Observations

ON

FRACTURES OF THE NECK OF THE FEMUR*

BY

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Fracture of the neck of the femur is a grave condition, and gives rise to considerable anxiety both to practitioner and to surgeon. No one can accurately foretell the final result as to either bony union or good function. Further, there is no fracture which has been more neglected. There are thousands of students and practitioners who have never had an opportunity of following a case through its various phases from beginning to end, but we have all seen several instances of the inefficiently treated and neglected case. Such fractures are very rarely treated in teaching hospitals; as a rule, they are sent off to Poor Law institutions because of scarcity of beds and the inevitably prolonged course to recovery. This has given rise to quite an unnecessary spirit of pessimism. We are apt, in the case of the aged, to conclude that the end-result is almost inevitably bad, and that if they escape death from chest complications they are fortunate and should be grateful, no matter how crippled they remain. But this is not all, for adequate treatment is withheld on the plea that it adds to the risk of death. I hope to show how wrong it is to take this view, and that we have every right, with modern knowledge, to expect a good functional result in a large majority of cases in spite of old age and feebleness. Even in the neglected case surgical procedures are at our command whereby pain and severe crippling can be overcome.

EPIPHYSEAL STRAINS IN THE ADOLESCENT

There are three types of cases with which I will deal, and each has its own special clinical importance. The first includes injury to the epiphysis in early adolescence, and is sometimes known as slipped epiphysis or traumatic coxa vara, first described by Royal Whitman. It is associated especially with school age, and is due to strain. It is not uncommon, and should not be overlooked in its early stage. The condition consists of a partial or complete separation of the epiphysis, a fracture through the neck, or a fracture involving both neck and epiphysis. Partial separation of the epiphysis is the more usual variety.

For diagnostic purposes I will describe a typical case of partial and of complete separation of the epiphysis. A boy while playing football attempts to turn suddenly, and feels a sharp pain and suffers disability at the hip. He hobbles off the field, and after resting a short time walks back to school and rests. If the surgeon is sent for he will find the movements fairly free in the direction of flexion, extension, and adduction; the rotations are distinctly painful and so is abduction, which is limited. The measurements of the limb are normal. For ten or twelve days he rests and later begins his games, when another strain reproduces his symptoms, and games are prohibited for the rest of the term. During exercise something again "gives" in the hip, and he has to be carried off to bed. The limb is now shortened about half an inch, and a partial, or complete, separation of the epiphysis will be found. The *x*-ray examination shows the femoral head in position and the femoral neck displaced upwards.

In another type the injury is much more severe, and the disability more pronounced and lasting. Here we find we are dealing with a fracture of the neck, with a com-

plete separation of the head, or with a combination of both.

There is a third type, which completes the clinical group. A youth strains his hip and is slightly disabled for a day or two. As the weeks pass he complains of an increasing lameness and stiffness of the hip. His symptoms closely resemble a starting arthritis. There is a limitation of movement in all directions, shortening of the limb, and elevation of the trochanter above Nelaton's line. A skiagram shows a coxa vara of the epiphyseal type in which the neck participates. The slight injury has partly separated the epiphysis, and under the strain of body weight coxa vara occurs, associated with traumatic arthritis.

We may assume, therefore:

(a) That a single strain, or a succession of strains, of the hip-joint in adolescence, if followed by disability, limited rotations, and limited abduction, denotes a partial epiphyseal separation.

(b) If a strain completely disables the patient and is accompanied by elevation of the trochanter complete separation of the epiphysis, or fracture of the neck, is suggested.

(c) If a slight injury be followed by a limp, rigidity, and shortening of the limb, developing slowly, we are probably dealing with a traumatic coxa vara following a partial separation of the head, and exhibiting signs of a traumatic arthritis.

The importance of an early diagnosis cannot be too strongly stressed; whichever type the case may be it will readily respond to treatment. A neglected coxa vara may leave a deformed and disabled hip. It should always be remembered that coxa vara may follow twist or strain, especially if the strain is repeated, even if the radiograph is at first negative.

Treatment

If the *x*-ray examination is negative the limb should be fixed for a few weeks in a splint or plaster. Abduction is not necessary. If the epiphysis has slipped, plaster should be applied in an abducted position for at least three months, and when walking is allowed body weight should be transmitted to a calliper splint. If arthritis is added to coxa vara, plaster and abduction should be continued for at least six months. The abduction should not be too forcible and extreme, as distortion may occur to the softened head of the femur.

FRACTURES OF THE NECK OF THE FEMUR IN THE AGED

A point that distinguishes fractures in the aged is that they occur usually with but little trauma, and often by a cross breaking or indirect force—for example, when a fracture occurs in bed or in getting out of bed. This is readily explained by the facts that in the aged the bone is atrophied and brittle, and the muscular control lessened, while the angle formed by the neck and shaft is more acute, sometimes approaching a right angle. I shall refer only to two sites of fracture: one occurring near the head (subcapital), often referred to as "intracapsular," and the other near the trochanter, formerly called "extra-capsular." The subcapital is the fracture which has always been, and still is, anathema to our profession.

In the aged, even under the best treatment, non-union is often observed, and it is found in practically all neglected cases. Although bony union is essential to a perfect result we may meet with a fair degree of function in a case with fibrous union, and with poor function in a bony mal-union. The explanation of this will be apparent later. The main reason for non-union is due here, as in other fractures, primarily to imperfect apposition, and also to the fact that the neck of the bone throws out a callus never exuberant. To this we may also add its

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sparse blood supply. The chief sources of supply are: (1) a vessel entering the upper part of the neck just above the great trochanter; (2) a vessel on the under side of the neck; (3) a small vessel at the internal side of the epiphysis of the head; (4) a vessel entering through the ligamentum teres, which is usually obliterated in early childhood. There is a network of small vessels surrounding the epiphyseal line which practically disappears in the aged.

In deciding upon treatment it is well to study the deformities found in the old neglected case. In this way we are taught what to avoid. This method of observation will also help us in dealing with fractures of other bones.

A neglected case will enter the out-patient room usually with a crutch and a stick. He is very lame, and walks with pain. He saves the injured limb from heavy pressure, his foot being turned out. Examination reveals a real shortening, from an inch and a half upwards; the practical or apparent shortening is more, due to elevation of the pelvis. The limb is adducted, and abduction is very limited, while rotation inwards cannot be performed. There is usually about 40 or 50 degrees of flexion deformity; therefore all movements of the hip are limited. Very often the tendo Achillis is shortened.

This description covers most cases displaying very gross and very unnecessary deformity, which should never be allowed to occur even in cases of non-union. To prevent these deformities, therefore, the recent fracture should be treated with the limb extended, abducted, and rotated inwards, and the foot should be kept at right angles. If the limb be placed and kept in this position for a sufficiently long period, such deformity as I have described need never occur. This is the first and most important fact I wish to emphasize.

The Recent Case

Diagnosis.—An aged person falls or strains his hip and is quite disabled. The limb is adducted, shortened, and externally rotated, and cannot voluntarily be lifted. There is pain on pressure over the femoral head below Poupert's ligament, and the ilio-tibial band is relaxed. A radiograph confirms the diagnosis of fracture of the neck of the femur.

Anatomy of the Deformity.—The femur is displaced upwards by the glutei, rectus femoris, adductors, and hamstrings; inwards by the adductors and quadratus femoris, and is rotated outwards by the weight of the limb in the recumbent position.

Position of Fractured Ends.—The face of the fracture of the outward fragment looks forwards. The radiograph will show the position of the fracture, whether subcapital or at the base of the neck. Non-union is much more apt to follow the subcapital than the basal fracture. The treatment of both varieties is identical. The fracture may be impacted. If left alone and not fixed it usually becomes disimpacted in a few days. When the impaction has been very firm it sometimes happens that the patient has walked upon the limb immediately after the accident, and has been able to lift the limb from the bed. I have seen several such cases.

Mechanical Treatment of the Recent Case.—If there is impaction we have to decide whether the fragments shall be disengaged. This depends entirely upon the alignment. Impaction seldom connotes good apposition, and therefore it should not be allowed to hold, except in rare cases. If the impacted limb is shortened we may be sure the fractured ends are not in alignment; if there is fixed external rotation or adduction it is obvious that reduction must be undertaken. An impaction should not be interfered with

when apposition is good and the limb is not rotated outwards, adducted, or shortened. Such an impaction is rare indeed. The aim of treatment is to secure good alignment, complete abduction, and internal rotation. If we fail by these means to obtain union we shall certainly have averted the possibility of ultimate gross deformity, and achieved a fair functional success. The abduction treatment may be carried out by means of a splint or by plaster. The splint I have advocated in the past is a double abduction frame reaching only to the umbilicus, with a groin strap to allow of fixed extension. In exceptionally fat people I think this is still the best method, but for the routine case I am convinced that the plaster method described by Royal Whitman is the safest and most efficient procedure. When we speak of the abduction treatment we refer to the method originated and first described by Royal Whitman, who has placed this technique on a scientific basis. Many of us have abducted the femur, but Whitman has shown us precisely what to do and the reasons for doing it. A femur may be abducted without the fractured ends being brought into apposition, and the results will be disappointing. Whitman states that if under anaesthesia the upward displacement of the shaft be reduced by manual traction on the limb; combined with slight inward rotation, the fragments would lie in the same plane, and abduction to the normal limit would secure the fragments in close apposition, while the tension on the capsule incidental to abduction would prevent displacement and force the fragments into direct contact, which in fractures of the cervical type is essential to repair. The security assured by bony contact and capsular tension will be further augmented by the contact of the trochanter with the side of the pelvis, while in the subcapital variety the fracture line will be included within the acetabulum. This secures the relaxation of the muscles which cannot be controlled by any other non-operative method. Whitman's contribution, therefore, consists of the correct apposition of fragments (which, in this fracture more than in any other, is positively essential) followed by fixation in position by abduction. Any splint which succeeds in holding these fragments in position would suffice, but none will compare with plaster-of-Paris, which can be relied upon to be effective, provided it is properly applied. It is necessary to emphasize this, for the correct technique is too often ignored. There is no time to enter into elaborate detail of the method of applying the plaster spica, although it must be mastered if it is to be both comfortable and efficient. Properly applied there need be no fear of pressure sores.

Reduction and Fixation.—The length of the two limbs should be measured, and the broken limb should be restored to its normal length by manual traction, and then rotated inwards. The limb should next be abducted. The abduction should be complete, and, as the angle varies in different people, information is gained by noting the amount of normal abduction on the sound side. The angle is usually about 40 degrees. If the hip sags it should be lifted, and I find it useful before abducting the limb to make traction outwards. This disengages the overlapping which is sometimes present. The patient is now placed on a pelvic support and manual traction is maintained on the limb, which should be rotated inwards. If the rotation is adequate the lesser trochanter should be barely seen in the radiograph. The thigh should be fully extended, or even slightly over-extended, and the knee kept slightly bent. Subsequent stiffness is more rapidly recovered from if the knee is not kept in full extension. The plaster should be continued sufficiently high and well rubbed in to grip the pelvis and secure adequate leverage, and should extend to, and include, the foot. While the

plaster is being applied both legs should be abducted in order to control the pelvis, otherwise the abduction may be complicated by pelvic obliquity. The foot should be kept at right angles. In transcervical and subcapital fractures the plaster support around the hip of the aged should be maintained for six months, but in three months the knee may be freed and put through its range of movements. Pillows may be placed below the head and shoulders, and the head of the bed may be raised eight or twelve inches. This will obviate any danger there may be in cases threatened by chest complications. The dorsal position of the patient can occasionally be changed to ventral or semilateral without in any way jeopardizing the correct alignment of the fractured ends. It is a relief to the patient sometimes to be placed on his face.

After-care treatment should be attentively conducted. The bowels should be carefully regulated, and for the first few days a fluid diet should be prescribed. Beef tea, broths, arrowroot made with water, should form the principal food. Large quantities of milk, which as we know becomes solid in the stomach, should not be given. In this way the abdominal disturbances, so awkward when they arise, will be avoided. X-ray examination should decide whether union has occurred or not, and if necessary the plaster should be continued beyond the six months. When the plaster is removed the patient should lie in bed for a few days, keeping his limb abducted, while massage and gentle passive movements may be given. No weight-bearing on the fractured limb should be allowed; a calliper should be carefully fitted so that weight-bearing is taken from the ischial tuberosity and not from the neck of the femur. Whether bony union has taken place or not freedom of abduction should be the aim. If fixed adduction is allowed to occur the functional result will be very imperfect. If these principles of reduction and fixation are observed, whether bony union occurs or not, we may expect a fair functional result. In other words, much of the disability which we encounter in old cases will be considerably lessened if we prevent a fixed adduction.

BASAL FRACTURE IN THE YOUNGER ADULT

The so-called extracapsular or basal fracture, commonly met with in the younger adult, should be treated as that of a fracture in the aged. Here, however, bony union is to be expected as a routine, and the plaster fixation need never exceed three months. In six weeks the knee can be freed, and when walking is begun it is rarely necessary to wear a calliper splint. It is essential that the power of abduction should be preserved. Non-union is likely to result even in "extracapsular" cases if treatment is carelessly conducted.

DISCUSSION OF ABDUCTION METHOD

It is useful to know what percentage of bony union may be expected in the aged treated by the abduction method. Perhaps the most complete recent statistics are those of Lofberg, published in 1927.¹ The number of cases treated was 264—88 males, 176 females; 78 per cent. of the patients were over 55 years of age; the youngest was 17, the oldest 95. Of the cases, 172 were intracapsular; in these bony union and good function were obtained in 76 per cent. In the 92 extracapsular, bony union and good function resulted.

A full abduction is difficult to obtain without anaesthesia; yet in the figures supplied by Lofberg the majority of the fractures were reduced without general anaesthesia. Further, the period of fixation was limited to eight weeks. Willis Campbell's figures are even more favourable. Scudder says: "The overwhelming accumulation of evidence that the abduction treatment is highly efficient in securing bony union has raised the most neglected of all

fractures to the first place in the therapeutic scale." One may offer a favourable prognosis both as to life and function in about 75 per cent. of all cases treated by the abduction method if it is effectively applied.

ARTIFICIAL IMPACTION

Cotton advocates artificial impaction of the femur in good position. Having reduced the fracture by traction and internal rotation he places a pad of felt over the great trochanter and strikes one or more blows with a wooden mallet weighing about 8 lb. Counter-pressure is put on the sound side of the pelvis. The hammering is considered to be successful when the neck appears to be firm and the limb does not fall back into eversion. The limb is then placed in abduction. I have had no personal experience of artificial impaction, and cannot, therefore, criticize it, but it is obviously very necessary to reduce the fracture completely before using the mallet, or only mischief will result. If alignment and apposition are good, is there much or anything to be gained by artificial impaction? Willis Campbell, however, whose experience is extensive, regards it as a distinct addition to the Whitman technique, and claims 89 per cent. of bony union. The method may be of definite service in cases which have been unreduced for some weeks. Reduction should, of course, be first effected and the limb placed in abduction.

OPEN OPERATIONS ON THE RECENT CASE

In view of what has been said as to the results of the abduction method, which is accompanied by only a 5 per cent. mortality, a very strong case should be presented before resorting to the risks of an open operation in the aged. It should never be needed in the so-called extracapsular fracture, which almost invariably unites. In my experience an open operation on a recent case of subcapital fracture of the neck should be a very rare event. It adds considerably to the mortality, and should never be undertaken except by very expert surgeons who have a sound practical knowledge of the mechanical methods at their disposal. Although I have never operated upon a recent case, I have seen many unhappy after-results.

THE OLD UN-UNITED CASE

The deformities here, as stated elsewhere, are flexion of the thigh, adduction, rotation outwards with marked functional disability, and generally pain. What should we do in such cases? In the old and feeble we should resist the temptation to practise any procedure accompanied by great shock. We should aim at relief of pain by posture and mechanism, and avoid prolonged recumbency. The adduction—always the evil factor—should be corrected as far as possible, and the hip should be fixed by a plaster spica. The spica should be light, and need not extend below the knee. Two or three weeks is generally sufficient to bring about ease and comparative comfort. Graduated walking exercise should then be practised. Any stiffness of the knee or ankle should be overcome by gentle passive movements assisted where possible by physiotherapy. When a few weeks have passed a weight-bearing ambulatory splint, such as a calliper, should be worn for an indefinite period. By abducting the limb we minimize the cross-breaking strain and release the hip from adhesions which, even more than chronic arthritis, give rise to constant pain on movement. We have often met with patients who, refusing to rest, have obtained considerable relief from gentle manipulation.

There is another type of "intracapsular" fracture in old and infirm people who have but little pain when they

limit their activities, but feel weakness and pain when they have walked a little distance. These cases are best treated by a weight-bearing splint, and the patients should be taught exercises for muscle development in the recumbent position, so that their condition is not complicated by the incidence of body weight. Many very old people will sometimes consult us because they have a short leg and limp badly, and cannot walk long distances, but have no pain. It is obvious in such cases that, apart from regulating the unequal length of the limbs, nothing should be done of a drastic character. A firm flannel spica bandage round the hip gives a sense of stability and strength. Even a calliper may not be needed, as there is no pain to be relieved, and further shortening is unlikely.

A certain number of patients, however, are sufficiently strong and disabled to warrant more drastic measures. The operative procedures which can be adopted may be divided into four main classes.

(a) Freshening and fixing the bones in good position. This entails exposing the fractured ends, removing all fibrous material, and opposing the freshened ends. They may be kept in apposition by the abduction method with or without pegs.

(b) Reconstruction of joint, as practised by Brackett or Royal Whitman.

(c) Transference of weight-bearing, such as modification of the bifurcation operation, devised originally by Lorenz for the treatment of unreducible congenital dislocation of the hip.

(d) Removal of the head of the femur.

The Pegging Operation.—If bone is employed it should be about half an inch in thickness. An incision is made over the front of the joint, the fibrous tissue dissected away, and the ends of bone freshened. The freshened ends are placed in apposition. The base of the trochanter is then exposed and a hole drilled along the neck into the head. With the fragments in position the bone peg is hammered into the tunnel. The correct alignment of the peg can be verified by an examination through the anterior wound.

Whitman's Operation.—This operation aims at removing the femoral head and adding to the length of the neck by removing the portion of the trochanter with muscle attached and by fixing it on the shaft as low as possible. The reconstructed neck is placed in the acetabulum and the limb fixed in abduction.

Brackett's Operation.—In this operation the head is retained in its socket. The tip of the trochanter is detached and the fractured surfaces are freshened, the trochanteric end made convex to fit into a concavity chiselled into the head. The portion removed from the trochanter with tendinous attachments is fixed below.

The Bifurcation Operation (see Fig.).—This operation can be employed for un-united fracture in the old. Osteotomy of the femur is performed usually just below the lesser trochanter, and the limb is abducted, the lower end being driven inwards so that it rests on the pelvis just below the rim of the acetabulum.

Removal of the Head of the Femur.—This can be performed through an anterior or a posterior incision. It is not always as easy an operation as it sounds. After the removal of the head the hip should be kept abducted for three or four weeks.

The Choice of an Open Operation

Let us remember that any reconstructive operation in the old and feeble, if it involves the exposure of the hip-joint, is a serious undertaking, and is accompanied by considerable shock. Stability and freedom from pain should be the primary objects, and if these be attained the patient is more than satisfied. A stiff joint even,

which will enable the patient to walk without discomfort, and with but little risk, is preferable to any reconstructive effort which aims at movement but endangers life. I do not think there is much to choose between the reconstructive operations devised by Brackett and Royal Whitman. Neither of them is inviting in old people with subcapital fractures. Brackett preserves the head; Whitman removes it. Brackett endeavours to bring about union, and there is necessarily the risk of failure; Whitman places the neck into the empty acetabulum. In both operations abduction is necessary, and I should have feared a liability to displacement on adduction. Both of these distinguished authors, and others, have reported successful cases, but I have had no personal experience of either method, nor of the reconstructive operation practised by Albee. On several occasions I have removed the head of the femur with moderate success. Pain is nearly always relieved, and, provided the limb is kept abducted, there is improvement of function.

The Bifurcation Operation

I feel satisfied that for an open attack in the aged the bifurcation operation has many advantages. The joint is

The bifurcation operation, showing how body weight is deflected from the un-united fracture of the neck on to the shaft.

not interfered with, shock is negligible, and the procedure occupies only a few minutes. Body weight is deflected directly on to the femur without the intervention of the joint. A four-inch incision is started at the base of the trochanter and carried downwards. The femur is divided almost transversely just below the lesser trochanter. The upper end of the lower fragment is pushed inwards and then directly upwards until it impinges against the pelvis at the lower border of the acetabulum. The limb is kept in moderate abduction in plaster. It is an incredibly simple procedure, and the result completely changes the patient's outlook, for stability is combined with movement. The same operation will relieve the distressing symptoms of advanced osteo-arthritis in old people. Fixation in very slight abduction should last three months.

Reconstructive operations can be performed with comparative safety in young and middle-aged adults, and the arguments I have used in dealing with the aged do not apply here. The type of reconstruction must depend largely upon the character of the fracture, but where it is possible a bone peg, as practised by Albee, offers the best functional success. A surgeon who has allowed deformity to occur should not operate unless he has learned the technique and principles of the abduction method.

COMMENTARY

Operations in old patients, therefore, take a very secondary place compared with primary mechanical treatment. The cases left for operation are usually neglected ones. Un-united and mal-united fractures occurring in the virile—for which reconstructive operations are needed—should very rarely occur if subjected to the abduction method. But we cannot be astonished at the unsatisfactory results in fractures of the neck generally when a spirit of pessimism and *laissez-faire* governs our treatment of the aged. In a modern textbook, speaking of "extra-capsular" fractures, the author says: "They will get well anyhow under good or bad treatment." This is an excuse for carelessness which may result in tragedy. We should further realize that the aged, subjected to appropriate mechanical fixation, are less in danger of death than when their fractures are untreated.

We need only refer to the report of the British Medical Association's committee of inquiry into the treatment of fractures, published twenty years ago, to realize how startling were the failures in fractures of the neck of the

femur. Of twenty cases occurring in patients between the ages of 26 and 45, only six good functional results are reported; in thirty patients between 45 and 60, only eight good results, and in thirty-six over 60, only five. These were the days of Liston's splint and sand-bags, before it was realized that it was essential and possible to reduce the displacement. But even so late as 1928 Katzensteen reported to the Surgical Society of Berlin the results of 169 cases of transcervical fractures treated by conventional methods, with only 11.5 per cent. of good results. This is an interesting commentary on conventional methods, which have not improved in fifty years. The profession owes a deep debt of gratitude to Royal Whitman for his persistent insistence in standardizing the abduction method.

In conclusion, may I again venture to urge that no student should leave hospital without being taught the modern method of treating fractures of the neck of the femur.

REFERENCE

¹ *Zeit. f. Chir.*, August 27th, 1927.

SPINAL ANAESTHESIA

A STUDY OF 250 CONSECUTIVE CASES*

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Without ether and chloroform the amazing expansion of possible surgical procedures in the last half-century would not have occurred. Recently, efforts have been made to restrict the action of paralyzing agents to the nerves which alone are responsible for giving offence, and to avoid a generalized toxæmia. The congregation of the spinal nerves in the lower part of the thecal tube renders them susceptible to a suitable drug injected into the cerebro-spinal fluid. Rapid and complete anaesthesia ensues, lasting for more than an hour. Further, it is obtained without the tedium of local infiltration methods and the sodden state of the tissues associated with them.

Formerly, using the spinal route, I was alarmed to find patients pale and sweating, with dilated pupils, and complaining of excessive weakness. Although none died, the anxiety was intolerable. However, reports on thousands of successful cases from various sources^{1 2} filled me with admiration and a great curiosity to find what were the technical requirements in order to obtain a satisfactory result. Great praise is due to Pitkin³ for revealing the underlying anatomical basis and physiology of spinal anaesthesia. He has evolved a safe injection called spinocain; novocain is the essential constituent, but its influence is controlled by other ingredients.

ACTION OF SPINOCAIN

The profound lowering of vitality in my former cases was due to excessive palsy of the sympathetic fibres, which leave the cord with the issuing dorsilumbar nerves (Fig. 1). This Pitkin combats by a preliminary subcutaneous injection of ephedrine. Further, to control the spread of spinocain, he mixes it with gliadin, a mucilage from wheat starch, which is viscous and which arrests ordinary diffusion; the addition of alcohol lightens it. Pitkin likens its behaviour, on entering the thecal tube, to "a bubble floating in a spirit level." Thus, with the spine horizontal, it will tend to produce a paraplegia up to

the segment of the cord opposite the level of injection. By tilting the tube tail end upwards only the parts supplied by the lumbo-sacral nerves are paralysed; by tilting the spine head upwards the paraplegia extends to the chest, and if the head is raised sufficiently, will implicate the phrenic nerves. The physics of spinocain needs to dominate the anaesthetist completely if disaster is to be avoided.

FIG. 1.—Pitkin's solutions. Diagram of spinal and sympathetic nerves and posture of patient.

If, while inducing anaesthesia, anxiety arises as to undue ascent of the paralysis or excessive lowering of vitality, or both, there appears one of the outstanding advantages of spinocain, for when such dangers threaten the method of combating both is identical. The Trendelenburg posture sends blood to the vital centres, and, thanks to the lightness of the solution, any remaining unfixed spinocain travels back to the harmless lumbo-sacral levels. Posture determines the distribution of the

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