

The article in which these original and extremely interesting observations are recorded deals with the subject in considerable detail, and the following conclusions are arrived at:

1. An inguinal testis or one late to descend into the scrotum is liable to torsion.
2. A slight degree of torsion may correct itself.
3. In severe degrees of torsion necrosis results.

The first surgeon in this country to describe torsion of the testicle was Mr. Thomas Bryant. In February, 1892, he related the following case before the Royal Medical and Chirurgical Society:

In September, 1889, Mr. Bryant saw a boy, aged 15, who had a swelling in his left groin and scrotum, with symptoms suggestive of strangulated hernia. He was a healthy lad, and two days before Mr. Bryant saw him had retired to bed after a long bicycle ride. "He woke his parents up during the night complaining of pain in his scrotum and left groin." During the next two days the local symptoms increased, and as the boy was in great pain it was decided to operate, though the diagnosis of the case was by no means clear. The soft parts were divided down to the tunica vaginalis, when "a glistening coal-black object came into view, which for the moment was thought might be congested bowel. On opening the vaginal sac and laying open half the inguinal canal, much blood escaped, and it became manifest that the black object which had been noticed was the testicle with its cord gorged with blood. On closer examination, it was found that the cord had been twisted upon its axis in the inguinal canal, and that as a result the testis had become strangulated with the epididymis. Three half twists made inwards completely untwisted the cord. As the testicle was warm and therefore viable, it was replaced into the vaginal sac, and the soft parts sutured together. All symptoms at once disappeared. For several weeks subsequently the testicle and cord remained thickened, but this soon disappeared, and later on the testicle atrophied.

Various explanations have been offered as to how and why the testicle and cord may become twisted, but none of them have so far met with anything approaching general acceptance. There is a general consensus of opinion that the most important predisposing cause is an imperfect development of the organ, the body of the gland being separated from the epididymis by a long mesorchium. Another fact of considerable importance is that in about one half of the recorded cases the symptoms of inflammation occurred at the time of puberty. Mr. Corner, in his work, *Diseases of the Male Generative Organs*, deals with this subject very fully. He says:

By going into the history of the cases there can be no doubt about three things: First, the developmental defect; secondly, the changes of puberty; and, thirdly, some muscular effort, which precipitated the onset of the final attack. Sometimes (30 per cent. of known cases) the onset occurred without any attributable cause; even during sleep in 8 per cent. This does not forbid the action of some muscular effort; for instance, the effort may be so slight as to be unnoticed. A case has been recorded in which a man had an attack of pain whenever he crossed his legs in a peculiar way. This muscular force must be divided into two classes: One concerning movement of the legs, and the other the raising of the abdominal pressure, as in straining or lifting. In the first case the testicle is twisted directly; in the second it is twisted indirectly as the cord is expelled from the abdomen by the effort.

Mr. Corner is of opinion that the final strangulation represents the summation of a series of small twists. As the result of an analysis of a number of cases he furnishes us with the following interesting table, which indicates the relative frequency with which torsion of the testis is met with in various periods of life:

1 to 10 years	...	...	...	20 per cent.
10 to 20 "	...	...	...	47 "
20 to 30 "	...	...	...	20 "
30 to 40 "	...	...	...	10 "
40 to 50 "	...	...	...	2 "
50 to 70 "	...	...	...	1 "

The figures show very clearly that the majority of the cases occur about, or shortly after, the changes in the testicle and spermatic cord which take place at puberty. Therefore these changes are factors in its production.

Mr. R. W. Taylor, in his *Practical Treatise on Genito-urinary Diseases*, says:

The exciting causes of torsion of the cord are in the main excessive labour and violent and sudden strain. . . . The essential underlying cause of torsion is a long mesorchium.

Mr. H. M. Rigby and Mr. R. J. Howard wrote a very interesting paper on torsion of the testis, which appeared in the *Lancet* (vol. i, 1907). The conclusion they came to was that "the predisposing cause is a congenital abnormality of the attachment of the testis to the spermatic cord. The exciting cause is not certainly known."

In the well-known surgical textbook of Rose and Carless it is stated that the cause of torsion of the testicle still remains unknown.

What, then, may be regarded as ascertained facts are:

1. In the majority of cases the testicle was imperfectly developed, a long mesorchium being a striking defect.
2. In the majority of cases the testicle had not descended to the scrotum.
3. The majority of cases occurred in young persons about the age of puberty.
4. In nearly one-half of the recorded cases no definite reason could be given for the torsion occurring. Not infrequently the symptoms occurred whilst the patient was in bed, and in some cases during sleep.
5. In many instances of acute torsion there had been slight recurrent attacks of pain.
6. In every case operated upon, and where careful examination was made, either the testicle was found to be twisted upon the epididymis, or both testicle and epididymis were twisted upon the cord.
7. In every case in which the testicle has been untwisted and replaced atrophy of the organ has resulted.

All surgeons who have expressed an opinion upon the subject agree that a long mesorchium is the chief predisposing cause, and that in a considerable proportion of cases a blow or strain appears to have been the exciting cause.

It has further been suggested that torsion occurs in an imperfectly descended testicle because of the free mobility which such organs are said to possess. Now, however free the mobility of an inguinal testis, it is not to be compared to that of the normally placed organ during infancy and childhood, which can frequently be seen to travel from the bottom of the scrotum up to the inguinal canal. Yet in spite of this considerable excursion I know of no instance of a child or infant in whom a testicle normally developed and normally placed has ever suffered from torsion. If mobility of the organ played an important part in producing torsion, then surely one would expect it to occur with considerable frequency during childhood.

It is commonly believed that muscular effort is a very important factor, but even supposing that a sudden strain did by some means or other twist an inguinal testis, it is hard to believe that any muscular effort could succeed in suddenly twisting the organ through three or more half turns, and this is what has been found in many cases subjected to operation.

Of course it might be argued that the symptoms calling for operative interference were the summation of many small twists, but to my mind this view fails to carry conviction; besides, even if it be granted that a muscular effort may twist an inguinal testicle, it would only account for a certain number of cases.

A very important fact is that in a large percentage of cases there was no apparent cause at all for the torsion, and in a fair proportion the symptoms occurred during sleep.

It is not as a rule very difficult to criticize adversely the views of others, but it is by no means so easy to offer an alternative explanation which will meet with approval. However, after reviewing what evidence we have, I would suggest the probabilities are that in every case presenting symptoms of torsion of the testicle some degree of torsion of the organ had existed since birth. In other words, torsion of the testicle is of congenital origin and not acquired. I feel confident this is so, and that on this basis all cases can be satisfactorily accounted for.

In nearly every recorded case there has been an imperfect development and an imperfect descent of the testicle, the separation of the body of the organ from the epididymis by a long mesorchium being a constant feature. Now when a testicle so loosely fashioned has to travel from the region of the kidney to the groin, passing through the inguinal canal, it surely is not improbable that during this gubernacular slide some degree of rotation might occur.

The attachment of the gubernaculum to a long mesorchium would certainly add to the probability of torsion occurring during the journey. I have endeavoured to illustrate this in the accompanying diagram.

A, Plica vascularis. B, Gubernaculum. C, Mesorchium. D, Body of testis inverted. E, Epididymis.

When the body of the testicle alone is rotated, or the whole organ twisted upon the cord, the vessels of the mesorchium or of the cord would of necessity be involved; and the more complete the twisting the more precarious would be the vascular supply. If the twist were a slight one—say, merely half a turn—the blood vessels might still be able to deal satisfactorily with a sudden vascular change; but should the twist be one of three or four half turns, then a sudden turgescence of the organ, from whatever cause, would not improbably result in thrombosis.

In the *BRITISH MEDICAL JOURNAL*, vol. i, 1897, Dr. M. R. Taylor relates a case of torsion of the testis in a newborn child. Nothing abnormal was noticed at the time of birth, but four hours later the nurse noticed that the right testicle was slightly larger than the left, and the skin of the scrotum was discoloured. Two days later the child was given an anaesthetic, and the testicle was removed. It was sent for examination to Mr. C. B. Lockwood, who reported as follows: "The spermatic cord is very thin, and twisted apparently just above the tunica vaginalis. The whole cavity of the tunica vaginalis and the whole testicle and epididymis were full of congested blood. The clot runs $\frac{1}{2}$ in. up the cord as far as the twisted part."

Though the testicle was in the scrotum, this is clearly a case in which intense congestion was due to a congenital twist of the cord, for this is the only reasonable explanation of the clinical symptoms and of the pathological findings. In the case of torsion of an inguinal testis where there is a clear history of a blow or strain, and in which it is believed that the torsion occurred suddenly as the result of the blow or of a muscular effort, it would appear more probable that in such cases some degree of torsion had existed since birth, and that the injury produced a venous engorgement of the organ which, owing to the precarious vascular supply, resulted in thrombosis.

In about 70 per cent. of recorded cases the symptoms have occurred before 20 years of age, and nearly 50 per cent. of them were observed at puberty. It is surely not unreasonable to suppose that, granted some degree of torsion of the vessels supplying the testicle, the sudden vascular changes which are known to take place at this time of life might readily result in excessive congestion and thrombosis. The view I am advocating receives additional support from a fact that in a certain number of cases the trouble originated during sleep. Slight degrees of torsion may be present without producing symptoms, and must have been observed by surgeons when operating for hernia associated with an undescended testicle.

It is of course impossible to advance direct evidence in support of my view, but I would submit that all the circumstantial evidence available makes it appear probable that torsion of the testicle is primarily of congenital origin and not acquired.

ACUTE EPIDIDYMITIS PRODUCED BY MUSCULAR STRAIN.

By J. W. GEARY GRANT, F.R.C.S.ENG.,
CARDIFF.

I READ with much interest the article in the *JOURNAL* of April 13th, p. 832, by Dr. Arnold Edwards, describing in a very exhaustive manner two cases which he considers bear out the theory that epididymitis may be caused by strain. The conclusions drawn therefrom are of considerable importance in their medico-legal relations, and are worthy of a somewhat close scrutiny and analysis. For if it be established that a muscular effort or strain can cause epididymitis, then it could quite conceivably follow that so serious a condition as tuberculous testis might owe its origin to the same cause—the sequence being obviously strain, effusion into epididymis, and inflammation upon which tuberculous infection is grafted. I cannot put my hand on the record now, but unless my memory is at fault, I have heard such a case successfully argued in court. From the employer's point of view it is rather a serious position.

I have met with two cases which present considerable similarity to those given with such detail by Dr. Edwards, although I regret that circumstances did not permit of my investigating them so closely as he did, and that the urine was examined in neither.

CASE I.

A. B., aged 39, on Thursday, whilst standing on two joists of a flooring with the feet about 16 in. apart, swung round a plank from the scaffolding, and as he did so "felt a slight sting in the right groin." No squeeze or blow. Pain was felt in groin, not testis; it was so slight that it did not cause him to stop his work, even momentarily. He felt slight soreness in groin, but continued working up to Sunday, when he noticed a swelling in the groin and laid up. On Tuesday the testis commenced to swell. A fortnight ago he got up for two days, but had to return to bed on account of the left testicle swelling.

The globus minor of the right testis was swollen, not hard, and there was evidently an inflammatory condition in process of resolution. The rest of epididymis, body of testis, vas, and cord were perfectly normal.

He never mentioned the condition of the left testis until I observed it for myself. There was a similar swelling of the globus minor of the left epididymis, much firmer and more tender than its fellow. Neither body of testis, vas, or cord was in any way affected. And there can be little doubt that it presented the early stage of the same inflammatory process that was previously existent on the right side. There was no suspicion of any urethral discharge. The urine could not be examined. He was a leading light of his particular religious denomination, and was greatly offended at being asked certain questions, and in fact that he should be examined at all.

I certified the case as one of bilateral epididymitis, cause unknown. But I think that it affords a strong commentary on the inferences that are drawn from the two cases given by Dr. Edwards. Here is a man who meets with "a strain" on Thursday, and all symptoms are latent until Sunday, and only on Tuesday does the epididymitis begin to swell. But suppose we admit this doubtful strain as the definite determining cause of the epididymitis on the right side, how can we connect the ensuing attack of epididymitis on the left after a strain in the right groin? Is not the weight of probability that both were due to some general cause—either an unrecognized inflammatory condition in the deep urethra, or a haematogenous infection?

CASE II.

Man, between 20 and 30, dock hobbler, on Wednesday, a fortnight before he came under treatment, as he was finishing work threw down the shute and jumped sideways out of the way; in doing so he felt "a twist on the right side of belly passing round to the groin." The following morning the testicle began to swell, and although he went to work the pain became so severe that he had to give up. The swelling is now subsiding and he has no pain. The globus major of the right epididymis was slightly enlarged and firm in consistence, but was neither stony hard nor craggy in feel. The rest of the testis was normal, as were the vas and cord, and there was no tenderness of the latter either in the scrotum or in the inguinal canal. The orifice of the urethra was perfectly healthy without the suspicion of a discharge. He complained of some tenderness over the lower part of the right side of the abdomen; there was no muscular rigidity. He resumed work in about two weeks after I saw him. No examination of urine was made.

In this case I suggested that in the jump sideways that he made the testicle was squeezed between the thighs or